

Draft

**Government of the People's Republic of Bangladesh
Ministry of Water Resources
Bangladesh Water Development Board**

Environmental Impact Assessment (EIA)

of

**Southwest Area Integrated Water Resources Planning and Management Project
Additional Financing**

ADB Loan 2200-BAN (SF) / GON Grant 0036 BAN



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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
BWDB	Bangladesh Water Development Board
DAE	Department of Agricultural Extension
DFR	Draft Final Report
DOE	Department of Environment
DOF	Department of Fisheries
DPHE	Department of Public Health Engineering
DTW	Deep Tube Well
EAP	Environmental Action Plan
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
EMU	Environmental Management Unit
ERP	Environmental Responsible Procurement
FAP	Flood Action Plan
FAO	UN Food and Agricultural Organisation
FCD/I	Flood Control, Drainage and Irrigation
FD	Forest Department
FGD	Focus Group Discussion
FPCO	Flood Planning Coordination Organisation
GC	Governing Council
GRM	Grievance Redress Mechanism
GOB	Government of Bangladesh
GPP	Guidelines for People's Participation
GPWM	Guidelines for Participatory Water Management
GRC	Grievance Redress Centre
GWT	Ganges Water Treaty
IEC	Important Environmental Components
IEE	Initial Environmental Examination
IMED	Implementation, Monitoring and Evaluation Division
IPM	Integrated Pest Management
ISPAN	Irrigation Support Project for Asia and Near East
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management
IWRMP	Integrated Water Resources Management Plan

JMC	Joint Management Committee
KJDRP	Khulna Jessore Drainage Rehabilitation Project
LLP	Low Lift Pump
LGI	Local Government Institution
MOA	Ministry of Agriculture
MOEF	Ministry of Environment and Forest
MOWR	Ministry of Water Resources
Mt	Metric Ton
NEDECO	Netherlands Engineering Consultants
NGO	Non-Governmental Organisation
NWMP	National Water Management Plan
NWPo	National Water Policy
O&M	Operation and Maintenance
PAP	Project Affected Person
PCU	Project Coordination Unit
PIU	Project Implementation Unit
PRRA	Participatory Rapid Rural Appraisal
PPTA	Project Preparation Technical Assistance
PSC	Project Steering Committee
PWD	Public Works Department
RSDP	Resettlement and Social Development Plan
SEIA	Summary Environmental Impact Assessment
SIEE	Summary Initial Environmental Examination
SMO	Subproject Management Office
SSWRDSP	Small Scale Water Resources Development Sector Project.
STW	Shallow Tube Well
SAIWRPMP	Southwest Area Integrated Water Resources Planning and Management Project
SWMC	Surface Water Modelling Center
UNDP	United Nations Development Program
WARPO	Water Resources Planning Organisation
WHO	World Health Organization
WMO	Water Management Organization
WSSL	Water Sealed Sanitary Latrine

EXECUTIVE SUMMARY

1. The Southwest Area Integrated Water Resources Planning and Management Project (SAIWRPMP) aims at the improvement of the performance of existing flood control and drainage/irrigation (FCD/I) systems, and to enhance and sustain the livelihoods of people living within the existing flood embankment systems. The strategic objective of the project is to achieve sustainable O&M of the project through handing over the water management infrastructure, to the stakeholders for improving economic growth and reducing poverty in a participatory way.

The project contains 11 subprojects¹ namely, Beel Sukunia, Daduria – Kandor Beel, Alfadanga-Boalmari, Chatlar- Fakurhat, Kalidashkhali- Arpara, Horai River, Bamonkhali- Barnali, Purulia-Charbhatpara, Arol Beel and Sonamukhi- Bonmandar. The project also includes developing Integrated Water Resources Management (IWRM) system based on the strategy adopted for the additional sub-region in the Southwest areas of Bangladesh that covers 17 upazilas in six districts of Faridpur, Rajbari, Magura, Jessore, Narail and Gopalganj with a total envisaged coverage of 108,636 ha gross area having 82,274 ha culvable area.

2. The EIA is a legal requirement of the Department of Environment (DOE) under provisions of the Environmental Conservation Act (ECA), 1995 and the Environmental Conservation Rules (ECR), 1997 of Bangladesh. As per ECR, 1997 of DOE it was determined that an EIA needs to be carried out for this project. As per ADB's safeguard policy statement 2009, the project activities fall under Category B for which IEE is required and it was determined that the ToR given for this EIA will fulfill ADB's requirements as well.

This environmental impact assessment (EIA) has been conducted in accordance with the ECR (1997), EIA Guidelines (1997) of the GOB and other relevant national regulations and policies as well as ADB's Safeguard Policy Statement 2009, and as per ToR given by DoE and ADB (Annex A).

3. The project has 11 subprojects that cover a vast area of land in southwestern part of Bangladesh. The project is located in the northern part of southwestern region. The subprojects of SAIWRPMP are:

- i. Beel Sukunia Subproject is located in Faridpur Sadar and Nagarkanda Upazila under Faridpur District;
- ii. Daduria Beel Subproject is located in Boalmari Upazila under Faridpur District;
- iii. Kandor Beel Subproject is located in Boalmari Upazila under Faridpur District;
- iv. Alfadanga-Boalmari Subproject is located in Alfadanga Upazila under Faridpur District;
- v. Chatlar-Fakurhat Subproject is located in Sadarpur and Bhanga Upazila under Faridpur District;

¹ It is expected that 9 sub-projects will be funded by ADB additional financing loan for Southwest Area Integrated Water Resources Planning and Management

- vi. Kalidaskhali-Arpara Subproject is located in Shalikhā Upazila under Magura District;
- vii. Horai River Subproject is located in Rajbari Sadar, Baliakandi and Kalukhali Upazila under Rajbari District;
- viii. Purulia- Charbhatpara Subproject is located in Kashiani Upazila under Gopalganj District;
- ix. Bamonkhali-Barnali Subproject is located in Narail Sadar Upazila under Narail District, and Shalikhā and Magura Sadar Upazila under Magura District;
- x. Arol Beel Subproject is located in Chougacha, Jessore Sadar and Jhikorgacha Upazila under Jessore District;
- xi. Sonamukhi- Bonmandar Subproject is located in Sharsha and Jhikorgacha Upazila under Jessore District;

The entire project requires re-sectioning of 72.8 km embankment and construction of 1.5 km new retired embankment; re-excavation of 344.5 km of khal and 1.04 km of river training work, constructing five (six vent-2, three vent-2, one vent-1) new and rehabilitating 43 regulators; rehabilitating 71 and constructing new 22 inlet-outlets; constructing eight new check and other structures; constructing 13 bridges/ culverts/ WRS; constructing 78 WMO offices and installing 78 tube wells.

4. In Alfadanga-Boalmari subproject 5.00 km long new retired embankment to prevent floods have been proposed as the original embankment eroded due to bank erosion of Modhumoti River. In this subproject, three alternatives were considered before the decision was taken for construction of 5.00 km retired embankment along the bank of Modhumoti River. Considering different social and environmental issues including disturbance of hydraulic phenomena, river erosion, cost of land acquisition and settlement, costs of earth works, etc., Alternative-2 were considered.

But with the passage of time, when investigation was done during 2012, the Modhumoti River was found very active causing land erosion. But very recently, during March 2015, it is seen that the loop cut as conceived, to divert flow, and stop bank erosion near Gridha, has been naturally cut and the flow of the river is passing through the new loop and the active river near Giridha has become dead now, and acting as Baor, with no flow or erosion. As such, the eroded embankment can be retired very close to the present river bank having a much shorter length and consequently with much less involvement of land acquisition.

Since the river is now having no current flow and almost dead, the embankment that has been already eroded can be replaced by an embankment very close to the present river bank line, instead of normal 500m set back distance, for a very eroding bank, shorter set back distance close to the present river bank will be sufficient for its existence. From mouza maps and field investigation, it is found that now only 1.50 km retired, plus re-sectioning existing low height embankment of 0.85 km at the upstream end and about 0.70 km at the downstream side will be required and the subproject may be implemented accordingly.

5. Potential impacts on various environmental components/parameters due to different project activities during design/pre-construction, construction, and operation stages have been identified through literature review, baseline environmental survey and public consultation. The Rapid Environmental Assessment (REA) checklist illustrated in ADB environmental assessment guidelines (2003) was filled up during field visit to identify potential impacts on major environmental components/parameters. The anticipated environmental impacts due to implementation of the proposed project during different stages of the project were studied in detail and all significant impacts were identified and mitigation measures were recommended for the project development team to adopt.

Based on the detailed evaluation of the likely impacts on various environmental parameters, an Environmental Management Plan (EMP) has been prepared. The Project Management Unit of BWDB along with the assistance of the Environment Specialist will be responsible for the implementation of the EMP. The total EMP budget for the project is estimated as BDT 47.336 million.

6. The SAIWRPMP aims at the improvement of the performance of existing flood control and drainage/ irrigation (FCD/I) systems and to enhance and sustain the livelihoods of rural people within the existing flood embankment systems having low performance. With the envisaged socio-economic development and the provision of safe water supply, the overall standard of living among the people in the project area will increase. Poverty will be reduced due to the job opportunities created, especially for the landless and the destitute women can benefit when the WMOs commence operating. The agricultural production is expected to increase due to the implementation of water resources infrastructure, improved drainage and on-farm development. Incomes from agriculture will rise, having a spin-off on other sectors. Although the natural capture fish habitats may be reduced the rehabilitation of ponds and the promotion of rice-fish culture will stimulate fish production. The specific management actions recommended to conserve remaining natural fish habitats will help conserve the remaining habitat in more organized manner.

People's consultations carried out demonstrated that rehabilitating the existing FCD/I structures while addressing internal local water management problems, applying the concept of coordinated management of local water infrastructures through a participatory approach, is the best alternative that can generate maximum positive impacts. While local stakeholders have diverse interests in terms of the structure operation, these can be effectively coordinated to bring about optimal benefits with participatory water management and its supporting systems.

In conclusion, the Project will have overall positive benefits by preserving and improving the flood protection, drainage control, and irrigation benefits provided by the existing facilities, and installment of additional small structures to address internal water management problems that have not been addressed. Its successful implementation will also serve as a model to demonstrate the process of achieving substantial under-achieved development potentials of existing FCD/I systems while sustaining their benefits through effective stakeholder participation.

7. The project mainly focuses on agricultural & fisheries demands but there are several additional uses and users of water (natural environment, domestic consumption, etc.) that need to be considered in the overall water management process.

To attain the overall objective of the project it is recommended that

- I. The project needs to make sure that the WMO will take into account the potential pressure and weakness of the fishermen community when establishing the WMO institutional structure.
- II. WMOs eventually assess the need of specific area(s) of the beel/flood plain which has to be maintained and managed as such are the only source(s) of water for the native fishes (capture fisheries) and environmental needs (ecological and hydrological).
- III. The project allocate resources to WMOs to scientifically improve the condition of these remaining flood plain areas as sanctuaries for the fish and wildlife in the area where it is practically possible through proper management and maintenance practices (fish friendly regulators, operation of gates, deepening of part of the flood plains, etc.).
- IV. Culture fisheries need to be promoted to compensate loss of capture fisheries activities that will result due to rapid drainage of flood water and khals. The project will provide detail specific structural and management recommendations needed to improve khal capture fisheries.
- V. Establishment and support for the operation of WMOs that will function under the bigger WMA.
- VI. The subprojects are recommended for implementation on the basis of Feasibility Study findings and recommendations.

1 INTRODUCTION

1.1 Introduction and Background

1.1.1 Introduction

The Southwest Area Integrated Water Resources Planning and Management Project (SAIWRPMP) aim at the improvement of the performance of existing flood control and drainage/ irrigation (FCD/I) systems and to enhance and sustain the livelihoods of rural people within the existing flood embankment systems having low performance, through (i) preparing participatory integrated water management plans (IWMPs) for the selected systems; (ii) delivering improved water management infrastructure and support services for agriculture, fishery development and gender & livelihood enhancement support activities; and (iii) strengthening institutions to operate these functions while delivering intended benefits with self-sustaining operation and maintenance (O&M) mechanisms. The overall objective is to achieve sustainable O&M of the project through handing over the water management infrastructure to the stakeholders for better management of those structures and thereby improve the economic growth and reduce poverty in the area.

The project, SAIWRPMP, contains eleven subprojects namely, Beel Sukunia, Daduria Beel, Kandor Beel, Alfadanga-Boalmari, Chatlar-Fakurhat, Kalidashkhali-Arpara, Horai River, Bamonkhali-Barnali, Purulia-Charbhatpara, Arol Beel and Sonamukhi-Bonmandar and includes the preparation of Integrated Water Resources Management (IWRM) based on the strategy for the northern sub-region of the Southwest areas of Bangladesh covering 17 upazila in six districts as Faridpur, Rajbari, Magura, Jessore, Narail and Gopalganj.

The project will take a process type approach of implementation with a total envisaged coverage of 108,636 ha of gross area (82,274 ha net cultivable area) by selecting rehabilitation schemes that do not have significant adverse environmental impacts. To support the process, feasibility study of seven subprojects were conducted presenting the range of development work in the proposed project. Beyond these seven subprojects, further four subprojects, two straight forward projects, namely, Bamonkhali-Barnali and Purulia-Charbhatpara, that involved simple rehabilitation works and another two drainage subprojects, namely Arol Beel & Sonamukhi-Bonmandar, that also involves simple rehabilitation works, and low renovation cost, have been selected by Asian Development Bank (ADB) for their implementation without undertaking feasibility study. This report presents the results of the environmental impact assessment (EIA) of the seven subprojects studied as a part of the project's feasibility study, that comprised initial environmental studies and the other four subprojects for which feasibility study was not conducted. The EIA and the environmental management plan (EMP) demonstrate the way environmental issues will be managed for all eleven subprojects.

1.1.2 Background

The project includes the preparation of IWRM based on the strategy for the northern sub-region of the Southwest areas of Bangladesh, including Faridpur, Narail, Magura, Rajbari, and Jessore districts prepared for the SAIWRPMP. On the basis of the sub-regional strategy, the consultants undertook

preparation of the detailed IWMP and feasibility studies for the seven selected FCD/I schemes, presented in the national workshop held on 02 October, 2013 as a draft in six reports (two subprojects-Daduria & Kandor beels- being too small, combined as one report) that presented IWRM, and other aspects following the Phase- I findings. Based on the comments received, the feasibility study reports of the seven subprojects were finalized. The total gross area of seven subprojects are 63,058 ha (net 49,425 ha). These seven FCD/I schemes are:

- i) Beel Sukunia Subproject
- ii) Daduria Beel Subproject
- iii) Kandor Beel Subproject
- iv) Alfadanga-Boalmari Subproject
- v) Chatlar-Fakurhat Subproject
- vi) Kalidaskhali-Arpara Subproject
- vii) Horai River Subproject

11 subprojects covering the above seven subprojects and additional four subprojects (i. Purulia-Charbhatpara Subproject, ii. Bamonkhali-Barnali Subproject, iii. Arol Beel Subproject and iv. Sonamukhi-Bonmandar Subproject) covering a gross area of 45,578 ha (Net 32,849 ha cultivable arera) will involve a simple intervention like repair work of some structures and re-excavation of khals located in southwest area have been planned to be implemented under the proposed project.

The construction of new embankment and repair/renovation of existing embankments, as well as construction of new structures/regulators and repair/renovation of existing structures/regulators, have its associated environmental impacts that require due consideration during project design. This EIA presents identification of the likely environmental impacts of both negative and positive due to the project activities and mitigation measures to avoid, minimize, or compensate negative impacts; also enhance positive impacts.

This EIA has been prepared following the guidelines of the Government of Bangladesh (GOB) and the ADB. Under the GOB requirements, based on the location and impact on the environment as illustrated in the Environmental Conservation Rules (ECR) 1997, the proposed SAIWRPMP falls under 'Red Category' project (as one of the eleven subprojects involves a large scale flood control, drainage/irrigation including construction of a new embankment of 1.5 kilometre length) which requires EIA. Based on the location and nature of impacts, and considering ADB's Rapid Environmental Assessment (REA) Checklist of Irrigation, Fisheries and Forestry for Environmental Classification the proposed project can be categorized under Category B of ADB's environmental classification system that requires initial environmental examination (IEE) to meet requirements under ADB's Safeguard Policy Statement 2009.

1.2 Extent of EIA

This EIA study has been carried out during the period of the techno-economic feasibility study. The project influence area or the impact zone has been defined as area within 500m boundary surrounding the project area. However, the project influencing area has been extended to 5 km wide area from the project boundary to analyse the land use and identify environmental sensitive areas that may be affected due to secondary impacts. Geographical Information System (GIS) was used based on recent satellite imageries of the project areas for above purposes (Map showing different subproject areas have placed in Figure 1.1). The impacts on ecologically sensitive areas if any (e.g. national parks, wildlife sanctuaries, biosphere reserve, and protected places) within 5 km of the project areas have also been assessed.



Figure 1.1: Project Location Map

1.3 Objectives of EIA

The main objective of undertaking the EIA of SAIWRPMP is to provide baseline data/information, to determine the likely potential environmental impacts (beneficial and adverse) associated with the project activities and to provide mitigation measures prior to implementation of the project. The overall objectives of the EIA are to:

- ❖ Assess the impacts on the physical environment (e.g. geology and topology, geomorphology, land use, soils, climate, hydrology, etc.), ecological environment (e.g. flora, fauna, environmental protected area), environmental quality (e.g. soil, dredged material, surface and ground water), environmental risks (e.g. climate change, flooding, cyclone, seismicity, etc.) and socio-economic environment (e.g. population, settlement and housing, traffic and transport, public utilities including water supply, sanitation and solid waste, economy and employment, cultural, archaeological and historical sites, etc.) related with the project activities.
- ❖ Engage stakeholders through public consultation regarding benefits, impacts, alternatives, mitigation measures and environmental management plans;
- ❖ Provide a quantitative or qualitative assessment of magnitude of each impact and prepare EMP to eliminate or reduce adverse environmental impacts ; and
- ❖ Obtain environmental clearance from Department of Environment (DOE).

1.4 Scope of Works

Following key tasks have been accomplished to meet the objective of the EIA as illustrated in the Terms of Reference:

- ❖ Collection and review of all relevant documents;
- ❖ Collection and analysis of environmental data from secondary and primary sources (e.g. field survey);
- ❖ Public consultation with the relevant stakeholders;
- ❖ Establishment of baseline environmental condition;
- ❖ Identification and assessment of the potential environmental impacts (both positive and negative) along with mitigation measures;
- ❖ Climate change risk assessment
- ❖ Preparation of EMP (such as formulation of mitigation and monitoring plans);
- ❖ Institutional arrangement and capacity building; and
- ❖ Grievance Redress Mechanism

1.5 Approach and Methodology

1.5.1 Approach

The EIA of SAIWRPMP has been conducted in accordance with the ECR (1997), EIA Guidelines (1997) of the GOB and other relevant rules, regulations and policies as well as ADB's Safeguard Policy Statement 2009 and the Environment Safeguards: A good Practice Sourcebook Dec 2012. Primary and secondary data and information have been used in the EIA of the project. Discussions were held with the relevant stakeholders including directly affected people, government officials, community representatives, and a wide range of potential beneficiaries of the project. The main

purpose of this approach was to obtain a fair impression of the people of the project and its environmental impacts. The list of stakeholders' consulted is in Annex H.

1.5.2 Methodology

The following methodology was adopted for carrying out the EIA of the proposed project:

(I) Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study and to agree on the approach and methodology including the scope and timeline for the study.

(II) Data Collection Planning

Subsequent to the concept clarification and understanding obtained, a detailed data acquisition plan was developed for the internal use of the EIA Consulting Team. The plan included identification of specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and other supporting needs for the execution of the data acquisition plan.

(III) Data Collection

The following data/information was collected.

Secondary data were collected from different concerned government departments, books, reports and published materials to establish baseline profile for physical, ecological and socioeconomic environmental conditions.

Primary data were collected through baseline environmental survey and public consultation during 04 October 2014 to 03 January 2015 by 12 environmental field surveyors. The Environmental Specialist guided the survey team by visiting the field frequently during the survey. Following activities were performed for data/information collection:

- Site Reconnaissance
- Analysis of Maps and Plans
- Literature Review
- Desk Research
- Public Consultations
- Field Observations and Studies

Moreover, environmental quality analyses of soil, bed material, surface water and ground water with selected parameters were conducted in the Soil, Water and Environment Laboratory of Dhaka University.

(a) Physical Environment

Information was collected on the existing physical environment, particularly as related to climate, topography and soil, geology and seismology, hydrology and drainage, water quality, air quality and noise.

Climate

Monthly maximum and minimum temperature, rainfall, humidity and wind speed data recorded in the local weather station have been collected from the Bangladesh Meteorological Department in order to depict the climatic condition of the project areas.

Geology, Topography and Soils

Data related to geology, topography and soil were collected to establish the baseline of the project area and further to find out the impacts of the project during the preconstruction, construction and operational phases.

Hydrology and Drainage

Data related to hydrology and drainage was collected to identify the elements of the hydrological cycle that are likely to have impacts on the project and the possible impacts that the project could have on the hydrological regime. Field assessments included a determination and verification of all the existing inflows into the drain, assessment of drainage issues, interviews with local community members, and discussions with stakeholders.

(b) Ecological Environment

Since the project included several beel areas, the assessment of flora and fauna, forest and wetlands, wildlife, endangered species, species diversity, fish and other aquatic animals was undertaken. The status of the flora and fauna of the project area was determined during baseline environmental survey and relevant literatures were reviewed to assess the ecological status (e.g. habitat, existence, scientific name etc.) of the floral and faunal species. Both terrestrial and aquatic habitats were taken in to consideration.

Flora

During the baseline environmental survey the diversity of floral species were identified. Following the survey work, a list of floral species has been prepared (Table D.1 of Annex D).

Fauna

Information on fauna was gathered through the consultation with local people and consultation with the Forest Department and also through review of literature (Table D.2 of Annex D).

(c) Environment Quality

Air and Noise Quality

It was expected that no significant change of air and noise qualities will happen due to the project and therefore no air and noise quality analyses were conducted. Further, baseline information will be collected in the beginning of project implementation at specific sites as per environmental management and monitoring plan.

Ground /Drinking Water Quality

Sampling of ground water has been performed by DevConsultants' environment team and analysis of ground/drinking water has been carried in the laboratory of Department of Soil, Water and Environment of University of Dhaka for ten parameters (pH, Total Hardness as CaCO₃, Chloride as Cl⁻, Nitrate as NO₃, Sulphates as SO₄, Fluorides as F⁻, Salinity, Mn, Fe and As).

Surface Water Quality

Sampling of surface water has been performed by DevConsultants' environment team and analysis of surface water has been carried in the laboratory of Soil, Water and Environment of University of Dhaka for seven parameters (pH, EC, DO, BOD, TDS, TSS and Salinity).

Soil and Bed Material Quality

Samplings of soil and bed material were conducted by the DevConsultants' environment team and analysis of samples was done at the laboratory of the Department of Soil, Water and Environment of University of Dhaka. For soil quality analysis six parameters (pH, Texture, TOC, N, P and K) were analysed. For bed material five parameters (Zn, Cu, Pb, Cd and As) were analysed.

(d) Environmental Risks

The issue of climate change as well as occurrences of flood, cyclone and seismicity have been considered as environmental risks.

(e) Socio- Economic Environment

The Consultants utilized a combination of desk research, field investigations, census data, structured interviews, maps, reports to generate the data required for description of the existing social environment and assessment of the potential impacts due to the project. Data was collected on the following aspects given below:

- ❖ Population: Demographic Profile
- ❖ Settlement and housing
- ❖ Traffic and transport
- ❖ Public Utilities: Water supply, sanitation and solid waste disposal
- ❖ Agriculture
- ❖ Fisheries
- ❖ Cultural, archaeological and historical sites

Public Consultations

Public consultation is an important component of the EIA preparation activities. Local knowledge about the ecosystem and issues associated with the implementation of SAIWRPMP were carefully recorded and used in the impact assessment and developing the mitigation plan. Formal institutional level public consultation, in tandem with opportunistic informal ones involving local villagers and people whose livelihood depends on the project, were carried out.

1.6 Contents of the Report

This EIA report contains eleven chapters which have been formulated as per the requirements illustrated in the guidelines provided by DoE and the ADB's Safeguard Policy Statement, 2009. In this report, the consultants have formulated mitigation measures for activities that lead to negative impacts on the environment. This report consists of the following chapters:

Chapter 1	: Introduction
Chapter 2	: Législation, Régulations and Policy Considérations
Chapter 3	: Description of the Project
Chapter 4	: Analysis of Alternatives
Chapter 5	: Description of the Baseline Environmental Conditions
Chapter 6	: Socio-Economic Environment
Chapter 7	: Identification, Prediction and Evaluation of Potential Environmental Impacts and Mitigation Measures
Chapter 8	: Public Consultations
Chapter 9	: Environmental Management Plan
Chapter 10	: Grievance Redress Mechanism
Chapter 11	: Conclusions and Recommendations

1.7 Limitation

The Project will be implemented by selecting rehabilitation schemes that do not have significant adverse environmental impacts. To support the process, feasibility study of seven numbers subprojects were conducted presenting the range of development work in the proposed Project. Beyond the seven subprojects, further four subprojects namely, Bamonkhali-Barnali and Purulia-Charbhatpara, that involved simple rehabilitation works and another two drainage subprojects, namely Arol Beel & Sonamukhi-Bonmandar that also involve simple and low renovation cost, have been selected for their implementation without the feasibility study.

2 LEGISLATIVE, REGULATION AND POLICY CONSIDERATION

2.1 Background

The proposed SAIWRPMP will be implemented in compliance with the applicable environmental laws and regulations of Bangladesh as well as guidelines given by Asian Development Bank (ADB). Bangladesh has an environmental legal framework that is conducive to both environmental protection and natural resources conservation. This environmental legal framework applies to the SAIWRPMP. In addition, there are several laws and regulations related to environmental issues in Bangladesh. Many of these are cross-sectoral and partially related to environmental issues. This section presents an overview of the major Bangladesh environmental policies, laws and regulations that are relevant and may apply to activities supported by the project, institutional arrangement at national and sub-national level, and ADB safeguard policies (including ADB's Safeguard Policy Statement 2009) and any project relevant international environmental agreements the country is party to.

2.2 National Environmental Policies, Laws and Guidelines

2.2.1 National Environmental Policy, 1992

Bangladesh has adopted the National Environmental Policy (NEP) in 1992 aimed at sustainable development. The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are as follows:

- ❖ Maintaining of the ecological balance for ensuring sustainable development;
- ❖ Protection of the country against natural disasters;
- ❖ Identifying and controlling activities which are polluting and destroying the environment;
- ❖ Ensuring environment-friendly development in all sectors;
- ❖ Promoting sustainable and sound management of natural resources; and
- ❖ Active collaboration with international initiatives related to the environment.

2.2.2 National Environmental Management Action Plan, 1995

The National Environmental Management Action Plan (NEMAP) builds on the NEP and was developed to address specific issues and management requirements during the period 1995-2005. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

- ❖ To identify key environmental issues affecting Bangladesh;
- ❖ To identify actions to halt or reduce the rate of environmental degradation;
- ❖ To improve management of the natural environment;
- ❖ To conserve and protect habitats and bio-diversity;
- ❖ To promote sustainable development; and
- ❖ To improve the quality of life.

2.2.3 Environmental Conservation Act, 1995 and Amendments

The Environmental Conservation Act (ECA), 1995

The ECA, 1995 authorizes the DOE to undertake any activity to conserve and enhance the quality of environment and to control, prevent and mitigate pollution. The DOE is the regulatory body and enforcement agency of all environmental related activities. The act includes amongst others the following main provisions:

- ❖ Declaration of Ecologically Critical Areas;
- ❖ Procedure for obtaining Environmental Clearance Certificate (ECC);
- ❖ Regulation with respect to vehicles emitting smoke harmful for the environment;
- ❖ Environmental regulations for development activities;
- ❖ Standards for quality of air, water, noise, and soils (river bed materials) for different areas and for different purposes;
- ❖ Acceptable limits for discharging and emitting waste; and
- ❖ Formulation of environmental guidelines to control and mitigate environmental pollution, conservation and improvement of environment.

The Environmental Conservation Act, 1995 (Amendment 2000)

Environment Conservation Act of Bangladesh Amended in 2000 focuses on ascertaining responsibility for compensation in cases of damage to ecosystems, increased provision of preventive measures both for fines and imprisonment and the authority to take cognizance of offences.

The Environmental Conservation Act, 1995 (Amendment 2002)

- ❖ The 2002 Amendment of the ECA elaborates on the following parts of the Act:
- ❖ Restrictions on polluting automobiles;
- ❖ Restrictions on the sale, production of environmentally harmful items like polythene bags;
- ❖ Assistance from law enforcement agencies for environmental actions;
- ❖ Break up of punitive measures; and
- ❖ Authority to try environmental cases.

The Environmental Conservation Act, 1995, (Amendment 2010)

This amendment of the act introduces new rules and restriction on:

- ❖ No individual or institution (Gov. or Semi Gov., / Non Gov. / Self Governing) can cut any Hill and Hillock. In case of national interest; it can be done after getting clearance from respective department
- ❖ Owner of the ship breaking yard will be bound to ensure proper management of their hazardous wastes to prevent environmental pollution and Health Risk
- ❖ No demarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and
- ❖ Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards.

2.2.4 The Environmental Conservation Rules, 1997 and Amendments

The Environment Conservation Rules (ECR), 1997 provide a first set of rules under the ECA, 1995. These provide amongst others standards and guidelines for:

- ❖ Categorization of industries and development projects, including roads and bridges on the basis of actual and anticipated pollution load;

- ❖ Requirement for undertaking initial environmental examination (IEE) and EIA, as well as formulating an EMP according to categories of industries/development projects/activities;
- ❖ Procedure for obtaining ECC; and
- ❖ Environmental quality standards for air, surface water, drinking water, industrial effluents, emissions, noise and vehicular exhausts.

2.2.5 Other Relevant National Policies

Considerable numbers of national policy documents have been prepared during recent years and these have been accepted by the GOB. These policy initiatives, strategies and plans emphasize the need for conservation of the environment and natural resources in order to achieve sustainable development. A summary of the key relevant policy documents prepared is mentioned in Table 2.1.

Table 2.1: Relevant Key Policies

Policy	Brief Description	Responsible Agency
The National Water Policy (1999)	<ul style="list-style-type: none"> ▪ Protection and restoration of water resources; ▪ Protection of water quality including strengthening regulations concerning agro-chemicals and industrial effluents; ▪ Sanitation and potable water; 	Ministry of Water Resources(MOWR)
National Land use Policy (2001)	<p>The policy deals with land uses for several purposes including agriculture, housing, forestry, industrialization, railways and roads. The plan identifies land use constraints in these sectors.</p> <p>The salient features of the policy objectives relevant to the proposed project are as follows:</p> <ul style="list-style-type: none"> • To prevent the current tendency of gradual and consistent decrease of cultivable land for the production of food to meet the demand of expanding population; • To ensure that land use is in harmony with natural environment; • To use land resources in the best possible way and to play supplementary role in controlling the consistent increase in the number of landless people and contribute towards the elimination of poverty and the increase of employment; • To protect natural forest areas, prevent river erosion and destruction of hills; • To prevent land pollution; and • To ensure the minimal use of land for construction of both government and nongovernment buildings. 	Ministry of Land (MOL)
National Fisheries Policy, 1998	Preservation and management of inland open water fisheries	Ministry of Fisheries & Livestock (MOFL)
National Forest Policy (1994) and Forest Sector Review (2005)	<ul style="list-style-type: none"> ▪ Afforestation of 20% land; ▪ Bio-diversity of the existing degraded forests; ▪ Strengthening of agricultural sector; ▪ Control of global warming, desertification, control of trade in wild birds and animals; ▪ Prevention illegal occupation of the forestlands, tree felling and hunting of wild animals. 	Ministry of Environment & Forests (MOEF)

Policy	Brief Description	Responsible Agency
National Biodiversity Strategy and Action Plan (2004); Bangladesh Biological Diversity Act 2012	<ul style="list-style-type: none"> ▪ Conserve, and restore the biodiversity of the country; ▪ Maintain and improve environmental stability of ecosystems; ▪ Ensure preservation of the unique biological heritage of the nation for the benefit of the present and future generations; ▪ Guarantee safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country; ▪ Stop introduction of invasive alien species, genetically modified organisms and living modified organisms. 	MOEF
Bangladesh Climate Change Strategy and Action Plan (2009)	Establishment of six strategic pillars for action, including: <ol style="list-style-type: none"> (1) food security, social protection and health, (2) disaster management, (3) protective infrastructure, (4) research and knowledge management, (5) decreased carbon development, and (6) Capacity building and institutional strengthening. 	MOEF

2.2.6 Other Relevant National Act, Rules, Laws and Ordinances

Table 2.2 presents an outline of the other national legal instruments that will have relevance to the project with respect to the social and environment considerations. The EIA is prepared in compliance with these national policies.

Table 2.2: Other Relevant National Act, Rules, Laws and Ordinances

Act/Rule/Law/Ordinance	Responsible Agency-Ministry/Authority	Key Features-Potential Applicability
Environment Court Act, 2000 and subsequent amendments in 2002, 2010	MOEF	The aim and objective of the Act is to materialize the Environmental Conservation Act, 1995 through judicial activities. This Act established Environmental Courts (one or more in every division), set the jurisdiction of the courts, and outlined the procedure of activities and power of the courts, right of entry for judicial inspection and for appeal as well as the constitution of Appeal Court.
Acquisition and Requisition of Immobile Property Ordinance, 1982	Ministry of Land	Power to make rules conferred upon by the Section 46 of the Ordinance
Acquisition of Immovable Property Rules, 1982	Ministry of Land	Procedural detailed required for acquisition of immovable property <ul style="list-style-type: none"> ❖ Proceedings for acquisition ❖ Notes under section 3, 6 and 7 ❖ Declaration of acquisition and possession ❖ Declaration of abatement and revocation of proceedings ❖ Transfer of acquired land ❖ Assessment of compensation ❖ Utilized acquired property

Act/Rule/Law/ Ordinance	Responsible Agency- Ministry/Authority	Key Features-Potential Applicability
Public Procurement Rule (PPR), 2008	Ministry of Public Works (MOPW)	This rule shall apply to the Procurement of Goods, Works or Services by any government, semi-government or any statutory body established under any law. The rule includes the adequate measure regarding the "Safety, Security and Protection of the Environment" in the construction works. This clause includes mainly, the contractor shall take all reasonable steps to (i) safeguard the health and safety of all workers working on the Site and (ii) protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others.
The Brick Burning (Control) Act, 1989 The Brick Burning (Control) Amendment Act, 1992, 2001 and 2013	MOEF	<ul style="list-style-type: none"> ❖ Control of brick burning; ❖ Requires a license from the MOEF for operation; ❖ Restricts brick burning with fuel wood.
Bangladesh Labour Act, 2006	MOL	This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions. In the chapter VI of this law safety precaution regarding explosive or inflammable dust/ gas, protection of eyes, protection against fire, works with cranes and other lifting machinery, lifting of excessive weights are described. And in the Chapter VIII provision of safety measure like appliances of first aid, maintenance of safety record book, rooms for children, housing facilities, medical care, group insurance etc. are illustrated.
Bangladesh Wildlife (Conservation and Security) Act, 2012	MOEF	<p>This Act was promulgated for conservation and security of biodiversity, forest and wildlife of the country. For the purpose the government may by notification in the official gazette a specific area or some areas as protected area.</p> <p>According to Bangladesh Wildlife (Conservation and Security) Act, 2012 protected area means all sanctuaries, national parks, community conservation areas, safari parks, eco-parks, botanical gardens notified under the provisions of sections 13, 17, 18 and 19 under Chapter IV and special biodiversity conservation area established under the provisions of section 22 under Chapter V and traditional heritage and kunjaban are declared under section 23.</p>
The Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry)	FD, MOEF	<ul style="list-style-type: none"> ❖ Declare any forests land or wasteland as protected forests; ❖ May stop public or private way or watercourse in the interest of preservation of the forest; ❖ Declare a reserved forest area as village forests; and ❖ Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission.
Wetland Protection Act 2000	MOWR	<ul style="list-style-type: none"> ❖ Advocates protection against degradation and resuscitation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc. affected by man-made interventions or other

Act/Rule/Law/ Ordinance	Responsible Agency- Ministry/Authority	Key Features-Potential Applicability
		<p>causes;</p> <ul style="list-style-type: none"> ❖ Prevents the filling of publicly-owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment; and ❖ Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.

2.2.7 EIA Guidelines for Industry, DOE, 1997

Based on the various activities of the industrial projects and on the requirements of the ECR, 1997, the EIA guidelines for Industry has been prepared by the DOE. This EIA include but not limited to the following items

- ❖ Introduction to the EIA in Bangladesh;
- ❖ Criteria for location of industrial plants;
- ❖ Steps involved in conducting EIA; and
- ❖ Review of the EIA report.

2.3 Categories of Projects

Under the ECR of the DOE, Bangladesh (1997), a classification system was established for development projects and industries on the basis of the location, the size and the severity of potential pollution. There are four categories of projects: green, orange A, orange B and Red with respectively no, minor, medium and severe environmental impacts. According to the guidelines illustrated in the ECR, the SAIWRPMP falls under the red category of projects as the proposed project involves construction of a river training embankment and several other project activities that directly impact on the existing environment. Therefore, for this project, it was decided that it is necessary to prepare an EIA following prescribed format and submit to the DOE for getting the ECC of the project. The approval of the EIA and EMP is required before submitting an application for an ECC.

Under the ECA (1995) and ECR (1997), the project will be required to obtain a site clearance as well as an environmental clearance. The procedure for obtaining environmental clearance is given in Figure 2.1.

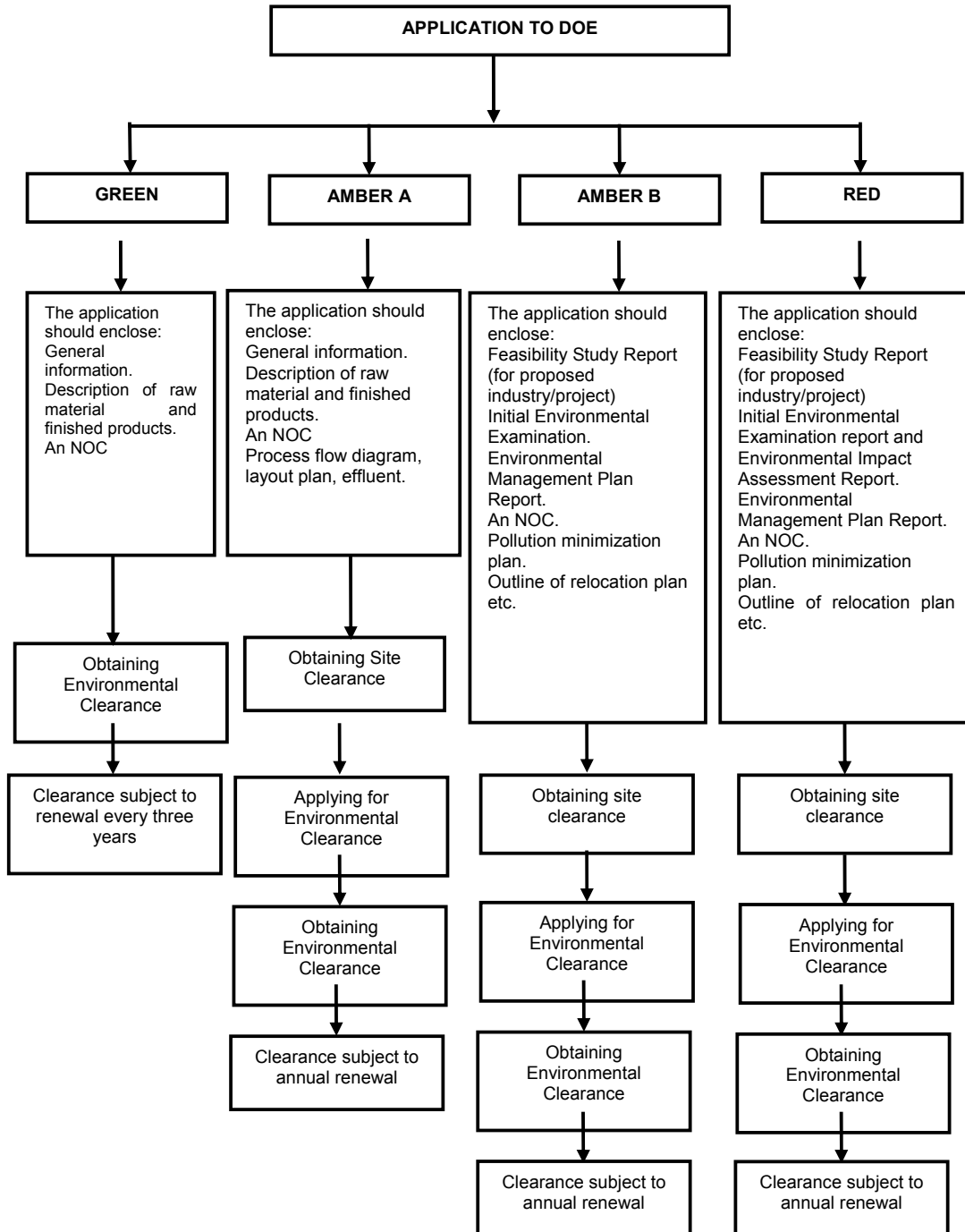


Figure 2.1: Environmental Clearance Procedure

2.4 International Treaties

Bangladesh has signed many international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversity conservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GOB is shown in Table 2.3.

Table 2.3: Relevant International Treaties, Conventions and Protocols signed by Bangladesh

Treaty or Convention	Year	Brief description	Responsible Agency
Protection of birds (Paris)	1950	Protection of birds in wild state	DOE/DOF
Conservation of wetland habitat (Ramsar, Iran)	1971	Conservation and proper use of wetlands and their resources	DOE/DOF
Occupational hazards due to air pollution, noise & vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	Ministry of Health & Family Welfare (MOHFW)
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MOHFW
Occupational health services (Geneva)	1985	To promote a safe and healthy working environment	MOHFW
International convention on climate changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	DOE/MOEF

2.5 Asian Development Bank Policies

According to ADB Safeguard Policy Statement (2009) and Operational Manual F1 (2010), the Project is classified as category “B” and therefore an EA is required for approval of the Project. The process of determining a project’s environment category involved preparation of a Rapid Environmental Assessment (REA). REA requires the completion of the environmental categorization form prior to the project initiation. REA uses sector-specific screening checklist, taking into account the type, size, and location of the proposed project; sensitivity and vulnerability of environmental resources in project area; and the potential for the project to cause significant adverse environmental impacts. A project is classified as one of the four environmental categories (A, B, C, or FI) based on the most environmentally sensitive component. Categories are as follows:

Category A: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA, including an EMP, is required.

Category B: A proposed project is classified as category B, if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

Category C: A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

Category FI: A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary.

According to ADB guidelines, this SAIWRPMP falls under Category B and therefore IEE is required for this project.

2.6 National Standards

At present there are environmental standards in operation in Bangladesh, promulgated under the ECR of 1997. There are standards prescribed for varying water sources; ambient air; noise; odour; industrial effluent and emission discharges; and vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. The Bangladesh standards for ambient air, noise, odour, sewage, industrial effluent and emission are furnished in Annex J.

2.7 Legal and Regulatory Provisions linked to the Project and its Activities

The legal and regulatory provisions linked or related to the project and its activities are being presented in Table 2.11.

Table 2.4: The legal and regulatory provisions linked or related to the project and its activities

Name of the Environmental law/regulation	Relevance to the project Direct/indirect/none	Institution or stakeholder organization approval should be sort.
The Environment Conservation Act, 1995	Direct	Ministry of Environment and Forests/ DOE
The National Water Policy, 1999	Indirect	Ministry of Water Resources/ BWDB
The National Land Use Policy, 2001	Indirect	Ministry of Land
The National Fisheries Policy, 1998	Indirect	Ministry of Fisheries & Livestock (MOFL)
National Forest Policy (1994) and Forest Sector Review (2005)	Indirect	Ministry of Environment and Forests/ BFD

Note→Relevance to the project: 'Direct' is mentioned where formal approval is required

3 DESCRIPTION OF THE PROJECT

3.1 The Project and It's Location

The SAIWRPMP intends to improve the water management of the subproject areas by improving the infrastructure and their management by establishment and enhancement of the capacity and capabilities of water management organizations in the area. The project has 11 subprojects that cover a vast area of land in southwestern part of Bangladesh. The total area under this project is 108,636 ha having net cultivated area of 82,274 ha (Table 3.1) and is located in the northern part of southwestern region. The project located in 17 upazila of six districts of Faridpur, Rajbari, Magura, Jessore, Narail and Gopalganj. The project location map showing 11 subprojects with priority details is shown in Figure 1.1.

Table 3.1: Areas of different Subprojects

Particulars	Name of Subprojects										Total
	Beel Sukunia	Daduria & Kandor Beel	Alfadanga - Boalmari	Chatlar - Fakurhat	Kalidaskhali-Arpara	Horai River	Purulia Char Bhatpara	Bamankhali-Barnali	Arol Beel	Sonamukhi Bonmandar	
	SP-1	SP-2&3	SP-4	SP-5	SP-6	SP-7	SP-8	SP-9	SP-10	SP-11	
Gross area (ha)	9,681	3,301	8,011	10,268	13,197	18,600	4,156	16,782	15,570	9,070	108,636
Net cultivated area (ha)	7933	2388	6632	8092	10616	13764	2871	12677	11086	6215	82,274
Net cultivated area (%)	81.9	72.4	82.8	78.8	80.4	74.0	69.1	75.5	71.2	68.5	75.7

The subprojects of SAIWRPMP follow (Details are placed in Annex B):

- I. Beel-Sukunia Subproject is located in Faridpur Sadar and Nagarkanda Upazila under Faridpur District;
- II. Daduria-Beel Subproject is located in Boalmari Upazila under Faridpur District;
- III. Kandor-Beel Subproject is located in Boalmari Upazila under Faridpur District;
- IV. Alfadanga-Boalmari Subproject is located in Alfadanga Upazila under Faridpur District;
- V. Chatlar-Fakurhat Subproject is located in Sadarpur and Bhanga Upazila under Faridpur District;
- VI. Kalidaskhali-Arpara Subproject is located in Shalikhha Upazila under Magura District;
- VII. Horai River Subproject is located in Rajbari Sadar, Baliakandi and Kalukhali Upazila under Rajbari District;
- VIII. Purulia-Charbhatpara Subproject is located in Kashiani Upazila under Gopalganj District;
- IX. Bamankhali-Barnali Subproject is located in Narail Sadar Upazila under Narail District, and Shalikhha and Magura Sadar Upazila under Magura District;
- X. Arol-Beel is located in Chougacha, Jessore Sadar and Jhikorgacha Upazila under Jessore District;
- XI. Sonamukhi-Bonmandar Subproject is located in Sharsha and Jhikorgacha Upazila under Jessore District;

The project plans to improve integrated water management capabilities and capacities of the stakeholders. Before the capacity development starts the project will first improve the drainage and flood control infrastructure in the area.

The proposed interventions to achieve the stated objective of the project can be grouped into two categories

1. Development or repair of infrastructure that includes excavation of rivers and khals, embankment resectioning, improve control structures and build needed structural facilities to support WMO functions.
2. Establishment of Water Management organizations, develop their capacities and transfer of operation and maintenance responsibilities to those organizations.

The project is expected to meet the demands from farmers enabling them to cultivate the land. The project will support the establishment and capacity development of the WMOs to operate and take over the overall management of overall activities affecting their livelihood. The EIA team agrees that this approach based on the lessons learnt from the previous exercises and also from elsewhere in the world is a more effective way to manage water resources. Therefore overall improvement to the livelihood and their living environment (health and sanitation) can be expected due to the project interventions.

The EIA study notes, that the project for obvious reasons focuses on agricultural demand but that there are several additional uses and users of water that need to be considered in the overall water management process. These water demands shall therefore also be considered not only during the post construction but also when the structures are being designed, constructed and operated. These demands include

- (1) water for agricultural fields from where water is to be drained rapidly after the rainy season to allow cultivation by farmers
- (2) water that need to be retained in ponds, and khals as long as possible to allow increase in culture fisheries in the project areas
- (3) water maintained for minimum environmental (natural) demands including indigenous fish migration and breeding of wildlife species and plants
- (4) Water for domestic uses such as washing, bathing and needs of domestic livestock during the dry period.

Considering all above aspects of water demand, the EIA team observed that the project's infrastructure development component have manageable impacts and the mitigation measures are addressed in the Environmental Management Plan.

The proposed project infrastructure designed were modified and improved to address following impacts and issues that may arise due to other demands for water as mentioned earlier.

The most significant impacts that will happen as a result of the project that were identified are as follows;

- (1) The project will increase drainage efficiency. However, although not explicitly given as an objective, the project also will increase the total area that will be drained converting some natural areas previously under water as wetlands into agricultural lands with more time available for cultivations. This draining of additional areas will reduce available area under water, during the dry period for the capture fisheries and will affect people involved in this type of fishing in the sub project. The poorest of poor men who depend on capture fishing during the dry period for their protein supply and also for their livelihood income will thus be pressurized to find alternate income sources when such opportunities are least. When the area available for capture fisheries is reduced significantly, those fishermen will be required to

find alternate income activities (if available) and also spend their savings if any to buy their fish (or meat) to meet the protein requirement in their daily diet (which is free currently). As this group is landless and very small in number (less than 10%) it is unlikely that they will have a strong enough voice in the WMO, unless specific arrangements are made to safeguard their rights. Hence project will make sure that the WMO will take into account the potential pressure and weakness of the fishermen community when establishing the WMO institutional structure.

- (2) Whilst it is appreciated that the project is primarily required to aim at improving the agricultural productivity it is realized that it is important to explore different ways other than increasing land area for enhancing the productivity. It is anticipated that current crop intensity will rise to 200% or more, based on the experience of other projects carried out earlier. If such high crop intensity can be realized together with high yielding and high value cropping varieties, the income levels of the farmers can be raised significantly. Therefore it is recommended for WMOs to eventually assess the need to increase the land area by halving the beel/flood plain which has the only source of water for the native fishes (capture fisheries), associated wildlife and environmental needs (ecological and hydrological).
- (3) Also it is recommended that the project allocate resources to WMA or WMOs to improve the condition of those remaining flood plain areas as sanctuaries for the fish and wildlife in the area where it is practically possible through proper management and maintenance practices (manage water retention, building fish friendly regulators, operation of gates, deepening of part of the flood plains etc. etc.). Such actions will ensure that native species associated with these areas will survive through the dryer periods.
- (4) The project recommends that culture fisheries to be promoted strongly to compensate loss of capture fisheries activities that will result due to rapid drainage of flood water and khals. The project will provide detail specific structural recommendations needed to improve khal capture fisheries among the communities. The project initially and WMOs eventually will pay special attention to social dynamics that operate in the community to ensure that the benefits are accrued or extended to poor segments of the community.
- (5) The project recommends establishment and support for the operation of WMOs that will function under the bigger WMA. The structure and the functional effectiveness of these WMOs will depend on the technical and management capacity that will be built. However considering the fact that fishermen in these areas are found to be extremely weak and vulnerable the project will pay special attention to their needs to ensure that they too have a role and place to influence decisions on water management.

3.2 Project Components

The project components of the SAIWRPMP are listed in the Table 3.2

Table 3.2: List of SAIWRPMP major components

SP SL No.	Name of Subproject	Embankment (km)		Khal Re- excavati on (km)	protecti on work (km)	Regulator		Inlets/Outlets		Bridge/ Culvert /WRS	Check & others Struct ures	WMO Office	
		Re- section ing	New			Rehab ilitatio n	New	Rehab ilitatio n	New			Buildi ng	Tube well
1	Beel Sukunia	11.70	0	25	0	2	1	0	2	2	0	10	10
2& 3	Daduria- Kandor Beel	10.40	0	9.20	0	3	1	1	0	2	0	3	3
4	Alfadanga- Boalmari	3	1.5	34.4	0.64	5	0	4	2	2	0	10	10
5	Chatlar- Fakurhat	2.2	0	62	0.4	2	1	0	1	2	0	5	5

SP SL No.	Name of Subproject	Embankment (km)		Khal Re- excavati on (km)	protecti on work (km)	Regulator		Inlets/Outlets		Bridge/ Culvert /WRS	Check & others Struct ures	WMO Office	
		Re- section ing	New			Rehab ilitatio n	New	Rehab ilitatio n	New			Buildi ng	Tube well
6	Kalidaskhali- Arpara	16	0	42	0	7	1	12	2	2	4	17	17
7	Horai River	5.7	0	110	0	7	1	0	0	3	3	20	20
8	Purulia- Charbhatpara	3	0	6	0	2	0	0	0	0	0	3	3
9	Bamonkhali- Barnali	20.5	0	55.1	0	15	0	54	15	4	1	10	10
10	Arol Beel	0	0	0	0	0	0	0	0	0	0	0	0
11	Sonamukhi- Bonmandar	0	0	0	0	0	0	0	0	0	0	0	0
Total		72.8	1.5	344.5	1.04	43	5	71	22	13	8	78	78

3.3 Project Activities

3.3.1 Designing of the major project infrastructure components for the SAWIRPMP, that include following:

- I. Excavation and re-excavation of canal/ Khal;
- II. Construction and re-construction of regulator
- III. Construction and rehabilitation/repairing of embankment
- IV. Installation and re-installation of inlet/outlet pipe
- V. Construction and repairing of bridge/culvert/WRS/ WMG office
- VI. Tube well installation.
- VII. Protection works by CC blocks for bridges/culverts;
- VIII. Protection works by grass turving on the embankment slopes; and
- IX. Tree plantation/ re-plantation on the slopes.

The design of the project will be done to make sure that all above mention constructions are carried out according to the national design standards. Specific environmental precautions that need to be taken during the design are given below.

3.3.1.1 List of main project activities during preconstruction/ site clearing

Following activities are expected during the preconstruction/ site clearing stage

- ❖ Debriefing of the contractors with clear instructions on the scope and contract specifications and environmental standards expected
- ❖ The work site will be handed over to the contractor by the implementing agency.
- ❖ The contractor will clear the worksite by removing any debris, leveling the land, clearing any erected structures including dwellings, stack yards and sheds for transport and safe storing of construction materials and equipment.
- ❖ Recruit labor and assign them for work. Give priorities to recruit people from the area if such labor is available. Provide accommodation with adequate sanitary facilities and proper environmental safeguards. Provide facilities for supply of adequate water by installing drinking tube wells with sufficient

- ❖ Construct temporary access roads for vehicle parking and labor movement, transport of goods and equipment and also build fully functional temporary office sheds for officials assigned to the site

3.3.1.2 List of main project activities during construction

Following activities are expected to happen during construction stage

- ❖ Sourcing of construction material and transportation to the site
- ❖ The construction materials stored with proper precautions at site.
- ❖ Deploy necessary equipment only after ensuring that they are meeting the necessary specifications.
- ❖ Ensure that all workers and staff are briefed adequately on work norms and practices to maintain highest work ethics.
- ❖ Ensure adequate health and safety at all work sites. Work to begin under constant supervision of qualified supervisors and conducting of regular inspection to ensure 100 percent compliance on aspects identified.

3.3.1.3 List of main project activities during operation & maintenance:

The project is about the management of water for achieving the best productivity possible. Setting up of the WMA and WMOs will happen prior to the operational phase and the members will be educated and made aware of the tasks, responsibilities of the organization. The following activities will be done during operation& maintenance stage

- ❖ Operation and maintenance of the built infrastructure according to the requirements of the beneficiary groups who will depend on efficient management of water.

3.4 Project plan, design, standard, specification, quantification

3.4.1 Project plan:

Project plans for all the 11 subprojects have been prepared with the objective of introducing Integrated Water Management practices to the subproject areas that will be improved by rehabilitation and construction of infrastructure needed for reducing of water logging and drainage congestion so that agricultural production will increase. To facilitate the process an Integrated Water Management Plan (IWMP) has been prepared in a participatory way by taking views of the stakeholders.

The interventions requested involve de-silting of silted up khals, repair of water controlling regulators, providing additional inlets/outlets to remove localized water logging, creating better water management through participatory planning design and management of system, building ownership of the infrastructure by the users/WMG members and finally taking over responsibility of the infrastructures by them including operation and maintenance responsibility of the water management system by the Water Management Organization themselves.

The project plan also includes capacity building of WMG members by imparting training on leadership, organizing agriculture Farmers Field School, demonstration of new improved HYV of rice, model vegetable gardening practices. Culture fishery will be promoted through organizing Field school of Fishery, demos, and fish sanctuaries.

The project also plans additional income generating activities and providing support for value addition to supply chains for sustainable economic development of the beneficiaries, and support to vulnerable destitute in the community.

3.4.2 Design

Opinion of the stakeholder had been taken while preparing IWMP as the first step towards conducting feasibility reports and the intervention and design consideration was finalized and it re-confirmed while disseminating the project information with the stakeholders formally.

3.4.3 Standard

BWDB design standard and national standards were followed in designing the intervention.

3.4.4 Specification

BWDB standard design specification was followed in designing infrastructures.

3.4.5 Quantification

Quantification of the work to be undertaken through pre-work and post work method, ascertained by field checking by the standard procedure of BWDB and also by consultants on random supervision.

3.5 Project Schedule phase and timing for development of the project

The total project has been planned to be implemented in a period of 6 years' time with phasing as per the bar chart shown in the report for implementation in Annex F.

3.6 Resources and utilization demand

The construction of the project will require considerable quantities of construction materials of various types and quantities and soils. A list of major materials required is presented in Table 3.3. Local sources (if available) will be used as much as possible for reducing the cost. Apart from the construction materials, electricity, telecommunication and internet services, office equipment etc. will be required. These services will be also sought from local sources. Electricity in the construction and associated sites will be provided by nearest local electricity distribution line. Fuel will be made available from the local fuel supply network.

Table 3.3: List of materials and their sources

Materials	Sources	Remarks
Surface Water	Nearby river or khal	Quality confirmed by testing
Ground Water	DTWS and HTWs	Quality confirmed by testing
Energy	Local PDB supply, diesel, octane and gas will be procured from local fuel supply network.	
Sand and soil for embankments	Embankment material from nearby river and khals are recommended. Sources to be identified before extraction and seek approval from authorities.	The quantities of soil needed to be access from same area where construction is to happen will reduce the excavation and transportation impacts.
Cement	Local agencies	
Bricks	Local agencies	
Wood	Jessore and Faridpur (commercial suppliers).	
Bamboo	Jessore and Faridpur (commercial suppliers).	
Labor	Preferably local.	

The tentative material requirement or natural resources utilization quantities, specially the earthworks, for the project are estimated as-

Particulars	Length (km)	Earthwork (m ³)
Khal Re-excavation	344.5	3,805.51
Embankment Re-sectioning	72.8	1,286.49
Retired Embankment Construction	1.50	137.50
Total Earth-work		5,229.50

As per above estimates given in the feasibility study, total of 1,423.99 m³ of soil suitable for embankment construction will be needed for the project, Also nearly 3,805.51 m³ of soil will be excavated. If the excavated materials are found to be suitable for construction and re-sectioning of embankment, it will be used. The contractor will be required to dispose off the balanced excavated material safely. The disposals of the extracted soil into brick extraction or previously dug holes that are abandoned in the area are suitable for such disposal. However, it is also noted that people may wish to get the soil spread in their home-gardens or fields as these soils are believed to be fertile with washed off nutrients. However if such action is requested the project will first test the soil to ensure that no heavy metals or toxic substances are found before allowing them to be disposed in areas where people can come in direct contact (home gardens and play grounds).

In any event the project will ensure that the contractor indicates the test results of the quality of the sediments that will be excavated and also provide details of where such material will be disposed according to the safety standards. These records will be kept for future references at the project office until the project is closed.

Resource will be acquired from the national sources and also through imports as needed. These packages require approval from the donors. The tender for taking up work packages need to be followed PPR 2008 of GoB and also requires approval by the ADB that meets their requirements. Major resources involved are soil which will be locally available either from BWDB lands, khals and rivers, or other approved sources. Major material resources involved in implementing the project has been shown in Annex G.

3.7 Map and Survey information

Following maps are presented.

- i. Project location maps showing 11 subprojects- 1 no.
- ii. Existing and proposed structures including topography for all 11 subprojects- 10 nos.
- iii. Location maps of environmental quality analysis sample 4 nos.
- iv. Earthquake zone of Bangladesh- 1 nos.
- v. Land use map of Bangladesh- 1 nos.
- vi. Agro-ecological zone of Bangladesh- 1 nos.
- vii. Climatic Sub regions of Bangladesh- 1 nos.

4 ANALYSIS OF ALTERNATIVES

All the subprojects under SAIWPMP are part of previously constructed FCD/I projects and now having partly defunct infrastructure due to long absence of O & M in the subprojects. The proposed activities consist mostly of rehabilitation works, like khal re-excavation, embankment re-sectioning and repair of regulators and in few cases only one new regulator. These improvements are proposed to enhance drainage and ease water logging in the beel areas to assist in agriculture production.

In Alfadanga-Boalmari subproject a 5 km long new retired embankment to prevent floods has been proposed as the original embankment eroded due to bank erosion of Modhumoti River. In this subproject, three alternatives were considered before the decision was taken for construction of 5 km retired embankment along the bank of Modhumoti River. These alternatives are:

i. Alternative-1:

Alternative-1 would have low height retired embankment for a length of 5 km at Gridha over the sand laden unproductive land to check spilling of water during high stage of Modhumoti River without bank protection work. Due to active erosion existing around the area, this portion of embankment will be threatened.

ii. Alternative -2:

Alternative-2 would have low height retired embankment for a length of 5 km at Gridha over the sand laden unproductive land to check spilling of water during high stage of Modhumoti River with bank protection work for a length of 1.00 km proposed to get rid of active erosion existing in the area.

iii. Alternative -3:

Alternative-3 would have low height retired embankment for a length of 5 km at Gridha over the sand laden unproductive land to check spilling of water during high stage of river Modhumoti. To get rid of active erosion existing in the area, a loop cut was planned instead of bank protection work at Gridha.

Alternative 1 was not acceptable as the embankment will be threatening to increase river erosion; Alternative 3 was not acceptable as loop cutting of a big river, like Modhumoti, is a complex one, involving high cost of earth work, disturbing hydraulic phenomena, at both upstream and downstream of the loop cut inviting erosion, cost of land acquisition and involuntary resettlement, sometimes requiring cross dam at the upstream of the loop cut to force river water to follow the new loop cut. All together is a very complex situation and was not considered.

Considering different social and environmental issues, including disturbance of hydraulic phenomena, river erosion, cost of land acquisition and settlement, costs of earth works, etc., Alternative-2 were considered.

But with passage of time, when investigation was done in March 2015, the Modhumoti River was found to be very active causing land erosion. But very recently it is seen that the loop cut (as

conceived, to divert flow and stop bank erosion near Gridha), has naturally emerged and the flow of the river is passing through the new loop and the previously active river near Gridha has gone dry now, and acting as Baor, with no flow or erosion. As such, the eroded embankment can be retired very close to the present river bank having a much shorter length and consequently with much less involvement of land acquisition and plots.

During the EIA study, the impacts of the land acquisition and environmental impacts associated were highlights and other alternatives were re-considered. It was found that since the river is now having no current flow, the embankment that has been already eroded can be replaced by an embankment very close to the present river bank line, instead of normal 500m set back distance. For a less potential for eroding a shorter set back distance close to the present river bank will be sufficient for flood control. From mouza maps and field investigation, it is found that now only 1.50 km retired embankment (instead of 5 km planned), plus re-sectioning of existing low height embankment of 0.85 km at the upstream end and about 0.70 km at the downstream side will be required and the subproject may be implemented accordingly.

5 DESCRIPTION OF THE BASELINE ENVIRONMENTAL CONDITIONS

5.1 General

This chapter describes the existing conditions of the environmental components (e.g. climate, topography and soil, land use, water, noise level, ambient air quality, flora, fauna etc.) along with socio-economic components (e.g. population/ demography, settlement and housing, traffic and transport, economy and employment, cultural, archaeological and historical resources, etc.) in the project area.

The primary objectives of this chapter are to provide an environmental baseline data that helps to identify Important Environmental and Social Components (IECs/ISCs) of the subproject area and to assess the potential impacts on the IECs and ISCs which may be caused by the project activities during pre-construction, construction and operation & maintenance (O&M) stages. The baseline data includes an inventory of physical resources, ecological resources, economic development and socio-cultural resources those that represent the project influencing area.

The information to establish the baseline of the project area was collected from different secondary (e.g. government and private sector agencies) and primary (e.g. field survey, site visits, public consultation, professional judgment etc.) sources.

In order to assess the impacts of the proposed Project on people living in the vicinity of the project area, detailed survey was conducted and existing environmental and socio-economic conditions and salient features of the area were duly observed. During the detailed site visit, relevant government agencies/departments were also consulted for the collection of the relevant data. To establish baseline soil, bed material and water (surface & ground) conditions of the area; ambient air quality and noise level were not required to be tested considering the nature of project implementation of which no significant change of ambient air quality and noise are expected. Surface and ground water samples were collected by the EIA team from different water sources in the project area, and those water samples were sent to the laboratory for analysis. Information on socio-cultural resources and economic development were collected through field survey, secondary sources and also by the social and resettlement study team of the project.

The project influence area (PIA) (impact zone) for the EIA covered 500m surrounding each subproject area of the project in order to include sufficient coverage of the receiving environment in accordance with the impacts of the Project. In case of identifying environmentally/ecologically sensitive and culturally/historically protected areas, up to 5 km surrounding the each subprojects of the project has been considered as PIA.

5.2 Physical Environment

All the 11 subproject areas of SAIWRPMP belong to the South-western Region of Bangladesh and fall within the Ganges Dependent Area (GDA), within the catchment of the Gorai River—the major distributaries of the Ganges River flowing to the south to discharge water in the Bay of Bengal. The project represents Ganges River Floodplain physiographic and falls under sweet water zone. The project area constitutes part of the Ganges Delta – the largest deltaic region on Earth, having flat topography and with land level varying from 1.20 meter PWD to 9.25 meter PWD (Beel Sukunia: 2.25m to 9.25m; Daduria-Kandor Beel: 1.20m to 5.60m; Alfadanga-Boalmari: 3.00m to 5.70m; Chatlar-Fakurhat: 1.25m to 7.00m; Kalidaskhali-Arpara: 2.00m to 5.60m; Horai River: 4.00m to 8.50m; Purulia-Charbhatpara: 2.50m to 5.50m; Bamonkhali-Barnali: 1.20m to 3.80m; Arol-Beel 7m, Sonamukhi-Bonmandar: 4.50m to 8.80m).

5.2.1 Geology and Topology

Geology of Bangladesh is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age). The geology of the study area consists of Quaternary deltaic sediments, which have been strongly influenced by tectonic movements on deep seated faults. The area lies on a tectonic block, which has been uplifted relative to the surrounding areas.

All the 11 subprojects of SAIWRPMP are located in the south-west part of the Bengal Basin, a long established area of subsidence and deposition containing an almost complete sequence from the Cretaceous to Recent alluvium. The Bengal Basin is essentially a flat (1 in 15,000) deposition center, formed by the deltas of the Ganges, Brahmaputra and Meghna rivers, and covers an area of some 60,000 km². The surface topography of the Quaternary deposits is very gentle. The whole of the south-west area is below elevation 17 m, and 75% is below 5 m. The surface geology consists mainly of Quaternary sediments, although there are some tertiary deposits in the eastern flood belt. Clay soils are prevalent in the low laying areas, and medium textured soils at the higher grounds.

The subprojects are sited within the High Ganges River Flood Plain so-called Agro-ecological zones-11 and Low Ganges River Flood Plain so-called Agro-ecological Zones-12. (Figure-5.1). The Low Ganges River Flood Plain area has a typical meander landscape of broad ridges and basins. Difference in elevation between ridge tops and basin centers are generally in the range of 3-5 meters.

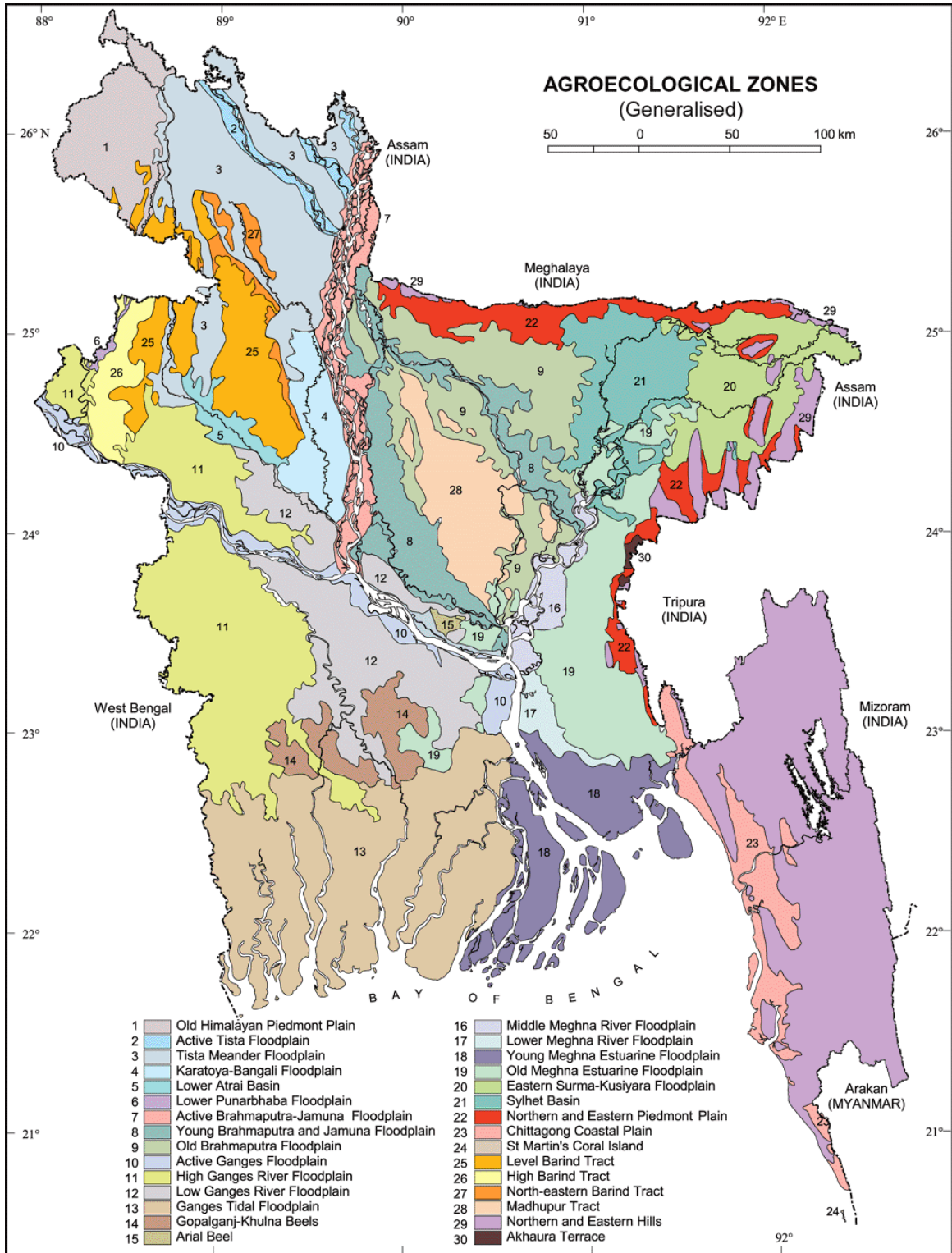


Figure 5.1: Agro-Ecological Zone of Bangladesh

5.2.2 Geomorphology

Geomorphology is the study of landforms, and in particular their nature, origin, processes of development and material composition. Storing, guiding or sluicing water and retaining water levels are measures which can enhance irrigation, drainage, navigation, energy production, drinking water supply, fishery, flood control, recreation, ecology and environmental control.

Bangladesh is a riverine country. Most of the country's land is formed through silt brought by the many rivers that flow through it. The subproject areas are influenced mainly by the following tributaries/ distributaries of the Ganges/Padma River:

The Gorai-Modhumoti River

The Horai-Kumar River

The Arialkha River

The Kapatakhya-Bhoirab Rivers

The Betna River

5.2.3 Land-use

The total area of the project is 108,636 hectare of which 82,274 hectare (about 76%) is cultivable land, 2,271 ha (about 2%) embankments & roads, 826 ha (about 1%) is rivers & khals, 20,188 ha (about 18%) housing & settlements and 3,078 ha (about 3%) comprises of ponds/other perennial water bodies. Land use pattern varies considerably in different subprojects of the project area. Figure 5.2: Shows land use of Bangladesh and Table 5.1 presents the land use patterns of 11 subprojects.

Table 5.1: Land use patterns (in percentage) in 11 subprojects.

Land Use	Subprojects										Total Project
	1	2&3	4	5	6	7	8	9	10	11	
Agriculture	81.9	72.4	82.8	78.8	80.4	74.0	69.1	75.5	71.2	68.5	75.7
Settlement	11.5	19.8	12.2	16.8	12.9	22.6	26.2	19.8	23.2	19.8	18.6
Embankment & Road	1.7	4.2	2.5	1.8	2.1	1.4	2.6	2.3	0.7	5.0	2.1
Rivers & Khals	0.5	0.3	0.6	1.5	0.8	0.6	0.9	0.8	0.2	1.7	0.8
Ponds & other Perennial water bodies	4.4	3.3	1.9	1.1	3.8	1.4	1.3	1.7	4.7	5.0	2.8
Total area in ha	9,681	3,301	8,011	10,268	13,197	18,600	4,156	16,782	15,570	9,070	108,636

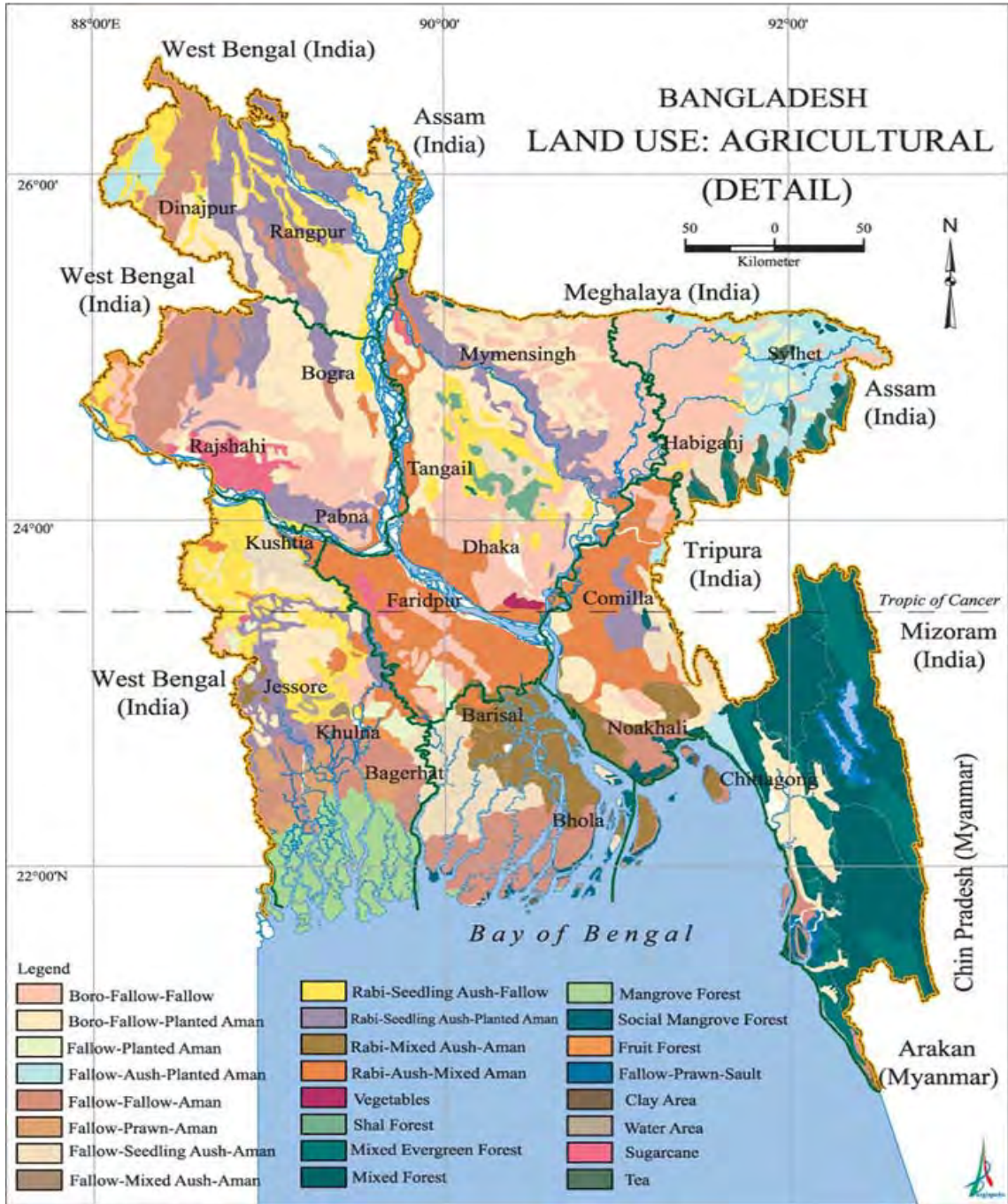


Figure 5.2: Land use map of Bangladesh

Land use of Beel-Sukunia Subproject (Subproject 1)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 9,681 ha. About 82% of the land is net cultivable area, around 12% is used as homestead including home gardens and trees, 2% is for embankments, roads, rivers and khals and around 4% is occupied by permanent water bodies including ponds.

Land use of Daduria and Kandor-Beel Subprojects (Subprojects 2 & 3)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 3,301 ha. About 72% of the land is net cultivable area, around 20% is used as homestead including home gardens and trees, 5% is for embankments, roads and khals and around 3% is occupied by permanent water bodies including ponds.

Land use of Alfadanga-Boalmri Subproject (Subproject 4)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 8,011 ha. About 83% of the land is net cultivable area, around 12% is used as Settlement including home gardens and trees, 2% is for embankments/ roads and 1% is for rivers/ khals and around 2% is occupied by permanent water bodies including ponds.

Land use of Chatlar-Fakurhat Subproject (Subproject 5)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 10,798 ha. About 79% of the land is net cultivable area, around 17% is used as homestead including home gardens and trees, 3% is for embankments, roads and khals and around 1% is occupied by permanent water bodies including ponds.

Land use of Kalidaskhali-Arpara Subproject (Subproject 6)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 13,197 ha. About 80% of the land is net cultivable area, around 13% is used as homestead including home gardens and trees, 3% is for embankments, roads and khals and around 4% is occupied by permanent water bodies including ponds.

Land use of Horai River Subproject (Subproject 7)

According to the Feasibility Study Report 2013, the gross area of the sub-project is 18,600 ha. About 74% of the land is net cultivable area, around 23% is used as homestead including home gardens and trees, 2% is for embankments, roads and khals and around 1% is occupied by permanent water bodies including ponds.

Land use of Purulia-Charbhatpara Subproject (Subproject 8)

According to an estimate, the gross area of the sub-project is 4,156 ha. About 69% of the land is net cultivable area, around 26% is used as homestead including home gardens and trees, 3% is for embankments & roads, 1% rivers & khals and around 1% is occupied by permanent water bodies including ponds.

Land use of Bamonkhali-Barnali Subproject (Subproject 9)

According to an estimate, the gross area of the sub-project is 16,782 ha. About 76% of the land is net cultivable area, around 20% is used as homestead including home gardens and trees, 2% is for embankments & roads and Rivers & Khals around 2% is occupied by permanent water bodies including ponds.

Land use of Arol-Beel Subproject (Subproject 10)

According to an estimate, the gross area of the sub-project is 9,681 ha. About 71% of the land is net cultivable area, around 23% is used as homestead including home gardens and trees, 1% is for embankments, roads, rivers & khals and around 5% is occupied by permanent water bodies including ponds.

Land use of Sonamukhi-Bonmandar Subproject (Subproject 11)

According to an estimate, the gross area of the sub-project is 9,070ha. About 68% of the land is net cultivable area, around 20% is used as homestead including home gardens and trees, 5% is for embankments & roads, 2% rivers & khals and around 5% is occupied by permanent water bodies including ponds.

5.2.4 Soils

Soils of the region range from silty loams and silty clay loams on ridges to silty clay loams and heavy clays in the lower areas. Based on flooding intensity, the project area belongs to moderate river flooding zone (subproject areas under Rajbari and part of Faridpur Districts) and Low River flooding zone (subproject areas under part of Faridpur, Magura, Jessore, Narail and Gopalganj Districts). The general soil types predominantly include Calcareous Dark Grey and Calcareous Brown Floodplain soils category.

There is a wide spread Zn and S deficiency. The general fertility level is medium. Degradation of soil quality in flood plain is mainly attributed to improper use of fertilizers and pesticides to boost up agricultural production. Three types of fertilizer such as Urea, T.S.P. and M.P. are used.

5.2.5 Meteorology

The subprojects of SAIWRPMP are located in the south-western (F) and the south-central (G) climatic sub-regions of Bangladesh (Figure 5.3). In order to draw the baseline climatic condition of the project area, climatic data (temperature, rainfall, humidity, wind speed and wind direction) recorded at Jessore weather station for last 10 years (during 2003-2012) presented in Table 5.2 below and described in the following sections.

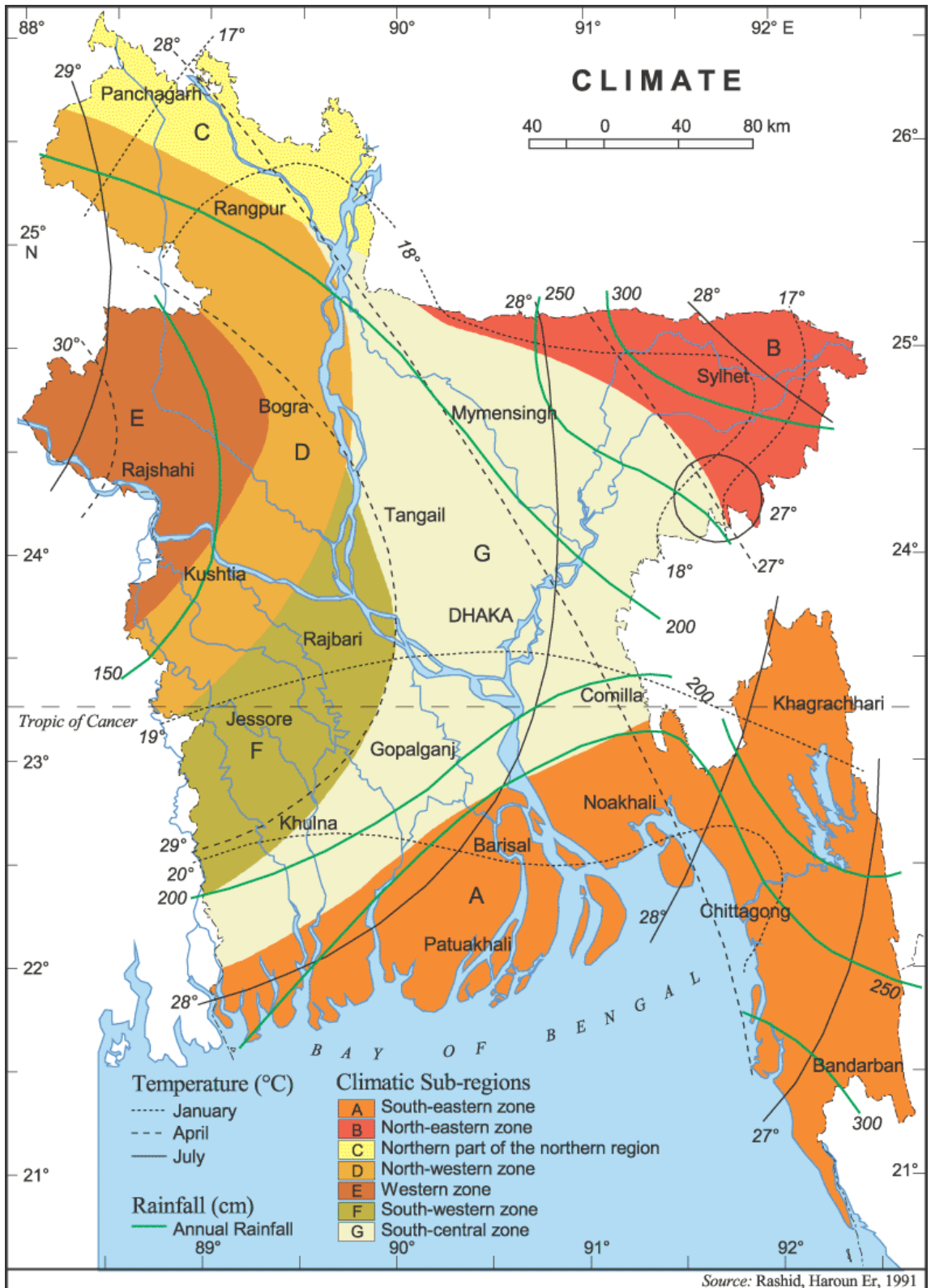


Figure 5.3: Climatic sub-regions of Bangladesh

Table 5.2: Climatic data of Jessore Weather Station

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Temp (0C)	23.1	26.9	30.8	32.6	34.8	33.7	32.1	31.8	31.5	31.6	27.7	22.5
Minimum Temp (0C)	10.9	14.5	19.2	21.3	23.8	26	25.6	23	24.7	21.3	18.3	11.6
Relative Humidity (%)	79.4	74	71.2	73.2	74.3	81.2	84.7	84.8	85	83	79.3	80.3
Wind speed (knots)	5.41	5.9	7.3	7.9	7.59	7.5	6.7	6.46	6.4	7.8	5.7	5.1
Average Rainfall (mm)	14	14	40	46	154	263	417	238	318	168	13	6

Source: Bangladesh Meteorological Department (BMD), 2013

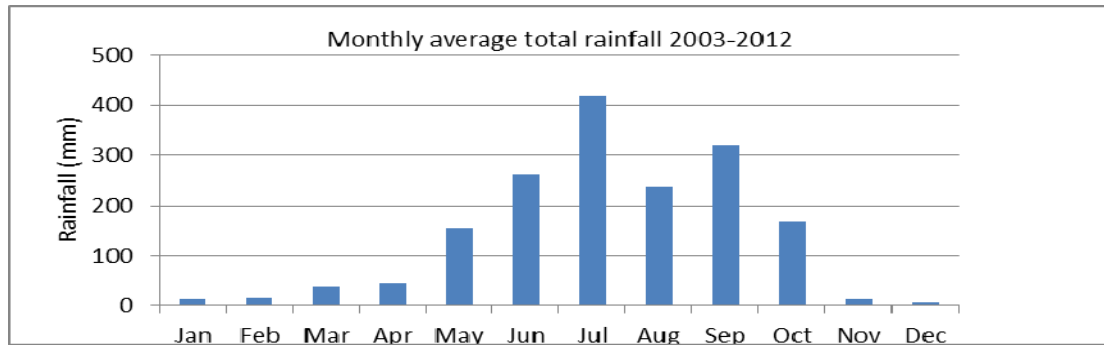


Figure 5.4: Monthly average rainfall (mm) recorded at Jessore Weather Station

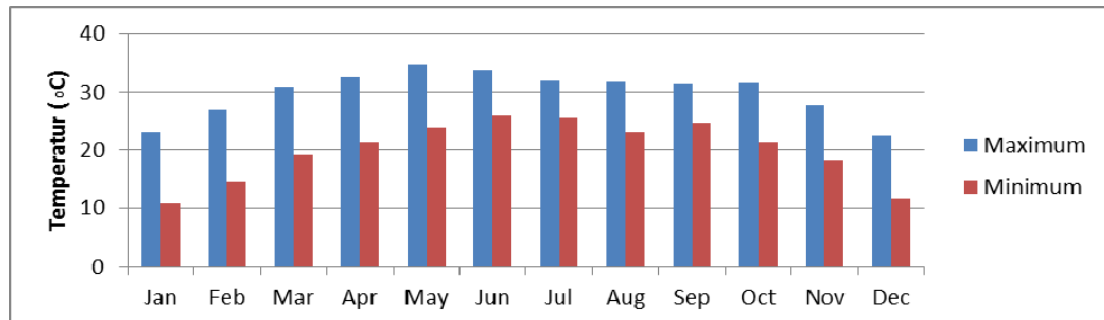


Figure 5.5: Monthly average maximum and minimum temperature (° C) recorded at Jessore Weather Station

Temperature data recorded at Jessore weather station have been collected from BMD and used to depict baseline climatic condition of the project area. The 10 years temperature data reflects that the monthly average maximum and minimum temperatures at Jessore weather station were 34.8°C in May and 10.9° in January respectively.

The relative humidity more than 80% recorded at Jessore in the months from June to October & December having the maximum relative humidity of about 85%.

Records from BMD show that the wind speed found to be high during July to November and reported to be 4.1 to 12 Knots with the predominant directions of S, SSE, SSW, NNE etc. The wind speed during December to February found to be 4.4 to 7.2 Knots with the predominant directions of N, NNW, NNE, etc. The wind speed during March to June found to be 5.3 to 11 Knots with the predominant directions of S & SSW.

Monthly average maximum and minimum rainfalls were 417mm in July and 6 mm in December respectively. During the above period heavy rainfall (more than 300 mm in a month) occurred in July and September. Dry weather conditions prevail during November, December, January, February, March and April where monthly average rainfall was less than 50 mm.

5.2.6 Hydrology

The main rivers influencing the project are the Ganges/ the Padma, and its distributaries. The distributaries of Ganges Padma are the Gorai/Modhumoti and the Arial Khan. The upper part of the Padma has a single channel and carries a dominant bank full flow of about 70,000 m³/sec and conveys an annual sediment load of 0.3 x 10⁹ tons. Two main fresh water carriers of the project are the Gorai-Modhumoti and the Arial Khan. The Arial Khan River is perennial while the Gorai has no or little flow during the few months in dry seasons when it is virtually cut-off from the Ganges due to heavy siltation at the origin. The Gorai is tidal in the downstream reaches while the Arial Khan is tidal all along its reach. The Gorai is very important distributaries as it fulfils a number of functions such as salinity control, maintenance of a large tidal volume at the head of the Pussur-Sibsa system influencing the siltation rates in the tidal zone. The hydrological characteristics of the main rivers can be described by their discharge and levels. Table 5.3 shows the hydrological characteristics of the main regional rivers in terms of flows.

Table 5.3: Hydrological characteristics of main rivers.

River name	Tidal/ Non-tidal	Dominant discharge m ³ /sec	Peak tidal flows M ³ /sec		Net flow M ³ /sec		Width (m)
			August	April	August	April	
Gorai	Non-tidal	4,250	-	-	-	-	500
Modhumoti	Non-tidal	-	4,490	1,300	5,010	93	600
Lower Modhumoti	Tidal	-	400	31	320	2	250
Arial Khan	Tidal	2,000	2,900	300	2,120	150	400

Source: FAP 4 Report (Volume -1) of 1993

Apart from major regional rivers, a large number of major and minor inter-connected rivers and channels run through and along the project area. The important rivers/channels which play vital roles in the hydrology of the individual subprojects are perennial and tidal. The upper Nabaganga is the main drainage channel of the Ganges Kapatakhyia Project. The lower Nabaganga receives the spill from the Modhumoti River. The Upper Kumar is the spill channel of the Arial Khan and flows into the Madaripur beel Route. Important rivers and channels for the subprojects are given in Table 5.4 and sketch diagram of a typical beel in Figure 5.6

Table 5.4: Rivers and channels important for Subproject hydrology

Sub-Project	Rivers & Channels Important for the Sub-Project area
1. Beel-Sukunia	Kumar river
2-3.Daduria & Kandor-Beel	Kumar river
4.Alfadanga-Boalmari	Lower Modhumoti river
5. Chattar-Fakurhat.	Arial Khan river
6.Kalidaskhali-Arpara	Chitra and Fatki river
7.Horai River	Padma and Horai river
8.Purulia-Charbhatpara	Lower Modhumoti river
9.Bamonkhali Barnali	Chitra, Fatki and Nabaganga river
10.Arol-Beel	Upper Bhairab River and Kapatakhyia
11.Sonamukhi-Bonmandar	Betna ,Kapatakhyia and Ichamoti river

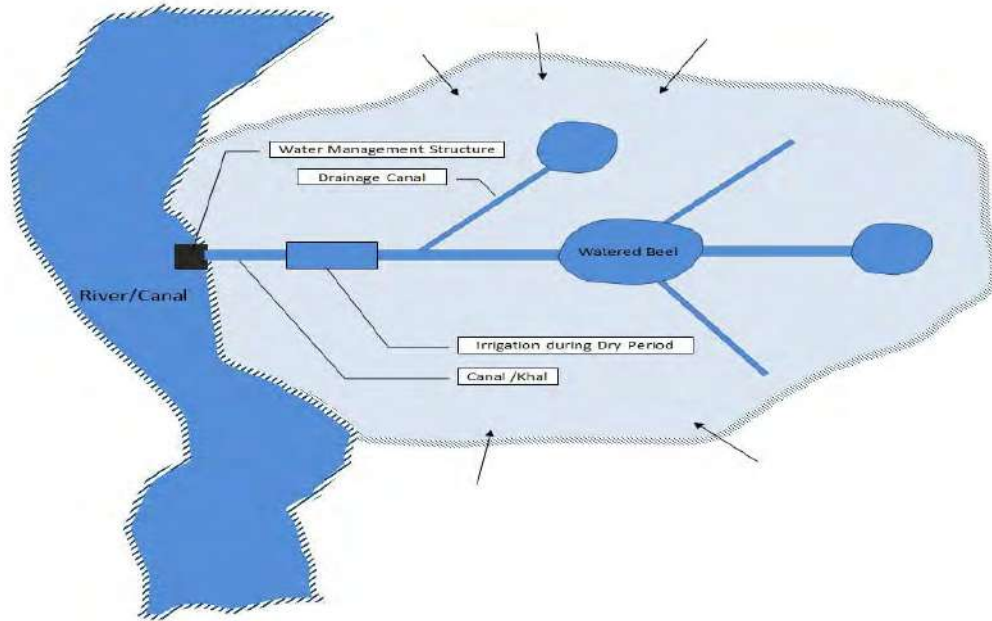


Figure 5.6: Sketch diagram of a typical beel and its water paths

7.1.1.1 Hydrology of the Subprojects

5.2.6.1.1 Hydrology of Beel-Sukunia Subproject

Daily water level data, ranging from 1990 to 2010 of the Kumar River for the station at Faridpur (SW-168), BWDB were processed and analysed. The interpolation resulting 20 years flood hydrographs generated for the Kumar River is shown in Figure 5.7. It shows that, after rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open as needed.

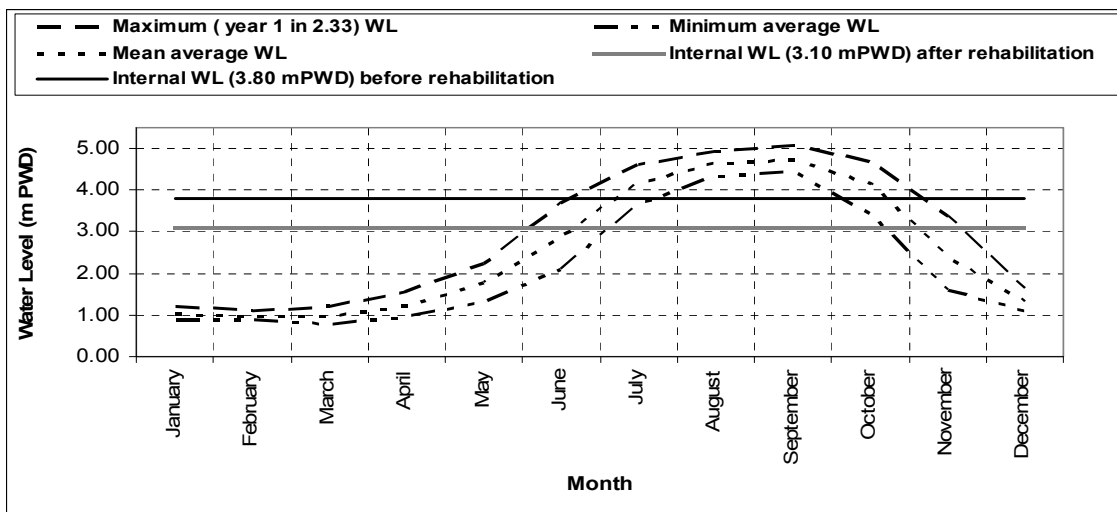


Figure 5.7: Kumar river water levels (station SW-168, Faridpur)

Internal water level data

A survey on the internal water levels was carried out during the monsoon period August, September and October 2012 and the results were reported to the project authority. From this report and the daily water level observations of Gauge SW-168, Faridpur of the Kumar River, the internal reference water level during the monsoon within the project was calculated at 3.80 m PWD, while the basin water level during the monsoon was calculated at 3.10 m PWD. The generated hydrograph for internal and river gauge water levels is shown in Figure 5.8.

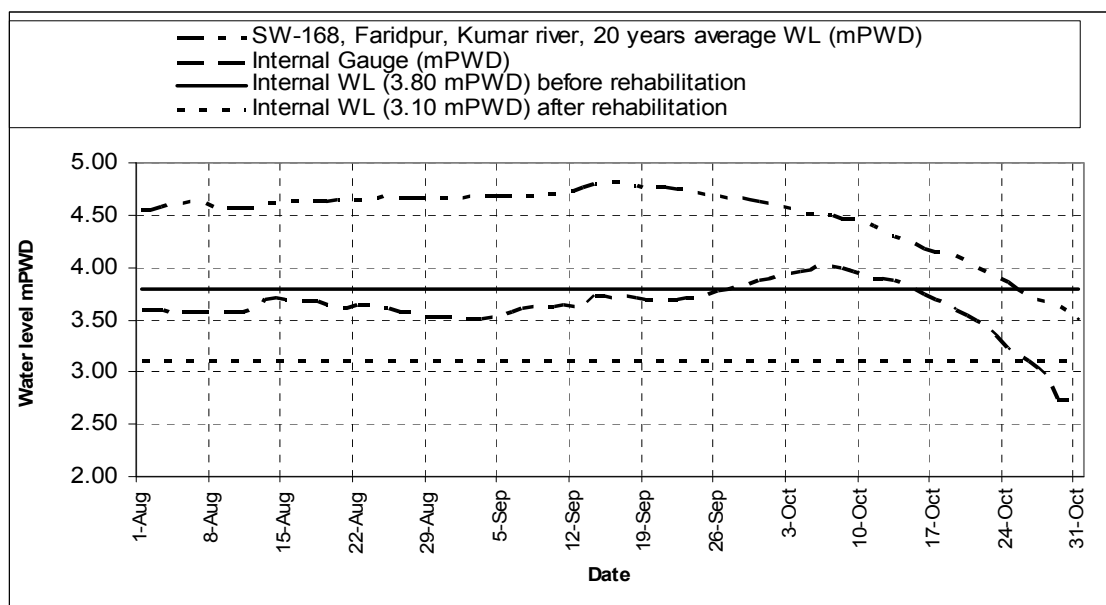


Figure 5.8: Monsoon water levels of Kumar River at Faridpur

Land types and flood depth of Beel-Sukunia Subproject

Table 5.5 shows the existing land types sorted by flood depth level during the monsoon. Land type F₀ is never flooded during the rainy season and may experience drought during the dry season. The F₂ land type is seldom and F₃ often flooded.

Table 5.5: Land Type, Elevation and Area of Beel-Sukunia sub-project

Land Type	Area covered		
	Gross area (ha)	Cultivable area (ha)	Percent of total area (%)
F ₀ (d<0.3m)	7,624	6,236	78.6
F ₁ (0.3m-0.9m)	1,104	1,046	13.19
F ₂ (0.9m-1.8m)	622	450	5.68
F ₃ (d>1.8m)	331	201	2.53
Total	9,681	7,933	100

5.2.6.1.2 Hydrology of Daduria-Kandor beel Subproject

Daily water level data, ranging from 1990 to 2010 of the Kumar River for the station at Faridpur (SW-168), BWDB were processed and analysed. The interpolation resulting 20 years flood hydrographs generated for the Kumar River is shown in Figure 5.7 and Figure 5.8. It shows that, after

rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open.

Land types and flood depth of Daduria- Kandor Beel Subproject

The land types as they are at existing flooding depth during the monsoon season with gross and net cultivated area, and proportion to total area are presented in table 5.6.

Table 5.6: Land type, elevation and area of Daduria and Kandor Beel subproject

Land Type	Area Covered		
	Gross area (ha)	Cultivable area (ha)	% of total net cultivable area
F ₀ (d<0.3m)	1,930	1,062	44.5
F ₁ (0.3m-0.9m)	530	520	21.8
F ₂ (0.9m-1.8m)	784	784	32.8
F ₃ (d>1.8m)	57	22	0.9
Total	3,301	2,388	100.00

5.2.6.1.3 Hydrology of Alfadanga-Boalmari Subproject

Daily water level data, ranging from 1990 to 2010 of the Modhumoti River for the station at Bhatiapara (SW-102) were collected from the Hydrology section, BWDB processed and analysed. The 20 years flood hydrographs generated for the Modhumoti River is shown in Figure 5.9. It shows that, after rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open.

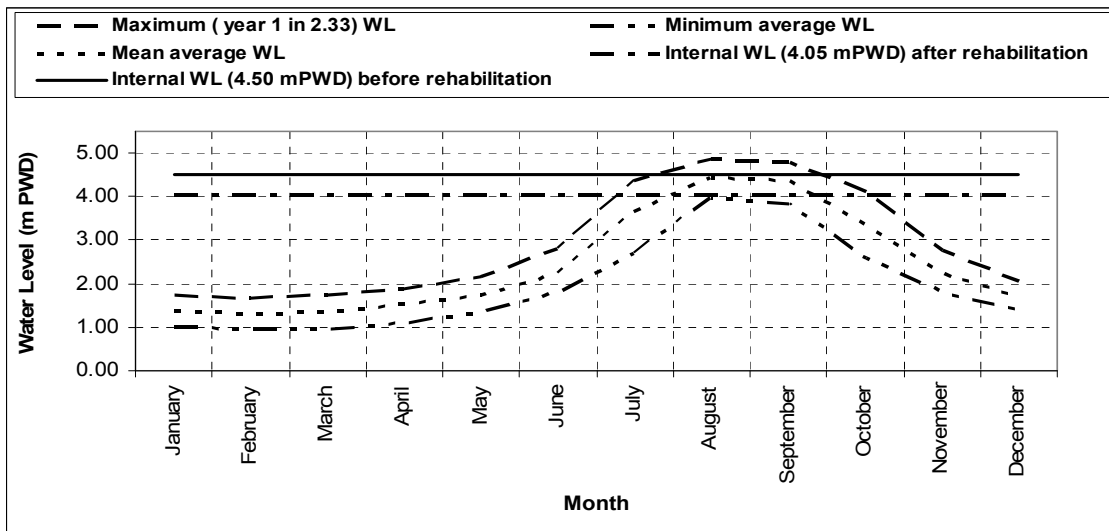


Figure 5.9: Modhumoti river water levels at Alfadanga-Boilmari SP area (station WS-102, Bhatiapara)

Internal water level data

A survey on the internal water levels was carried out during the monsoon period August, September and October 2012 and the results were reported to the project authority. From this report and the daily water level observations of Gauge SW-102, Bhatiapara, Gopalganj of the Modhumoti River, the internal reference water level during the monsoon within the project was calculated at 4.50 m PWD, while the basin water level during the monsoon was calculated at 4.05 m PWD. The generated hydrograph for internal and river gauge water levels is shown in Figure 5.10.

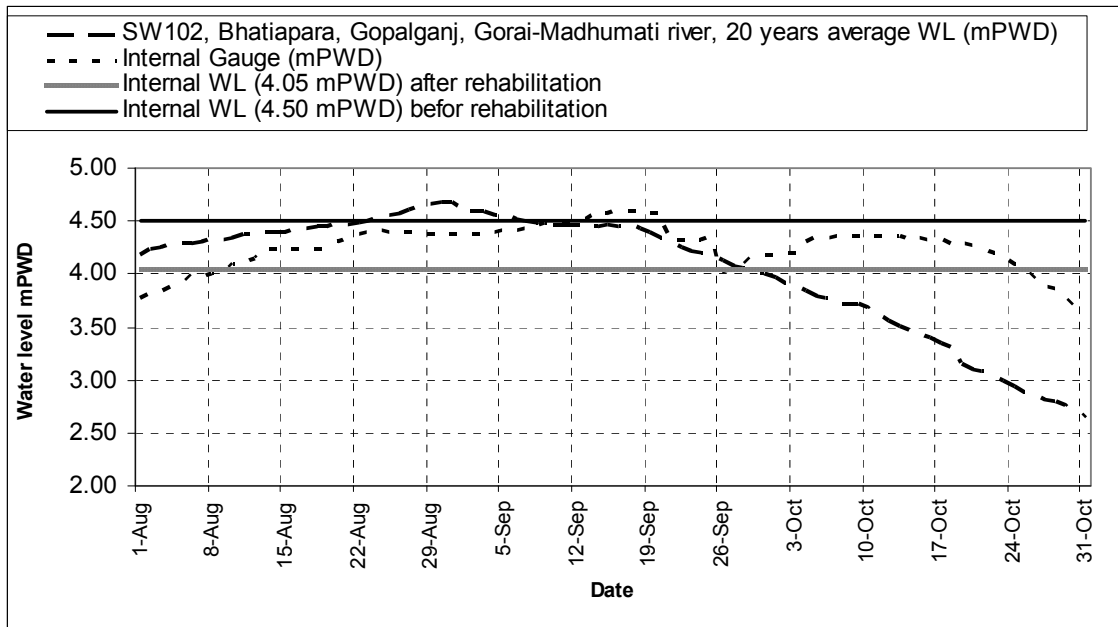


Figure 5.10: Monsoon water levels of Modhumoti River at Bhatiapara

Land types and flood depth of Alfadanga-Boalmari Subproject

The land types as they are existing flooding depth during the monsoon season with gross and net cultivated area, and proportion to total area are presented in Table 5.7. Land types F_0 may be temporary flooded up to 0.3 m for a short period during the rainy season and may experience drought during the dry season. The F_1 land type may be flooded up to 0.9 m and F_2 up to 1.8 m during the monsoon. F_3 is often flooded, even during the dry season. It comprises beels and ghers.

Table 5.7: Land type, flood depth and cultivable area in ha and in percentage

Land Type	Area Covered		
	Gross area (ha)	Net Cultivable area (ha)	Percent of NCA (%)
F_0 (d<0.3m)	5,968	4,607	69.47
F_1 (0.3m-0.9m)	1,153	1,107	16.69
F_2 (0.9m-1.8m)	687	687	10.36
F_3 (d>1.8m)	203	231	3.48
Total	8,011	6,632	100

5.2.6.1.4 Hydrology of Chatlar-Fakurhat Subproject

Daily water level data, ranging from 1990 to 2010 of the Kumar River for the station at Bhanga (SW-170) were collected from the Hydrology section, BWDB and subsequently processed and analysed. The 20 years flood hydrograph generated for the Kumar River, is shown in Figure 5.11. It shows that, after rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open.

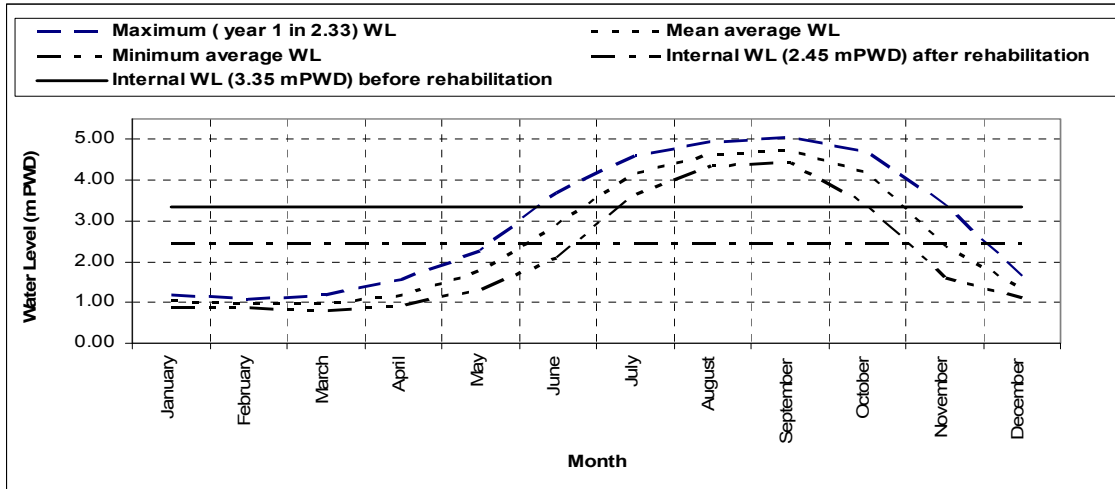


Figure 5.11: Kumar river water levels at Chatlar-Fakurhat SP area (station WS-170, Bhanga, Faridpur)

Internal water level data

A survey on the internal water levels was carried out during the monsoon period August, September and October 2012 and the results were reported to the project authority. From this report and the daily water level observations of Gauge SW-170, Bhanga, Faridpur of the Kumar River, the internal reference water level during the monsoon within the project was calculated at 3.35 m PWD, while the basin water level during the monsoon was calculated at 2.44 m PWD. The generated hydrograph for internal and river gauge water levels is shown in Figure 5.12.

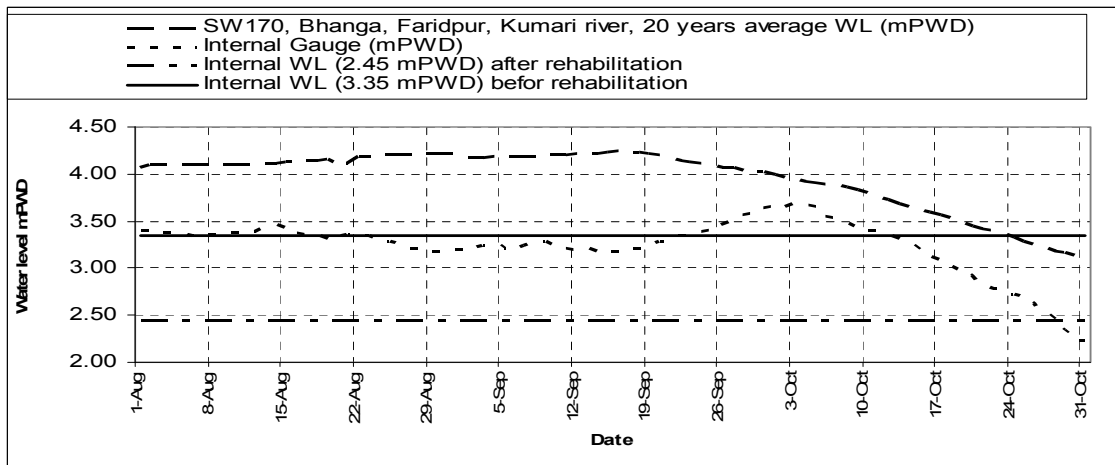


Figure 5.12: Monsoon water levels of Kumar River at Bhanga

Land types and flood depth

The land types as they are at present existing and after project rehabilitation and construction works based on anticipated flooding depth during the monsoon season with gross and net cultivated area, and proportion to total area are presented in Table 5.8. Land type F_0 is never flooded during the rainy season and may experience drought during the dry season. The F_2 land type is seldom and F_3 is permanently flooded even during the dry season. It comprises beels and ghers.

Table 5.8: Land type, flood depth and cultivable area in ha and in percentage

Land Type	Area covered		
	Gross area (ha)	Cultivable area (ha)	Percentage of NCA
F_0 ($d < 0.3m$)	8,345	6,465	79.9
F_1 ($0.3m - 0.9m$)	530	281	3.5
F_2 ($0.9m - 1.8m$)	961	914	11.3
F_3 ($d > 1.8m$)	432	432	5.3
Total	10,268	8,092	100.00

5.2.6.1.5 Hydrology of Kalidaskhali-Arpara Subproject

Daily water level data, ranging from 1990 to 2010 of the Begabati-Fatki River for the station at Arpara (SW-21) were collected from the Hydrology section, BWDB and subsequently processed and analysed. The 20 years flood hydrograph generated for the Begabati-Fatki River, is shown in Figure 5. 13. It shows that, after rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open.

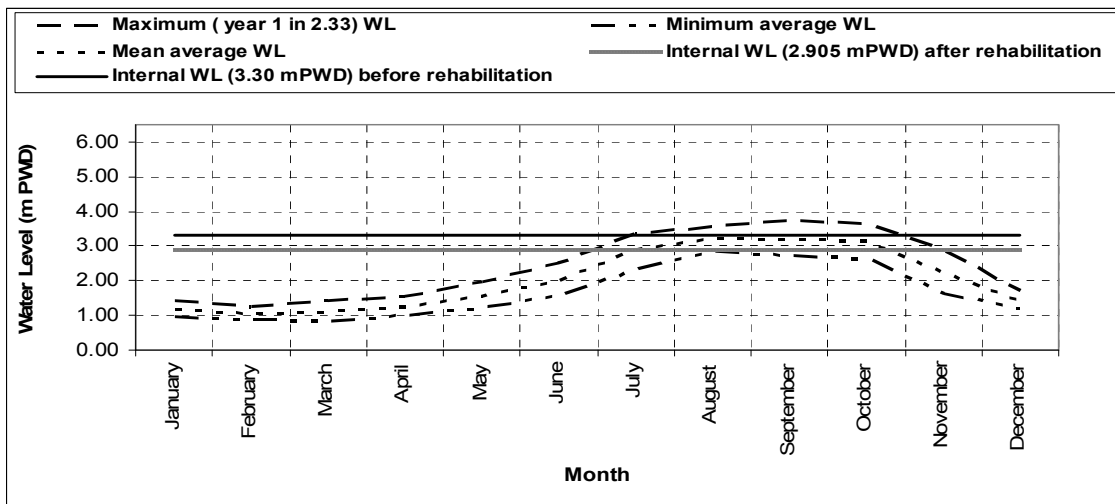


Figure 5.13: Begabati-Fatki river water levels at Kalidaskhali-Arpara SP area (station WS-21, Arpara, Magura)

Internal water level data

A survey on the internal water levels was carried out during the monsoon period August, September and October 2012 and the results were reported to the project authority. From this report and the daily water level observations of Gauge SW-21, Arpara, Magura of the Begabati-Fatki River, the internal reference water level during the monsoon within the project was calculated at 3.30 m PWD, while the basin water level during the monsoon was calculated at 2.90 m PWD. The generated hydrograph for internal and river gauge water levels is shown in Figure 5.14.

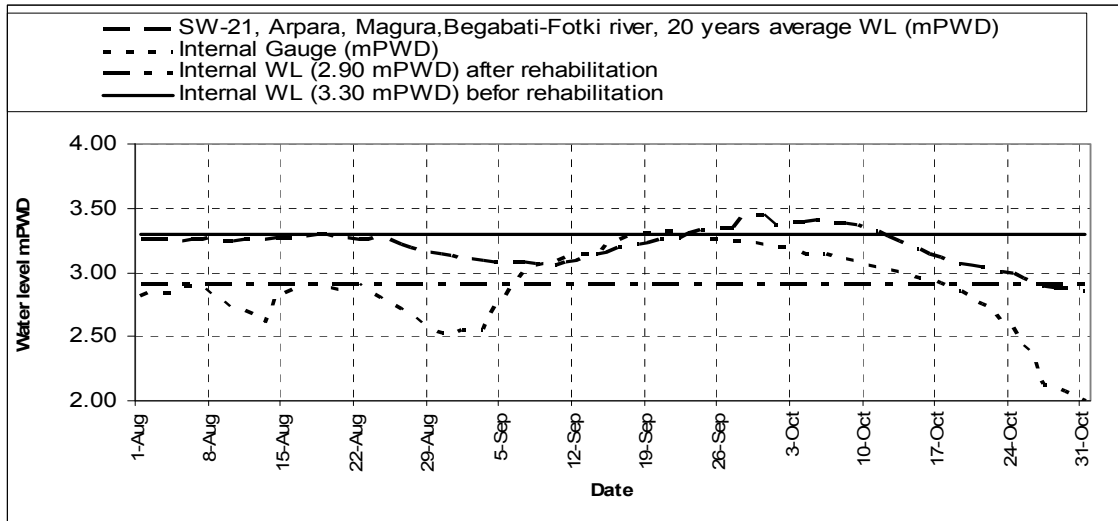


Figure 5.14: Monsoon water levels of Beghabati- Fatki River at Arpara

Land types and flood depth

The land types as they are at present existing, and after project rehabilitation, and based on anticipated flooding depth during the monsoon season with gross and net cultivated area, and in proportion to the total area are presented in table 5.9. Land types F_0 may be temporary flooded up to 0.3 m for a short duration during the rainy season and may experience drought during the dry season. F_1 type may be flooded up to 0.9 m and F_2 up to 1.8 m during the monsoon. F_3 is permanently flooded, even during the dry season. It comprises beels and ghers.

Table 5.9: Land type, flood depth and cultivable area in ha and in percentage

Land Type	Area covered		
	Gross area (ha)	Cultivable area (ha)	Percentage of NCA
F_0 (d<0.3m)	10,199	8,192	77.2
F_1 (0.3m-0.9m)	1929	1,578	14.9
F_2 (0.9m-1.8m)	1050	827	7.8
F_3 (d>1.8m)	19	19	0.2
Total	13,197	10,616	100.0

5.2.6.1.6 Hydrology of Horai River Subproject

Daily water level data, ranging from 1990 to 2010 of the Padma River for the station at Mohendrapur (SW-91.2) were collected from the Hydrology section, BWDB and subsequently processed and analysed. The 20 years flood hydrograph generated for the Padma River, is shown in Figure 5.15. It shows that, after rehabilitation, in the periods June-July and October-November the focus will be on regulating the water levels, while in the remaining periods in between the regulators will be closed or open.

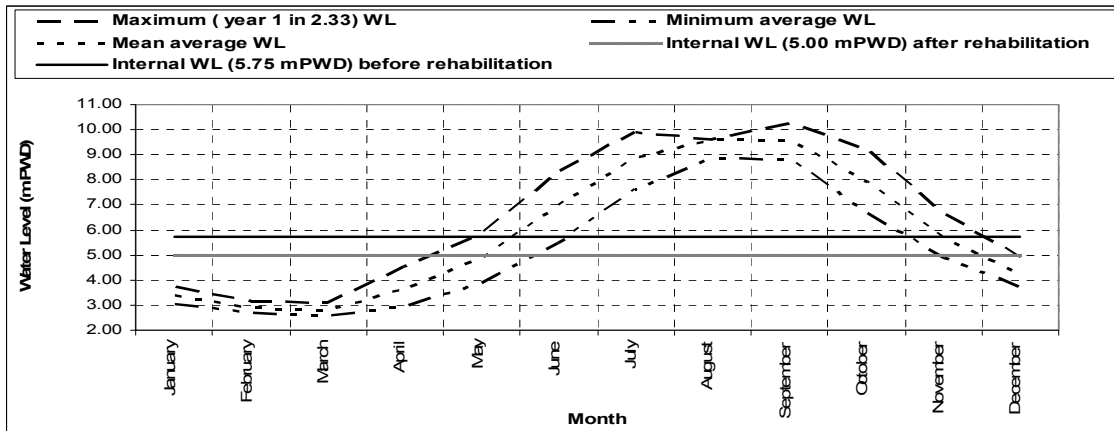


Figure 5.15: Padma river water levels at Horai River SP area (station WS-91.2, Mohendrapur, Rajbari)

Internal water level data

A survey on the internal water levels was carried out during the monsoon period August, September and October 2012 and the results were reported to the project authority. From this report and the daily water level observations of Gauge SW-91.2, Mohendrapur, Rajbari of the Padma River and Gauge SW-168, Faridpur of the Kumar River, the internal reference water level during the monsoon within the project was calculated at 5.75 m PWD, while the basin water level during the monsoon was calculated at 5.00 m PWD. The generated hydrograph for internal and river gauge water levels is shown in Figure 5.16.

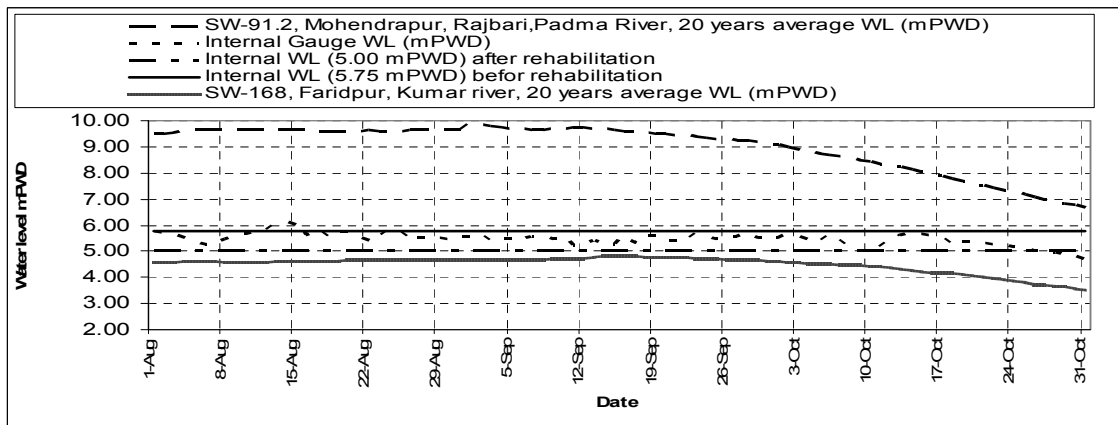


Figure 5.16: Monsoon water levels of Padma River at Mohendrapur

Land types and flood depth

The land types as they are at present existing and after project implementation based on anticipated flooding depth during the monsoon season with gross and net cultivated area, and proportion to the total area are presented in Table 5.10. Land types F_0 may be temporary flooded up to 0.3 m for a short duration during the rainy season and may experience drought during the dry season. F_1 type may be flooded up to 0.9 m and F_2 up to 1.8 m during the monsoon. F_3 is permanently flooded, even during the dry season. It comprises beels and ghers

Table 5.10: Land type, flood depth and cultivable area in ha and in percentage

Land Type	Area Covered		
	Gross area (ha)	Cultivable area (ha)	Percent of NCA
F_0 (d<0.3m)	17,954	13,257	96.3
F_1 (0.3m-0.9m)	109	71	0.5
F_2 (0.9m-1.8m)	502	436	3.2
F_3 (d>1.8m)	35	0	0.0
Total	18,600	13,764	100.0

5.2.6.1.7 Hydrology of Purulia- Charbatpara Subproject

Purulia-Charbhatpara subproject is adjacent to and a bit down to the Modhumoti River that flows along the right side of the Alfadanga-Boalmari subproject. It is assumed by observation that hydrology of Purulia-Charbhatpara subproject will be more or less similar to that of the Alfadanga-Boalmari subproject (sub-section 5.2.6.1.3).

5.2.6.1.8 Hydrology of Bamonkhali-Bornali Subproject

Bamonkhali-Bornal subproject is adjacent to Kalidaskhali-Arpara subproject having similar to hydrology to that of the Kalidaskhali-Arpara subproject that has been described in sub-section 5.2.6.1.5.

5.2.6.1.9 Hydrology of Arol Beel and Sonamukhi-Bonmandar Subprojects

As there will be no involvement of constructing any new FCD/I structure, no hydrological study will be conducted for these subprojects.

5.3 Ecological Environment

5.3.1 General

Bio-ecologically the study area falls under Ganges-Padma Floodplain. Field visits indicated that the subproject sites and adjacent floodplain ecology has changed in the area and only some limited number of floral and faunal species are now observed. Natural factors such as river erosion, climatic effects, natural calamities, etc. also have impacted on ecological characteristics; however, the study area seems to be moderate to highly disturb by the natural factors as well as anthropological activities.

The beels and khals together in subprojects present a unique ecosystem in the riverine environment of the subproject areas. The environment of the south west of Bangladesh where the subprojects are located is subjected to extensive agriculture due to immense pressure to increase food production. The pressure on land has virtually changed the ecosystem of beel from natural wetlands to cultivated paddy fields that are subject to paddy and vegetable cultivations two to three times a year.

The ecosystems found today in subproject area can be categorized into three main categories

- i. Low lying crop cultivation area with paddy and vegetable cultivations
- ii. Homestead with home garden crops, and build up area with embankments, etc.
- iii. Flood plains that remains under water during most of the dry period and other aquatic systems such as ponds and khals where the fisheries activities are taking place

The environment assessment covered these three main ecosystems independently. However the subproject activities are expected to take place in all three areas of the ecosystems and thus may have cumulative impacts.

Table: Different ecosystems in the subproject areas and their components

Ecosystem	Abiotic components and activities	Biotic components
Low lying area with annual crop cultivations	-alluvial soils with flat topography intersected with drainage channels and khals -regular land preparation take place that loosens soil and make them vulnerable for erosion -spray of chemicals and fertilizers are common	Intensely cultivated with food crops, do not find any trees or shrubs. frequented by birds, amphibians, reptiles and small mammals that feed and frequent the area
Homestead home gardens with perennial crops and building with associated structures	Houses both temporary and permanent nature are found in homestead. Many socio economic activities take place in these areas throughout the day. drinking water is obtained from the tube wells found scattered in these areas	Many different economically useful perennial crops lining the road side are found with common domestic animals also raised. not much wild animals can be found in these areas due to intense human activities
Flood plains and other water bodies	Mostly fisheries take place due to aquatic environmental condition. the only natural wetland hydrological ecosystem is found in the flood plains where water remains longer period after the dry period sets-in both culture and capture fisheries take place while the domestic water needs are also met during the dry periods	The wild and natural fish and animals last resort is found in the flood plains. Many different fish, amphibians, reptiles and small mammals are found in addition to birds listed in the annex. No management attention is currently paid to these open areas

In view of the direct relationship between the project activities and the ecosystems mentioned above a detail flora and fauna survey of the areas was undertaken.

As part of the EIA of SAIWRPMP, an environmental baseline study was carried out in areas surrounding the project site. The specific objective of the baseline study is to gather information on the existing biological environment of the areas (ecosystems dynamics) in and around the project site; to gather and assess peoples' perception on environmental aspects of the proposed project. The baseline ecological survey primarily focused on identifying floral and faunal diversity and distribution within and surrounding of the subproject sites.

The main purposes of the ecological survey were:

- ❖ To identify ecosystems diversity in the project area and enlist the plant and wildlife species with their national and international status,
- ❖ To enlist keystone, rare and threatened flora and fauna,
- ❖ To investigate the distribution and abundance of flora and fauna including fish species,
- ❖ To make an assessment of the impacts for the proposed project activities on the ecological environment.

A rapid survey was conducted during field visits during October 2014 to January 2015. The EIA team visited areas surrounding the project site to collect first-hand information on floral and faunal diversity. Literature review and informal interviews with local people were also conducted as a part of the EIA. Information gathering on faunal and mammalian species was through visual observations on walk through the area and also through discussion with the local people. Fish and fishery information were collected through field study, fishermen interview as well as local fish market survey. Floral survey was conducted through visual and rapid field survey. Local status of species considering availability in the locality was taken in terms of Common, Fairly Common and Rare. However, a species locally identified as rare may not necessarily be threatened for greater geographical context.

According to the IUCN Red Book 2001 species are classified as Extinct, Critically Endangered, Endangered, Vulnerable and Lower Risk based on status of each species to understand the importance for conservation of those species. Species under Critically Endangered, Endangered and Vulnerable are combined termed as Threatened.

5.3.2 Flora

Plant species that grows in the wild in a habitat for a particular period plays a vital socio-economic and ecological role for a particular type of habitat or ecosystem survival. These plants are usually part of the naturally occurring local food chains. On the basis of habitat, the floral species are divided into two major categories viz. (a) aquatic flora, and (b) terrestrial flora. This Section describes the floral diversity in areas within and surrounding the subproject sites with their status in Bangladesh.

Aquatic flora is divided into three major types – trees, shrubs and herbs. Aquatic floral species grow in rivers, canals, ditches, seasonal wetland and low lying agricultural lands in submerged, free-floating, or rooted floating states. Common aquatic floral species in the study areas include Water hyacinth – *Eichhornia crassipes*, Khudipana-*Lemna perpusilla*, and Kalmi-*Ipomoea aquatica*.

The study area supports various terrestrial flora, some of these grow naturally, while most have been introduced. Generally, terrestrial flora make-up complex ecosystem with which wildlife develops a direct relationship for their survival. However in many ecosystems these relationships are poorly understood or studied. This lack of knowledge on food chains that operate in such ecosystem is a major impediment when planning economic development activities.

List of flora available in the project influencing areas are given in Table D.1 of Annex D. Of the total 130 floral species found in the project influencing area, 8 species are found rare locally.

Most of the flora in homesteads is mix crops and in Agriculture fields are mono crops or mix crops with smaller populations and usually are under the care of owners. However those in common public places are not been maintained and therefore subject to external influence.

5.3.3 Fauna

The study areas have various assemblages of animal communities; some species use the area as permanent habitat, while others as temporary transit habitat.

Based on habitat, faunal species are divided into two major categories viz. (a) aquatic fauna, and (b) terrestrial fauna. This Section describes the faunal diversity in areas surrounding the project site with their status in Bangladesh.

Aquatic fauna refers to wildlife and fish species that fully or partially depend on aquatic environment to live and produce offspring. Amphibian, reptile, bird, mammal and fish species that depend on aquatic environment are the main component of aquatic fauna in the study area. Reproduction, breeding and multiplication of aquatic fauna is usually finely tuned and adjusted with the rhythm and amplitude of monsoon flooding. Aquatic wildlife is divided into 5 major groups- Fish, Mammal, bird, reptile and amphibian.

Fish is the most important aquatic fauna in the project areas, along with other species. The other aquatic fauna includes prawns (*Macrobrachium spp.*), crabs, snails (*Pila*, *Vivipara*, *Lymna*, etc.), freshwater mussels (*Lamellidens spp.*) etc. invertebrates and about 23 species of common fishes. Kolabang (*Rana tigrina*); Guishap (*Varanus bengalensis*) and Matia sap (*Enhydris enhydris*) are common. The aquatic birds are – Pancowri (*Phalacrocoraxcarto*), Kanibok (*Ardeolagravii*), Sadabok (*Egretta garzetta*), Borobok (*Egretta alba*), Machranga (*Halcyon pileata*), Dahuk (*Gallixcinerea*), and winter migratory birds – Balihash (*Dendrocygna javanica*) and Chakha (*Tadornaferu ginea*).

Gangetic Dolphin (*Platanista gangetica*) is one of the important endangered aquatic mammals observed in the Padma River (Figure 5.17). The Padma River passes along the northern boundary of Horai River Subproject of Rajbari district under SAIWRPMP. The population of this species is considered to be decreasing day by day. The species has been adversely affected by human use of the River system. Entanglement in fishing nets is causing significant damage to the local population of this fish species. Some individual dolphins are still taken each year through illegal hunting for their oil and meat that is used as a liniment.



Figure 5.17: Gangetic Dolphin of the Padma River

There are different aquatic habitats (e.g. river, beel, khal/canal, ditch, pond etc.) for fishes in and around different subprojects of SAIWRPMP. Among the habitats of the fishes, the Padma river is the largest aquatic habitat in the project influencing area with diverse fish species; Gorai, Horai, Kumar, Modhumoti, Arial Khan, Kapatakhyia are other rivers and, beels and canals of the different subproject areas are other important aquatic habitats for different fish species. Major fishes in the project area are carps (Rui, Karla, Mrigal, Ghania, Kalbasu, Kalia), Hilsa, Shrimp, Cat Fish (Rita, Boal, Pangas, Silon, Aor, Bacha) and Snake Head (Shol, Gazar, Taki).

Different types of Mammals, Amphibians, Reptiles and Avian species can be found in the project areas. During the baseline environmental survey, most of the Aves (e.g. birds), Mammals, Amphibians, and Reptiles were identified through direct observation and consultation with the local people. A total of 103 species were identified during field survey among them 49 Fish, 3 Amphibian, 11 Reptilian, 30 Avian, and 10 Mammalian species were identified. The list of those species with their availability in the project area is given in Table D.2 of Annex D. Of all the identified species, there are a total of 22 species found rare locally in the study area.

5.3.4 Rare and Endangered Species

There are no rare and endangered species of local biota in the project area in real terms except the Gangetic Dolphin (*Platanista gangetica*) observed in the Padma River adjacent to the Horai River subproject. The project will not directly affect the Padma River, therefore there is no impact to the habitat of the Gangetic Dolphin.

5.3.5 Environmental Protected Area

Based on the Bangladesh Wildlife (conservation and security) Act 2012, some specific areas of environmentally important are declared as Environmental Protected Areas (EPA). The EPAs include national parks, wildlife sanctuaries, eco parks, safari parks and private game reserves for some specific purpose of environmental protection. There is no such EPA near the subproject areas of SAIWRPMP.

Moreover based on the Environment Conservation Act, 1995 and the Environment Conservation Rules, 1997 some specific areas of ecologically important are declared as Ecologically Critical Area (ECA) for conservation of ecological condition of that area restricting certain activities detrimental to the environment. There is no such ECA surrounding the subproject areas of SAIWRPMP.

5.4 Environmental Quality

5.4.1 Ground Water Quality

Ground water is abundant in Bangladesh and the aquifers are highly productive. The sediments are predominantly non-indurate and easy to drill by hand, at least to shallow levels. Water tables vary across the study area but are typically shallow at around <5.0–10 m below the ground surface. These factors have made groundwater an attractive and easily accessible resource and have led to a rapid proliferation in the use of groundwater over the last few decades. The majority wells are private tube

wells, which penetrate the shallow alluvial aquifers to depths typically of 10–60 m. Irrigation boreholes typically tap deeper aquifers in the study region of 70–100 m depth.

To assess the shallow and deep ground water quality of the project area, three water samples were collected in the month of January 2015 and analyzed for various physico-chemical parameters in the laboratory of the Department of Soil, Water and Environment of Dhaka University. The locations of ground water samples collected in the project influence area are shown in Table 5.11 and Figure 5.18; and the test results are given in Table 5.12.

Table 5.11: Details of the ground water samples collected in the project influence area.

Sample Code	Description of the Location	Geographical Co-ordinates	Parameters analysed
GW-1	Tube well of Md. Nizam Uddin at Jhaudia of Arol Beel Subproject, Jessore.	23°11'93" N 89°08'46" E	pH, Total Hardness as CaCO ₃ , Chlorides as Cl ⁻ , Nitrates as NO ₃ , Sulphates as SO ₄ , Salinity, Mn, Fe, As.
GW-2	Tube well of Sujon Bhuyian at Gridha of Alfadanga-Boalmari Subproject, Faridpur	23°15'65" N 89°41'68" E	
GW-3	Tube well of Sirgram Bazar Jame Masjid at Sirgram of Alfadanga- Boalmari subproject, Faridpur	23°20'88" N 89°40'19" E	



Figure 5.18: Map showing locations of ground beel water sample collection points

Table 5.12: Analytical Results of Ground Water Samples

Sample Code	Results of Test Parameters								
	pH	CaCO ₃ (mg/L)	Cl ⁻ (mg/L)	NO ₃ (mg/L)	SO ₄ (mg/L)	Fe (mg/L)	Mn (mg/L)	As (mg/L)	Salinity (ppt)
GW-1	7.37	346	79.88	0.08	12.80	0.074	0.643	*BDL	0.64
GW-2	7.26	328	54.16	0.10	Nil	0.481	0.436	0.0038	0.44
GW-3	7.33	355	77.55	0.06	34.20	0.005	Nil	0.0075	0.51
Bangladesh Standard for drinking water	6.5-8.5	200-500	150-600	10	400	0.30-1.0	0.10	0.05	-

*BDL = below detection limit of As = 0.002 ppb

Source: Lab Analysis, January 2015, Soil, Water and Environment Department, Dhaka University

Laboratory analysis (From Table 5.12) of the ground water samples collected from the various sources showed that-

- I. pH value and Total hardness as CaCO₃ of all the sample tube well waters are within the acceptable standard values;
- II. Chlorides of all the sample tube well waters are much less than that of the lower limit of the acceptable standard value;
- III. Nitrates as NO₃ is much less in all the samples than the standard;
- IV. Sulphates is much less in samples GW-1 and GW-3 than the standard and no SO₄ present in sample GW-2;
- V. Presence of Fe is within the standard in the sample GW-2, but the values are much less in the samples GW-1 and GW-3
- VI. Presence of Mn is much higher in samples GW-1 and GW-2, but no Mn is there in sample GW-3
- VII. Presence of Arsenic (As) is below detection limit in GW-1 and much less in GW-2 and GW-3.

Analytical results show that the ground water quality in the project influence area is found to be satisfactory for drinking purpose.

5.4.2 Surface Water Quality

The project area is drained by rivers, khals, streams, etc. and the same are in swift flow during the monsoon period and also having considerable flow during non-monsoon period. The majority of the rivers, streams, and khals in Narail and Gopalganj districts may receive the sea water during the high tide and drains out fresh water during low tide period. In order to assess the surface water quality in the project area three surface water samples were collected in the month of January 2015 and analysed for various physico-chemical parameters in the laboratory of the Department of Soil, Water and Environment of Dhaka University. The locations of surface water samples collected in the project influence area are shown in Table 5.13 and Figure 5.19; and the results are given in Table 5.14.

Table 5.13: Locations for Surface Water Quality Samples

Sample Code	Description of the Location	Geographical Co-ordinates	Parameters analysed
SW-1	Baor at Jhaudia, Arol Beel Subproject, Jessore	23°11'84" N 89°08'45" E	pH, EC, DO, BOD, TDS, TSS and Salinity.
SW-2	River: Modhumoti river at Gridha, Alfadanga/Boalmari Subproject, Faridpur	23°15'62" N 89°41'72" E	
SW-3	Khal at Sirgaram of Alfadanga-Boalmari subproject, Faridpur	23°20'89" N 89°40'24" E	



Figure 5.19: Map showing locations of surface water sample collection points

Table 5.14: Analytical Results of Surface Water Samples

Sample Code	Results of Test Parameters						
	pH	EC (µS/cm)	DO (mg/L)	BOD 5days (mg/L)	TDS (mg/L)	TSS (mg/L)	Salinity (‰) (ppt)
SW-1	8.20	615	7.66	0.14	304	317	0.39
SW-2	8.05	328	8.02	0.23	154	96	0.21
SW-3	8.10	347	7.76	0.26	157	58	0.22
Inland Surface Water Standard for Fish	6.5-8.5	-	5.00 or more	6.00 or less	-	-	-
Inland Surface Water Standard for Irrigation	6.5-8.5	2250 (at 25°C temp.)	5.00 or more	10 or less	-	-	-

Analytical results show that the surface water in the project influence area is found to be satisfactory for fishery and irrigation purposes. However as the tests done here are only one off test it is recommended that the tests be carried out over a longer period to capture the seasonal variation in water quality during construction as well as part of after care services. It is therefore recommended that a more comprehensive representative samples be collected from the rivers and khals subject to various activities under the project be collected to establish a baseline water quality. The monitoring of such criteria over several seasons is therefore recommended.

5.4.3 Soil Quality

Soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. The land in the area is mostly used for agricultural cultivation and water bodies for fish cultivation.

As part of the EIA Studies, soil samples were collected from three locations of the project and analysed for various physico-chemical parameters in the laboratory of the Department of Soil, Water and Environment of Dhaka University. The locations of soil samples collected in the project influence area are shown in Table 5.15 and Figure 5.20; and analytical results are given in Table 5.16.

Table 5.15: Locations for Soil Quality Samples

Sample Code	Description of the Location	Geographical Co-ordinates	Parameters analysed
S-1	Agricultural land at Jhaudia of Arol Beel Subproject, Jessore	23 ⁰ 11'86" N 89 ⁰ 08'45" E	pH, Texture, Total Organic Carbon (TOC), Nitrogen, Potassium and Phosphorous
S-2	Agricultural land at Gridha of Alfadanga/Boalmari Subproject, Faridpur	23 ⁰ 15'63" N 89 ⁰ 41'72" E	
S-3	Agricultural land at Sirgram of Alfadanga-Boalmari subproject, Faridpur	23 ⁰ 20'90" N 89 ⁰ 40'25" E	



Figure 5.20: Map showing locations of soil sample collection points

Table 5.16: Analytical Results of Soil Samples

Sample Code	Results of Test Parameters					
	pH	Texture	TOC (%)	Total N (%)	Total P (%)	Total K (%)
S-1	7.68	Silty clay	1.68	0.14	0.065	0.66
S-2	7.86	Silt loam	0.65	0.08	0.055	0.49
S-3	7.84	Silty clay	1.28	0.12	0.065	0.53

Analytical results show that the soil in the project area has been degraded and need enrichment for better productivity based on establishing baseline data for specific sites by conducting site specific soil quality analysis.

5.4.4 Sediment / Bed-material Quality

During the construction of new retired embankment and re-sectioning of existing embankments, soils needed will be met with the material from re-excavation and de-silting of khal/river and sediment/bed-material from the nearby river. As the silt is build up every season after flooding, it will be beneficial to excavate this silt deposited from the river provided they meet the physical quality needed for embankment construction. However the stipulated guidelines for such extractions in terms of depth of excavation will be followed.

As part of the EIA Studies, sediment samples were collected from four locations of the project and analysed to know the concentrations of heavy metals detrimental to health and environment in the laboratory of the Department of Soil, Water and Environment of Dhaka University. The locations of sediment samples collected in the project influence area are shown in Table 5.17 and Figure 5.21; and analytical results are given in Table 5.18.

Table 5.17: Locations for Bed Material Quality Samples

Sample Code	Description of the Location	Geographical Co-ordinates	Parameters analysed
BM-1	Khal at Jhaudia near one vent regulator of Arol Beel Subproject, Jessore	23 ^o 11'96" N 89 ^o 08'45" E	As, Zn, Cu, Pb, and Cd.
BM-2	Modhumoti River at Gridha of Alfadanga-Boalmari Subproject	23 ^o 15'62" N 89 ^o 41'72" E	
BM-3	Khal at Sirgram Bazar near one vent regulator of Alfadanga-Boalmari Subproject	23 ^o 20'89" N 89 ^o 40'24" E	
BM-4	Khal near Horai River at Sorusail adjacent to two vent regulator of Horai River Subproject, Rajbari	23 ^o 39'85" N 89 ^o 35'80" E	



Figure 5.21: Map showing locations of bed materials quality sample collection points

Table 5.18: Analytical Results of River Bed Materials

Sample Code	Results of Test Parameters (mg/kg)				
	Zn	Cu	Pb	Cd	As
BM-1	51.21	21.26	10.80	*BDL	3.92
BM-2	70.88	36.94	19.10	BDL	2.01
BM-3	59.80	25.20	13.92	BDL	2.11
BM-4	50.41	21.90	10.00	BDL	2.39
**PEC	459	144	128	4.98	33

*BDL: Below detection limit for Cd = 0.001 mg/kg

**PEC: Probable Effect Concentration, Prediction of sediment toxicity using consensus-based freshwater sediment quality guide (US EPA, 2000).

Analytical results show that the sediment quality in the project selected khals/rivers in the project area is found to be satisfactory for use in embankments.

However it is important that the excavation work is carried out without damaging the river banks and other river training structures. The project will guide the contractors who will supply the soil material to follow those guidelines and also comply with the EMP.

5.5 Environmental Risks

5.5.1 Climate Change

Climate change impacts- Bangladesh is categorized as a highly vulnerable to climate change impacts due to its location and heavy dependence of hydrological features.

One of the major climate change impacts that will effect Bangladesh in general and areas like south east more specifically, is the Sea Level Rise (SLR) due to its direct impact on floods and drainage regimes of the area; Scientific evidences show that sea level is likely to rise by 50cm in the next 50 years(Ref. IPCC 2007). Some other effects include abrupt change of climatic conditions such as unusual seasonal changes, irregular excess or low rainfall, increased frequency and intensity of natural calamities like flooding, cyclone, thunder storm, desertification, prolonged draughts, landslides, acid rain, etc.

5.5.2 Flooding

Geographically, subproject areas of Rajbari, Faridpur, Gopalganj, Narail and Magura districts fall under Moderate River Flooding Zone whereas subproject areas of Jessore district fall under Low River Flooding Zone. But because of the locations and physiological conditions almost all the subproject area of SAIWRPMP falls under Moderate River Flooding Zone. However under the climate change scenario where the intensity of flooding may increase with longer flood receding time due to SLR, the area may experience higher flood damages in future.

5.5.3 Cyclones

Bangladesh coast is notoriously known for the tropical cyclones that may cause tremendous personnel and physical damage. It is therefore, pertinent to have an account of these cyclones. Table 5.19 shows monthly and annual frequency of depressions and deep depression in the Bay from 1948 to 1979 and the number of such depression that matured in to cyclonic storms and severe cyclonic storms over the period. It is noticed that although the highest number of depressions occurred during September, the depressions that matured into severe cyclonic storms are maximum during May in the pre-monsoon period and during October and November in the post monsoon period. These two periods are the periods of transition for the onset and recession of monsoon.

Table 5.19: Frequency distribution of tropical cyclones forming in the Bay of Bengal 1948–1970

Cyclonic Intensity	Cyclone Nos.											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Depression	1	1	None	3	18	31	31	32	37	21	6	5
Moderate Storms	2	None	None	None	1	1	1	3	6	15	14	4
Severe Storms	None	None	None	None	6	None	None	None	1	5	3	4
Total	3	1		3	25	32	32	35	44	41	23	13

Source: Bangladesh Meteorological Department

Cyclonic coastal storms are notorious climatic feature that causes immense damages to the life and properties of coastal zone located at the southern parts of southwest and southeast areas in Bangladesh. The high wind, associated storm surges and rainfall together causes widespread damages to the coastal and adjoining areas.

The subprojects of SAIWRPMP are located adjacent of the northern fringe of coastal area. At times coastal cyclonic storm may pass over the area and the storm surges will be substantially attenuated during passage through the coastal area, the residual wind speed may have sufficient strength to cause damages to properties. Table 5.20 presents a summary of cyclone characteristics after landfall in Bangladesh coast during 1990-2009.

Table 5.20: Summary of Coastal Cyclones (1990-2009)

Year	From	To	Type	ECP	Wind Speed max kmph	Surge (m)	People Killed	Landfall location
1990	16-12-90	18-12-90	SCS	997	102			Cox Bazar coast
1991	25-04-91	30-04-91	SCS_H	940	235	6-7.6	138882	Chittagong coast
1991	31-05-91	02-06-91	CS	990	83	2.5		Patuakhali-Chittagong coast
1991	12-10-91	14-10-91	D					Patuakhali-50 km west coast
1992	17-05-92	18-05-92	CS					Teknaf coast
1992	20-10-92	21-10-92	DD	998				Cox Bazar-Teknaf coast
1992	17-11-92	21-11-92	SCS	952				Cox Bazar-Teknaf coast
1994	24-04-94	02-05-94	SCS_H	948	275	3.64-4.85	184	Bangladesh-Tripura
1995	10-06-95	12-06-95	D					Sitakunda
1995	22-07-95	23-07-95	D					Bangladesh coast
1995	21-11-95	25-11-95	SCS	960	55			Cox's Bazar coast
1996	07-05-96	08-05-96	CS					Chittagong-Cox Bazar coast

Year	From	To	Type	ECP	Wind Speed max kmph	Surge (m)	People Killed	Landfall location
1996	24-05-96	27-05-96	D			3.03- 4.55		Chittagong-Cox Bazar coast
1996	26-10-96	29-10-96	CS	1000	70	1.52- 2.12	9	Sundarban coast
1997	15-05-97	19-05-97	SCS	965	232	4.55	155	Chittagong coast
1997	25-09-97	27-09-97	SCS		150	3.03- 4.55	67	Bhola-Laxmipur coast
2004	02-05-04		SCS_H					Myanmar
2004	19-05-04		CS	990	90	0.6- 1.22		Cox's Bazar-Akyab Coast
2007	16-11-07		SCS_H					SIDR hit Bangladesh Coast
2008	26-10-08							Rashmi hit Bangladesh coast affecting
2009	17-04-09							Bijli hit Noakhali and Chittagong coast
2009	25-05-09							Aila hit entire Bangladesh coast

Note: D Depression; DD Deep Depression CS Cyclonic Storm
 SCS Severe Cyclonic Storm SCS_H Severe Cyclonic Storm with core of hurricane
 ECP Estimated Central Pressure in millibars

5.5.4 Seismicity

Bangladesh has long been one of the seismically active regions of the world, and has experienced numerous large earthquakes during the past 200 years. Many of seismic-tectonic studies have been undertaken on the area comprising the Indo-Burman ranges and their western extension and in the northern India. Major active fault zones of the country have been delineated through geological trenching and dating methods. A list of reference of this is provided in Haque, (1990), using data from various sources. A seismic zoning map of Bangladesh has been proposed in 1979 by Geological Survey of Bangladesh (GSB) Figure 5.22. dividing the country into three seismic zone which was accompanied by an outline of a code for earthquake resistant design. Later, a new updated seismic zoning map and detailed seismic design provisions have been incorporated in Bangladesh National Building Code (BNBC 1993). A seismicity map of Bangladesh and its adjoining areas has also been prepared by BMD and GSB. Bangladesh has been classified into three seismic zones with Zone-1 is the most and Zone-3 is the least vulnerable to seismic risks. The areas under SAIWRPMP are falling under Zone-3 means the least vulnerable to seismic risks. Table 5.21 and Table 5.22 are showing the earthquakes history in Bangladesh and recent earthquake data in the influencing area of Bangladesh respectively.

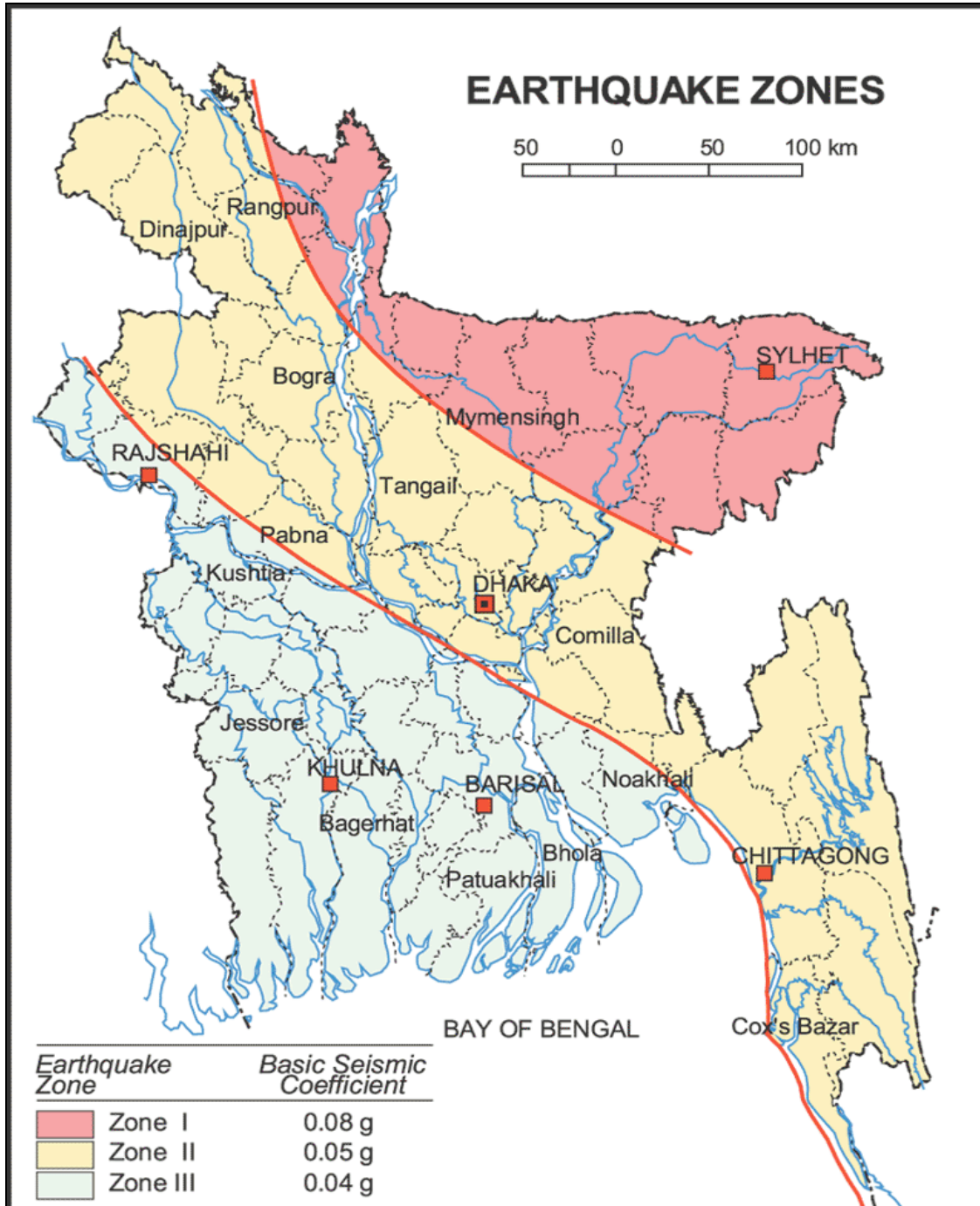


Figure-5.22: Earthquake Zone of Bangladesh

Table 5.21: History of Earthquakes in Bangladesh

Date	Name	Magnitude (Richter)	Epicentre Distance from Dhaka (km)	Epicentre Distance from Sylhet City (km)	Epicentre Distance from Chittagong (km)
10 January, 1869	Cachar Earthquake	7.5	250	70	280
14 July, 1885	Bengal Earthquake	7.0	170	220	350
12 June, 1897	Great Indian Earthquake	8.7	230	80	340
8 July, 1918	Srimongal Earthquake	7.6	150	60	200
2 July, 1930	Dhubri Earthquake	7.1	250	275	415
15 January, 1934	Bihar-Nepal Earthquake	8.3	510	530	580
15 August, 1950	Assam Earthquake	8.5	780	580	540

Table 5.22: Recent earthquake data in the influencing area of Bangladesh

Date	Time (UTC)	Latitude (deg.min.sec)	Longitude (deg.min.sec)	Magnitude	Distance (km) from Dhaka Seismic Observatory	Region
18/09/2011	12:40:47.00	27:75.00N	088:20.00E	6.8	495	Sikkim, India
01/08/2011	00:26:08.17	24:04.65N	093:41.97E	4.0	343	India-Myanmar Border
27/08/2011	00:55:59.00	23:45.00N	090:93.00E	4.0	69	Chandpur region, Bangladesh
28/07/2011	17:53:39.12	25:02.00N	088:58.00E	4.4	228	Nawgaon Region, Bangladesh
22/07/2011	00:58:49.36	24:20.67N	092:02.85E	4.1	183	Bangladesh-India Border Region
03/07/2011	00:15:10.12	25:27.92N	092:01.46E	3.6	253	Shilong Region, India
30/06/2011	21:45:33.00	25:50.00N	093:25.00E	3.6	326	North Chachar Hills, Assam, India
21/06/2011	04:50:58.93	23:24.43N	090:51.65E	4.0	64	Comilla-Chandpur Border Region, Bangladesh
09/06/2011	07:34:23.73	23:26.40N	089:43.80E	4.5	108	Rajbari-Faridpur Border Region, Bangladesh.

Source: Bangladesh Meteorological Department, Dhaka, 2011

* Most recent data

6 SOCIO-ECONOMIC ENVIRONMENT

As part of the EIA a sample socio-economic baseline study was carried out at randomly selected places of all the eleven subproject sites of SAIWRPMP. The specific objectives of the baseline study were to gather information on the existing socio-economic environment of the areas in and around the project site; to gather and assess peoples' perception on different aspects of the proposed project. This topic describes the existing socio-economic environment of areas in and around the project site based on the social studies carried out as a part of the present study.

As a part of the EIA, a rapid socio-economic study was carried out to assess the current socio-economic condition of the areas surrounding the proposed project site. Efforts were made to identify the socio-economic attributes that may be impacted due to the proposed project activities. The main objectives of the socio-economic study were:

1. To understand people's socio-economic condition
2. To understand extent of people's access to basic services
3. To understand people's perception regarding possible impacts of proposed project
4. To get feedback from people regarding preferred and possible mitigation measures

The socio-economic study has been done covering the proposed project site. Field study, questionnaire survey, meetings (both formal and informal), and focus group discussions is the core methods of socio-economic study. It is targeted to interact with more than 500 people directly during the study. The photographs showing the socio-economic survey under progress in [Figure 6.1](#)



Figure 6.1: Socio-economic survey under progress

6.1 Population: Demographic Profile

As per the Population and Housing Census 2011, Bangladesh Bureau of Statistics the national Census and details were compared with the study districts. The socio-demographic details of the same are given in Table 6.1.

Table 6.1: Socio-demographic Details of the Subproject areas (2011)

Sl. No	Name of Sub Project and District	Gross Area (Ha)	No. of Total H/H (BBS 2011)	No. of Population (BBS 2011)	Average H/H Size	Population Density (per Sq.km)	Literacy Rate %
1	Bangladesh	147,570 km ²	32,173,630	144,043,697	4.44	976	51.8
2	Beel Sukunia, Faridpur	9,681	18764	84438	4.5	872	52%
3	Daduria & Kandor Beel, Faridpur	3,301	3695	15519	4.2	470	65%
4	Alfadanga–Boalmari, Faridpur	8011	8971	35884	4.0	447	80%
5	Chatler-Fakurhat, Faridpur	10268	11500	48300	4.2	470	72%
6	Kalidaskhali-Arpara, Magura	13197	14781	59124	4.0	448	66%
7	Horai River, Rajbari	18,600	24875	99500	4.0	534	61%

Source: Population and Housing Census, 2011, Bangladesh Bureau of Statistics.

6.1.1 Beel Sukunia Subproject

In Beel-Sukunia, the population was estimated to be 84,438 giving a density of 872 per km². It is less by 9% of the national average density. The national average density per square kilometre is 976. This is one of the highest densities in the world. Over population or thick density creates pressure on natural resources. However it is declining as a result of decline in population growth rate. Nationally it is now 1.3, a rate one of the lowest in South Asia. In Beel-Sukunia also it is expected to decline and current population size and density will reduce.

For social stability, the desired sex ratio (female male ratio) should be 100 or very close to 100. In Bangladesh, the national average sex ratio is 100.3 meaning an almost equal number of males and females. In Beel-Sukunia, it is also 100.3. A balanced sex ratio suitable for development exist therefore in sub project area

The average household size in Beel-Sukunia was estimated to be 4.5. The national average household size is 4.4. Population growth is one of the reasons for larger household size. But the cultural reason is also important and influence household size. Practice of joint family with parents, brothers etc may also make the household size larger. It is a common practice in rural Bangladesh. Household size in Beel-Sukunia although a little bit higher, is however, consistent with the national average. Currently it is a reasonable size but it continues to decline.

The age structure of a population is important to analyze its current productivity. Generally children below 15 and adults above 59 years of age are considered non-productive. The productive age groups for the population of Beel-Sukunia are 62.69%. A majority of the population in sub project area is therefore within the productive age range

The ratio of male and female-headed households is an important aspect of socio economic and gender perspective of a society. It influences the vulnerability, family bindings, child security, and incidence of poverty, social inequality, injustice and overall instability. In Beel-Sukunia male and female headed household ratio is 14:1. It is not significant that may create any kind of social insatiability.

There is no ethnic group among people of Beel-Sukunia.

6.1.2 Daduria-Kandor Beel Subprojects

The population in Daduria-Kandor Beel subprojects was estimated to be 15,519 giving a density of 470 per km². It is less than 50% of the national average density (976), a density one of the highest in the world. Existing population growth in Bangladesh is 1.3, a figure one of the lowest in south Asia. The trend in growth rate will continue to decline with the progress of development. In Daduria-Kandor Beel subproject area it is also expected to decline. The declining trend will reduce the population size and density. This will reduce pressure on natural resource.

The sex ratio (male female ratio) in the sub project area it is 100.4 which is consistent with the national average (100.3). It means the male female balance here is very close to desired ratio and friendly to social stability.

The average household size in the sub project area was estimated to be 4.5. The national average is 4.4. Population growth is one of the reasons for larger household size. But the cultural reason is also important and influence household size. Practice of joint family with parents, brothers, etc. may also make the household size larger. It is a common practice in rural Bangladesh. Household size in Daduria and Kandor, although a little bit higher, is consistent to national average. It is expected to decline further with the progress of development.

The age structure of a population is important for analyzing its current productivity. Generally children below 15 and adults above 60 years of age are considered non-productive. In Daduria and Kandor Beel the percentage of population within the age range of 15 - 59 is: 61%. A majority of the population in sub project area is therefore within the productive age range.

The ratio of male and female-headed households is an important aspect of socio economic and gender perspective of a society. It influences the vulnerability, family bindings, child security, and incidence of poverty, social inequality, injustice and overall instability. In Daduria and Kandor Beel the percentage of male and female headed households is 95% and 5% respectively or approximately 19:1. This is an insignificant figure and will not create any barrier for social development.

There is no ethnic group of people among people of Daduria & Kandor Beel.

6.1.3 Alfadanga-Boalmari Subproject

In Alfadanga-Boalmari subproject the population was estimated to be 35,884. The population density is 447 per km². Compared to the national average (976) the project area is not over populated.

The sex ratio is defined as the number of males per 100 females. In Alfadanga-Boalmari the ratio is 1.145 (calculated on the basis of 57,914 males and 50,538 females) which is higher than the national average (1.003 according to the BBS Population Census Report 2011).

The household size is below 4.6 for a single family. In a joint family it may be more than 5, but in that case the number of couples living in the household is also proportionately more. As per BBS 2011 Population Census Report the national average household size 4.4 and for the district Faridpur it is 4.5.

In Alfadanga-Boalmari the productive or 15-59 years age group population is, with 61%, significantly higher than the two other groups (1-14 and 60 above). The non-productive population involves those

who are able to work but enjoy the social benefit at the cost of productive people. Generally children less than 15 and adults older than 60 year ages are considered non-productive people.

In Alfadanga-Boalmari no female headed household was found. No national data is available to compare the male and female household percentage of the sub-project. However, the result is consistent with other sub-projects of the project where the percentage is less than 10%.

An occupation indicates the source of income derived from work, time spent in work as well as social position. The highest percentage of people is having an occupation in farming and labour, where the share of women is extremely poor. The main reason is that women work at home for housekeeping, agriculture product processing and storage, poultry and cattle rearing and vegetable gardening. These works except housekeeping are income generating or income substitution to meet the need of household demand. In spite of intensive gender advocacy by NGOs and civil society an official and social recognition of this work as occupation not much progress has yet been made.

The average literacy rate in the subproject area is 80% with literate female and male ratio 1: 1 is better than the national average. The national average for rural literacy rate as per BBS is 57% with a literate female and male ratio of 1:1.17. The schooling facilities and motivation of the people appeared to be the cause for such higher level of literacy rate.

Observations of the PRRA team showed that degraded, makeshift or thatched houses were hardly seen in sample villages. Observations of the PRRA team in the sub-project Alfadanga-Boalmari recorded its percentage as insignificant. The housing structures of most households are either corrugated sheet or brick walled.

In the household survey within the sample villages of sub project Alfadanga-Boalmari no households were found who drink contaminated water. The high rate of pure drinking water supply in the sub-project area is consistent with the national average which is 94.98% (BBS HIES Report 2011). The reasons are the large scale motivational campaigns by the Government and NGOs for the use of pure drinking water and the availability of low cost simple technology (hand tube well) for lifting groundwater.

An estimated 63% of the households within the sub-project area are using hygienic sanitation, a figure better than the national average (51%). A major portion of the households are still out of hygienic sanitation coverage. The reason could be lack of motivation and access to public health facilities or both.

The nationally poverty is based on the measurement of calorie intake converted in to cost, a method called food poverty. This is the cost of food with daily nutritional requirement of 2122 k.cal plus an average cost for non-food items (clothes, medicines etc) of basic need. In Bangladesh this method is used to measure the poverty through expenditure survey. Within this concept of poverty measurement upper and lower poverty lines were established by Bangladesh Bureau of Statistic (BBS).

The upper poverty line is the per capita household expenditure to meet the cost of food with daily nutritional requirement of 2,122 k.cal plus an average cost of non-food items. The lower poverty line is the per capita household expenditure to meet the cost of daily nutritional amount of 1,810 k. cal

plus an average cost of non-food items. People living in between the two lines are moderate poor and people living below the lower poverty line are extreme poor.

The average incidence of poverty in the sub-project is 41.54%, a figure consistent with the district figure shown in poverty map of Bangladesh (ref:BBS web site- poverty map). In the map the poverty incidence for the district Faridpur is between 38-48%. The average rural poverty for Bangladesh is 34%. A more than average level of poverty therefore exists in the subproject area.

6.1.4 Chatlar-Fakurhat Subproject

The population in Horai River subproject was estimated to be 48,300 giving a density of 470 per km². It is less than half of national average density (976), a density one of the highest in the world. The population growth in Bangladesh is 1.3. It is declining as a result of progress in social and economic development. In sub project area it is also expected to decline. As a result the population size and density will decline. Declining trend of population and density will reduce the pressure on natural resources in sub project area.

The sex ratio (male female ratio) in the sub project area is 111. The national average is 100.3. A balanced sex ratio contributes to promote social stability and it is needed for social development. In sub project area, although it is a little bit higher, equilibrium may be maintained through social interaction with the neighbouring areas.

The average household size in the sub project area was estimated to be 4.2. The national average is 4.4. Population growth is one of the reasons for larger household size. But the cultural reason is also important and influence household size. Practice of joint family with parents, brothers etc may also make the household size larger. With the progress of development the social trend is to make it smaller. This trend is evident in sub project area. Household size in Chatler-Fakurhat sub project is even smaller than national average.

The age structure of a population is important for analysing its current productivity. Generally children below 15 and adults above 60 years of age are considered non-productive. In Chatler-Fakurhat the percentage of population within the age range of 15 - 59 is: 62.72%. A majority of the population in sub project area is therefore within the productive age range and able to contribute to its development.

The ratio of male and female-headed households is an important aspect of socio economic and gender perspective of a society. It influences the vulnerability, family bindings, child security, and incidence of poverty, social inequality, injustice and overall instability. In Chatler-Fakurhat this ratio is 99:1.09. It is an insignificant figure and will not influence any aspect of development

There is no ethnic group among the people of Chatler-Fakurhat subproject.

6.1.5 Kalidaskhali-Arpara Subproject

The population in Kalidaskhali-Arpara was estimated to be 59,127 giving a density of 448 per km². It is less even less than half of the national average (976). Existing population growth in Bangladesh is 1.3, a figure one of the lowest in south Asia. The trend in growth rate will continue to decline with the progress of development. In Kalidaskhali-Arpara sub project area it is also expected to decline. The

declining trend will reduce the population size and density. This will reduce pressure on natural resource.

The sex ratio (male female ratio) in the sub project area is 100.7 and closely consistent with the national average (100.3). It means the male female balance here is very close to desired ratio and friendly to social stability. Social stability contributes to a sustainable development. The same is expected in the case of Kalidaskhali-Arpara subproject.

The average household size in the subproject area was estimated to be 4. The national average is 4.4. Population growth is one of the reasons for larger household size. But the cultural reason is also important and influence household size. Practice of joint family with parents, brothers etc. may also make the household size larger. At any case it creates pressure on natural resources. However it is not the case in Kalidaskhali-Arpara subproject. It is here even less than national average and will not affect the development.

The age structure of a population is important for analysing its current productivity. Generally children below 15 and adults above 60 years of age are considered non-productive. In Kalidaskhali-Arpara the percentage of population within the age range of 15 - 59 is 62%. A majority of the population in sub project area is therefore within the productive age range.

The ratio of male and female-headed households is an important aspect of socio economic and gender perspective of a society. It influences the vulnerability, family bindings, child security, and incidence of poverty, social inequality, injustice and overall instability. In Kalidaskhali-Arpara the percentage of male and female headed households is approximately 32:1. This is an insignificant figure and will not create any barrier to social development.

There is no ethnic group among people of In Kalidaskhali-Arpara Subproject.

6.1.6 Horai River Subproject

The population in Horai River subproject was estimated to be 99,500 giving a density of 534 per km². It is less than the national average density (976), a density one of the highest in the world. The population growth in Bangladesh is 1.3. It is declining as a result of progress in social and economic development. In sub project area it is also expected to decline. As a result population size and density will decline. Declining trend of population and density will reduce the pressure on natural resources in subproject area

The sex ratio (male female ratio) in the sub project area is 100.2 which are consistent with the national average (100.3). Social stability is needed for social development. A balanced sex ratio desired for social stability exists in subproject area.

The average household size in the subproject area was estimated to be 4. The national average is 4.4. Population growth is one of the reasons for larger household size. But the cultural reason is also important and influence household size. Practice of joint family with parents, brothers, etc. may also make the household size larger. With the progress of development the social trend is to make it smaller. This trend is evident in sub project area. Household size in Horai River Subproject is even than less than national average.

The age structure of a population is important for analyzing its current productivity. Generally children below 15 and adults above 60 years of age are considered non-productive. In Horai River the percentage of population within the age range of 15 - 59 is: 61%. A majority of the population in sub project area is therefore within the productive age range and able to contribute to its development.

The ratio of male and female-headed households is an important aspect of socio economic and gender perspective of a society. It influences the vulnerability, family bindings, child security, and incidence of poverty, social inequality, injustice and overall instability. In Horai River subproject the ratio of male and female-headed households is 25:1. It is an insignificant number and will not influence any aspect of development.

There is no ethnic group among the people of Horai River subproject

6.2 Settlement and Housing

Human settlement and housing create adverse impact on environment if not developed in a planned manner. The villages around beel areas are generally situated along the boundary especially upper side of the slope of Beel. Human settlement established in these locations is due to the fact that most part of Beel is flooded in rainy season but its upper slope area is outside the flooding zone. There is no official record when and how the settlement in these locations started. But Key Informant Survey with local elderly elites who observed the settlement in these locations for more than 60 years anticipated that initially households from neighbouring district/upazilla settled in these areas mostly for fishing and also cultivation of rice in dry season. Gradually new settlers came in this area and as the population increases and household divided the settlement expanded by piling the soil from the lower portion of the beel to its upper portion. The settlement happened in cluster. Families and relatives or people familiar to each other settled very close to each other.

The following is a description of housing in seven subproject areas for which feasibility study has been done.

6.2.1 Beel Sukunia Subproject

The subproject has estimated population 84,764 with 18,764 households in 86 villages. The housing system of Beel evaluated following the same approach as of settlement. Initially the settler used to depend on Beel's natural resources to construct their houses, but now build houses with Corrugated Iron (CI) sheet and brick, wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. Based on information provided by Key Informant PRRA team estimated that most houses are build with CI sheet for roofing and for fencing mud wall or bamboo. Thatched house completely with natural materials are insignificant in number. Current tendency is to build the house with alternative materials as it is more durable and carry higher social status.

6.2.2 Daduria-Kandor Beel Subprojects

The subproject has 15,695 estimated populations with 3,695 households. The housing system of Beel evaluated following the same approach as of settlement. Initially people used to depend on Beel's natural resources to construct their houses, but now build houses with CI sheet and brick,

wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. Based on information provided by Key Informant PRRA team estimated that most houses are with CI sheet roofing and bamboo fencing or mud wall. People are building brick houses and the trend of building houses with CI sheet and brick is increasing.

6.2.3 Alfadanga-Boalmari Subproject

The subproject has 35,884 estimated populations with 8,971 households in 76 villages. Evaluation of housing system took place following the same approach as of settlement. Initially the settler used to depend on local natural resources to construct houses, but now build houses with CI sheet and brick, wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. PRRA team for project survey found houses build completely with natural materials (thatch house) are insignificant. Most houses are built with CI sheet for roofing with mud wall or bamboo fencing. Approximately one third of the houses were built with CI sheet for roofing and with brick wall.

6.2.4 Chatlar-Fakurhat Subproject

The subproject has 48,300 estimated populations with 11,500 households in 113 villages. The housing system in subproject area evaluated following the same approach as of settlement. Initially the settlers used to depend on local natural resources to construct houses, but now build houses with CI sheet and brick, wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. PRRA team for project survey found houses build completely with natural materials (thatch house) area are insignificant in number. Most houses are built with CI sheet for roofing with mud wall or bamboo fencing. A significant number of the houses were also build with CI sheet for roofing with brick wall.

6.2.5 Kalidaskhali-Arpara Subproject

The subproject has 59,124 estimated populations with 14,781 households in 82 villages. The housing system in sub project area evaluated following the same approach as of settlement. Initially people used to depend on local natural resources to construct houses, but now build houses with CI sheet and brick, wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. PRRA team for project survey found houses build completely with natural materials (thatch house) area are insignificant in number. Most houses are built with CI sheet for roofing with mud wall or bamboo fencing. A significant number of the houses were also build with CI sheet for roofing with brick wall. This tendency of choosing alternative materials for construction houses will continue in near future also.

6.2.6 Horai River Subproject

The subproject has 99,500 estimated populations with 24,875 households in 173 villages. The housing system in subproject area evaluated following the same approach as of settlement. In certain period people used to depend on local natural resources to construct houses, but now build houses with CI sheet and brick, wood etc. This reduced the dependency on natural resources for housing. The houses were built in cluster and very close to each other with small spaces between the houses. In most cases pond are common and shared by a number of households for bathing and washing. PRRA team for project survey found houses build completely with natural materials (thatch house) area are insignificant in number. Most houses are built with CI sheet for roofing with mud wall or bamboo fencing. Approximately one third of the houses were built with CI sheet for roofing with brick wall.

6.3 Traffic and Transport

A description of traffic and transport system in different subproject area is as follows.

6.3.1 Beel Sukunia Subproject

Motorized vehicle like small pick-up van, battery and engine operated 3 wheel van, 3 wheel tractor, paddle operated rickshaw and van constitute the traffic system of sub project villages. There are some deteriorated tarmac (pucca) roads along the fringes and a north-south partly paved road through the subproject. People from Beel villages can get access to Dhaka- Khulna high way which passes through the northern side of subproject whenever they want by local transport system. Agriculture products, fish, livestock etc. from the subproject are transported to upazila or district or any other national markets using appropriate transport vehicle (except truck). Bringing goods from outside for local consumption are done by similar vehicles to local markets.

6.3.2 Daduria-Kandor Beel Subprojects

Motorized vehicle like small pick up van, battery and engine operated 3 wheel van, 3 wheel tractor, paddle operated rickshaw and van constitute the traffic system of Beel villages. The paved rural roads, although in poor condition, running through the sub project villages are approximately 85 Km. People from Beel villages can get access to Dhaka Khulna high way through Amurdi- Boalmari-Kashiani regional road which runs through the project for 7 km. along the regional road is a railway line with a station at Boalmari. Agriculture products, fish, livestock, etc. from the subproject are transported to upazila or district or any other national markets using motorized transport vehicle (pick up, small truck, power tiller or tractor van, pedal operated van etc.) and also by railway line. Bringing goods from outside for local consumption are done by similar vehicles to local markets.

6.3.3 Alfadanga-Boalmari Subproject

Engine operated or motorized vehicle like small truck, pick up van, battery and engine operated 3 wheel van, 3 wheel tractor, pedal operated rickshaw and van constitute the traffic system of sub project villages. There are 7 Km regional paved road passing through the sub project connect it with Khulna highway. Inside the subproject paved rural roads including feeder roads, although in poor condition, will be approximately 110 Km. People from sub project villages can get access to Dhaka Khulna high way through Amurdi-Boalmari-Kashiani regional road. Along the regional road is a railway line stationed at Boalmari. Agriculture products, fish, livestock, etc. from the subproject are

transported to upazila or district or any other national markets using engine operated or motorized transport vehicle (pick up, small truck, power tiller or tractor van, pedal operated van, etc.) and also by train. Bringing goods from outside for local consumption are done by similar vehicles to local markets.

6.3.4 Chatlar-Fakurhat Subproject

Similar to other sub projects engine operated or motorized vehicle like small truck, pick up van, battery and engine operated 3 wheel van, 3 wheel tractor, paddle operated rickshaw and van constitute the traffic system of sub project villages. The Faridpur-Barisal two-lane national highway runs at the western part of the subproject. The road has a reasonable good condition. On the southern part of the SP, there exists another Gopalganj-Kawrakandhi highway which also is in very good condition. The inner part of the subproject has very limited access. There are some deteriorated tarmac (pucca) roads along the fringes and a partly metalled road through the subproject, but it is interrupted at the Fukurhat, Doshhazra & Hashemdia Khals and thus making marketing of produce difficult. In spite of all these problems people can get access to high way. Agriculture products, fish, livestock etc from the subproject are transported to upazila or district or any other national markets using engine operated or motorized transport vehicle.

6.3.5 Kalidaskhali-Arpara Subproject

Engine operated or motorized vehicle like small truck, pick up van, battery and engine operated 3 wheel van, 3 wheel tractor, paddle operated rickshaw and van constitute the traffic system of sub project area. The Jessore-Magura two-lane national highway runs through the middle of the subproject. Some rural deteriorated tarmac (pucca) roads and mud roads pass through the sub project villages. People from sub project villages can get access to Jessore-Magura highway through these roads. Agriculture products, fish, livestock etc. from the subproject are transported to Upazila or district or any other national markets using engine operated or motorized transport vehicle. Bringing goods from outside for local consumption are done by similar vehicles to local markets. The lack of infrastructure, particularly roads in the centre of the subproject, makes all agricultural activities time consuming and cumbersome.

6.3.6 Horai River Subproject

Motorized or engine operated vehicles like small truck, pick up van, battery and engine operated 3 wheel van, 3 wheel tractor, paddle operated rickshaw and van constitute the traffic system of sub project villages. The Rajbari-Kushtia two-lane regional highway runs across the SP. There are some rural deteriorated tarmac (pucca) roads. People from sub project villages can get access Rajbari-Kushtia two-lane regional highway through these roads. Agriculture products, fish, livestock etc from the SP are transported to Upazila or district or any other national markets using engine operated or motorized transport vehicle (pick up, small truck, power tiller or tractor van, pedal operated van, etc.). Bringing goods from outside for local consumption are done by similar vehicles to local markets. Road communication in some sub project villages are however not up to the desired level, making marketing of produce difficult.

6.4 Public Utilities (Water Supply, Sanitation and Solid Waste)

Public utilities including water supply, sanitation and solid waste disposal system affect the public health of a society. If not properly managed these systems harm the environment. In any development project this issue should therefore be addressed for adequate planning and management. A description of water supply, sanitation and solid waste for the subprojects in pre project and its effect on environment in post project situation is as follows. Secondary information and data from the project feasibility study report has been used to describe it.

6.4.1 Beel Sukunia Subproject

In Beel-Sukunia subproject area about 87% of the household drinking water supply comes from underground source. It is lifted by pumping with hand tube wells. Besides this there is also a pipe water supply system with purified water. This however is only 7%. Project survey did not find information how other 6% household collect drinking water. It is reported by the community leaders that nobody drinks surface water unless it is collected directly from rain. These households also might collect their drinking water from public tube well installed at Union Parishad, schools or Mosques. Both tube well and pipe water is safe unless it is contaminated with an unacceptable arsenic level. That however could not be verified through household survey. People's opinion collected through FGD revealed no sign of health hazards due to drinking of tube well water. People seem to be satisfied with household water supply in Beel-Sukunia.

The sanitation facilities for discharging human waste are an important element for a healthy and hygienic environment. Over the last decades, the use of sanitary/water sealed latrines has increased tremendously in Bangladesh. This happened in Beel-Sukunia subproject area as well. Almost 86% of household uses hygienic water sealed latrine in sub project area and the social tendency is to adopt improved hygienic sanitation technology.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Satisfactory level water supply and sanitation in the sub project area prevents people in many cases from acute communicable diseases.

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Traditionally households subproject area use kitchen and animal waste for composting in pits. Agriculture and organic/wood waste they use for fuel in cooking stove. Plastic and metal are being sold for recycling

6.4.2 Daduria-Kandor Beel Subprojects

Low lift hand tube wells are used by 84% households for drinking water supply from underground source and the rest is from other sources, including surface water, ponds and river. Their own way of filtration and boiling may have made the water safe. Contaminated water with arsenic was also reported but the percentage of tube well or household using this water could not be verified due to absence of proper water testing facilities.

The sanitation is an important element for a healthy and hygienic environment. Progress in socio economic development and awareness campaign contributed to use of improved and hygienic

sanitation technology/water sealed latrine in Bangladesh over the last decades. Although the Faridpur district average is 84%, in Daduria & Kandor beel subprojects' area it is only 47%. Current tendency is to adopt improved hygienic sanitation technology.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Due to inadequate sanitation facilities a significant number of households are still at risk of commutable diseases and health hazards in the subproject area. Though WMA and in cooperation with local government representative this problem may be addressed.

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Traditionally households use kitchen and animal waste for composing in pits. Agriculture and organic/wood waste they use for fuel in cooking stove. Plastic and metal are being sold for recycling

6.4.3 Alfadanga-Boalmari Subproject

In the sub project area almost 100% households use tube well water from underground source. Arsenic contamination was not reported. However, regular arsenic contamination test should be undertaken by upazila Public health Engineering Department. The high rate of pure water supply in the sub-project area is consistent with the national average which is 94.98%. The reasons are the large scale motivational campaigns by the Government and NGOs for the use of pure water and the availability of low cost simple technology (hand tube well) for lifting underground water

The sanitation is an important element for a healthy and hygienic environment. Progress in socio economic development and awareness campaign contributed to use of improved and hygienic sanitation technology/water sealed latrine in Bangladesh over the last decades. Although the Faridpur district average is 84%, it is 63%in Alfadanga-Boalmari SP area. A significant portion of the households remain still out of hygienic sanitation. This may pollute environment and also spread commutable diseases like Diarrhoea, typhoid etc. Current tendency, however, is to adopt improved hygienic sanitation technology.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Due to inadequate sanitation facilities a significant number of households are still at risk of commutable diseases and health hazards in the sub project area. Though WMA and in cooperation with local government representative this problem may be addressed

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Traditionally households use kitchen and animal waste for composing in pits. Agriculture and organic/wood waste they use for fuel in cooking stove. Plastic and metal are being sold for recycling.

6.4.4 Chatlar-Fakurhat Subproject

In this subproject almost all the households use tube well water from underground source. Arsenic contamination in tube well water was not reported. However, this may not be expected as the end answer. Upazila Public Health Engineering Department should regularly undertake arsenic

contamination test. Large scale motivational campaigns by the Government and NGOs for the use of pure water and the availability of low cost simple technology (hand tube well) for lifting groundwater have led to the high rate of pure water supply in the subproject area.

Healthy and hygienic environment requires an improved sanitation system. Over the last decades, there has been a progress in socio economic development and awareness campaign which has contributed to the use of improved and hygienic sanitation technology/water sealed latrine in Bangladesh. While in the Faridpur district the average is 84%, in Chatler-Fakurhat area it is 83.19%. Although 16% of the households are out of hygienic sanitation the tendency, however, is growing to adopt improved hygienic sanitation technology.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Satisfactory level water supply and sanitation in the sub project area prevents people in many cases from acute communicable diseases

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Kitchen and animal waste for composting in pits are used traditionally by the households. Agriculture and organic/wood waste are used for fuel in cooking stove. Plastic and metal are being sold for recycling.

6.4.5 Kalidaskhali-Arpara Subproject

In the subproject area approximately 85% household use ground water and 15% of households water from ponds or river by indigenous filtering and boiling. Arsenic contamination in tube well water was not reported. However, this should not be the end answer. Regular arsenic contamination test should be undertaken by upazila Public health Engineering Department. Current tendency of using pure water from underground source is increasing in subproject area.

An improved sanitation system is one of the preconditions for a healthy and safer environment. Progress in socio economic development and awareness campaign contributed to use of improved and hygienic sanitation technology/water sealed latrine in Bangladesh over the last decades. Although the Faridpur district average is 84%, in Kalidaskhali subproject area it is 62%. A significant portion of the households remain still out of hygienic sanitation. The tendency for adopting improved hygienic sanitation technology is increasing in subproject area.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Due to inadequate sanitation facilities a significant number of households are still at risk of communicable diseases and health hazards in the sub project area. Though WMA and in cooperation with local government representative this problem may be addressed

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Traditionally households use kitchen and animal waste for composting in pits. Agriculture and organic/wood waste they use for fuel in cooking stove. Plastic and metal are being sold for recycling.

6.4.6 Horai River Subproject

In this subproject area approximately 98% households use tube well water from underground source. Only 2% households may not have access to hygienic water supply. Arsenic contamination in tube well water was not reported. However, this should not be the end answer. Regular arsenic contamination test should be undertaken by upazila Public health Engineering Department. The high rate of pure water supply in the sub-project area is due to large scale motivational campaigns by the Government and NGOs for the use of pure water and the availability of low cost simple technology (hand tube well) for lifting groundwater

For a healthy and hygienic environment an improved sanitation system is one of the preconditions. Progress in socio economic development and awareness campaign contributed to use of improved and hygienic sanitation technology/water sealed latrine in Bangladesh over the last decades. Although the Faridpur district average is 84%, in Horai River subproject area it is only 49%. A significant portion of the households remain still out of hygienic sanitation. Current tendency, however, is to adopt improved hygienic sanitation technology.

No public or private health care system with qualified health professionals exist in village and Union level. Upazila level health care system is not sufficient enough to provide health care to most of the people. Due to inadequate sanitation facilities a significant number of households are still at risk of communicable diseases and health hazards in the sub project area. Though WMA and in cooperation with local government representative this problem may be addressed

Solid waste includes kitchen waste, used or damaged/broken household goods and agriculture and domestic animal waste. Traditionally households use kitchen and animal waste for composting in pits. Agriculture and organic/wood waste they use for fuel in cooking stove. Plastic and metal are being sold for recycling.

6.5 Economy and Employment

Economy and employment are closely related to each other. Progress in economic development promotes employment. On the other hand productive employment contributes to economic progress. Both issues affect environment unless it is addressed and managed properly in a planned way. The following is a description of these issues and its affect on environment for the subprojects. Secondary information and data from the project feasibility study report has been used to describe it.

6.5.1 Beel Sukunia Subproject

The economy of Beel-Sukunia is basically agro based. Other occupational areas, although insignificant, are also play a role in the local economy. The economic activities (also Income Generating Activities or IGA) are farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction etc). The Employment structure of the subproject is shown in table 6.2.

Table 6.2: Employment structure in Beel-Sukunia

Occupation	Percentage of total sample population		Average number of worked days per year	
	Male	Female	Male	Female
Farmer	16	0.97	240	90
Fisherman	8	1	160	73
Business	5	0.46	340	310
Labour(mostly in farming)	16	1.3	293	183
Rickshaw	1.75	0	290	0
Carpenter	0.92	0	275	0
Mason	0.85	0	272	0
Mechanic	0.22	0	250	0
Service (wage employment)	4	1.20	260	260
Boatmen	0.21	0	320	0
Driver	1.12	0	300	0

Source: Main Report of Project Feasibility Study, October 2013.

As per this table, the highest number in terms of employment and duration are in agriculture. Women representation in employment is extremely poor. Gender inequality in employment creates vulnerability among the women particularly single women and members of women headed households. They have become socially and economically marginalized. On the other hand poverty in sub project area is high (45%), compared to national average (34%), Poverty creates vulnerability. Vulnerability in the society increases the risk of environmental damage due to over exploitation and misuse of natural resources. Unemployment in sub project area was not reported. Nationally it is less than 5%. It is not unrealistic if subprojects do not have unemployment or insignificant unemployment.

One important economic practice of rural Bangladesh including sub project area is the transfer of livelihood asset (land and cattle) through sale and purchase by the farmers. The process goes on among all classes of farmers and other households on win-win principle. This is beneficial to local economy. In economic crisis, cases of land selling by the small or marginal farmers to big farmers or local rich people occurred in sub project area. But these are not significant in number and do not affect the existing employment structure.

Culturally people choose employment in farming when there is no alternative. But the tendency is to find wage or self-employment in areas other than agriculture. Public and private sector work, teaching, medical and engineering services, labour contracts, overseas employment and working in technical area (driver, mechanic, carpenter, electrician etc.) carry more weight in considering social status. These are therefore priority areas of employment.

These demographic characters were found in almost all the subprojects areas across the project.

6.5.2 Daduria-Kandor Beel Subprojects

These subprojects have an agro based economy with most households depend on agriculture for livelihood. Economic activities other than agriculture are also there but its role is not significant. Farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction etc.) are the visible economic activities in the subproject area. Current employment structure of the people is shown in table 6.3

Table 6.3: Employment Structure of Daduria & Kandor Beel.

Name of occupation	Percentages of total sample population		Average number of employment days in a year	
	Male	Female	Male	Female
Farmer	50.30	2.53	230	85
Fisherman	6.98	0.63	130	105
Business	3.32	0.86	350	220
Labour (mostly in farming)	17	1.63	300	230
Rickshaw /van puller	1.05	0	270	0
Carpenter	0.21	0	290	0
Mason	0.42	0	280	0
Mechanic	0	0	0	0
Service (wage employment)	1.48	.68	285	284
Boatmen	0	0	0	0
Driver	0.84	0	270	0
Unemployed	3.34	9.00	-	-

Source: Main report of project feasibility study, annex F

The table shows the highest employment percentage and duration in agriculture. Women representation in employment is extremely poor. Employment generates income. Gender inequality in employment therefore creates vulnerability among the women particularly single women and members of women headed households. They become socially and economically marginalized. Poverty is related to employment and income. It is high (39%) in subproject area and creates vulnerability among all classes of poor women and men. The more the community is economically vulnerable more is the pressure on natural resources. Unemployment in the subproject area was not reported. Nationally it is less than 5%. It is not unrealistic if sub project do not have unemployment or insignificant unemployment

6.5.3 Alfadanga-Boalmari Subproject

The economy of the sub project is mostly agro based. Major portion of the households depend on agriculture for their livelihood. Activities other than agriculture are also there, but they play little role in the local economy. Farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction etc.) are the dominant economic activities in the subproject area. Current employment structure in the project area is shown in table 6.4

Table 6.4: Employment Structure of Alfadanga-Boalmari.

Name of occupation	Percentages of total sample population		Average number of employment days in a year	
	Male	Female	Male	Female
Farmer	51	0.96	242	93
Fisherman	4	0	167	0
Business	6	0.48	340	308
Labour (mostly in farming)	18	1.8	289	178
Rickshaw /van puller	1.39	0	304	0
Carpenter	1.	0	279	0
Mason	0.92	0	277	0
Mechanic	0.35	0	240	0
Service (wage employment)	3.31	1.12	268	263
Boatmen	0.36	0	220	0
Driver	1.16	0	309	0
Unemployed	1.15	7	-	-

Source: Project feasibility study report 2013

The table shows the highest employment percentage and number of day in agriculture. Women representation in employment is extremely poor. Employment generates income. Gender inequality in employment, therefore, creates vulnerability among the women particularly single women and members of women headed households. They became socially and economically marginalized. Poverty is related to employment and income. In sub project area it is high (41%) and creates

vulnerability among all classes of poor women and men. Pressure on natural resource will increase due to increase of economic vulnerability in the society. However, poverty In general is declining throughout Bangladesh due to progress in socio economic development. This declining tendency of poverty was also observed in sub project area and the members of vulnerable communities are getting the benefit of this process.

People's employment in fishing is only 4%. But the important fact is their employment days per year. It is only 163 days, means less than half a year no employment in fishing. It is reported that they are employed as wage labour in agriculture, construction or any other service oriented income generating activities in non-fishing season.

Unemployment in subproject area although very high for women compare to men, it is not significant in percentage. In addition separate programme has already been proposed in project feasibility study to address gender inequality in employment.

6.5.4 Chatlar-Fakurhat Subproject

As the most households depend on agriculture for livelihood, the sub project includes an agro based economy. Other economic activities except agriculture also exist having insignificant role. Farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction etc.) are the visible economic activities in the sub project area. Current employment structure of the people is shown in table 6.5

Table 6.5: Employment Structure of Chatlar- Fakurhat

Name of occupation	Percentages of total sample population		Average number of employment days in a year	
	Male	Female	Female	Male
Farmer	54	0.31	249	0
Fisherman	1.20	0	187	0
Business	2.33	0.12	345	0
Labour	14.52	2.78	297	278
Rickshaw /van puller	2.42	0	314	0
Carpenter	1.17	0	271	0
Mason	1	0	286	0
Mechanic	0.45	0	280	0
Service (wage employment)	2.31	0.57	288	0
Boatmen	0.46	0	227	0
Driver	0.46	0	301	0
Auto Rickshaw driving-	1.12	0	323	0
Unemployed	7	7.78		

Source: Project feasibility study report, annex F

The table shows agriculture has the highest employment percentage and duration. There is extremely poor representation of women in employment. Gender inequality in employment creates vulnerability among the women particularly single women and members of women headed households. As a result, social and economic marginalization of women occurs. Both employment and income have a close relation with poverty. The rate of poverty is 43% in sub project area. Such high rate of poverty is the cause of vulnerability among all classes of poor women and men. The increase of the vulnerability in a community also puts pressure on natural resources. Unemployment is insignificant in sub project area.

6.5.5 Kalidaskhali-Arpara Subproject

The economy in sub project area is mostly agro based with most households depend on agriculture for livelihood. Economic activities other than agriculture are also there but its role is not significant. Farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction etc.) are the visible economic activities in the sub project area. Current employment structure of the people is shown in table 6.6

Table 6.6: Employment Structure of Kalidaskhali-Arpara

Name of occupation	Percentages of total sample population		Average number of employment days in a year	
	Male	Female	Male	Female
Farmer	53	0.93	247	93
Fisherman	0.51	0	177	0
Business	3.86	0.43	341	308
Labour	16.86	1.76	285	178
Rickshaw /van puller	2.37	0	301	0
Carpenter	0.79	0	276	0
Mason	0.82	0	277	0
Mechanic	0.36	0	240	0
Service (wage employment)	3.33	1.33	288	263
Boatmen	0.31	0	220	0
Driver	1.11	0	305	0
Unemployed	2.38	10.15	-	-

Source: Project feasibility study report, annex F

The table shows the highest employment percentage and duration in agriculture. Women representation in employment is extremely poor. Employment generates income. No or less employment means no or less income for women. Gender inequality in employment, therefore, creates vulnerability among the women particularly single women and members of women headed households. They became socially and economically marginalized. Poverty is related to employment and income. It is high (41%) in sub project area and creates vulnerability among all classes of poor women and men. The more is the vulnerability in a community the more is the pressure on natural resources. Unemployment is insignificant in sub project area.

6.5.6 Horai River Subproject

The households within the subproject area are involved mostly with agro based activities. Subproject economy is therefore an agro based economy. Other economic activities are also there, but they play little role in local economy. Farming, fishing, small and medium scale business, transport and services (repairing, maintenances, construction, etc.) are the dominant economic activities in the sub project area. Current employment structure in the project area is shown in table 6.7

Table 6.7: Employment Structure of Horai River

Name of occupation	Percentages of total sample population		Average number of employment days in a year	
	Male	Female	Male	Female
Farmer	55	0.63	241	193
Fisherman	2.51	0	197	0
Business	3.88	0.38	331	308
Labour (mostly in farming)	17.86	2.46	291	198
Rickshaw /van puller	2.77	0	311	0
Carpenter	0.69.	0	276	0
Mason	0.72	0	267	0
Mechanic	0.33	0	244	0
Service (wage employment)	3.36	1.21	281	266
Boatmen	0.39	0	210	0
Driver	0.79	0	305	0
Unemployed	2,18	7.54	-	-

Source: Project feasibility study report, annex F

According to the table 6.7, highest percentages of people are employed in farming. An insignificant percentage of women are employed in these activities. Employment generates income. Gender inequality in employment creates vulnerability among the women particularly single women and members of women headed households. They became socially and economically marginalized. Poverty is related to employment and income. In subproject area it is high (44%) and creates vulnerability among all classes of poor women and men. High poverty and vulnerability creates pressure on natural resource Unemployment is insignificant in sub project area

6.6 Agriculture

Agriculture in seven different subprojects out of the eleven subprojects under study for which feasibility study has been done has been described below.

6.6.1 Agriculture in Beel Sukunia Subproject

Agriculture is the most important sector in the SP and provides employment and income to some 55% of the population. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on a limited scale, and mostly on the higher elevated parts (land type F0) of the SP. The larger part of the SP (60%) is double cropped (Table 6.8). The cropping intensity comes at 193%, which is high.

Table 6.8: Agricultural land use of Beel Sukunia

Land use	Area	
	(ha)	(%)
Triple cropped	1,315	18.79
Double cropped	4,256	60.80
Single cropped	1,059	15.13
Temporarily fallow	370	5.29

The most important crops are paddy, jute, wheat and vegetables. The total paddy production for 2011 came to 17,000 tons.

A summary on the type of crops, yields, acreage and production is given in Table 6.9. Paddy yields² are not impressive and range on average from 1.5 t/ha for the deep water varieties B. Aus to 4.5 t/ha for the HYV Boro, cultivated during winter where sufficient water is available. The climate contributes to the moderate yields recorded. Summer and monsoon rains come, apart from flooding, with low

² The national average is 4 t/ha

insulation and high air humidity provoking diseases and pests. Farmers by and large apply crop protection and fertilizer, though seldom at the recommended rates.

Table 6.9: Crops, yields and production of Beel Sukunia

Name of Crop	Average Yield (t/ha)	Cultivated area (ha)	Production (mt)
HYV Boro	4.5	2,793	12,568.5
Hybrid Boro	5.0	100	500
B. Aman	1.5	185	277.5
T. Aman	2.5	1,255	3,375
LT. Aman	1.8	1,143	2,057.4
B. Aus	1.8	305	549
Jute	2.0	5,940	11,280
Pulses	2.0	1,802	3,604
Mustard	1.0	780	780
Wheat	2.0	400	800
Onion/Garlic	13.0	500	6,500
Coriander (seed)	1.2	500	240
Vegetables	28.0	405	11,340
Others	Fallow	300	0
Total		16,308	53,871.4

Depending on water availability (land type) and adapted varieties, paddy can be grown year-round; wheat is grown during winter and jute³, at the end of the summer. Vegetables are grown at the end of the monsoon and during winter. There is also a limited area under sugar cane, grown during summer and monsoon, mostly for direct consumption. In Table 6.10 the cropping pattern over the various land types is given for 2011. Obviously, the least flood-prone areas are most intensively cultivated and with multiple crops, while the lowland is used for one (deep water) paddy crop only.

Table 6.10: Cropping pattern and cropped area according to land type of Beel Sukunia

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₀ (0 - 30 cm)	Pulses	Jute	T. Aman	3	750	2,250
	HYV Boro	Jute		2	1,600	3,200
	Wheat	Jute	T. Aman	3	400	1,200
	Mustard	Jute		2	780	1,560
	Pulses	Vegetables		2	100	200
	Vegetables	B. Aus	T. Aman	3	305	915
	HYV Boro		LT. Aman	2	1,043	2,086
	Coriander	Jute		2	500	1,000
	Onion/Garlic	Jute	T. Aman	3	250	750
		Jute		1	208	208
	Others			1	300	300
Sub-total					6,236	13,669
F ₁ (30 - 90 cm)	Onion/Garlic	Jute		2	250	500
	Pulses	Jute		2	652	1,304
	Hybrid Boro		LT. Aman	2	100	200
	Temporarily fallow				44	0
Sub-total					1,046	2,004
F ₂ (90 - 180 cm)	HYV Boro			1	150	150
		Jute		1	250	250

³ Jute was from the early 1970s until 2004 a marginal cash-crop, due to the increasing use of polythene and other synthetic materials. Of late the demand is on the increase due to the biodegradable quality of jute. Between 2004–2010, the jute market recovered and the price of raw jute increased more than 500%

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
	Mustard	B. Aman				
Sub-total				450	500	
F ₃ (Above 180 cm)		B. Aman		1	135	135
	Temporarily fallow				66	
Sub-total				201	135	
Grand Total				7,933	16,308	

Provision of certified seed to the farmers through the DAE is limited as the government agency Bangladesh Agricultural Development Cooperation (BADC) provides only 5% of total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of high-yielding variety (HYV) paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

The DAE has 7 blocks within the SP area of which 5 blocks under Sadar upazila, one of Nagorkanda and another one block under Saltha upazila. DAE conducts different training programs and farmers' field schools as well as demonstrations of new agricultural technologies. The number of such activities is probably not sufficient to reach all stakeholders. It is estimated that only some 20% of the farmers are directly or indirectly reached through this type of extension. Further to that the services of DAE officials are mostly directed towards the large farmers. Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of the total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

Farmers' cooperatives are not existent in the SP. Nor is there any form of water management organization involving farmers.

6.6.2 Agriculture in Daduria-Kandor Beel Subprojects

Agriculture is the most important sector in the SP and provides employment and income to some 6,000 farmers. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on more than 50% of the area, and mostly on the higher elevated parts (land type F₀) of the SP which suffers from drought during the dry season. Farmers with pumps (over 300) generally share irrigation water.

Cereals and jute are the most important crops of the area. Among cereals, rice is cultivated on 51% and wheat on 5% of the area, and jute on 24% followed by pulses and oil crops (11%) and other crops (10%). Coriander is a popular herb. The total cropped area is 4,416 ha corresponding with a cropping intensity of 185%.

The present production of major crops (cereals) has been calculated as 7,029 tons of which 6,585 tons of rice and 444 tons of wheat is produced annually. Crop wise yields, cultivated area and production are presented in Table 6.11 below. Paddy yields⁴ are not impressive and range on average from 1.5 t/ha for the monsoon deep water variety B. Aman to 5 t/ha for the Hybrid Boro, cultivated during winter where sufficient water is available. The climate is partly debit to the moderate

⁴ The national average is 4 t/ha

yields. Summer and monsoon rains come, apart from floods, with low insulation and high air humidity provoking diseases and pests, winter comes with sunshine but low temperatures. Further, where farmers by and large use crop protection chemicals and fertilizer, they seldom use the recommended rates.

Table 6.11: Crops, yields and production of Daduria- Kandor Beel

Name of Crop	Average Yield (t/ha)	Cropped area(ha)	Production (tons)	By-product (tons)
HYV Boro	4.5	680	3,060	2560
Hybrid Boro	5.0	100	500	400
B. Aman	1.5	550	825	1230
T. Aman	2.5	712	1,780	1914
LT. Aman	1.8	100	180	194
T. Aus	2.0	120	240	428
Jute	2.5	1,042	2,605	4007
Pulses	2.5	250	625	962
Mustard	1.0	220	220	232
Wheat	2.0	222	444	516
Onion	13.0	258	3,354	
Chilli (green)	12.0	62	744	
Vegetables	25.0	50	1,250	
Others		50	-	
Total		4,416	15,827	

Depending on water availability (land type) and adapted varieties, paddy can be grown year-round; wheat is grown during winter mostly under irrigation and jute⁵, at the end of the summer. Vegetables are grown at the end of the monsoon and during winter. In Table 6.12 the cropping pattern over the various land types is given for 2012. Obviously, the least flood-prone areas are most intensively cultivated and with multiple crops, while the lowland is used for one (deep water) paddy crop only.

Table 6.12: Cropping pattern and cropped area according to land type of Daduria- Kandor Beel

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif – I	Kharif – II			
F ₀ (0 – 30 cm)	Wheat	Jute	T. Aman	3	222	666
	Pulses	Jute	T. Aman	3	120	360
	Hybrid Boro		T. Aman	2	100	200
	HYV Boro	T. Aus		2	120	240
	Mustard	Jute	T. Aman	3	150	450
	Vegetables		T. Aman	2	50	100
	Chilli	Jute		2	62	124
	Onion	Jute		2	138	276
	Others			1	50	50
	Temporarily fallow				50	-
Sub-total					1,062	2,466
F ₁ (31-90 cm)	Pulses	Jute		2	130	260
	Onion	Jute		2	120	240
	Mustard		T. Aman	2	70	140
			Jute+B. Aman	2	100	200
	HYV Boro		LT. Aman	2	100	200
Sub-total					520	1,040
F ₂ (91-180 cm)	HYV Boro	B. Aman		2	200	400
	HYV Boro			1	260	260
		B. Aman		1	250	250
		Temporarily fallow				74
Sub-total					784	910
F ₃ (> 180 cm)	Temporarily fallow				22	-
Sub-total					22	-
Grand Total					2,388	4,416

⁵ Jute was from the early 1970s until 2004 a marginal cash-crop, due to the increasing use of polythene and other synthetic materials. Of late the demand is on the increase due to the biodegradable quality of jute. Between 2004–2010, the jute market recovered and the price of raw jute increased more than 500%

Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

The DAE has three blocks within the sub-project area under Boalmari upazila. It is mandatory for the DAE to disseminate modern and appropriate agriculture technologies through different training programs and farmers' field school (FFS) as well as demonstrations of new agricultural technologies. However, the numbers of such activities are relatively limited due to budget constraints.

Farmers' cooperatives are not existent in the SP, but irrigation is for a significant part of the project area organized through irrigation sub-committees.

6.6.3 Agriculture in Alfadanga-Boalmari Subproject

Agriculture is the most important sector in the SP and provides direct or indirect employment and income to some 65% of the population. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on a large scale (>60%), and mostly on the higher elevated parts (land type F0) of the sub-project. The larger part of the sub-project (60%) is double cropped.

Cereals and jute are the most important crops of the area. Among cereals, rice is cultivated on 48% and wheat 7% of the area, and jute on 21% followed by pulses and oil crops (14%) and other crops (10%) The total cropped area is 13,235 ha with corresponding with a cropping intensity of 200%.

The present production of major crops (cereals) has been calculated as 19,638tons of which 17,678 tons of rice and 1,960 tons of wheat is produced annually. Crop wise yields, cultivated area and production are presented in Table 6.13.

Table 6.13: Yields and production of commonly cultivated crops of Alfadanga- Boalmari

Name of Crop	Average Yield (t/ha)	Cropped area (ha)	Production (tons)	By product (tons)
HYV Boro	4.5	1,607	7,232	5,232
Hybrid Boro	5.0	300	1,500	500
B. Aman	1.5	1,430	2,145	3,198
T. Aman	2.5	1,932	4,830	3,194
LT. Aman	1.8	470	846	612
B. Aus	1.5	350	525	583
T. Aus	2.0	300	600	450
Jute	2.5	2,752	6,880	8,583
Pulses	2.5	1,157	2,893	2,452
Mustard	1.0	685	685	722
Wheat	2.0	980	1,960	1,161
Onion	13.0	450	5,850	
Chilli	12.0	300	3,600	
Vegetables	17.0	372	6,324	
Others		150		
Total		13,235	45,870	

During the colder Rabi growing season, different pulses, chillies, oil seeds and vegetables are cultivated on F₀ land but during Kharif-I season, when the rains start, jute is the major crop. During the monsoon season F₀ type land is also inundated to some extent. The inundation depth of F₀ land is minimal and does not affect the yield of HYV T. Aman. For this reason, during the Kharif-II transplanted Aman is dominating the F₀ land in the sub-project area. Flooding depths of F₂ and F₃ land is higher and affect the yield of Aman rice. HYV Aman is more sensitive to flood depths than local transplanted Aman (LT. Aman) or local broadcasted Aman (B. Aman). Thus, LT. Aman and B. Aman are usually grown on F₂ and F₃ land during the Kharif-I season and continue to Kharif-II season. HYV/Hybrid Boro is cultivated mainly in F₁ and F₂ type lands. Some land remains fallow due to flooding, lack of irrigation water or lack of farmers' interest. Different cropping patterns according to land type and flood depth adopted in this area are presented in Table 6.14.

Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

The DAE has three blocks within the sub-project area under Boalmari upazila. It is mandatory for the DAE to disseminate modern and appropriate agriculture technologies through different training programs and FFS as well as demonstrations of new agricultural technologies. However, the numbers of such activities are relatively limited due to budget constraints.

Farmers' cooperatives are not existent in the SP, but irrigation is for a significant part of the project area organized through irrigation sub-committees.

Table 6.14: Cropping pattern and cropped area according to land type of Alfadanga- Boalmari

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₀ (0 - 30 cm)	Pulses	B. Aus		2	350	700
	Wheat	Jute		2	600	1,200
	Vegetables	Jute		2	372	744
	Pulses	Jute+B. Aman		3	480	1,440
	HYV Boro	B. Aman		2	600	1,200
	HYV Boro	Jute	T. Aman	3	470	1,410
	Mustard		T. Aman	2	685	1,370
	Chilli	T. Aus		2	300	600
	Onion	Jute	T. Aman	3	450	1,350
		Others			1	150
	Temporarily fallow				150	0
Sub-total					4607	10,164
F ₁ (31 - 90 cm)	Pulses		T. Aman	2	327	654
	Wheat	Jute		2	380	760
	Hybrid Boro		LT. Aman	2	300	600
	HYV Boro			1	100	100
Sub-total					1,107	2,114
F ₂ (91 - 180 cm)	HYV Boro		LT. Aman	2	170	340
	HYV Boro			1	267	267
		B. Aman		1	250	250
Sub-total					687	857
F ₃ (>180 cm)		B. Aman		1	100	100
	Temporarily fallow				131	-
Sub-total					231	100
Grand Total					6,632	13,235

During the rainy season, irrigation is not required because rainfall exceeds the evapo-transpiration, but during the dry period (October to March), there is no rainfall or an erratic distribution of rainfall, which causes low soil moisture resulting in drought stress. To avoid drought stress, supplementary irrigation is needed. Around 36% of the farmers have pumps for irrigation. They abstract water for irrigation through shallow tube wells or deep tube wells though a few farmers use low lift pumps (LLPs) and share the water with other farmers. In the project area there are a total of 1621 shallow tube wells, 8 deep tube wells and 9 low lift pumps, more than sufficient to irrigate the whole area. Surface water irrigation is limited due to lack of water in canals and beels during the dry season. This situation may change after the implementation of the project, when the khals/channels have been excavated from silt and permanent water levels will be maintained through regulators to safeguard fisheries and nature.

6.6.4 Agriculture in Chatlar-Fakurhat Subproject

Agriculture is the most important sector in the SP and provides direct or indirect employment and income to some 54% of the population. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on a large scale (>60%), and mostly on the higher elevated parts (land type F0) of the sub-project. The larger part of the sub-project (60%) is double cropped.

Cereals and jute are the most important crops of the area. Among cereals, rice is cultivated on 48% and wheat 5% of the area, and jute on 20% followed by pulses and oil crops (11%) and other crops (16%) The total cropped area is 16,016 ha with corresponding with a cropping intensity of 198%.

The present production of major crops (cereals) has been calculated as 24,426 tons of which 22,233 tons of rice and 2,193 tons of wheat is produced annually. Crop wise yields, cultivated area and production are presented in Table 6.15.

Table 6.15: Yields and production of commonly cultivated crops of Chatlar- Fakurhat

Name of Crop	Average Yield (t/ha)	Cropped area (ha)	Production (tons)
HYV Boro	4.5	1,664	7,488
Hybrid Boro	5.0	400	2,000
B. Aman	1.5	650	975
T. Aman	2.5	3,800	9,500
LT. Aman	1.8	300	540
T. Aus	2.0	865	1,730
Jute	2.5	3,191	7,978
Pulses	2.5	800	2,000
Mustard	1.0	865	865
Lentil	1.0	200	200
Wheat	3.0	731	2,193
Onion/Garlic	13.0	870	11,310
Chilli	12.0	530	6,360
Coriander	1.2	530	636
Vegetables	25.0	200	5,000
Others		420	
Total		16,016	58,775

During the colder Rabi growing season, different pulses, chillies, oil seeds and vegetables are cultivated on F₀ land but during Kharif-I season, when the rains start, jute is the major crop. During the monsoon season F₀ type land is also inundated to some extent. The inundation depth of F₀ land is minimal and does not affect the yield of HYV T. Aman. For this reason, during the Kharif-II transplanted Aman is dominating the F₀ land in the sub-project area. Flooding depths of F₂ and F₃ land is higher and affect the yield of Aman rice. HYV Aman is more sensitive to flood depths than local transplanted Aman (LT. Aman) or local broadcasted Aman (B. Aman). Thus, LT. Aman and B. Aman are usually grown on F₂ and F₃ land during the Kharif-I season and continue to Kharif-II season. HYV/Hybrid Boro is cultivated mainly in F₁ and F₂ type lands. Some land remains fallow due to flooding, lack of irrigation water or lack of farmers' interest. Different cropping patterns according to land type and flood depth adopted in this area are presented in Table 6.16.

Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

The DAE has ten blocks within the sub-project area under Bhanga/Sadorpur Upazila. It is mandatory for the DAE to disseminate modern and appropriate agriculture technologies through different training programs and FFS as well as demonstrations of new agricultural technologies. However, the numbers of such activities are relatively limited due to budget constraints.

Farmers' cooperatives are not existent in the SP, but irrigation is for a significant part of the project area organized through irrigation sub-committees.

Table 6.16: Cropping pattern and cropped area according to land type of Chatlar- Fakurhat

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₀ (0 - 30 cm)	Chilli	Jute		2	530	1,060
	Wheat	Jute	T. Aman	3	650	1,950
	Pulses	Jute	T. Aman	3	700	2,100
	HYV Boro		T. Aman	2	750	1,500
	HYV Boro	Jute		2	600	1,200
	Mustard	T. Aus		2	865	1,730
	Onion		T. Aman	2	670	1,340
	Hybrid Boro		T. Aman	2	300	600
	Coriander	Jute	T. Aman	3	530	1,590
	Vegetables	Lentil	T. Aman	3	200	600
	others			1	420	420
Temporarily fallow					250	
Sub-total					6,465	14,090
F ₁ (31 - 90 cm)	Pulses	Jute		2	100	200
	Wheat	Jute		2	81	162
	Hybrid Boro		LT. Aman	2	100	200
Sub-total					281	562
F ₂ (91 - 180 cm)	HYV Boro			1	314	314
		B. Aman		1	400	400
	Onion		LT. Aman	2	200	400
Sub-total					914	1,114

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₃ (Above 180 cm)		B. Aman		1	250	250
	Temporarily fallow				182	
Sub-total					432	250
Grand Total					8,092	16,016

During the rainy season, irrigation is not required because rainfall exceeds the evapo-transpiration, but during the dry period (October to March), there is no rainfall or an erratic distribution of rainfall, which causes low soil moisture resulting in drought stress. To avoid drought stress, supplementary irrigation is needed. Around 30% of the farmers have pumps for irrigation. They abstract water for irrigation through shallow tube wells or deep tube wells though a few farmers use low lift pumps (LLPs) and share the water with other farmers. It is estimated that about 5,000 ha of lands is irrigated. Surface water irrigation is limited due to lack of water in canals and beels during the dry season. This situation may change after the implementation of the project, when the khals/channels have been excavated from silt and permanent water levels will be maintained through regulators to safeguard fisheries and nature.

6.6.5 Agriculture in Kalidaskhali-Arpara Subproject

Agriculture is the most important sector in the SP and provides direct or indirect employment and income to some 53% of the population. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on a large scale (about 60%), and mostly on the higher elevated parts (land type F₀) of the sub-project. The larger part of the sub-project (90%) is double or triple cropped.

Cereals and jute are the most important crops of the area. Among cereals, rice is cultivated on 50% and wheat 10% of the area, jute on 17% followed by pulses and oil crops on 18% and other crops (5%) The total cropped area is 23,046 ha with corresponding with a cropping intensity of 217%.

The present production of major crops (cereals) has been calculated as 38,224 tons of which 31,063 tons of rice and 7,179 tons of wheat is produced annually. Crop wise yields, cultivated area and production are presented in Table 6.17.

During the colder Rabi growing season, different pulses, chillies, oil seeds and vegetables are cultivated on F₀ land but during Kharif-I season, when the rains start, jute is the major crop. During the monsoon season F₀ type land is also inundated to some extent. The inundation depth of F₀ land is minimal and does not affect the yield of HYV T. Aman. For this reason, during the Kharif-II transplanted Aman is dominating the F₀ land in the sub-project area. Flooding depths of F₂ and F₃ land is higher and affect the yield of Aman rice. HYV Aman is more sensitive to flood depths than local transplanted Aman (LT. Aman) or local broadcasted Aman (B. Aman). Thus, LT. Aman and B. Aman are usually grown on F₂ and F₃ land during the Kharif-I season and continue to Kharif-II season. HYV/Hybrid Boro is cultivated mainly in F₁ and F₂ type lands. Some land remains fallow for reasons of flooding, lack of irrigation water or lack of farmers' interest. Different cropping patterns according to land type and flood depth adopted in this area are presented in Table 6.18.

Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of total demand. The private sector provides for the remaining seed supply,

if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

Table 6.17: Yields and production of commonly cultivated crops in Kalidaskhali- Arpara

Name of Crop	Average Yield (t/ha)	Cropped area (ha)	Production (tons)
HYV Boro	4.5	2,360	10,620
Hybrid Boro	5.0	740	3,700
B. Aman	1.5	269	404
T. Aman	2.5	2,873	7,183
LT. Aman	1.8	2,367	4,261
T. Aus	2.0	1,173	2,346
B. Aus	1.5	1,700	2,550
Jute	2.5	3,919	9,798
Pulses	2.5	2,100	5,250
Mustard	1.0	1,390	1,390
Sesame	1.0	698	698
Wheat	2.5	2,393	5,982
Vegetables	17.0	1,064	18,088
Total		23,046	72,270

The DAE has twelve blocks within the subproject area under Magura/Shalikha upazila. It is mandatory for the DAE to disseminate modern and appropriate agriculture technologies through different training programs and FFS as well as demonstrations of new agricultural technologies. However, the numbers of such activities are relatively limited due to budget constraints.

Farmers' cooperatives are not existent in the SP, but irrigation is for a significant part of the project area organized through irrigation sub-committees.

During the rainy season, irrigation is not required because rainfall exceeds the evapo-transpiration, but during the dry period (October to March), there is no rainfall or an erratic distribution of rainfall, which causes low soil moisture resulting in drought stress. To avoid drought stress, supplementary irrigation is needed. Around 33% of the farmers have pumps for irrigation. They abstract water for irrigation through shallow tube wells or deep tube wells though a few farmers use low lift pumps (LLPs) and share the water with other farmers. It is estimated that about 5,000 to 6,000 ha is irrigated. Surface water irrigation is limited due to lack of water in canals and beels during the dry season. This situation may change after the implementation of the project, when the khals/channels have been excavated from silt and permanent water levels will be maintained through regulators to safeguard fisheries and nature.

Table 6.18: Cropping pattern and cropped area according to land type in Kalidaskhali- Arpara

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₀ (0 - 30 cm)	Pulses	B. Aus	T. Aman	3	1,700	5,100
	Wheat	Jute		2	1,905	3,810
	Vegetables	Jute		2	1,064	2,128
	Mustard	T. Aus	T. Aman	3	1,173	3,519
	HYV Boro		LT. Aman	2	1,600	3,200
	HYV Boro	Jute	LT. Aman	3	550	1,650
	Temporarily fallow					200
Sub-total					8,192	19,407

Land type and flood depth	Cropping Pattern			No. of Crop	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₁ (30 - 90 cm)	Wheat	Sesame		2	488	976
	Pulses	Jute		2	400	800
	Hybrid Boro			1	590	590
	Temporarily fallow				100	
Sub-total					1,578	2,366
F ₂ (90 - 180 cm)	Mustard		LT. Aman	2	217	434
	Hybrid Boro			1	150	150
	HYV Boro	Sesame		2	210	420
		B. Aman		1	250	250
Sub-total					827	1,254
F ₃ (> 180 cm)		B. Aman		1	19	19
Sub-total					19	19
Grand Total					10,616	23,046

6.6.6 Agriculture in Horai River Subproject

Agriculture is the most important sector in the SP and provides direct or indirect employment and income to some 56% of the population. Most of the crops are rainfed and rainfall distribution is such that double cropping, and sometimes triple or tetra cropping is possible. Irrigation is used on a large scale (>60%), and mostly on the higher elevated parts (land type F₀) of the sub-project. The larger part of the sub-project (80%) is double or triple cropped.

Cereals and jute are the most important crops of the area. Among cereals, rice is cultivated on 51% and wheat 5% of the area, and jute on 24% followed by pulses and oil crops (11%) and other crops (10%) The total cropped area is 28,889 ha with corresponding with a cropping intensity of 210%.

The present production of major crops (cereals) has been calculated as 41,802 tons of which 39,788 tons of rice and 2,014 tons of wheat is produced annually. Crop wise yields, cultivated area and production are presented in Table 6.19.

Table 6.19: Yields and production of commonly cultivated crops in Hoai River

Name of Crop	Cultivated area (ha)	Average yield (mt/ha)	Total production (mt)
HYV Boro	4,650	4.5	20,925
B. Aman	136	1.5	204
T. Aman	3417	2.5	8,542
LT. Aman	4,391	1.8	7,903
T. Aus	300	2	600
B. Aus	1,007	1.5	1,511
Jute	5,291	2.5	13,228
Pulses	1,580	2.5	3,950
Mustard	1,770	1	1,770
Wheat	1,007	2	2,014
Sugarcane	2,320	80	185,600
Onion	1,600	13	20,800
Chilli	860	12	10,320
Vegetables	560	28	15,680
Total	28,889		193,049

During the colder Rabi growing season, different pulses, chillies, oil seeds and vegetables are cultivated on F₀ land but during Kharif-I season, when the rains start, jute is the major crop. During the monsoon season F₀ type land is also inundated to some extent. The inundation depth of F₀ land is minimal and does not affect the yield of HYV T. Aman. For this reason, during the Kharif-II transplanted Aman is dominating the F₀ land in the sub-project area. Flooding depths of F₂ and F₃ land is higher and affect the yield of Aman rice. HYV Aman is more sensitive to flood depths than

local transplanted Aman (LT. Aman) or local broadcasted Aman (B. Aman). Thus, LT. Aman and B. Aman are usually grown on F₂ and F₃ land during the Kharif-I season and continue to Kharif-II season. HYV/Hybrid Boro is cultivated mainly in F₁ and F₂ type lands. Some land remains fallow for reasons of flooding, lack of irrigation water or lack of farmers' interest. Different cropping patterns according to land type and flood depth adopted in this area are presented in Table 6.20.

Provision of certified seed to the farmers through the DAE is limited as the government agency BADC provides only 5% of total demand. The private sector provides for the remaining seed supply, if farmers are using certified seed. Certified seed is mainly used in the production of HYV paddy and vegetables. For the more traditional production farmers use often their own stock of seed.

The DAE has fourteen blocks within the sub-project area under Rajbari Sador, Baliakandi and Kalukhali upazila. It is mandatory for the DAE to disseminate modern and appropriate agriculture technologies through different training programs and FFS as well as demonstrations of new agricultural technologies. However, the numbers of such activities are relatively limited due to budget constraints.

Farmers' cooperatives are not existent in the SP, but irrigation is for a significant part of the project area organized through irrigation sub-committees.

During the rainy season, irrigation is not required because rainfall exceeds the evapo-transpiration, but during the dry period (October to March), there is no rainfall or an erratic distribution of rainfall, which causes low soil moisture resulting in drought stress. To avoid drought stress, supplementary irrigation is needed. Around 33% of the farmers have pumps for irrigation. They abstract water for irrigation through shallow tube wells or deep tube wells though a few farmers use low lift pumps (LLPs) and share the water with other farmers. It is estimated that about 6,000 to 7,000 ha are irrigated. Surface water irrigation is limited due to lack of water in canals and beels during the dry season. This situation may change after the implementation of the project, when the khals/channels have been excavated from silt and permanent water levels will be maintained through regulators to safeguard fisheries and nature.

Table 6.20: Cropping pattern and cropped area according to land type in Hoai River

Land type and flood depth	Cropping Pattern			No. of Crops	Net area (ha)	Cropped area (ha)
	Rabi	Kharif - I	Kharif - II			
F ₀ = (0- 30 cm)	Chilli	Vegetables	T. Aman	3	560	1,680
	Wheat	B. Aus	T. Aman	3	1,007	3,021
	HYV Boro	Jute		2	2,100	4,200
	Onion	Jute		3	1,000	3,000
	HYV Boro		LT. Aman	2	2,450	4,900
	Mustard		LT. Aman	2	1,770	3,540
	Pulses	Jute	T. Aman	3	1,550	4,650
	Chilli	T. Aus	T. Aman	3	300	900
		Sugarcane		1	2,320	2,320
	Temporary fallow			200	0	
Sub-total					13,257	28,211
F ₁ (30- 90 cm)	Pulses		LT. Aman	2	71	142
Sub-total					71	142
F ₂ (90-180cm)	HYV Boro		LT. Aman	2	100	200
		B. Aman		1	336	336
Sub-total					436	536
Grand Total					13,764	28,889

6.7 Fisheries

Fisheries sector play a vital role in improving the socio economic status of the people of Bangladesh. The role of fisheries in the national economy is very important. According to the government statistics about 60% of the national protein in our food comes from fish. Of the total national income, the Fisheries sector alone contributes 4% to the national export income, the contribution of fisheries sector is third. About 1.2 million people are engaged full time and another 10.2 million are engaged in part time in this sector for their livelihoods.(Source: Statistical year book of Fisheries, 2012)

6.7.1 Fishing Resources

All the subproject areas of the Project have the potential of both captured and cultured fisheries. Fisheries resources base in the subproject area consists of khals, floodplains, inundated paddy fields, borrow pits and ponds. People of the subproject area catch fish from khal and flood plain from July to November when water is available in these areas. People especially the fishermen catch fish from peripheral rivers and beels during July to end of December each year. The highest catch is recorded in the month of October. During flood, natural fish mainly the riverine fish and other indigenous fish can enter into the subproject area through khals and other floodplains for food, shelter, breeding and rearing purpose. The common open water fishes are Tengra, shing, Kakila, chanda,Taki, Koi, small Chingri, Baim,Taki, Shol,Puti and Magur fish etc But their availability has reduced due to many causes like blocked migration route, destruction breeding and feeding ground, etc.Some species like Gonia, Pabda, Boal, Sorputi, Chitol, Foli, Pabda and Aor have been being endangered locally in some areas.

In culture fisheries, pond fishery is considered as the most important fisheries to increase significantly the total fish production and also to offset any adverse effect of FCD/I activities on natural floodplain fish production. Fish culture ponds are available in all the subproject areas which are privately owned and fish culture is practiced commercially. Cultured fishes such as Silver carp, Katla, Rui Mrigel, Pangus, Common carp, Grass carp, Thai puti and Tilapia, are very common. Culture fishery practices are intensifying rapidly in the area which is also common practice throughout Bangladesh.

Both the capture and culture fishery play a vital role to improve socio economic status of the people generating employment and income and, providing considerable portion of protein to the people.

It is worth noting that in Bangladesh fish availability and consumption has been reducing day by day. This is especially relevant to poorest segments of the society. Poor people who consumed fish almost every day (about 27days a month) in the past 20-25 years report that they can now avail fish only for 13-14 days a month in general. These poor people caught the fish from open water bodies such as those in the flood plains for their consumption without an extra payment to anyone (free hold) and the fish catch in these open water bodies are becoming scarce and the such water areas too are getting reduced.

The captured fish production is declining day by day due to continuing degradation of water bodies, obstruction of fish migration, unsuitability of the khals for fish habitation, destroying fish breeding and rearing grounds etc. Fish culture is gradually increasing as a result of converting the farmlands and

adopting advanced technologies of fish production. Table 6.21 presents the status of fish producing area and fish production in different subproject area

Table 6.21: The status of fish producing area and fish production in different subproject area

Subprojects	Culture Fish		Capture Fish		Total	
	ha	mt	ha	mt	ha	mt
Beel Sukunia	240	390	975	226	1215	616
Daduria- Kandor Beel	87	144	847	128	934	272
Alfadanga- Boalmari	161	290	913	106	1074	396
Chatlar- Fakurhat	126	219	1417	180	1563	399
Kalidaskhali- Arpara	124	208	1113	141	1237	349
Horai River	423	825	684	73	1107	898
Purulia- Char Bhatpara	16	23	551	67	567	90
Bamonkhali- Barnali	184	302	6,508	613	6,692	915
Arol Beel	687	1,203	3,654	315	4,341	1,518
Sonamukhi- Bonmandar	2,306	2,733	9,812	801	12,118	3,534
Project Total	4354	6337	26474	2650	30848	8987

6.7.2 Fishing Community

Fishing Community lives scattered in different areas of the Project. Field survey indicates that there are three categories of fisherman- (i) Professional (ii) Subsistence (iii) Occasional.

The Socio-economic condition of the community in the area differs from category to category.

Out of the total fishing population, professional fishermen constitute the smallest group. Their socio-economic condition is very poor⁶ and has no permanent land or houses for themselves. They live as squatters or illegal occupants in government owned lands in temporary mud huts or thatched houses. They are the neglected or economically marginalized people in the society and are usually deprived of health and education. They are engaged in this profession since long but suffer heavily due to lack of fishing facilities (lack of fish habitat, fish, fishing gear, fishing craft, credit etc.) As a result, they have started leaving this profession and switching over to other profession like, day labourer in other's lands, salesman, earth cutters and peddler etc. Some have opted to migrate to urban areas and run rickshaws. The left-over fishing households presently available in the area are living from hand to mouth. If ignored from the development process, they could suffer further in the light of reduce water body available for their livelihood.

The subsistence fishermen are mostly agriculture farmers that engage themselves in fishing activities only during monsoon period, when they have no agricultural works in hand. During monsoon period (July- November) they do fishing in their surrounding floodplain, whatever catch they get, they consume it for themselves. And if the fish catch is satisfactory, they sell the surplus catch after meeting their own consumption. The reduction in the floodplains and capture fisheries can affect their income as well as increase the expenses unless their income is increased due to other alternate income generation activities and agriculture.

The third category of fishermen in the area is occasional fisherman. They too are relatively poor people, and are known as Neo-fishermen. Their main profession is rickshaw pulling, earth cutting,

⁶ The nationally poverty is based on the measurement of calorie intake converted in to cost a method called food poverty. This is the cost of food with daily nutritional requirement of 2122 K.cal plus an average cost for nonfood items of basic need. The upper poverty line is the per capita household expenditure to meet the cost of food with daily nutritional requirement of 2122k. cal plus an average cost non food items. The lower poverty line is the per capita household expenditure to meet the cost of daily nutritional amount of 1810 k. cal plus and average cost of non food items. People living in between the two lines are moderate poor and people living below the lower poverty line are extreme poor.

day labour etc. on some occasions, they come for fishing and whatever catch they get they sell it out and earn some money for their family maintenance.

On the whole fishermen community in the area is leading a miserable life. But they are an active man-power. They could be utilized in their respective profession provided they are integrated in to the social development and provided with facilities and support.

There are many identified and unidentified fishermen based associations in the project area and these are mostly concentrated in some specific patches of different subprojects. Main objectives of association is to remain united so as to get uninterrupted fishing activities in common properties, good price of their harvested fish and also helping the jeopardize fishermen during hardship. However they do not hold a strong voice or position in the society and may exert less influence in decision making on common issues such as water allocation and management.

6.7.3 Fisheries in different subprojects

Water bodies in different subproject areas are available for cultured fisheries as well as for captured fisheries. Both capture and culture fishery play a vital role to improve the socio economic status of the people, generate employment and provide a significant portion of protein needed.

6.7.3.1 Fisheries in Beel Sukunia Subproject

About 16 % of the household have culture ponds and average size of these ponds are 0.14 - 0.16 ha. The number of pond is about 2913 and the total area is estimated at 240 ha. In the Beel-Sukunia, the average fish production rate is 1,625 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant scope to increase the production rate. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (3.50 ha) or impounded water bodies.

In capture fisheries, production rate of 232 kg/ha/yr against the national average of 271 kg/ha/yr, is slightly lower, possibly due to over fishing, migration problems, scarcity of breeding and feeding ground, lack of brood fish and absence of proper management of the water body.

Beside of these, major constraints are dewatering of low land areas, land use conflict between agriculture and low land areas, use of pesticides and different fertilizers for HYV of rice which is washed into the waterways and are harmful for capture fisheries.

The professional fishing community lives all over the project area and mainly belongs to lower caste Hindu community. About 220 fishermen households live at Sholakia, Asragram and Rongkail village under the project area. Most of households live in and around the surrounding villages of the beel area. The average family size is about 5. According to the field survey, the average fish catch in peak period varies from 2.5 to 3.5 kg/day of miscellaneous fish worth of estimated Tk. 180-300/-. But their income in the off season is only Tk. 80-120/day.

There are two community based fisheries associations the villages of beel-Sukunia. Some portion of beel they have used for fish culture and earn additional money from these activities. Department of Fisheries (DOF) conducts trainings on fish culture for fish farmers under different development

projects. Some NGOs, Brac, Grameen Bank, ASA are working, but very much limited to granting micro credit rather than extension services and aquaculture training.

6.7.3.2 Fisheries in Daduria-Kandor Beel Subprojects

About 19 % of the households have culture ponds with an average size of 14-16 decimal. The total culture fisheries area is estimated at 87 ha having production of 144 MT and total pond number is about 1244. The average fish production is 1,655 kg/ha, which is much lower than the national average of 3600 kg/ha. There is a significant scope to increase the production rate. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*'; rice after fish (1.20 ha) or impounded water bodies.

In capture fisheries, there are about 847 ha area having fish production of 128 MT. The production rate is 151kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 70 households of professional fishermen in Taljuri and Poila village of the subproject area. The average family size is about 4-5. According to the field survey, the average fish catch in the peak period varies from 2.5 to 3.0 kg/day of miscellaneous fish worth of estimated Tk. 170-280, while their income in the off-season is only Tk. 85-120 per day.

There is 2 community based fisheries association in Tajuri and Poila area. DoF has limited activity for resources conservation and management in this area. They have conducted training on fish culture for fish farmers under different development projects. Some NGOs, Brac, Grameen Bank, ASA are working, but very much limited to micro credit rather than extension services and aquaculture training.

6.7.3.3 Fisheries in Alfadanga-Boalmari Subproject

Water bodies in Alfadanga-Boalmari subproject are available for both cultured fisheries and captured fisheries. In culture fisheries, fish ponds are the most important form of fisheries and their numbers are steadily increasing. About 30 % of the households have culture ponds and the average size is 0.13 - 0.17 ha. The total area for cultural fisheries is estimated as 161ha and the number of fish ponds is 3,765 (according to the CEGIS survey, 2012). The average fish production rate of 1,801 kg/ha/year is much lower than the national average of 3,600 kg/ha (DoF report, 2012). Different types of fish culture system are adopted by local people, such as mix culture, mono culture, golda cum fish culture and fish culture in gher. No formal beel culture is practiced within the project area, although with individual initiatives some pockets of low areas in the beels have been transformed into '*ghers*' (2.50 ha) or impounded water bodies. The pond fish and gher culture in this area are mainly traditional in nature while improved technology is also adopted by some big farmers.

In capture fisheries, there are about 913 ha area having fish production of 106 MT. The production rate is 116 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are canals with some potential productivity but most of the canals are silted up. For this reason, this habitat cannot function as spawning ground of the resident fishes species and thus

capture fishery is declining day by day, and require re-excavation not only as a measure to facilitate drainage/ irrigation but also to allow natural fishes to grow.

Major constraints are dewatering, conflict between agriculture and low land area, use of pesticides and different fertilizers for HYV which harmful for capture fisheries.

Professional fishermen of about 120 HH are living in Tikorpur, Charnandia, Helencha and Pobonbeg villages in the project area and their population. Their average family size is about 4-5. According to field survey, the average fish catch in peak period varies from 3 to 4 kg/day of miscellaneous fish worth of estimated Tk150-200/-. So they are struggling for existence. They need to be immediately provided with financial helps and supports.

There are many identified and unidentified fishermen based associations in the project area and these are mostly concentrated in Snanghat union. At least five such fishermen cooperative associations have been identified in the project area. Main objectives of association is to remain united so as to get uninterrupted fishing activities in common properties, good price of their harvested fish and also helping the jeopardize fishermen during hardship.

6.7.3.4 Fisheries in Chatlar-Fakurhat Subproject

About 16 % of the household have culture ponds and the total number is about 1509, average sizes of the ponds are 15 decimal to 22 decimal. The total area is estimated as 126 ha and production as 219 MT. The average fish production rate is 1738 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant scope to increase the production rate. No formal beel culture is practiced although with individual initiatives pockets of low water depth areas in the *beels* have completely been transformed into *'ghers, fish after rice* (4.50 ha) or impounded water bodies.

In capture fisheries, there are about 1,417 ha area having fish production of 180 MT. The production rate is 127 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 320 professional fishermen households in the subproject area among them 140 fishermen households live at Horina, Krishnopur and Deokhali village. The average family size is about 5-7. According to the field survey, the average fish catch in peak period varies from 3 to 4.5 kg/day of miscellaneous fish worth of estimated Tk. 300-450/-. But their income in the off season is only Tk. 90-130. So they are struggling for existence.

There is 3 community based fisheries association in Horina, Krisnopur and Deokhali area. DoF conducts training on fish culture for fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA are working, but very much limited to micro credit rather than extension services and aquaculture training.

6.7.3.5 Fisheries in Kalidaskhali-Arpara Subproject

About 17% of the household have culture ponds with an average size of 22- 28 decimal. Total area is estimated at 124 ha having production of 208 MT. In the Kalidaskhali-Arpara subproject, the average fish production rate from fisheries is 1,677 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant scope to increase the production rate. No formal Beel

culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (4.50 ha) or impounded water bodies.

In capture fisheries, there are about 1,113 ha area having fish production of 141 MT. The production rate is 127 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 400 professional fishermen households in the villages of Shalica, Borogram, Halbaria and Digigram of Kalidaskhali-Arpara subproject area. The average family size is about 4-6. According to the field survey, the average fish catch in peak period varies from 3.5 to 5 kg/day of miscellaneous fish worth of estimated Tk. 300 - 400/-, while their income in the off season is only Tk. 95-130.

There is 3 community based fisheries association in Salica, Digigram and Bonogram area. DoF conduct training on fish culture for fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA are working, but very much limited to micro credit rather than extension services and aquaculture training. DOF is not very strong to control the fishing of brood fish and under size of fish.

6.7.3.6 Fisheries in Horai River Subproject

About 14% of the household have culture ponds with an average size of 0.13 - 0.16 ha and the number of fish ponds is 4,484. The total estimated area is 423 ha having production of 825 MT. The average fish production rate is 1,950 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha.. No formal beel culture is practiced within the project area, although with individual initiatives some pockets of low areas in the *beels* have been transformed into '*ghers*' (4.50 ha) or impounded water bodies.

In capture fisheries, there are about 684 ha area having fish production of 73 MT. The production rate is 107 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 400 professional fishermen households in Shibpur, Rajdarpur, Barumollick and Nolia villages of Horai River subproject. Their average family size is about 5-7. Whatever income they earn out of fishing they cannot maintain their family and need other sources of income. According to the field survey, the average fish catch in the peak period varies from 3 to 4 kg/day of miscellaneous fish worth of estimated Tk. 250 - 300/-, while their income in the off season is only Tk. 90-130.

There is no community based fisheries association in the subproject area. DOF has limited activity for resources conservation and management in this area. They have conduct training on fish culture for fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA are working, but very much limited to micro credit rather than extension services and aquaculture training.

6.7.3.7 Fisheries in Purulia-Char Bhatpara Subproject

About 17% of the household have culture ponds with an average size of 15- 18 decimal. Total culture fisheries area is estimated as 16 ha having production of 23 MT. The average fish production rate is 1,438 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant

scope to increase the production rate. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (8.00 ha) or impounded water bodies.

In capture fisheries, there are about 551 ha area having fish production of 67 MT; the production rate is 122 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 491 professional fishermen households in 6 different villages of the subproject. Their average family size is about 5-6. Whatever income they earn out of fishing they cannot maintain their family and need other sources of income. According to the field survey, the average fish catch in the peak period varies from 5 to 8 kg/day of miscellaneous fish worth of estimated Tk. 600/- mainly in the month of October when reduced the inundation area after monsoon, while their income in the off season is only Tk. 150-180.

There are 3 community based fisheries association in the subproject area. DoF has limited activity for resources conservation and management in this area. They have conduct training on fish culture for fish farmers under different development projects. Some local NGOs, brac, Grameen Bank, ASA are working, but very much limited in micro credit rather than extension services and aquaculture training.

6.7.3.8 Fisheries in Bamonkhali-Barnali Subproject

About 14% of the household have culture ponds with an average size of 20- 25 decimal. Total culture fisheries area is estimated as 184 ha having production of 302. In the Bamonkhali-Barnali subproject, the average fish production rate is 1,641 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (88 ha) or impounded water bodies.

In capture fisheries, there are about 6,508 ha area having fish production of 613 MT; the production rate is 94 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 605 professional fishermen households in 16 villages in different areas of the subproject. Their average family size is about 5-7. Whatever income they earn out of fishing they cannot maintain their family and need other sources of income. According to the field survey, the average fish catch in the peak period varies from 3 to 7 kg/day of miscellaneous fish in the month of October each year worth of estimated Tk. 400-600/-, while their income in the off season is only Tk. 120-150 /day because catch rate is very low due to reduce the inundation area in dry season.

There is 9 community based fisheries association in the subproject area for sanctuary development, fish culture in canal and lease out the water bodies. DoF has limited activity for resources conservation and management in this area. They have conduct training on fish culture for fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA and CNRS are working, but very much limited in micro credit rather than extension services, conservation of aquatic habitat and aquaculture training.

6.7.3.9 Fisheries in Arol Beel Subproject

About 12% of the household have culture ponds with an average size of 20- 25 decimal. Total culture fisheries area is estimated as 687 ha having production of 1,203 MT. The average fish production rate is 1,751 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant scope to increase the production rate. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (16 ha) or impounded water bodies.

In capture fisheries, there are about 3,654 ha area having fish production of 315 MT; the production rate is 86 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 765 professional fishermen in 14 villages of the subproject. Their average family size is about 5-6. Whatever income they earn out of fishing they cannot maintain their family and need other sources of income. According to the field survey, the average fish catch in the peak period varies from 3 to 5 kg/day of miscellaneous fish worth of estimated Tk. 250- 450-, while their income in the off season is only Tk. 80-140 due to scarcity of water and fish.

There is 6 community based fisheries association in the subproject area due to take the lease of boar and pond and other water bodies. DoF has limited activity for resources conservation and management in this area. They have conduct training on fish culture for fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA and some local NGOS are working, but very much limited in micro credit rather than extension services, aquaculture training and open water management.

6.7.3.10 Fisheries in Sonamukhi-Bonmandar Subproject

About 9 %of the household have culture ponds with an average size of 18-20 decimal. Total culture fisheries area is estimated as 2,306 ha having production of 2,733 MT. The average fish production rate is 1,185 kg/ha/yr, which is much lower than the national average of 3,600 kg/ha. There is a significant scope to increase the production rate. No formal Beel culture is practiced although with individual initiatives pockets of low areas in the *beels* have completely been transformed into '*ghers*' (24 ha) or impounded water bodies.

In capture fisheries, there are about 9,812 ha area having fish production of 801 MT; the production rate is 82 kg/ha/yr. The low production rate is due to over fishing, migration problems, scarcity of breeding and feeding ground, and lack of brood fish.

There are about 952 professional fishermen households in 21 villages of the subproject. Their average family size is about 5-6. Whatever income they earn out of fishing they cannot maintain their family and need other sources of income. According to the field survey, the average fish catch in the peak period varies from 3to 5 kg/day of miscellaneous fish worth of estimated Tk. 450-, while their income in the off season is only Tk. 80-100 due to lack of fish in the surrounding water bodies in dry season.

There is 12 community based fisheries association in the subproject area. DoF has limited activity for resources conservation and management in this area. They have conduct training on fish culture for

fish farmers under different development projects. Some NGOs, brac, Grameen Bank, ASA are working, but very much limited in micro credit rather than extension services and aquaculture training.

6.8 Cultural, Archaeological and Historical Sites

There are no cultural areas like school, college, madrasa, mosque, eidgah, temple, graveyard, etc. along the embankments of the project. There are no archaeological or historical sites along the project influence area

7 IDENTIFICATION, PREDICTION AND EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Identification, Prediction and Evaluation of Potential Impacts

This chapter identifies the potential significant impacts related with project location, design construction and operation phases of the project on the physical, biological and socioeconomic domains of the environment. An environmental impact is defined as any significant change to an existing condition or services of the environment. Identification, prediction and evaluation of potential impacts have been done on the basis of baseline data collected from secondary and primary sources. Identification of potential impacts due to the SAIWRPMP is shown in the checklist (Annex C).

As the 11 subprojects are situated in different geographical locations in five different districts, therefore, in addition to the common potential impacts, specific potential impacts along with mitigation measures for specific subprojects have also been studied. The potential impacts of the project include but are not limited to the following:

7.1.1 Common Potential Impacts of the project:

Common potential impacts during various stages of the project were studied as follows.

During Design/Preconstruction Stage: Impacts during design/ preconstruction stage will be localized and temporary in nature. They are reversible and will have no long term effects on the environment. Following environmental components are addressed during design/ preconstruction stage.

- ❖ Terrestrial habitats
- ❖ Agricultural areas
- ❖ Tree cover areas
- ❖ Wetlands: water bodies
- ❖ Rivers and Khals and dredged material
- ❖ Housing and home gardens
- ❖ Resource Users

During Construction Stage: Impacts during construction stage will be localized and temporary in nature. They are reversible and will have no long term effects on the environment. Following environmental components are addressed during construction stage.

- ❖ Hydrological aspects of the area
- ❖ Ambient Air quality and noise levels
- ❖ Surface Water bodies including wetlands
- ❖ Soils and agricultural lands
- ❖ River/ khal erosion
- ❖ Health and safety of people

During Operation and Maintenance Stage: Impacts during operation and maintenance stage will be localized and temporary in nature. They are reversible and some of them will have long term effects on the environment. Following environmental components are addressed during operation and maintenance stage.

- ❖ Tree coverage
- ❖ Agriculture areas and Agrochemical usage
- ❖ Resource users

7.1.2 Specific Potential Impacts of Alfadanga-Boalmari Subproject during construction of 1.5km Retired Embankment

During Design/Preconstruction Stage:

- ❖ Land acquisition

During Construction Stage:

- ❖ Landscape

7.1.3 Climate change induced impacts of the project: Climate change is a global issue. Climate change induced impacts of the project is considered and mitigation measures are discussed on the following climate change issues

- ❖ Flood and wind
- ❖ Drainage and droughts
- ❖ Greenhouse gas emission

7.2 Potential Impacts and Mitigation Measures

The impacts identified during the EIA study are manageable and can be mostly mitigated through design and management interventions. Environmental impacts identified can be broadly classified as those taking place during pre-construction, construction and operational stages of the project. Activities that may affect environmental resources at different stages of the project implementation are discussed below

7.2.1 Potential Impacts and Mitigation Measures Common to all the Subprojects

7.2.1.1 During Design and Pre-Construction Stage

Impact: Designs were meant to improve drainage facilities in the subproject area, where the land available for rice crops will increase and the natural flood plain water bodies that retains water over the dry period will reduce. This will reduce area available for natural capture fishery and other natural environmental services such as area available for wildlife and native aquatic species. It is expected that the reduction in capture fisheries will be compensated through increased culture fisheries and modern fishery techniques but impact due to the reduction of area under natural water body, will affect other environmental services including wild species that depend on these last remaining water bodies for their survival. If wiped out by draining of the area completely the loss cannot be expected to be reinstated and the wild and native species will be impacted negatively. This was identified during the design stage of the project and precautionary measures to retain and improve some of these natural water body areas were recommended.

Recommended Mitigation: It is important to determine the critical area that need to be kept under flood plain and make improvements without wiping them out of the subproject area. The designers of project had taken note of this requirement and agreed to demarcate the area to be kept inundated following draining. The project will therefore make arrangements to identify the area for sanctuaries

and include measures in the overall management plan of the subproject area to save these areas and manage them.

7.2.1.1.1 Terrestrial habitats

Impact: There may be some disturbances and damages to terrestrial habitats due to clearing of worksites for construction and reconstruction of structures like culvert, regulator, embankment, and soil extraction for embankment re-sectioning, construction, etc.

Mitigation: Disturbances and damages of terrestrial habitats due to clearing of worksites can be reduced by clearing of land near the work site only and avoid using productive land for taking borrow soil for earth work.

7.2.1.1.2 Agricultural areas

Impact: There will be some negative impact of low intensity on agriculture lands due to clearing of worksites for construction/ rehabilitation of embankment as well as from collecting soil for such construction/ rehabilitation.

Mitigation: Negative impact of low significance on agriculture due to clearing of worksites will be reduced by planning for utilizing soils from dry riverbed/ khal or where new fish ponds are to be constructed in farmer's plots for such earth works.

7.2.1.1.3 Tree cover areas

Impact: There will be some marginal negative impact of low significance on tree cover due to clearing of worksites for construction/ rehabilitation of embankment. There is no natural forest in the area hence the impact will be only on home garden tree cover.

Mitigation: Action will be taken to minimize negative impact of low significance on tree cover due to clearing of worksites for construction/ rehabilitation of embankment. Tree planting plan with suitable species will be prepared for carrying out tree planting along the embankment during O & M stage. This will increase the tree coverage that will also act as wind barriers during windy seasons while providing improved shade from scorching sun during the dry period for those who use the embankment as access roads,

7.2.1.1.4 Wetlands: Common Water bodies

Impact: Due to clearing of worksites or due to planning of structures that may prevent water from flowing into these wetlands there may be damage to wetland habitats/resources. Soil extraction for construction/ rehabilitation of embankment if done from wetlands, will damage wetland ecosystems if adequate precautions are not stipulated.

Mitigation: Plans are prepared so that critical natural wetland habitats important for hydrological and ecological significance will be identified and designs will be made to maintain them during construction and operation stages. FCD/I structures to be planned in such a manner that will allow safe fish migration during operational stage.

7.2.1.1.5 Rivers and Khals and dredged material

Impact: Re-excavation of khal and river-training will involve extraction of about 3,806m³ soil required to be dredged out mostly from khal beds. Some portions of the dredged materials are to be used for

construction/ re-sectioning of embankment and the excess will need to be disposed of to some other suitable places.

Mitigation: The project will plan and design khal excavation and disposal. So that appropriate measures to avoid/ minimize negative impacts will be adopted. The project will stipulate to all contractors about the need to comply with the guidelines provided by DOE to extract and dispose material from river beds and khals. Guidelines for dredging and disposal of dredging material will be included in the contractor's agreement and made adoption compulsory by incorporation of appropriate protective clause to be followed by the contractor. The contractors will be responsible to identify possible suitable location for disposal of dredged materials before executing the contracts. Prior to start dredging, the qualities of bed materials will be assessed by testing the presence of heavy metals not detrimental of human health and environment. This will help ascertain that it meets necessary standards before the extracted soil is used for re-sectioning and reconstruction of embankments. This will reduce the demand to dispose extracted material elsewhere.

7.2.1.1.6 Housing and home gardens

Impact: There are about 286 housing structures in the RoW of the 254.5 km embankment that some of them may be affected temporarily or permanently by construction/ re-sectioning of embankment.

Mitigation: The specific resettlement framework was prepared to guide the preparation of due diligence and resettlement plan if required.

7.2.1.1.7 Resource Users

Impact: Development of flood control, drainage/ irrigation (FCD/I) facilities will create conflicts of resources usage among different users. If no sufficient attention is paid during the design stage to different resource users (example is between agriculture and fisheries), a conflict situation may arise that could exert negative impact; In wet seasons agriculture requires water to drain out from the land, fisheries need to retain water to certain minimum depths for survival of fish; However In dry seasons agriculture needs water for irrigation inspire of fisheries' also require the scarce water to be retained. The other environmental services such as associated wildlife too will need water be retained longer in the natural water bodies and this too need to be considered.

If not planned and managed with sufficient attention to those conflicting water demands FCD/I facilities will be managed to increase agriculture in terms of area as well as production. This will be detrimental for fisheries and wildlife in the natural water bodies that will dwindle further. This will affect other aquatic wildlife.

Mitigation: The project is fully aware of the need to manage the water to meet for conflicting water demands in mind. The project will ensure formation of WMOs consisting of various users including farmers and fishermen. WMO need to be a legal institution to resolve any dispute related to land, water or any other resources. The training will be provided on minimum techniques to carry out with agriculture with minimum water usage and other agricultural production techniques without fully depending on the scarce water during dry seasons.

7.2.1.2 During Construction Stage

Environmental impacts during construction phase are expected to be of temporary nature. Construction impacts are considered to be minimal as all the construction works will be carried out within the boundaries of each site and will be controlled via the mitigation measures defined in the EMP. Contractors should be issued with a copy of the EMP at the time of bidding and make it mandatory to price their quotation to comply fully with the EMP recommendations. Each contractor who wins the project construction will make adequate arrangements and have sufficient capabilities and capacity to implement all recommendations of the EMP at all stages of the project construction.

7.2.1.2.1 Hydrological aspects of the area

Impact: Due to construction of temporary by-pass roads and other alternative structures during the construction or repair of structures like culverts, regulators, embankments, etc., natural surface run off of water during the rainy seasons can be affected (Since we don't have new structures except in Alfadanga 1.5 km embankment the impact of such constructions will remain minimum or insignificant). However if not properly constructed with adequate provisions for rapid drainage, these temporary structures may still cause local flooding during monsoons/rainy seasons. Dredging, piling and diversions at the locations of constructing the structures may also hinder existing surface water flow and as a result, localized drainage congestion may occur. Hence, if diversions with adequate pipe culverts are not provided and dredged materials are not properly managed the flooding of new areas can occur. Stockpiling of materials dredged from the riverbeds for the construction/repairing of embankment if exposed to floods may also result in increased erosion and subsequent siltation in the adjacent water bodies.

Mitigation: During construction of all temporary or permanent structures such as the by-passes culverts or gates, proper practices will be applied to avoid drainage congestion. The contractor will be asked to provide adequate drainage provisions to meet the highest rainfall situations recorded.

The stockpiling of earth shall not cause any interruption of the regular water flow in the surface water streams. If the area does not have enough space for stock piling of the dredged material or construction soil, the contractor will be asked to stockpile in a nearby location suitable for stock piling and transport them as and when needed.

All wastes will be disposed in a controlled manner at designated sites approved by the project engineer only according to the characteristics of the waste. Adequate cross drainage structures shall be built to drain off water into water bodies. Careful attention will be given so that there are no negative impacts caused by the temporary diversion roads at the regulator and culverts construction/reconstruction sites. Adequate number and size of pipe culverts have to be provided in the diversion road at the bridge/culvert sites to avoid drainage congestion.

Once the construction or repair phase is over, the contractor shall be required to immediately remove and dispose the material and construction debris in a manner without affecting the drainage or environmental functions of another location. Ideally, disposing such material if not used for reconstructions will be done in adjacent dug holes such as brick pits that may have been abandoned and unused.

The contractors will therefore be required to identify exact locations where the dredged material are deposited prior to commencement of the construction activities and made sufficient provisions in their budgets to provide such services. Obtaining the required approvals for such deposition, if any, will be part of the contract awarded to the contractors.

7.2.1.2.2 Air quality and noise levels

Impact: The impact on air quality during construction is expected only in the immediate vicinity of the work site. Increased dust and particulate matter is expected from aggregate production, transport route and construction sites where use of diesel equipment for earth moving and excavation operate. These impacts can be expected to be high during the dry windy periods. However, the anticipated ambient air quality and noise problems will be localized and minor lasting only during the construction stage.

Mitigation: Newly exposed soil surfaces on the embankment during construction shall be regularly watered to prevent wind erosion and dust. When materials are transported contractor will be asked to ensure box trucks are covered during transporting of construction materials to minimize dust pollution. All machines and plants used for construction purposes shall be required to follow manufacturers' specifications to prevent/minimize gaseous emission and noise. The mixing of concrete using cement shall be done carefully preventing inhalation by workers. Also such operations shall be done without being exposed to windy conditions and avoid doing such cement mixing in areas close to where public gather.

The contractor will be required to spray regularly (dry weather conditions) during construction phase to reduce dust problems. Construction equipment will be maintained to acceptable standards; Machinery causing excessive pollution (e.g. visible clouds of smoke and noise) shall not be allowed in construction sites; Vehicles delivering materials will be asked to be covered with tarpaulin to reduce spills; Construction material, machinery and equipment will be maintained in a good working condition and shall be handled with due precaution and only by trained staff. It is recommended that project to arrange to provide adequate training and protective gear to workers who are designated to handle cement and other hazardous construction material as they tend to ignore or ignorant about long term health impact of such exposures.

7.2.1.2.3 Surface Water bodies including wetlands

Impact: Excessive draining of water before the dry seasons to gain more land may reduce available water for other environmental demands such as recharging of ground water and survival of aquatic/benthic/bird life in wetlands during dry periods. These changes could affect the long term functioning of various food chains operating within the local environment.

Mitigation: It is required to retain (do not drain) water in the sufficient quantities in a minimum area/depth for environmental demands and to meet dry period requirements by well-planned management process. Need to design regulators to meet this requirement. Also it is strongly advised that WMOs are provided with training and capacity building on environmental management. If the management of these water bodies as sanctuaries for wildlife is difficult due to land owner's

demands, it may be necessary for the project to assist the WMOs to negotiate and come to compromise situation and also educate the owners about the implications.

7.2.1.2.4 Soils and agricultural lands

Impact: Having to plough new lands and/or dig burrow pits for soil for embankment repairs from adjacent lands, will increase possibility of soil loss through erosion. The future repair works and piling after excavations may also contribute to such increased erosion possibilities.

Mitigation: If suitable, will use soils from river or khal beds or its flood plains for embankments. It is preferred as those pits could well be re-silted during following flooding seasons. The project will promote use of ICM techniques in agriculture and minimize the extent that need to be harrowed to reduce soil disturbances during the O and M stages. The training programs to promote such techniques shall be introduced through the project.

7.2.1.2.5 River/ Khal erosion

Impact: Re-excavation of 344.5 km khal will involve about 3,806m³ soil required to be dredged out from the beds of those khals and rivers. There will be some risks of khal/ river bed erosion if appropriate measures are not taken during excavation of those water bodies and management of re-excavated materials.

Mitigation: The contractors will be required to follow the khal/river excavation plan prepared for the purpose. The plan shall identify the suitable locations for extraction of soils and seek approval from relevant authorities. The Contractor needs to follow proper contracts and guidelines for dredging and dredging material disposal. Prior to start dredging, the quality of bed materials will be tested for checking the presence of heavy metals not detrimental to human health and environment. Proper compaction of disposed materials will be ensured.

7.2.1.2.6 Health and Safety

Impact: The health and safety for the workers and community is an essential factor that may have impacts if not addressed during construction phase.

Mitigation: The project will ensure that during construction proper environmental safeguards for safety are taken by demarcating the work sites to be clearly visible during day and night to prevent any accidents happening. Use of luminous tapes for marking the work sites and night lamps to indicate the work sites will be made compulsory for the contractors who will be hired for the construction works.

Workers will also be required to be provided with adequate health and sanitary facilities and the workers accommodation will be required to be set up with sufficient facilities. This will be included as a contractual requirement of the contractor.

7.2.1.3 During Operation and Maintenance Stage:

7.2.1.3.1 Tree coverage

Impact: Removal of trees due to clearing of worksites for construction/ rehabilitation of embankment will be marginal but if had to be done will have a stress on the natural ecosystem functions. Wildlife such as birds, reptiles will also be affected due to removal of trees.

Mitigation: The contractors will be instructed to avoid and minimize removal of trees from construction site. However if this is unavoidable the Project engineer will instruct the environmental officer of the project to ascertain the minimum number of trees that had to be removed and approval will be granted for such action. The project is recommending to launching tree planting along the embankments with suitable indigenous species to enhance the environmental quality of the area and also to add additional strength to embankments against erosion. Such tree cover is expected to improve shade for the future road users and also improve the micro climate of the area.

Tree planting campaigns will be organized to enhance the overall tree cover of the area. This will not only strengthen the embankments but also will provide some form of wind resistance against the possible wind damage risks to the field crops. Tree plantation plan (Presented in Annex E) with suitable species has been prepared for carrying out plantation during O & M stage.

7.2.1.3.2 Agriculture area and agrochemical usage

Impact: With increased agricultural activities the use of agrochemicals (pesticides and fertilizers) will increase and the potential pollution of soil, water and environment will aggravate

Mitigation: It is important that agriculture production is increased through technological improvements and high yielding varieties, however usually these high yielding varieties will lead to use of higher quantities of agrochemicals in the fields. It is strongly recommended that WMO capacity to make people aware of the agrochemical hazards if overused or misused be improved. The Integrated Pest Management (IPM) and Integrated Crop Management (ICM) practices will be encouraged and promoted among the farmers.

7.2.1.3.3 Resource users

Impact: Development of flood control, drainage/ irrigation (FCD/I) facilities will create conflicts of resources use among different users. It create conflicts of resource bases between agriculture and fisheries; In wet seasons agriculture requires water to drain out from the land, fisheries need to retain water or certain depth; In dry seasons agriculture needs water for irrigation from fisheries' scarce water.

FCD/I facilities is expected to encourage increase agriculture in terms of area as well as production. This raises concern on availability of natural water bodies for fisheries and other aquatic wildlife.

Mitigation: The project has planned the management of land, water and other resources for achieving their sustainable uses. The users include agriculture, fisheries and other competing natural users. Any dispute related to water use among them shall be resolved by WMO, which is the legal institution that will take over the management of these resources. The project will provide necessary training to improve the capacity to the WMOs for this purpose.

7.2.2 Specific Potential Impacts and Mitigation Measures of Alfadanga-Boalmari Subproject due to construction of 1.5 km New Retired Embankment

7.2.2.1 During Design/Preconstruction Stage

7.2.2.1.1 Land Acquisition

Impacts: The construction of 1.50 km new retired embankment will require about 2.75 ha of land along the left bank of Modhumoti River to be acquired. This will require either resettlement or payment of compensation to affected parties.

Mitigation: The project will prepare a resettlement plan for this particular section of embankment that will involve land acquisition.

7.2.2.2 During Construction Stage

7.2.2.2.1 Landscape

Impact: Construction of new retired embankment on the flood plain area along the river-bank will change the landscape of the area together with the vegetation due to more control conditions.

Mitigation: The embankment along with other structures to be constructed as per plan will make the new landscape beneficial to the community. It is recommended that project help community to carry out planting of trees along the embankment with suitable species after construction. .

7.2.3 Climate Change Associated Impacts and Mitigation Measures

7.2.3.1 Impact due to Changes in Climatic Condition

Climate change and its associated impacts will be experienced through changing temperatures and precipitation, rising sea levels, changes in the frequency and severity of climate extremes and in the dynamics of hazardous conditions (IPCC, 2007). Developing countries are considered to be particularly susceptible to climate change because of their exposures and sensitivities to climate-related extremes, and especially because of their limited adaptive capabilities to deal with the effects of hazardous events. Given this limited capacity to adapt, they are considered to be particularly vulnerable to damages associated with climate, just as they are particularly vulnerable to other stresses.

Bangladesh is recognized worldwide as one of the most vulnerable countries to the impacts of climate change. This is due to dominance of floodplains, low elevation from the sea, high population density, high levels of poverty, and overwhelming dependence on nature, its resources and services. The country has a history of extreme climatic events claiming millions of lives and destroying past development gains. The people and social system have knowledge and experience of coping with the effects of such events—to some degree and extent. Historically, Bangladesh is trying to adapt with the changing environment. The Inter-government Panel on Climate Change (IPCC) has identified the country as one of the most vulnerable countries to climate change, which may severely affect lives and livelihoods of millions of Bangladeshi people in the coming decades. In this regard, Bangladesh has already prepared the National Adaptation Programme on Action (NAPA) and Climate Change Strategy and Action Plan (MOEF, 2005 and MOEF, 2009).

According to the fourth assessment, report of IPCC, continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century, which would very likely be more severe than those observed during the 20th century would. The climate change impacts are described for the following two aspects:

- i. Likely changes in the climatic conditions with respect to temperature, flooding and drainage aspects; and
- ii. Greenhouse gas emission reduction

The increasing trend of temperature shows that it will increase 1.3°C by the 2050s while rainfall will increase by 8%. The maximum estimated change in temperature for the project area is 2°C in 2050s. These possible changes should be considered in the design and implementation of the project.

7.2.3.2 Climate Change Impact on Flooding

Impact: The secondary impacts of climate change are expected to be not only in magnitude but also in frequency. For example, there are chances of not only increasing of flood water levels but also reduction of flood return periods. This indicates that a 20 year return period flood might become a 15 year return period flood under climate change scenarios.

Mitigation: Additional embankment height to incorporate climate change induced flooding is required in design. The designs had been carried out using the 20 year flood data and it is anticipated this will meet the risks posed by climate induced flood events.

7.2.3.3 Climate Change Impact on Drainage

Impact: The future trans-boundary inflows of the three major rivers (Ganges, Brahmaputra and Meghna) during the monsoon period indicate that inflows into Bangladesh are on average projected to increase over the monsoon period which will also be applicable for SAIWRPMP areas. As a result of these increased discharges, the drainage structures throughout the area have to drain much more water under climate change scenario.

Mitigation: Adequate numbers of drainage facilities along with larger openings have been considered during designing the structures for the project, potential impact of climate change are considered during all stages of designing.

The increase in river inflow from India will result in higher water levels, during and immediately after rainy seasons while the beel areas get inundated due to rainfall in Bangladesh. The beel areas will be difficult to drain out and this will result in longer inundation/flooding periods. Such impact due to climate change may need to be tackled either by deepening and retaining the water within a deepened beel and freeing some area early for cultivation or by introducing short term varieties. It must be noted that deepening the beel at selected places will also help sustain the associated capture fisheries and wildlife as recommended elsewhere in this EIA report.

7.2.3.4 Greenhouse Gas (GHG) emissions

Impact: The project may have associated benefits with respect to Greenhouse Gas (GHG) emission reduction.

Mitigation: Climate change issues must be considered while finalizing the project design. Tree planting will be done on the slopes of the embankments as per the prescription of forest department after completion of the project construction activities. Plantation of trees is one of the ways of mitigating greenhouse gas emission. Planting of new forests can help militate against climate change by removing CO₂ from the atmosphere.

It is recommended to establish tree covers either along the embankments, as wind shields to protect the vast fields with no such covers or even as plants around the sanctuary. Also the rationale use of chemical fertilizers and promotion of organic fertilizers should be promoted and IPM techniques introduced as part of the extension work.

8 PUBLIC CONSULTATIONS

8.1 General Consideration

This chapter deals with the information disclosure to the public and consultation sessions held with the different stakeholders that are likely to be affected adversely and/or beneficially due to the implementation of the proposed irrigation and drainage project. The purpose of public participation and consultation was to gather opinions and suggestions on any environmental issues considered relevant by the people living in the area of the Project impact zone. The public consultation is an essential part of the environmental assessment process and has been undertaken both formally and informally throughout the study to ensure that the knowledge, experience and views of stakeholders and the general public are taken into account during the EIA. The information shared and recorded has been applied where relevant to justify design, alignment, construction methodology and timing changes, in order to reduce predicted negative environmental impacts. The consultation process was carried out as per the environmental guidelines of DOE and ADB.

The consultation task had the following objectives:

- ❖ Share information with stakeholders on proposed improvement works and expected impacts on the physical, biological and socio-economic environment of the project area;
- ❖ Understand stakeholders' concerns regarding various aspects of the project, including the existing land use pattern, adverse and benefits of the project, and the likely impact of construction and operation related activities;
- ❖ Provide an opportunity to the public to influence project design in a positive manner;
- ❖ Obtain local and traditional knowledge before decision making;
- ❖ Increase public confidence about the proponent, reviewers and decision makers;
- ❖ Reduce conflict through the early identification of controversial issues, and work through them to find acceptable solutions;
- ❖ Create a sense of ownership of the proposal in the mind of the stakeholders; and
- ❖ Develop the proposal which is truly sustainable.

8.1.1 Identification of Stakeholder

During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. During the field survey different stakeholders identified were the villagers/local residents, government officials, farmers, fishermen, businessmen, shop keepers, public representative, and NGO's. All those stakeholders had different types of stakes according to their professions and livelihood characteristics.

8.1.2 Information Disclosure

The discussions were primarily focused on receiving maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the project. The purpose of this stakeholder consultation is to identify the views of major institutional and project affected persons and stakeholders in the project area, and to identify issues of relevance to the EIA, as well as any impacts which the project may have on project planned by the stakeholders, and to assess any mitigation measures which may be undertaken to minimize any adverse impacts of the proposed project. Subsequently, stakeholder consultation is one of the important parts of the EIA to address the environmental aspects as well as socio-economic issues from stakeholders' point of view. Issues

were discussed in depth with the government officials and NGOs while in case of the people those issues were touched upon which are relevant to them. To begin with, they were given a brief outline of the project's objectives, type and components of the project in a simplified manner and in their native language. A set of pre-determined common questions were provided to the stakeholders to seek their perception of the project. The discussion with the stakeholders was focused mainly on the following points:

- ❖ Whether they have heard about the project or not and their understanding regarding the activities and requirements of the project;
- ❖ Any concerns about significant negative impacts of the project on different components of the environment (e.g. surface water, ground water, soil, air, and biotic and abiotic lives and the ecosystems as a whole) and the possible mitigation measures of the impacts;
- ❖ Past experience with Inundation/flood in the project area;
- ❖ Presence of wildlife and issues relevant to their conservation;
- ❖ About environmentally sensitive issues; and
- ❖ Overall expectation of the stakeholders regarding the SAIWRPMP.

8.1.3 Compliance with Relevant Regulatory Requirements

Public consultation was undertaken as per the DOE and ADB's requirements. All the five principles of public consultation given by ADB such as information dissemination, information solicitation, integration, coordination and engagement into dialogue were incorporated during the task. A framework of different environmental impacts likely from the project was strengthened and modified based on opinions of all those consulted, especially in the micro level by setting up dialogues with the village people from whom information on site facts and prevailing conditions were collected. The requirement of public consultation during the implementation of the project is proposed as part of the mitigation plan.

8.1.4 Major Comments Received

While a wide range of people from different administrative, social and economic backgrounds were consulted, their concerns and outcome of the consultation along with suggestions made by them are described in the following sections.

8.2 Focus Group Discussion

Each group consisted of more than five people that were gathered and discussions were held for minimum of half an hour to share information. This helped to gather their opinion and concerns. Altogether 15 FGDs were held starting from 15 November 2014 to 15 December 2014. A total of 472 participants from different locations have taken part in those consultations. The schedules, venues and the participant's number are given in Table 8.1 (Detail list of participants are presented in Table H.1 of Annex H); photos of FGD conduction are given in Figure 8.1

Table 8.1: Summary of the participants participated during FGD

FGD No.	Date	Location (Village, Upazila, District)	No. of Participants
01	15/11/2014	Solua, Chowgacha, Jessore	33
02	29/11/2014	Dohor Magura, Jhikorgacha, Jessore	20
03	01/12/2014	Ghoshgati, Shalikha, Magura	26
04	01/12/2014	Amura, Magura	31
05	01/12/2014	Maijpara, Boramara, Narail	30
06	03/12/2014	Gatipara, Shialghona, Sharsha, Jessore	40
07	06/12/2014	Bhaduria/Ghonpara, Kashiani, Gopalganj	32
08	06/12/2014	Ghonpara, Kashiani, Gopalganj	32
09	08/12/2014	Gopalpur, Alfadanga, Faridpur	34
10	08/12/2014	Bonchaki, Boalmari, Faridpur	25
11	09/12/2014	Jandi, Bhanga, Faridpur	13
12	10/12/2014	Bhabukdia, Salttha, Faridpur	20
13	11/12/2014	Matipara, Rajbari	20
14	13/12/2014	Sorusail, Baliakandi, Rajbari	80
15	15/12/2014	Kuatpur, Shalikha, Magura	36
		Total Participants	472



Figure 8.1: Focus group discussions under progress

During the consultation, the participants expressed their opinions and suggestions about the implementation of the SAIWRPMP. They told that the project will add a new dimension to their lives by increasing agricultural production system in the area. Moreover, they were of the opinion that livelihood as well as socio economic status of the people will greatly improve due to increase of production and service related activities. The summary of the FGD's findings are presented in Table 8.2.

Table 8.2: Summary of the FGD Findings

Questions to the Groups	Participants opinion, comments and suggestions
1. The participants were asked about the present land use patterns of different land types of the area.	According to the participants, the highland is used for Settlement, Grazing, Irrigated crop, Rabi crop, Social forestry, Grazing and Fallow land, and medium highland is used for Irrigated crop, Rabi crop, Rain-fed crop, medium lowland is used for Irrigated crop, Rain-fed crop, Fishery and lowland is used for Fisher mainly with occasional B. Aman cultivation.
2. Question made on drainage conditions of the area?	Drainage congestion takes place in some areas due to siltation of khals, river and other drainage channels, requiring re-excavation.
3. Question made on river erosion of the areas?	River erosion has been observed in Arol Beel, Purulia-Charbhatpara and Alfadanga-Boalmari sub-projects, requiring measure for erosion control.
4. Question made on problem of siltation?	-Siltation of water bodies is a common problem in most of the SPs
5. Whether there is salinity intrusion in the area?	Salinity intrusion takes place in Purulia- Char Bhatpara and Kalidashkhali-Arpara SPs, saline water intrudes through the non-functioning sluices during high tide.
6. Whether surface water is available round the year?	Most of the Sub-projects do not have surface water during dry period (March-April)
7. Average depth of ground water for Hand tube well along with fluctuation of discharge?	Average depth of Hand tube well ranges between 24 m and 60 m and their discharge get reduced during dry season (February- May) in most of SPs
8. Information on mode of irrigation and occurrence of drought?	Shallow tube well are the most popular equipment with some Deep tube well and Low lift pump are the major equipment for irrigation. Use of indigenous equipment is almost non-existent
9. Biodiversity and availability?	Availability of some fish species is reducing at present, like Pabda, Rita, Sorpunti, Magur, Bashpata, Ayre, Boal etc. Culture fishery is expanding. Many faunal species like Jalpadma, Ponyal, Mohua, Jarul, Garjan, Telikadam, Telsur have reducing trend. Birds like Bhubanchil, Baz, Sadachil, Ababil, Kali bok and Mammals like Bagdasha, Shushuk, Udd etc. have reducing trend.
10. Reduction of soil fertility/productivity?	Soil productivity is reducing due to lack of deposition of fresh alluvium, use of excessive chemical fertilizer/ insecticides, less use of organic manure and lack of adoption of IPM, growing crops continuously with same types of crop etc.
11. What are the main reasons of crop damage?	Drought affects jute, rabi crops, in Purulia- Char Bhatpara and Kalidashkhali-Arpara SPs salinity intrusion affects crops. Pest/insect attack damage all kinds of crops.
12. Drinking water quality and availability?	Hand tube well is the main source of supplying drinking water, discharge is reduced during dry season in most SPs due to lowering of water layer. In some cases drinking water is contaminated with arsenic beyond tolerable limit. Awareness on problem from drinking of arsenic contaminated water carried out in some areas mainly by NGOs in the areas.
13. Livestock animals?	Most of the dairy animals have reducing trend, whereas the poultry animals have increasing trend. Lack of feed/fodder, lack of treatment facilities, lack of training are the major limitations for improvement of livestock animals in the SPs.
14. What are the major sources of energy in the areas?	Cow-dung and crop residues are the major sources of renewable energy in the area, although fuel wood and leaves and twigs are also sources of renewable energy to a considerable extents. Cooking is the major field of using renewable energy followed by crop processing. There are some brick fields in the areas, where both coal and fuel wood is used.
15. Extent of air Pollution?	Air pollution has increasing trend mainly because of cooking, burning of crop by products, indiscriminate disposal of wastes, use of excessive chemical fertilizers and pesticides etc.
16. What are the major fertilizers used for crop production?	The farmers use urea, TSP, MP, DAP etc. where few people use organic manure. Various types of liquid and granular pesticides/ insecticides for crop protection. Use of chemical fertilizers has increasing trend every year, indicating continuous reduction of natural fertility of soil.
17. Information about sanitation facilities?	Ring slab toilets are the major facility for defecation, although there are some pucca latrines in the areas. A few open latrines are also found in the SP areas, which need to be improved. In some SPs some poor HHs don't own any latrine, rather they have use others toilets. Some awareness training has been provided mostly by NGOs of the localities.
18. Women's involvement in IGA?	In general women are not actively involved in agricultural activities, but in some areas poor women are involved in raising paddy seedlings for transplantation. But they are involved in crop processing after harvest in all the SPs. In some areas poor women are involved in earthwork, making handicraft, for selling, working in offices, school and other offices.
19. In-migration and out-migration	In-migration takes place during peak agricultural activities like harvesting of paddy, jute and other crops, whereas out migration takes place by some garment workers, professional workers, some service holders etc. Out-migration also takes place in some areas during peak agricultural around the SSP area.
20. What are human diseases in the areas?	The major diseases in the area include Cold and fever, diabetes, female diseases, hypertension, indigestion, jaundice, scabies etc. Dengue and cancer are also found to be increasing at present. Scabies is caused by water decomposition as caused by jute retting in many areas.
21. Demand for the project?	The local people expressed demand of the proposed projects for improvement of water management, which will provide surface water availability for irrigation (by the excavation works) and want to check saline water intrusion in some SPs. Moreover, they expect various trainings which will facilitate involvement of various IGA works in addition to improvement of agriculture, which will enhance income generation and improve their livelihood.

8.3 Other Stakeholder Consultations

Stakeholder consultations were performed among different stakeholders (farmer, businessman, teachers, local representatives, government officials, etc.) to achieve their personal view related to the environmental issues of this project. Details of other stakeholders' list are presented in Table H.2 of Annex H. Photos of consultations with some of the stakeholders are shown in Figure 8.2.



Figure 8.2: Stake holders' consultation under progress

8.4 Findings of Public Consultations

During the public consultation through FGD and stakeholder consultations, the local people in the project area expressed their opinions/comments. Most people expect quick implementation of the project.

The inputs from consultation particularly on the aspect related directly with the project such as drainage condition, local flooding, and siltation problem have been taken into account by the project design.

The people of the area especially the farmers and fishermen are facing water related problems including flooding, drainage congestion, irrigation insufficiency, and arsenic contamination.

While many facilities are being managed without major incidents, conflicts of usage were reported by some stakeholders. Specifically, there are reported cases about the conflicts between farmers, fishermen and vested interest groups exploiting water control structures, but this was found only in some locations. This conflict relates to water control for checking flood or drainage and fish cultivation. The fishermen are restricted to some extent from for fishing in the open water and the interest groups are exploiting these groups.

In general, people are in favour of fish sanctuaries, but the fishers/leaseholders of water bodies are sometimes skeptical in allowing these activities to continue. However, where facilities have been constructed with active stakeholder consultation and formation of WMOs to manage those facilities, they tend to be managed with better performance in terms of successfully coordinating diverse stakeholder interests, although regular monitoring with social audits is also felt essential to sustain the optimal and agreed operational practices.

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 General

This chapter describes Environmental Management Plan (EMP) for eleven subprojects of SAIWRPMP. It aims to provide environmental management guidance by delineating compliance requirements, accountabilities and performance objectives, and contains practical recommendations to reduce the potential environmental impacts which may occur as a result of the project activities. Since, SAIWRPMP is comprised of development of FCD/I facilities which have both positive and negative environmental impacts at the pre-construction, construction and operational phases. Potential negative impacts of the project as per the EIA study were classified as significant, low significant and no impact. It is therefore necessary to manage the environmental issues timely with proper manner with the help of EMP in compliance with the environmental guidelines of the Department of Environment. The purpose of this EMP is to protect the environment of the project areas by facilitating mitigation measures and management plan of potential adverse impacts arising from the project implementation. An adequate provision for EMP implementation budget is also made in the project to ensure its successful implementation.

The EMP is necessary on the grounds that it will help manage the environment by off-setting or mitigating the negative impacts with possible measures and enhancing the positive impacts. Thus, it is recommended that EMP be made a part of the tender documentation as a requirement to be fulfilled by contractors so that when they make estimates sufficient attention is paid to EMP recommendations.

The main objectives of the EMP for the SAIWRPMP are:

- I. Define the responsibilities of the related project stakeholders in accordance with the three project phases (design, construction and operation& maintenance);
- II. Facilitate the implementation of the mitigation measures by providing the technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures;
- III. Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
- IV. Identify training requirements at various levels;
- V. Identify the resources required to implement the EMP and outline corresponding financing requirements; and
- VI. Providing a cost estimate for all proposed EMP actions.

9.2 Environmental Mitigation Plan

On the basis of the identified environmental impacts and recommended mitigation measures linked with the project activities, Environmental Mitigation Plan has been prepared which will be followed at the pre-construction, construction and operation stages. While preparing the EMP, highly significant impacts are taken into consideration to recommend possible mitigation measures. A mitigation measure will be considered as successful when it complies with the Environmental Quality Standards (EQS) outlined in ECR, policies, and legal requirements set by DoE and other relevant institutions of the GOB. In absence of any environmental quality standard of DOE, other relevant international environmental quality standard (e.g. USEPA, European) will have to be followed. The details of EMP have been formulated in the Table9.1:

Table 9.1: Environment Mitigation Plan

Environmental Component	Impact	Actions to be taken	Implementing Agency/Authority	Supervision Agency
Mitigation Measures for Common Impacts				
Design and Preconstruction Stage				
Terrestrial habitat	-Damage to terrestrial habitats due to clearing of worksites for construction and reconstruction of structures like culvert, regulator, embankment, etc.	-Clearing of land near the toe; Plan to avoid using productive land for burrow soil for earth work (if dredged material is not utilized).	PIU/ WMO/ Contractor	MED
Agricultural areas	-Damage on agriculture due to clearing of worksites	-Plan for utilizing soils from dry riverbed/ khal for such earth works.	Contractor	PIU/MED
Tree cover areas	-Damage of tree cover due to clearing of worksites	-Tree planting plan with suitable species to be prepared for carrying out plantation along the embankment	WMO/ PIU/ FD	MED/ FD
Wetlands: Common water bodies	-Damage of wetland resources due to clearing of worksites or planning structures to prevent supply of water to these water bodies	-Provision for keeping ecologically and hydrologically important natural wetland habitat undisturbed -Planning drainage structures favourable for fish migration	PIU/ WMO/ Contractor	MED
Rives and Khals and dredged materials	-About 3,806 m ³ of soil will be dredged out from beds of khals due to re-excavation -Proper plan for disposal and use of dredged material is an important issue	-Planning and designing khal excavation for adoption of appropriate measures to avoid/ minimize negative impacts. -Incorporation of appropriate protective clause to be followed by the contractor -Identifying suitable location for disposal of dredged materials -Prior to start dredging, the quality of bed materials to be confirmed by testing presence of heavy metals not detrimental of human health and environment.	PIU/ WMO/ Contractor	MED
Housing and Home gardens	screening process as part of due diligence for each sub-project will be carried out, and structure or home garden e affected by the project will be identified	the Resettlement Plan (RP) will be prepared based on the resettlement framework	DC/PIU/WMO/GRC	MED
Resource users	-Development of FCD/facilities may result in conflicts of among different users. Eg: create conflicts of resource uses between agriculture and fisheries;	-Understand the nature and extent of resource dependants by different user groups Appropriate management through consultation that will result in minimum conflict shall be selected -WMO formation with all stakeholders' representation to be ensured -Agreeing on operational practices of facilities to ensure it meet all user requirements	PIU/ WMO/ Contractor	MED

Environmental Component	Impact	Actions to be taken	Implementing Agency/Authority	Supervision Agency
Climate change	Climate change impact on flooding and drainage; and Greenhouse gas emission	Considering the climate change induced impact water management structures including height of the embankment have to be designed Also training to be provided for use of ICM techniques that will result in low water dependency for agriculture.	Design consultants	MED
Construction Stage				
Hydrology/Drainage	-Temporary drainage congestions specially at construction sites -Increased flood risks due to flood prone area -Drainage congestions and flood will occur if adequate drainage structures are not provided.	-Provision for adequate temporary drains at construction of drainage structures (if required) -Provision for adequate number of drainage structures with adequate waterway openings at required locations	Contractor	PIU/MED
Air quality and noise levels	-Dust Generation due to construction activities and transport of construction materials. -Emissions and noise from vehicles, equipment and machinery.	-Vehicles transporting construction material will be covered with tarpaulin. -Construction equipment will be maintained to a good standard and idling of engines will be discouraged; -Machinery emitting visible smoke will be banned from construction sites; -Contractor to prepare a dust and noise suppression program detailing action to be taken to minimize dust generation, and the equipment to be used. It is proposed to sprinkle the water twice in a day with two vehicles throughout the construction period. -Proper dust collection and control systems to be installed at stone crushers; -Air quality monitoring will be carried out as per the schedule stated in the environmental monitoring plan.	Contractor	PIU/MED/ DOE
Surface water bodies including wetlands	-This is intentional but may reduce the surface water for other environmental demands such as recharging of ground water and survival of aquatic/benthic/bird life during dry periods.	-Retain (do not drain) water in a sufficient area/depth for environmental demands and to meet dry period requirement. Design of regulators/sill to meet this requirement.	Contractor	PIU/MED / DOE
Soils and agricultural lands	- Ploughing of new lands and digging burrow pits for soil embankment repairs on adjacent lands will increase soil loss thru erosion	-If suitable, use soil high in clay from river or khal beds for embankments as those pits could well be re-silted during next flooding seasons. Use ICM techniques to reduce soil disturbances	Contractor	PIU/MED / DOE
River/ Khal erosion	-Re-excavation of 332.15 km khal for 3,806 m ³ soil from the khals will pose risks of khal/ river bed erosion unless appropriate measures are taken.	-It is required to follow a plan and design khal/river excavation prepared for the purpose. The plan should identify suitable locations for extraction that will cause least damage. -Contractor will need to follow proper contracts and guidelines for dredging and dredging material disposal. -Proper compaction of disposed materials will be ensured	PIU/ WMO/ Contractor	MED

Environmental Component	Impact	Actions to be taken	Implementing Agency/Authority	Supervision Agency
Health and safety	-Construction workers are susceptible to accident during construction work.	-Appropriate personal protective equipment (PPE) (ear plug, safety glasses, helmets, protective footwear and gloves, high visibility vests and other protective clothing) to be provided to all workers; -First Aid Box will be readily available at construction site; All workers will receive adequate and appropriate information, instruction, training and supervision in relation to safe working practices appropriate to the work; -Provision of adequate sanitation, washing, cooking and dormitory facilities including lighting separately for male and female workers; -Adequate signage, lighting, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.	Contractor	PIU/MED
Operation and Maintenance Stage				
Tree coverage	-Removal of trees due to clearing of worksites for construction/ rehabilitation of embankment will have a stress on the natural ecosystem functions. -Wildlife will also be dislocated due to removal of trees	-Tree planting has been planned along the embankments with suitable indigenous species to compensate loss of trees due to construction/ rehabilitation of embankment and to improve health of existing ecosystem. -Tree planting campaigns be organized to enhance the overall tree cover of the area.	WMO/ PIU/ FD	MED / FD
Agrochemical usage	-With increased agricultural activities the use of agrochemicals (pesticides and fertilizers) will increase and the potential pollution of soil, water and environment will aggravate	-WMO's capacity building to make people aware of the agrochemical hazards -The IPM and ICM practices should be encouraged and promoted among the farmers.	WMO/ PIU	MED
Conflicts on resources	-Development of FCD/facilities will create conflicts of resources use among different users. -It create conflicts of resource bases between agriculture, fisheries and other competing users;	-Planned management of land, water and other resources to be ensured for agriculture and fisheries users, considering the demand of those for domestic as well as for nature. -Monitoring of irrigation efficiency -Carry out proper maintenance of facilities and remediation	WMO/ PIU	MED

Specific Potential Impacts and Mitigation Measures of Alfadanga-Boalmari Subproject for construction of 1.5km New Retired Embankment

During Design/Preconstruction Stage				
Land acquisition	-Construction of new retired embankment involves about 2.75 ha land acquisition.	The project will prepare a resettlement plan where Provision for compensation and protection of the affected persons will be developed for the project to materialize.	WMO/ Contractor/ PIU	MED
Construction Stage				
Landscape	Landscape change will take place due to construction of embankment	-Embankment along with the other structures to be constructed as per plan to make the changed landscape beneficial. -Provision for carrying out plantations with suitable species after construction	WMO/ Contractor/ PIU	MED

9.3 Environmental Monitoring Plan

Environmental monitoring is an essential tool for environmental management as it provides the basic information for rational management decisions. The purpose of the monitoring program is to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population. To ensure the effective implementation of the mitigation measures, it is essential that an effective monitoring program be designed and carried out. Compliance monitoring will be conducted in accordance with the environmental monitoring plan provided with this report (Table 9.2).

The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period, and to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. The main objectives of the pre-construction, construction and operation& maintenance stages of monitoring plans are to:

- ❖ Monitor the actual impact of the works on physical, biological and socioeconomic receptors within the project area for indicating the adequacy of the EIA;
- ❖ Recommend mitigation measures for any unexpected impact or where the impact level exceeds that were anticipated in the EIA;
- ❖ Ensure compliance with legal and community obligations including safety on construction sites;
- ❖ Monitor the rehabilitation of borrow areas and the restoration of construction camp sites as described in the EMP;
- ❖ Ensure the safe disposal of excess construction debris and extracted dredged material;
- ❖ Appraise the adequacy of the EIA with respect to the project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;
- ❖ Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- ❖ Monitor the survival rate of trees planted
- ❖ Ensure that critical habitats that could be affected are saved and sustained with their environmental functions

Components to be monitored

Monitoring has two components:

- I. Compliance monitoring, which checks whether prescribed actions have been carried out, usually by visual observation and by the use of checklists.
- II. Effects monitoring which records the beneficial and adverse consequences of activities on the biophysical and social environment. This is often done by repeat measurements of a set of objectively verifiable indicators.

Monitoring for this project will concentrate on compliance monitoring to ensure that measures are being implemented on time and according to sound environmental principles.

Table 9.2: Environmental Monitoring Plan

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
Pre-construction Stage						
Bed Materials	Cadmium (Cd), Copper (Cu), Zinc (Zn), Manganese (Mn) and Arsenic (As),	Government of Bangladesh (GOB) and international standard	Proposed re-excavation/dredging sites (one each subproject)	Once prior to start dredging	Contractor	PIU
Air and Dust	SO _x , NO _x , CO, CO ₂ , SPM, PM ₁₀ and PM _{2.5}	Air quality standard by DOE, Bangladesh	i) Gridha of Alfadanga- Boalmari subproject ii) – of Sonamukhi Bonmandar subproject	Once	Contractor	PIU
Water Quality	Surface water: pH, TDS, EC, TSS, Fe, NH ₃ – N, Cl ₂ , DO, COD, BOD ₅	Surface water quality standard by DOE, Bangladesh	At four locations (one each (khal/river/beel/ pond) for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once	Contractor	PIU
	Groundwater: pH, Mn, As, Fe, Cl ⁻ , Total hardness, TC, FC	Groundwater quality standard by DOE	At four locations (one each (Tube well) for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once	Contractor	PIU
Tree Felling and site clearances	Tree numbers and area involved to be verified	By Inspection visits to potential sites	Each subproject area	During tree felling and site clearing operations	Contractor/ WMO/ PIU	MED
Construction Stage						
Water Quality	Surface water: pH, TDS, EC, TSS, Fe, NH ₃ – N, Cl ₂ , DO, COD, BOD ₅ , Oil and Greases	Water quality standard by MOEF, Bangladesh	At four locations (one each (khal/river/beel/ pond) previously selected for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once per year per site	Contractor	PIU
	Groundwater: pH, Mn, As, Fe, Cl ⁻ , Total hardness, TC, FC	Water quality standard by MOEF, Bangladesh	At four locations (one each (Previously selected four Tube well) for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once per year per site	Contractor	PIU
Soil Erosion	Visual check for Soil erosion signs and siltation Suspended matters and sediments in drained waters	Acceptable to BWDB	All major water bodies	Once during rainy seasons	Contractor	PIU/ MED
Drainage Congestion	Check drainage plan implemented correctly Conduct regular inspection	Acceptable to BWDB	Construction site	Weekly during monsoon	Contractor	PIU/ MED
Soil Pollution	▪ Check how waste is disposed off: whether done in proper way that will prevent leakages, and	Acceptable to BWDB /international standards (EU directive/USEPA)	Construction sites, dumping site	Regularly	Contractor	PIU/ MED

Environmental Components	Parameters/ Units	Standards/ Guidelines	Location	Monitoring Period/ Frequency/ Sampling, No/year	Responsibility	
					Implementation	Supervision
	blockages of water bodies or other lands ▪ Careful and proper handling of oil and other hazardous liquids used by construction equipment					
Fisheries	Impact on fish productivity , breeding and spawning	Acceptable to BWDB and DOF	All major water bodies	Once in a year	Contractor	PIU/ MED
Operation & Maintenance Stage						
Tree Plantation	Check that the planted trees are maintained as mentioned in tree plantation plan	Inspection to ensure proper plantation with proper species	Along the embankment and other available land	Regular during June/July	WMO/ PIU/ FD	PIU/ MED
Water Quality	Surface water: pH, TDS, EC, TSS, Fe, NH ₃ – N, Cl ₂ , DO, COD, BOD ₅ , Oil and Greases	Water quality standard by DOE, Bangladesh	At three locations (one each (khal/river/beel/ pond) previously selected for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once per year per site	WMO/ PIU	MED
	Groundwater: pH, Mn, As, Fe, Cl ⁻ , Total hardness, TC, FC		At three locations (one each (Previously selected four Tube well) for project area of Faridpur, Rajbari, Magura and Jessore Districts)	Once per year per site	WMO/ PIU	MED
Soil Erosion	Visual check for soil erosion and siltation including water quality of water draining khals	Acceptable to BWDB	All major water bodies	After first precipitation	WMO/ PIU	MED
Fisheries	Impact on fish productivity , breeding and spawning	Acceptable to BWDB /DOF	All major water bodies	End of first year of operation and subsequent years afterwards	WMO/ PIU	MED

9.4 EMP Implementation Schedule

An implementation schedule has been prepared based on the environmental components that may be affected during the pre-construction, construction and operation of the project and presented in Annex F. Since the project is likely to have impact on various components of environment, a comprehensive EMP implementation schedule covering terrestrial and aquatic ecology, soil erosion, drainage, tree cover, air quality, noise, and vibration are provided in Table 9.2. Monitoring Plan has been separately done for pre-construction, construction and operation stages of each subproject separately.

There will be a provision for environmental audit at the half way of the project implementation to check the main issues raised and level of compliances with the EMP and to make necessary recommendations as an EMP action.

9.5 Environmental Management Plan implementation Budget

The estimated budget for the implementation of the EMP of each of the subprojects of SAIWRPMP is presented in Table 9.3. The overall costs of the EMP will comprise:

- I. Environmental monitoring through sample collection and analysis;
- II. Any remedial measures necessary to reduce or avoid environmental damage; and
- III. Designing and implementing all mitigating and enhancement measures for six years.

The total environmental budget for the project is estimated as BDT 47.366 million.

Table 9.3: Environmental Budget for SAIWRPMP

Sl. No.	Environmental Components	Items	Unit	Quantity	Rate (BDT)	Amount (BDT)
A. Pre-Construction Stage						
1	Technical Support	Review of EIA and preparation of updated EMP	Included under Civil Works			0
2	Land Acquisition and Resettlement	Compensation against land acquisition	Included under Resettlement Plan			0
3	Flora and Fauna	Vegetation clearing and protection of wildlife	Included under Civil Works			0
4	Air & Dust	Ambient air quality measurement	Included under Civil Works			0
5	Bed Materials	Quality measurement of dredged materials	Included under Civil Works			0
7	Water Quality	Measurement of surface water quality	Included under Civil Works			0
		Measurement of ground water quality	Included under Civil Works			0
Sub-total for pre-construction stage						0
B. Construction Stage						
8	Drainage Congestion	Provision of adequate opening	Included under Civil Works			0
9	Erosion and Siltation Control	River bank protection work	Included under Civil Works			0
10	Air & Dust	Measuring ambient air & dust quality				

Sl. No.	Environmental Components	Items	Unit	Quantity	Rate (BDT)	Amount (BDT)
13	Water Quality	Surface water quality				
		Ground & drinking water quality				
15	Solid Waste	Disposal and management of solid waste	Included under Civil Works			0
16	Occupational Health and Safety	PPE, ambulance, clinic, First Aid Box etc.	Included under Civil Works			0
18	Traffic signs and Road Safety	Installation of traffic signs and ensure road safety	Included under Civil Works			0
Sub-total for construction stage						0
C. Operation Stage						
17	Tree Plantation	Tree plantation during monsoon period Maintenance	Following Tree Plantation Plan			41,409,474
22	Water Quality	Surface water quality	Number	11	10,000	110,000
		Ground water quality	Number	11	10,000	110,000
23	Environmental Resources Management Including an environmental audit done on the project in half way of the implementation to make any further corrections	Functioning of WMO	Included under Civil Works			0
Sub-total for Operation Stage						41,629,474
D. Training and Miscellaneous						
24	Training and Awareness Programmes		LS			500,000
25	Management Information System		LS			500,000
Sub Total for Training and Miscellaneous						1,000,000
Total (A+B+C+D)						42,629,474
Contingencies 10%						4,736,608
Grand Total Environmental Cost in BDT						47,366,082
Grand Total Environmental Cost in million BDT						47.366

9.6 INSTITUTIONAL ARRANGEMENT

9.6.1 Overall Institutional Framework

The Environmental Management of the Project will involve a number of national level agencies.

These main agencies will include:

- i. The BWDB, under the control of the Ministry of Water Resources (MOWR) and guidance and supervision of the Governing Council (GC) of the Board, would be the lead agency of the project
- ii. Department of the Environment (DOE), Ministry of Environment and Forestry, responsible for enforcement of the national environmental legislation
- iii. A Project Steering Committee (PSC) headed by Secretary, MOWR and participated by representatives of the DOE and other relevant ministries and agencies to be formed for the coordination of project implementation and relevant environmental issues at the central level
- iv. A Joint Management Committee (JMC) participated by representatives of BWDB and relevant line departments, local governments, and WMOs to jointly decide on Project activities and post-Project O&M activities including mitigation measures that will be undertaken by responsible line departments (including Department of Public Health Engineering (DPHE) responsible for supporting pilot arsenic mitigation), private providers, NGOs, and WMOs

9.6.2 Project Level Institutional Framework

The BWDB will be the executing agencies for the Project under the overall management and coordination of the Project Implementation Unit (PIU) to be set up at the BWDB Southwest Zonal Office at Faridpur, and headed by the Project Director at the level of Chief Engineer or Additional Chief Engineer. The overall responsibility for the environmental management and monitoring for the Project including liaison with DOE Khulna divisional office will be with the Monitoring and Evaluation Division (MED) in PIU headed by an executive engineer having environmental management experience and assisted by the consultants. MED will monitor, support, and guide the operation of the Environmental Management Plan implemented through the designated organizations and contracted agents. An environmental management monitor will also be included in the consultants' team to monitor and advice on its operation on a part time bases throughout the Project implementation period, along with an environmental specialist who will provide capacity development support.

At the central level, BWDB will establish a Project Coordination Unit (PCU). A Project Coordinator will be appointed who will be the Director Planning II BWDB. PCU will provide technical backstopping and coordination, including the liaison with DOE headquarters on environmental management issues, which is coordinated by a designated executive engineer within PCU. A Project Steering Committee (PSC) will be established for project coordination and monitoring and attending to implementation bottlenecks. The PSC will be headed by the Secretary, MOWR and would include representatives of the concerned ministries and agencies as members.

At the subproject level, subproject management office (SMO) will be established within the subproject area (by converting the existing O&M divisional and sub-divisional offices of BWDB) to execute day-to-day subproject implementation activities, following the annual and periodic activity plans prepared with and endorsed by the subproject JMC. An experienced senior executive engineer will be assigned as full-time subproject manager in each SMO, who will be closely supervised and guided by Superintending Engineer in Jessore Circle, BWDB, who serves as subproject advisor. To effectively manage environmental issues, MED environmental staff and consultants will participate in JMC and ensure that EMP has been duly incorporated in the subproject periodic activity plans. An environmental officer will be placed in SMO to monitor and support the concerned mitigation activities and relevant indicators, with the assistance of the environmental monitor in the consultant's team and staff in MED.

Under the Project, localized water management infrastructures (water retention structures, inlet/outlet, small regulators, and irrigation and drainage canals) with a command area of less than 5,000ha in principle are expected to be managed by WMOs after these facilities are constructed and on-the-job O&M training is provided. EMP activities associated with these infrastructure will be undertaken by the concerned WMOs during the O&M phase, with the monitoring and support by the SMO and MED, which is expected to be set up as a permanent establishment in the BWDB zonal office.

9.6.3 Capacity Strengthening

In order to manage environmental issues, appropriate institutional arrangements and capacities need to be in place, with clear definition of a range of required activities, powers and responsibilities of the concerned organizations including the WMOs. The assessment of environmental impacts and mitigation measures have identified the need for effective operation of environmental management activities within the pre-construction, implementation, and O&M activities, to ensure optimal management of water resources, and due local resource mobilization for sustainable O&M while minimizing the negative environmental impacts. These have to be operated with necessary hardware and software to establish and monitor appropriate indicators.

The key to effective environmental management would be well-trained and motivated human resources within BWDB in particular, and collaborating agencies and WMOs as well. As to BWDB, sensitivity to non-engineering issues, ability to work with beneficiary population and affected people, skills to coordinate conflicts need to be developed on top of engineering skills already in place. To meet the requirements, BWDB has made some progress in diversifying the skill mix to establish positions for social, environmental, and other subject matter specialists. However, these need to be further expanded with establishment of skills development and career progression path. BWDB, with the support of the GC, is in the process of improving the service rules for recruitment, promotion, and job rotation, which is expected to further the progress made.

Within this context, competence levels of BWDB staff to adapt to the demand of the Project as well as other water sector interventions need to be enhanced. BWDB is also in the process of developing appropriate human resources development policy and plan, with the support of the GC. In coordination

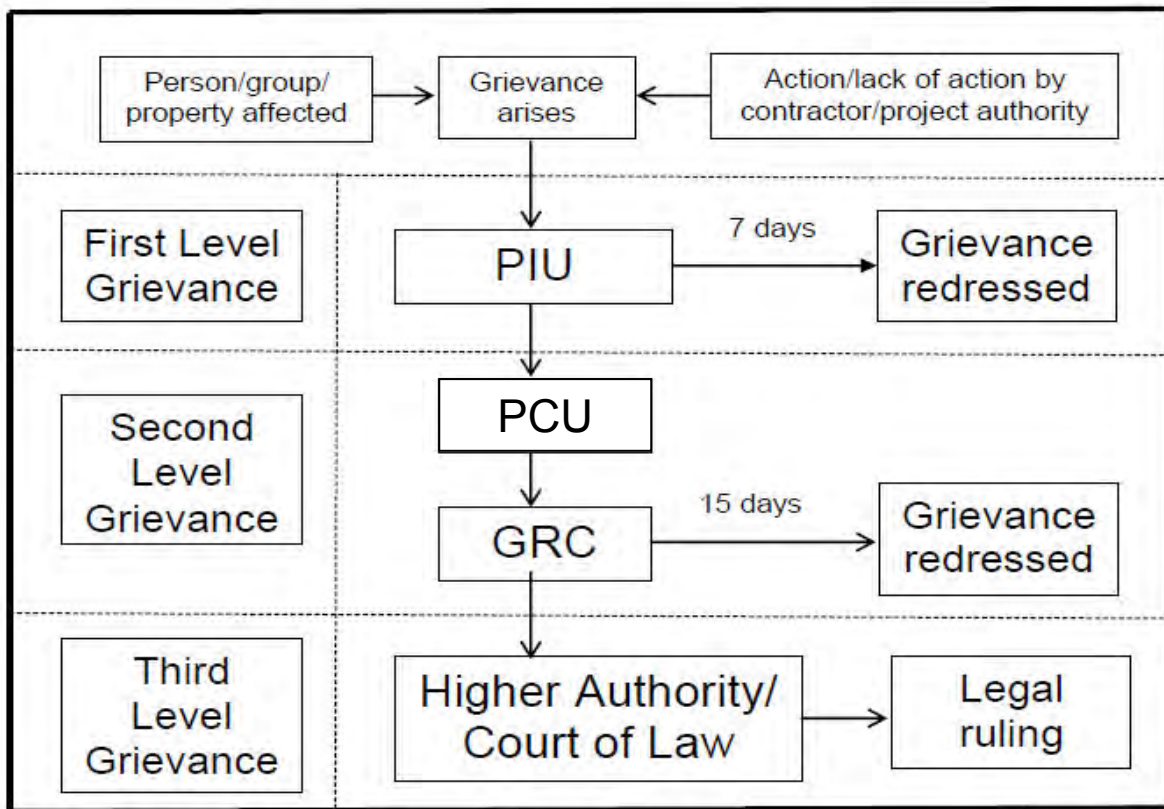
with the ongoing programs for capacity strengthening assisted by external funding agencies including ADB, the proposed Project also intends to identify capacity gaps in terms of effectively implementing EMP and provide training to BWDB and other concerned organizations including WMOs through the consultants. In the absence of sufficient environment subject matter specialists, capacity strengthening of the existing engineers to address environmental issues would also be provided.

In the context of the EMP implementation in the two subproject areas, the Project through consulting services would also provide necessary hardware (such as monitoring equipment and computer facilities) and software, with a focus on establishing effective environmental and other monitoring indicators, and its effective recording, reporting, and auditing mechanisms.

10 GRIEVANCE REDRESS MECHANISM

This section describes the grievance redress framework (formal and informal channels) setting out the time frame and mechanism for resolving complaints about environmental performances.

The concern/grievances from local/affected people may come up related to inappropriate implementation of various components of EMP or the overall road upgrading itself. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. A grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected people’s concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people’s concerns.



GRC=Grievance Redress Mechanism, PIU= Project Implementation Unit, PCU = Project Coordination Unit

Figure 10.1: Proposed Grievance Redress Mecgabism

The Project Coordination Unit (PCU) of BWDB shall make the public aware of the GRM through public awareness campaigns. The contact phone number of the respective PCU will serve as a hotline for complaints, and shall be publicized through the media and placed on notice boards outside their offices and at construction sites. The project information brochure will include information on the GRM and shall be widely disseminated through the project area by the Environmental Specialist in the PCU, with support from the NGOs and communication firm. Grievances can be filed in writing or by phone with any member of the PCU. Figure 10.1 represents how GRM will be implemented for the SAIWRPMP.

First Tier of GRM: The Executive Engineer, PCU of BWDB (member of CC of BWDB HQC) shall be the designated as the key specialist for grievance redress (1st tier). Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, field level government officials, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

- ❖ Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- ❖ Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- ❖ Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the PCU office, construction site, and other key public offices along the project area. Should the grievance remain unresolved, it will be elevated to the second tier.

Second Tier of GRM: The Chief of CC of BWDB HQC (Dy/Adl. Chief of ----Division of BWDB), will activate the second tier of GRM by referring the unresolved issue (with written documentation). The Grievance Redress Centre (GRC) shall be established by the PCU of BWDB before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the DOE for environmental related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land

acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

The Executive Engineer, PCU will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

Third Tier of GRM: In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIUs or GRC will be kept informed by the city corporation authority. The grievance redress mechanism and procedure is depicted in Figure 10.1. The monitoring reports of the EMP and the resettlement plan implementation shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The SAIWRPMP aims at the improvement of the performance of existing flood control and drainage/irrigation (FCD/I) systems and to enhance and sustain the livelihoods of rural people within the existing flood embankment systems having low performance, through (i) preparing participatory integrated water management plans (IWMPs) for the selected systems; (ii) delivering improved water management infrastructure and support services for agriculture, fishery development and gender & livelihood enhancement support activities; and (iii) strengthening institutions to operate these functions while delivering intended benefits with self-sustaining operation and maintenance (O&M) mechanisms. With the socio-economic development and the provision of safe water supply, the overall standard of living will increase. Poverty will be reduced due to the job opportunities created, especially for the landless and the destitute women. The agricultural production will increase due to the implementation of water resources infrastructure, improved drainage and on-farm development. Incomes from agriculture will rise, having a spin-off on other sectors. The rehabilitation of ponds and the promotion of rice-fish culture will stimulate fish production. The project will directly benefit agriculture and culture fisheries. The flood free embankments will serve as roads and thus help to open up the areas, now inaccessible at places. Avoiding regular floods, the overall sectors within the economy will be allowed to develop without the regular setbacks the floods cause. Again, this will add to the socio-economic development and increase the standard of living. Further, the Project will mitigate the negative impacts of the existing and inadequate infrastructure, such as water logging, water shortage, interruption of fish movement, and water pollution. Planned improvements have taken the potential climate change impacts and made adjustments to ensure that the infrastructure will withstand and serve the communities to withstand potential climate change induce enhanced impacts. The positive effects of the Project will substantially surpass the negative ones. Measures to mitigate gher and unavoidable damage to capture fisheries and associated wildlife have been identified and pursued, by careful water management and gate operation to allow maximum passage of fish species, an adequate location and design of embankments and structures and by conserving the critical habitats by appropriate interventions to sustain the wildlife associated with those places . Professional fisher folks will be provided with priority (secured) opportunity to project-supported income enhancement activities such as fish culture in public water bodies created and enhanced. Likewise, the risk of potential local conflicts associated with water management will be mitigated by careful site selection, stakeholder participation and agreement in design and operational practices, O&M training and post-completion monitoring and social audits. Overall, the final impact of the project on all environmental aspects will be limited due and manageable to the mitigation measures. Nevertheless, implementing identified environmental management activities including monitoring of environmental impact, mitigation, and enhancement indicators is critical to minimize negative environmental impacts and maximize positive impacts. The identified EMP should be integrated with the Project-specific information management systems so that all project-related activities are effectively

managed through appropriately identified process and outputs indicators encompassing environmental, institutional, social, financial, and economic aspects. This also calls for effective operation of basic mechanisms for recording, reporting, monitoring and auditing systems among SMO, JMC, PIU, and PCU, which should be embedded within BWDB's field office structures. EMP will be operated within this context, with appropriate capacity strengthening support including training and recommendations on institutional reforms provided through the consultants. People's consultations carried out demonstrated that rehabilitating the existing FCD/I structures while addressing internal local water management problems, applying the concept of coordinated management of local water infrastructures through a participatory approach, is the best alternative that can generate maximum positive impacts. While local stakeholders have diverse interests in terms of the structure operation, these can be effectively coordinated to bring about optimal benefits with participatory water management and its supporting systems. In conclusion, the Project will have overall positive benefits by preserving the existing flood protection, drainage control, and irrigation benefits provided by the existing facilities, and enhancing their positive impacts through rehabilitation of existing structures, and installment of additional small structures to address internal water management problems that have not been addressed. Its successful implementation will also serve as a model to demonstrate the process of achieving substantial under-achieved development potentials of existing FCD/I systems while sustaining their benefits through effective stakeholder participation.

11.2 Recommendations

The project mainly focuses on agricultural demand but that there are several additional uses and users of water (fisheries, natural environment, domestic consumption, etc.) that need to be considered in the overall water management process.

To attain the overall objective of the project it is recommended that

- i. The project need make sure that the WMO will take into account the potential pressure and weakness of the fishermen community when establishing the WMO institutional structure.
- ii. WMOs eventually assess the need to specific area of the beel/flood plain which has the only source of water for the native fishes (capture fisheries) and environmental needs (ecological and hydrological).
- iii. The project allocate resources to WMOs to improve the condition of these remaining flood plain areas as sanctuaries for the fish and wildlife in the area where it is practically possible through proper management and maintenance practices (fish friendly regulators, operation of gates, deepening of part of the flood plains, etc.).
- iv. Culture fisheries to be promoted to compensate loss of capture fisheries activities that will result due to rapid drainage of flood water and khals. The project will provide detail specific structural recommendations needed to improve khal capture fisheries
- v. Establishment and support for the operation of WMOs that will function under the bigger WMA.

ANNEXES

Annex A: Terms of Reference

Government of the People's Republic of Bangladesh
Department of Environment
www.doe.gov.bd
Head Office, E-16 Agargaon
Dhaka-1207

Memo No: DoE/Clearance/5333/2014/ 228

Date: 11/09/2014


Subject: Approval of Terms of Reference for EIA of the Proposed Participatory Integrated Water Resources Planning and Management Project (PIWRPMP) in Southwest Region under Southwest Area Integrated Water Resources Planning and Management Project.

Ref: Your Application dated 04/08/2014.

With reference to the above, the undersigned is directed to convey the approval of the Terms of Reference (TOR) for Environmental Impact Assessment (EIA) of the proposed Participatory Integrated Water Resources Planning and Management Project (PIWRPMP) in Southwest Region under Southwest Area Integrated Water Resources Planning and Management Project.

- I. The project authority shall submit a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the said project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE) and additional suggestions provided herein..
- II. The EIA report should be prepared in accordance with following indicative outlines:
 1. Executive summary
 2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
 3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)
 - 4a. Project activities:
 - A list of the main project activities to be undertaken during site clearing, construction as well as operation
 - Project Plan, Design, Standard, Specification, Quantification, etc.
 - 4b. Project schedule: The phase and timing for development of the Project
 - 4c. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.
 - 4d. Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area), Topographical map, Geological map showing geological units, fault zone, and other natural features,
 5. Baseline Environmental Condition should include, inter alia, following: (Identification and Quantification of Physical Situation that has been proposed to be changed)
 - Physical Environment : Geology, Topology, Geomorphology, Land-use, Soils, Meteorology, and Hydrology
 - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
 - Environment Quality : Air, Water, Soil and Sediment Quality
 - Relate baseline in both Quantitative and Qualitative term with the anticipated outcomes, achievement of goals, objectives and changes due to project interventions
 6. Socio-economic environment should include, inter alia, following:
 - Population: Demographic profile and ethnic composition
 - Settlement and housing
 - Traffic and transport
 - Public utilities: water supply, sanitation and solid waste
 - Economy and employment: employment structure and cultural issues in employment
 - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors.

7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).
In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.
 8. Management Plan/Procedures:
For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not mitigable, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures.
An outline of the Environmental Management Plan shall be developed for the project.
In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).
 9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
 10. Conclusion and Recommendations
- III. Without approval of EIA report by the Department of Environment, the project authority shall not be able to open L/C in favor of importable machineries.
- IV. Without obtaining Environmental Clearance, the project authority shall not be able to start the physical activity of the project.
- V. The project authority shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the applicable fee in a treasury chalan, the no objection certificates (NOCs) from the local authority, NOCs from forest department (if it is required in case of cutting any forested plant, private or public) and NOC from other relevant agencies for operational activity etc. to the Head Office of DOE in Dhaka with a copy to the concerned divisional office of DOE


11.09.2014

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
and
Member Secretary
Environmental Clearance Committee
Phone # 02-8181778

Project Director

Southwest Area Integrated Water Resources Planning and Management Project
Bangladesh Water Development Board
149, Motijheel C/A, Ansar Chamber (7th Floor)
Dhaka-1000.

Copy Forwarded to :

- 1) Director, Department of Environment, Khulna/Barisal Divisional Office, Khulna/Barisal.
- 2) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

বাংলাদেশ পানি উন্নয়ন বোর্ড
প্রকল্প ব্যবস্থাপনা দপ্তর
দক্ষিণ-পশ্চিমাঞ্চলীয় সমন্বিত পানি সম্পদ
পরিকল্পনা ও ব্যবস্থাপনা প্রকল্প,
১৪৯, মতিঝিল বা/এ, আনছার চেম্বার (৮ম তলা)
ঢাকা-১০০০।
ফোনঃ ৭১২১৫১১, ফ্যাক্স : ০২-৭১২১৫১১



BANGLADESH WATER DEVELOPMENT BOARD
PROJECT MANAGEMENT OFFICE
Southwest Area Integrated Water Resources
Planning and Management Project.
149, Motijheel C/A, Ansar Chamber(7th Floor),
Dhaka-1000. Tele: 7121511, Fax: 02-7121511
E-mail : pds.w.bwdb@yahoo.

Memo. No. PD/SWAIWRPMP /PMO/E-1/ 310

Date: 30-10-2014

✓ Additional Director General
Department of Environment
Paribesh Bhaban, E-16, Agargaon

[Signature]
05.11.2014

[Attention: Mr. Syed Nazmul Ahsan, Deputy Director (Environmental Clearance Section)]

Subject: Correction of Proposed Project Title and inclusion of 4 (four) Subprojects into the Project Implementation Plan [ADB Loan no. 2200 & GoN Grant no. 0036].

Reference: Your memo no. DoE/Clearance/5333/2014/ 228 dated 11.09.2014

Sir

In reference to this office memo no. PD/SWAIWRPMP /PMO/E-1/92 dated 04-08-2014, a draft ToR was sent to DoE for approval in regards to the preparation of Environmental Impact Assessment (EIA) report for the proposed project, "Participatory Integrated WaterResourcesPlanning and Management Project (PIWRPMP) in Southwest Region" comprising 7(seven) FCDI Subprojects (copy enclosed-1). Accordingly, approved ToR has been received from DoE vide memo under reference (copy enclosed-2) .

Consultation Mission of Asian Development Bank (ADB) HQ [fielded from 12 to 16 October 2014 in Bangladesh] has agreed to include 4 (four) more Subprojects of similar nature into the project implementation plan after discussion with the Ministry of Water Resources (MoWR) and the External Resources Division (ERD). So the total number of Subprojects will be 11 instead of 7 (detail in sl. no. 2). Moreover, ADB has changed the project title (sl no. 1). Project title & Subprojects detail is shown below:

Sl	Issues	Previous Proposal for ToR approval	Revised Proposal for ToR approval
1	Project Title:	Participatory Integrated Water Resources Planning and Management Project (PIWRPMP) in Southwest Region	Southwest Area Integrated Water Resources Planning and Management Project - Additional Financing
2	Name & No. of Subprojects under the project	Subprojects: 07 (seven) 1: Beel Sukunia Subproject 2: Daduria Beel Subproject 3: Kandor Beel Subproject 4: Alfadanga-Boalmari Subproject 5: Chatlar-Fakurhat Subproject 6: Kalidaskhali -Arpara Subproject 7: Horai River Subproject	Subprojects: 11 (eleven) 1: Beel Sukunia Subproject 2: Daduria Beel Subproject 3: Kandor Beel Subproject 4: Alfadanga-Boalmari Subproject 5: Chatlar-Fakurhat Subproject 6: Kalidaskhali -Arpara Subproject 7: Horai River Subproject 8: Arol Beel Subproject 9: Sonamukhi Banmandor Subproject 10: Purulia Char Bhatpara Subproject 11: Bamankhali Barnali Subproject

Under the above circumstances, you are requested to please consider the new project title as mentioned above and to take necessary action for approval of ToR for the proposed project comprising 11 Subprojects to prepare the Environmental Impact Assessment (EIA) required to furnish the Environmental Clearance from DoE.

Encl: 1. Previous proposal with draft ToR-1(one) set.
2. Approved ToR from DoE- 1 (one) set.

[Signature]
30/10/14
(Md. Kamalur Rahman Talukder)
Project Director

CC:

1. Addl. Director General, West Region/Planning, BWDB, Dhaka.
2. Joint Chief, MoWR, Bangladesh Secretariate, Dhaka.
3. C. S. O to Director General, BWDB, Dhaka.
4. Ms Natsuko Totsuka, Mission Leader/Water Resource Specialist, Environment, Natural Resources and Agriculture Division, South Asia Department, ADB HQ, Manila.

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DoE approved ToR for EIA of ASP Inbox

★ Muhammad Anisul Islam Sun, Sep 14, 2014 at 12:35 PM
 ★ ntotsuka@adb.org <ntotsuka@adb.org> Thu, Sep 18, 2014 at 8:11 AM

To: Muhammad Anisul Islam <anis.bwdb@gmail.com>
 Cc: Kamalur Rahman Talukder <bwdb.pd.sw@gmail.com>, nmamerasinghe@adb.org

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Dear Mr. Anis,

Thank you very much for the information and TOR.
 We understand you are waiting for quotations from the consultant. Please ask them to expedite. The recruitment of international consultants including Environment Specialist are at the final stage.

The below are our observations on TOR. To meet ADB's requirements, please add the following items in the TOR that will be given to the consultant for the draft EIA preparation.

(1) In section 3 - on Legislative requirements. Please add the following at the end of the sentence in the round brackets:

including ADB's requirements as per ADB's Safeguard Policy Statement (2009) and any project relevant international environmental agreements the country is party to.

(2) Under 4c - please add:

Identify possible locations of quarry sites, borrow pits and disposal sites considered as associated facilities of the project.

(3) Please add a new section 4e after 4d- titled Analysis of Alternatives

This section should look at alternatives to the proposed project site, technology, design and operation including the no project alternative in terms of their potential environmental impacts, feasibility of mitigating these impacts, capital and recurrent costs, etc., It states the basis for selecting the particular project design proposed.

(4) Section 7 : Suggest changing the title to "identification, prediction and evaluation of potential impacts and mitigation measures".

- Then, in the description, please add a sentence saying the proposed mitigatory measures have to be discussed.

- Further, suggest adding a following sentences at the end of the description.

In addition identify impacts on occupational health and safety, community health and safety and vulnerable groups. This section should also discuss impacts of associated facilities. Discuss transboundary and cumulative impacts as appropriate. Assess the impacts of climate change on the projects.

(5) Suggest shifting section 8 Management Plan/ Procedures to after the section 9 on consultation, because the EMP often should incorporate findings of the consultation.

(6) Under Section 8 Management Plan/ Procedures, suggest deleting the existing sentence at the middle "an outline of an environment management plan shall be developed", and suggest replacing with the following. The existing sentence looks to be contradict with the subsequent sentence, and the consultants need more specific instructions.

An Environmental Management plan which includes details on (i) mitigation measures, (ii) monitoring, and (iii) implementation arrangements shall be prepared.

mitigation shall : (a) identify and summarise the significant adverse environmental impacts and risks, (b) describe each mitigation measures with technical details , including type of impact of which it related to and the duration for which is is required and cross refer to any other mitigation plans such as resettlement plan, indigenous peoples plan etc,

Monitoring shall indicate the (a) monitoring measures with technical details, including parameters to be measures, methods to be used, sampling locations, frequency of measurements, detection limits and definition of thresholds that signal need for corrective action and (c) describe monitoring and reporting procedures. For ADB, semi annual monitoring reports are required.

implementation arrangements - will describe institutional arrangements- as to who will be responsible to implement and monitor mitigation measures, identify any training needs to strengthen environmental management and identify the capital and recurrent costs to implement the EMP.

(7) Under section 9- would suggest changing the title to "information disclosure, consultation and participation", and please add the following description.

the EIA should document the process taken during project preparation to consult and engage with stakeholders and affected persons. Their concerns and comments should be tabulated and measures taken to address these comments in the project design should be described. This section should also describe the planned information disclosure (type of information to be disseminated and method of dissemination) and process for engaging and consulting with affected persons and facilitating their participation during project implementation.

(8) Please Include a new section titled "Grievance Redress Mechanism" before the "conclusion and recommendation" section, and please add the following description

This section describes the grievance redress framework (formal and informal channels) setting out the time frame and mechanism for resolving complaints about environmental performance . It is recommended that one GRM be established to deal with social and environmental issues.

Regards,

N Totsuka

From: Muhammad Anisul Islam <anis.bwdb@gmail.com>
To: ntotsuka <ntotsuka@adb.org>,
Cc: Kamalur Rahman Talukder <bwdb.pd.sw@gmail.com>
Date: 14/09/2014 14:35
Subject: DoE approved ToR for EIA of ASP

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Annex B: Project Descriptions

B. Description of the Project

B.1 The Project and It's Location

The SAIWRPMP have 11 subprojects that cover a vast area of land in southwestern part of Bangladesh. The total area under this project is 108, 636 hectare having net cultivated area of 82,274 hectare and is located in the northern part of southwestern region. The project located in 17 upazila of six districts as Faridpur, Rajbari, Magura, Jessore, Narail and Gopalganj.

The project location map showing 11 subprojects with is shown in Figure 1.1

The subprojects of SAIWRPMP follow:

- i. Beel-Sukunia Subproject is located in Faridpur Sadar and Nagarkanda Upazila under Faridpur District;
- ii. Daduria-Beel Subproject is located in Boalmari Upazila under Faridpur District;
- iii. Kandor-Beel Subproject is located in Boalmari Upazila under Faridpur District;
- iv. Alfadanga-Boalmari Subproject is located in Alfadanga Upazila under Faridpur District;
- v. Chatlar-Fakurhat Subproject is located in Sadarpur and Bhanga Upazila under Faridpur District;
- vi. Kalidaskhali-Arpara Subproject is located in Shalikhha Upazila under Magura District;
- vii. Horai River Subproject is located in Rajbari Sadar, Baliakandi and Kalukhali Upazila under Rajbari District;
- viii. Purulia-Charbhatpara Subproject is located in Kashiani Upazila under Gopalganj District;
- ix. Bamonkhali-Barnali Subproject is located in Narail Sadar Upazila under Narail District, and Shalikhha and Magura Sadar Upazila under Magura District;
- x. Arol-Beel Subproject is located in Chougacha, Jessore Sadar and Jhikorgacha Upazila under Jessore District;
- xi. Sonamukhi-Bonmandar Subproject is located in Sharsha and Jhikorgacha Upazila under Jessore District;

The project plans to improve integrated water management capabilities and capacities of the stakeholders. Before the capacity development starts the project will first improve the drainage and flood control infrastructure in the area.

The proposed interventions to achieve the stated objective of the project can be grouped into two categories.

Development or repair of infrastructure that includes excavation of rivers and khals, embankment re-sectioning, improve control structures and build needed structural facilities to support WMO functions.

Establishment of Water Management organizations develop their capacities and transfer of operation and maintenance responsibilities to those organizations.

The project is expected to meet the demands from farmers enabling them to cultivate the land. The project will support the establishment and capacity development of the WMOs to operate and take over the overall management of overall activities affecting their livelihood. The EA team agrees that this approach based on the lessons learnt from the previous exercises and also from elsewhere in the world is a more effective way to manage water resources. Therefore overall improvement to the livelihood and their living environment (health and sanitation) can be expected due to the project interventions.

The EA study notes that the project for obvious reasons focuses on agricultural demand but that there are several additional uses and users of water that need to be considered in the overall water management process. These water demands shall therefore also be considered not only during the post construction water management but also when the structures are designed, constructed and operated. These demands include:

- ❖ water for agricultural fields from where water is to be drained rapidly after the rainy season to allow cultivation by farmers
- ❖ water retained in ponds, and khals as long as possible to allow increase in culture fisheries in the designated areas
- ❖ water maintained for minimum environmental (natural) demands including indigenous fish migration and breeding of wildlife species and plants
- ❖ Water for domestic uses such as washing, bathing and needs of domestic livestock during the dry period.

Considering all above aspects the EA team observed that the project's infrastructure development component have manageable impacts and the mitigation measures are addressed in the Environmental Management Plan.

However it is necessary that the proposed project infrastructure designs to address following aspects that may arise due to other demands for water as mentioned earlier.

The most significant overall impacts that will happen as a result of the project that were identified are as follows;

The project will increase drainage efficiency. However, although not explicitly given as an objective, the project also will increase the total area that will be drained converting some natural areas previously under water as wetlands into agricultural lands with more time available for cultivations. This draining of additional area will reduce available area during the dry period for the capture fisheries and people involved in this type of fishing in the sub project. The poorest of poor men who depend on capture fishing during the dry period for their protein supply and also for their livelihood income will thus be pressurized. When the area available for capture fisheries is reduced significantly those fishermen will be required to find alternate income activities (if available) and also spend their savings if any to buy their fish to meet the protein requirement in their daily diet (which is free currently). As this group is landless and very small in number (less than 10%) it is unlikely that they will have a strong voice in the WMO unless specific arrangements are made to ensure their rights are safeguarded. Hence project will make sure that the WMO will take into account the potential pressure and weakness of the fishermen community when establishing the WMO institutional structure.

Whilst it is appreciated that the project is primarily required to aim at improving the agricultural productivity it is realized that it is important to explore different ways other than increasing land area for enhancing the productivity can be improved. It is anticipated that current crop intensity will rise from 33% to 200% or more based on the experience of other projects carried out earlier (page 16 Table 10 of the feasibility

report on Alfadanga). If such high crop intensity can be realized together with high yielding and high value cropping varieties the income levels of the farmers can be raised significantly. Therefore it is recommended for WMOs to eventually assess the need to increase the land area by halving the beel/flood plain which has the only source of water for the native fishes (capture fisheries) and environmental needs (ecological and hydrological).

Also it is recommended that the project allocate resources to WMA or WMOs to improve the condition of these remaining flood plain areas as sanctuaries for the fish and wildlife in the area where it is practically possible thru proper management and maintenance practices (fish friendly regulators, operation of gates, deepening of part of the flood plains etc). Such actions will ensure that native species associated with these areas will survive through the dryer periods.

The project recommends that culture fisheries to be promoted to compensate loss of capture fisheries activities that will result due to rapid drainage of flood water and khals. The project will provide detail specific structural recommendations needed to improve khal capture fisheries

The project recommends establishment and support for the operation of WMOs that will function under the bigger WMA. The structure and the functional effectiveness of these WMOs will depend on the technical and management capacity that will be built. However considering the fact that fishermen in these areas are found to be extremely weak and vulnerable the project will pay special attention to their needs to ensure that they too have a role and place to influence decisions on water management.

B.2. Descriptions of each subproject:

Each Subproject including proposed activities is presented below.

B.2.1 Beel Sukunia subproject

B.2.1.1 Description

The Beel-Sukunia sub-project with coordinates between Longitude 89°47' and 89°51'E and Latitude 23°36' and 23°26'S, is located near the district's capital Faridpur, about 60 km west-Southwest of Dhaka. The area is bounded by the N7 highway in the north, the Kumar River in the north-east, north-west and south, and by the Salta Kanaipur road in the west.

The gross area is 9,681 ha and net benefitted area is 7,933 ha. The objective of this subproject was to improve the conditions of crop cultivation in the project area after completion of flood control and drainage works. The project implementation was completed in the late 80's with construction of embankment, along left bank of Kumar River to enclose the area. The drainage network improvement amounted to about 20 km. Other main infrastructure included 2 nos. regulators. With time and lack of regular operation and maintenance the system has deteriorated and needs improvements for returning back to desired goals. The feasibility study recommends rehabilitation of regulators, construction of a new 6-Vent regulator at Joyjhap, along with re-excavation of khals and re-sectioning of embankment to bring back to the conceived drainage improvements in the area, remove water logging and rendering benefits to the

area. The project aims at providing support to agriculture, fisheries and livelihood needs to be given to increased production and justify the investments.

One most important component of the subproject is to build strong Water Management Organisation, capacity building of WMG and WMA members, their awareness building through intensive training and demonstration activities including taking part in Farmers' Field School (FFS) and Field School of Fisheries (FSF) at the grass root level ,for increased agricultural & fishery production, intensive training with hand holding demonstration on operation & maintenance of infrastructures with the aim of taking over operation and maintenance responsibility of the project by WMG members/beneficiaries themselves as the project goal of sustainable development.

The subproject is not a new one. It was implemented during 1980s and degradation occurred due to lack of O & M and the drainage khals have been silted up and along with deterioration of infrastructure, problem of water logging are being faced and environmental problem has cropped up. The problem of water logging and the environment can be improved by desilting the khals, repairing the structures to its proper functioning and repairing the embankment to a stable original section has been planned in the study.

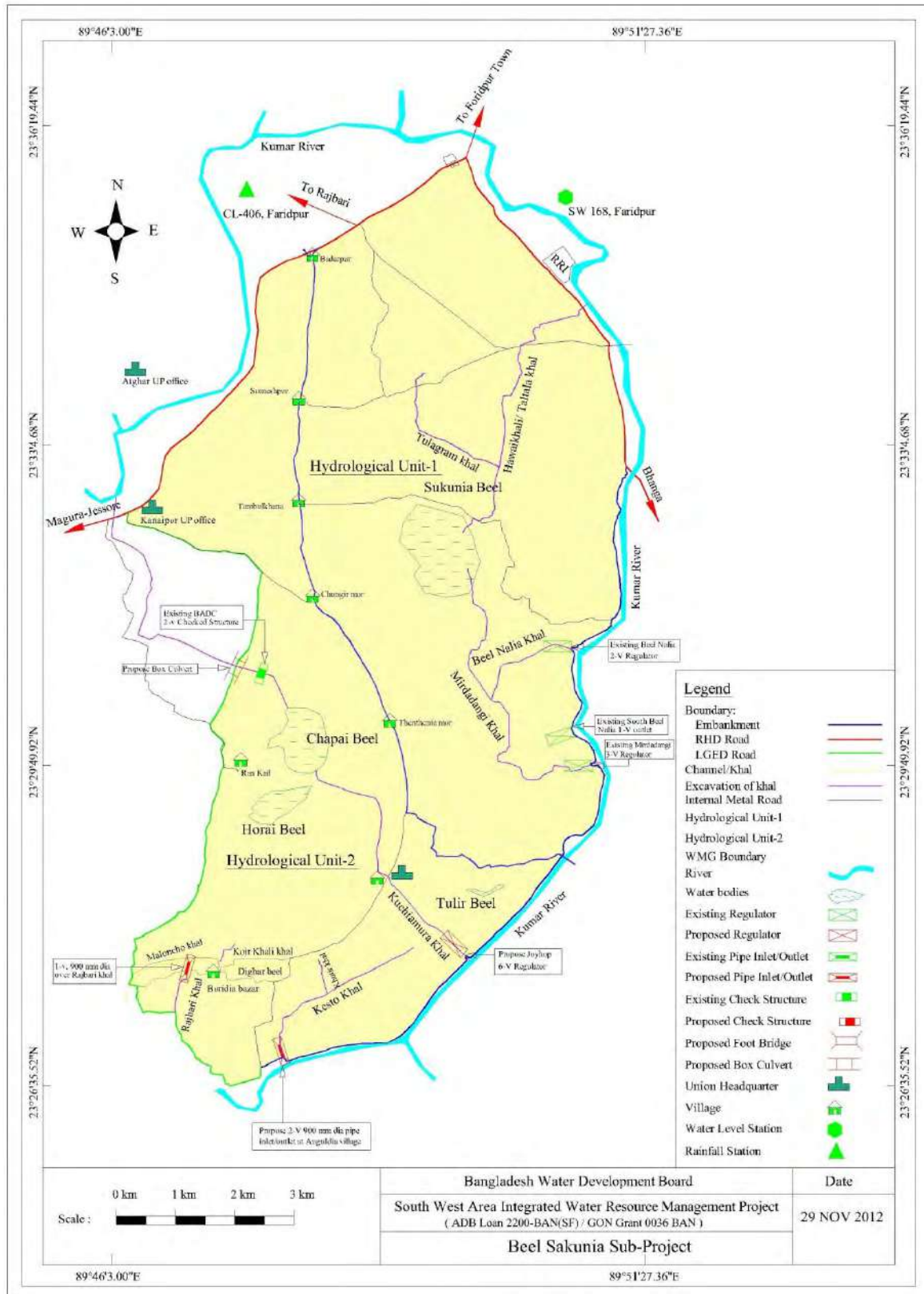


Figure B.1: Existing infrastructure and proposed intervention along with topography of Beel-Sukunia subproject

B.2.1.2 The Major interventions

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.1)

(i) Rehabilitation of regulators- 2 nos., (ii) construction of one new 6 vent regulators, (iii) re-excavation of khals 25 km, (iv) Re-sectioning of embankment-11.70 km.

Other infrastructures and facilities: pipe inlets/outlets-2 nos., Bridge/culvert/WRS-2 nos., WMG offices-10 nos., installing tube wells for delivering safe drinking water-10 nos. to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.2: Daduria-Kandor Beel Subprojects

B.2.2.1 Descriptions

The Daduria Beel and Kandor Beel subprojects with coordinates between Longitude 89°40' and 89°45'E and Latitude 23°25' and 23°21'S, is located near the upazila township of Boalmari of Faridpur District. The area is bounded by the Kumar River on the north-east and east and the Barasia river on the west as well as a railway line that passes along the river Barasia. The gross area is 3,301 ha and net benefitted area is 2,338 ha. The objective of this subproject was to improve the drainage facilities of the area. Drainage through the existing regulators was interrupted due to siltation of Kumar River. As a result, the accumulated rainfall run-off flowed towards the south and resulted in drainage congestion. To mitigate the drainage congestion the local people made cuts in the embankments in the south periphery during periods of heavy rainfall. With time the system has deteriorated further and needs improvements.

In order to improve water management and increase food production the structures, channels and flood protection works will have to be (re)constructed, re-excavated or repaired while support towards agriculture, fisheries and livelihood needs to be given to increase production and justify the investments. There is a need for one new regulator at Shaker bazar where there is now an open box culvert. Further 2 bridge culverts, 6 WMG offices and 6 drinking deep tube wells will be constructed. Further, there are 6 khals with a total length of 9.20 km and the re-sectioning of these khals is needed. There is 15.60 km of embankment and the re-sectioning of the embankment requires to be done.

One most important component of the subproject is to build strong Water Management Organisation, capacity building of WMG and WMA members, their awareness building through intensive training and demonstration activities including taking part in FFS and FSF at the grass root level ,for increased agricultural & fishery production, intensive training with hand holding demonstration on operation & maintenance of infrastructures with the aim of taking over operation and maintenance responsibility of the project by WMG members/beneficiaries themselves as the project goal of sustainable development.

The subproject is not a new one. It was implemented during 1980s and degradation occurred due to lack of O & M and the drainage khals have been silted up and along with deterioration of infrastructure, problem of water logging are being faced and environmental problem has cropped up. The problem of water logging and the environment can be improved by desilting the khals, repairing the structures to its proper functioning and repairing the embankment to a stable original section has been planned in the study.

An Initial Environmental Study was carried out. There were no major negative environmental constraints observed, although the interventions will have a substantial impact on nature, agriculture and fisheries due to the absence of annual flooding. With respect to nature it is considered that the sub-project will be brought back to its 1980 status.

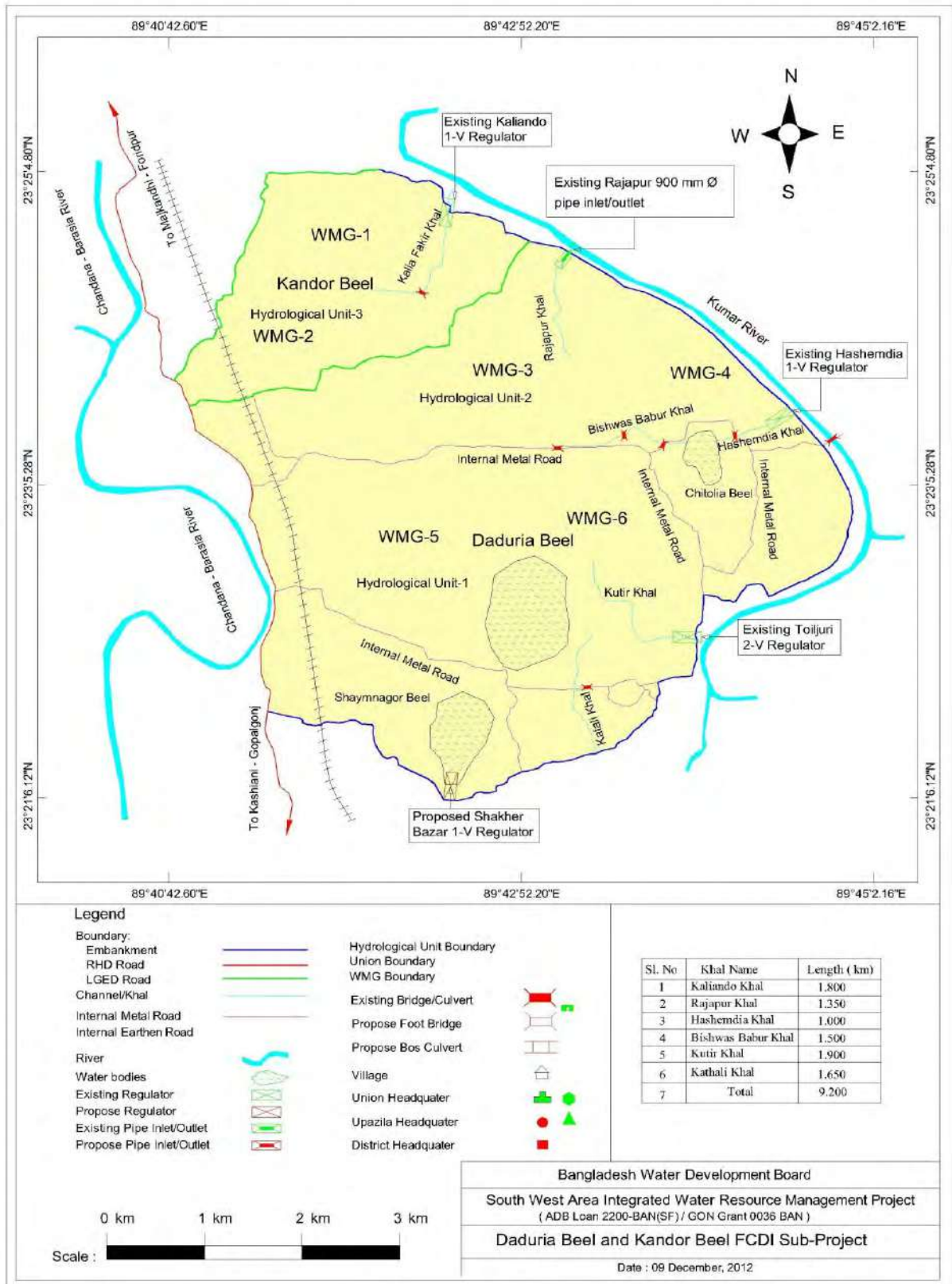


Figure B.2: Existing infrastructure and proposed intervention along with topography of Daduria Beel and Kandor Beel subproject

B.2.2.2 The major interventions of the project includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.2)

(i) Rehabilitation of regulators-3 nos., (i) construction of one new 1 vent regulator at shaker bazar, (ii) re-excavation of khals-9.20 km, (iii) Re-sectioning of embankment-10.40 km,

Other infrastructures and facilities: –pipe inlets/outlets-1 no., Bridge/ culvert-2 nos., WMG offices-3 nos., installing tube wells for delivering safe drinking water-3 nos. to be finalized during implantation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood upliftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.3 Alfadanga-Boalmari Subproject

B.2.3.1 Description

The proposed Alfadanga-Boilmari subproject is located in the Southwest region of Bangladesh and is bounded by the Modhumoti River on the west, Mora Boroda River on the north, Barasia River on the east and Barasia-Madhumati confluence on the south. The sub-project is located in parts of Boalmari and Alfadanga Upazila of Faridpur district to constitute the gross area of 8,011 ha. To protect the area against flooding dikes were constructed along left bank of Modhumoti River, right bank of Mora Baroda and right bank of Chondona-Barasia river in the 1972. In addition, to discharge accumulating run-off from monsoon rainfall, channels were excavated and five regulators, six inlet/outlet pipe regulators and two Check structures constructed at different locations to facilitate proper water management within the sub-project. The tidal effect Alfadanga-Boilmari subproject is about ± 30 mm and does hardly influence the drainage regime when drainage is possible in the area after the monsoon.

Due to lack of funding O&M of the system, operated by the BWDB, most of the drainage channels have silted up and, most of the regulators are not functioning at present.

At the southern periphery there is a depression, where a damaged pipe sluices on the flooding dike. To remove water logging of this area, have proposal of 2-v 900 mm dia pipe inlet/outlet regulators. The flooding dike has been eroded by the Modhumoti river at the south part of the project area, village: Gidoho-Gram and also parts of Gopalpur and Togor Union. It is in open connection with the river, preventing proper control of water levels within its command area and thus affecting agriculture.

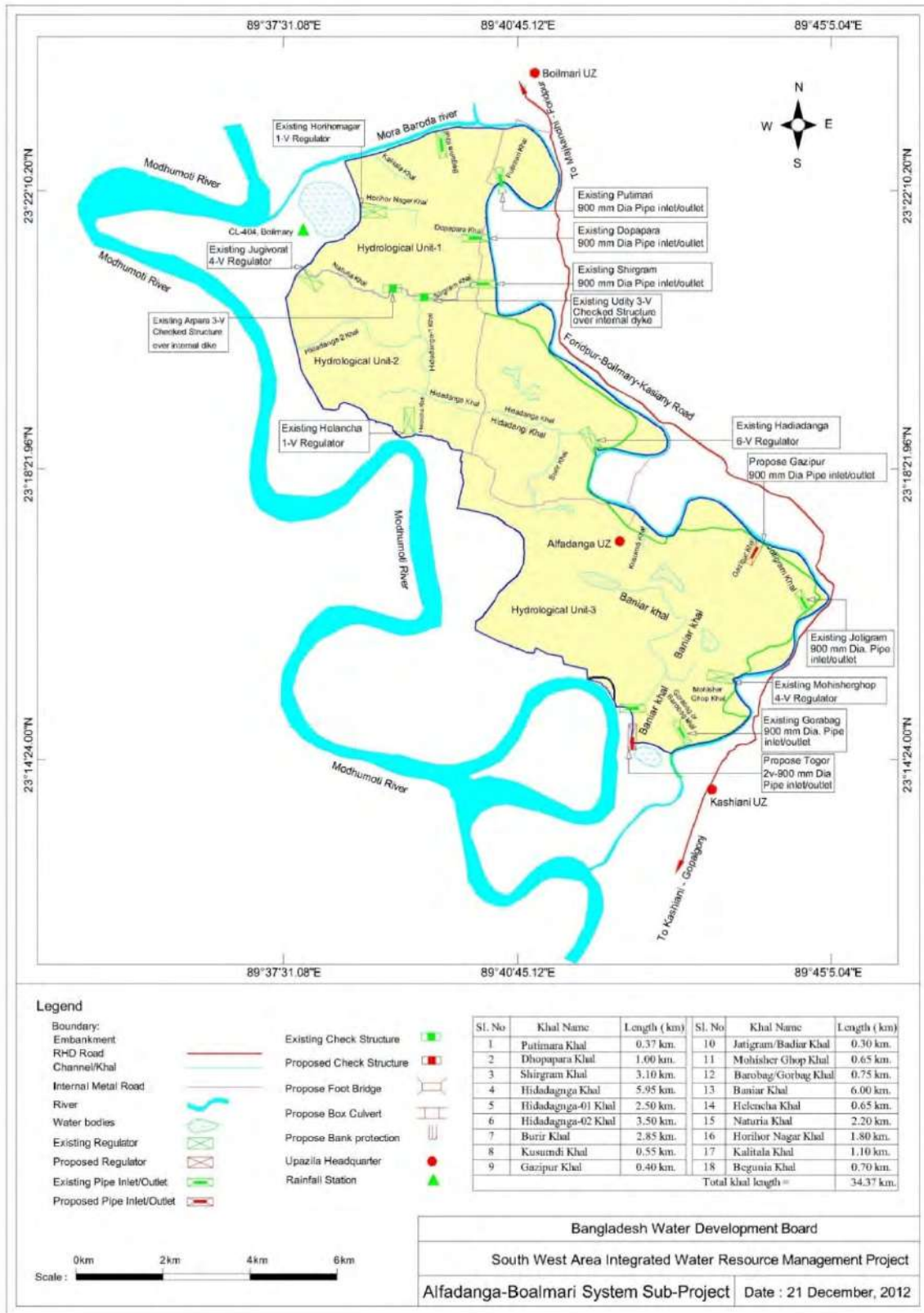


Figure B.3: Existing infrastructure and proposed intervention along with topography of Alfadanga-Boalmari subproject

B.2.3.2 The major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.3)

(i) Rehabilitation of regulators – 5 Nos. (ii) re-excavation of khals-34.4 km, (iii) Re-sectioning of embankment-3.0 km, (iv) Retired embankment at Grida 1.5 km, (v) River training 0.64 km.

Other infrastructures and facilities: pipe inlets/outlets-4 nos., rehabilitation, new-2 nos., Bridge/culvert-2 nos., WMG offices-10 nos., installing tube wells for delivering safe drinking water-10 nos. to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.4: Chatler-Fakurhat subproject

B.2.4.1 Description

The proposed Chatler-Fakurhat subproject is located in the Southwest region of Bangladesh and is bounded by the Bhubaneswar River on the north, Arial Khan River on the east and the Kumar River on the south and south west. The subproject is located in parts of Bhanga and Sadorpur Upazila of Faridpur district to constitute the gross area of 10,268 ha. To protect the area against flooding dikes were constructed along the right bank of the Arial Khan River in the 1963s. The right bank of the Bhubaneswar River is a regional road and the right bank of the Kumar River is a high way. In addition, to discharge accumulating run-off from monsoon rainfall, channels were excavated and (3) regulators constructed at different locations to facilitate proper water management within the sub-project. Whereas in other sub-projects tide may have a significant impact on the river water levels and thus also on flooding, in Chatler-Fakurhat the tidal effect is about ± 10 mm and does hardly influence the drainage regime when drainage is required in the area after the monsoon.

Due to lack of funding O&M of the system, operated by the BWDB, left to be desired and at present most of the regulators are not functioning, while most of the drainage channels have silted up.

At the south-west periphery and middle of the sub-project, there are some depression areas, and where a new 6-vents regulator in the flood embankment, to remove water logging of these areas, needs to be rehabilitated. At the east part of the sub-project area at Chandropara and Duar-Durgapur bazaar the embankment has been eroded by the Arialkha River, and a temporary bank protection work has been started by BWDB.

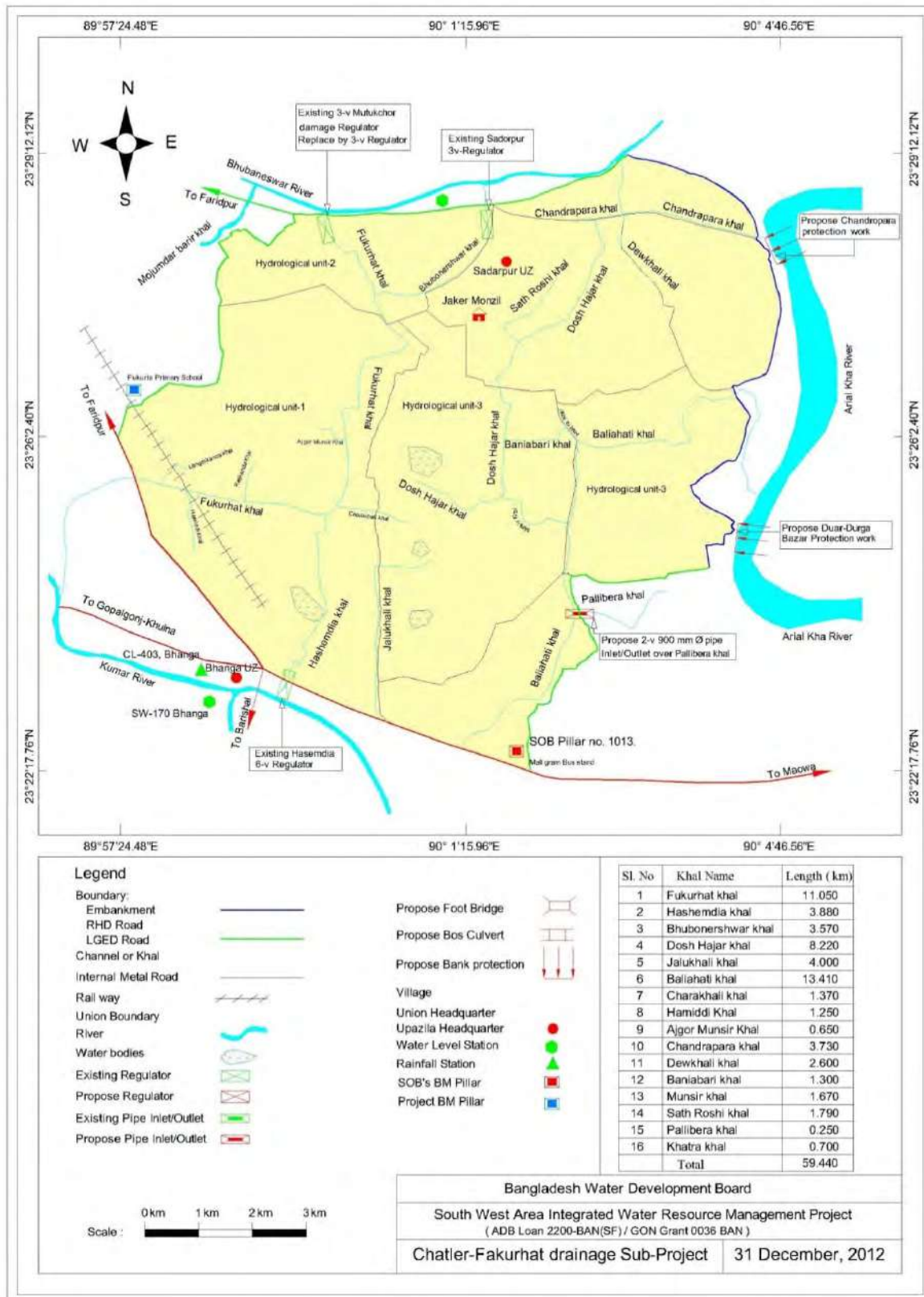


Figure B.4: Existing infrastructure and proposed intervention along with topography of Chatler- Fakurhat subproject

B.2.4.2 The Major interventions of the project includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.5)

(i) Construction of 3 vent regulator- 1 No. and rehabilitation of regulators 2 nos., (ii) Re-excavation of khals-62 km,(iii) Re-sectioning of embankment-2.2 km, (iv) River training works-400 meter.

Other infrastructures and facilities: –pipe inlets/outlets-1 no. New Bridge culvert-1 no., WMG offices-5 nos., installing tube wells for delivering safe drinking water-5 nos. to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ *Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.*

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.5 Kalidaskhali- Arpara subproject

B.2.6.1 Description

The proposed Kalidaskhali-Arpara subproject is located in the Southwest region of Bangladesh and is bounded by the Begabati-Fatki river on the north and east, Chitra river on the southern side of the project area and on the west is bounded by local katcha roads running from Simakhali on the Chitra river to Garibpur, then north to Baral and north-east to Khilgati on the Begabati-Fatki river. The sub-project is located in Shalikhha Upazila of Magura district and partly or fully in the Arpara, Bunagati, Dhaneswargati, Shatakhali and Talkhari unions to constitute a gross area of 13,197 ha. To protect the area against flooding dikes were constructed along the right bank of Begabati-Fatki and Chitra River in the 1980s. In addition, to discharge accumulating run-off from monsoon rainfall, channels were excavated and (5) regulators and (13) pipe inlet/outlet regulators were constructed at different locations to facilitate proper water management within the sub-project. Whereas in other sub-projects tide may have a significant impact on the river water levels and thus also on flooding, in Kalidaskhali-Arpara the tidal effect is about ± 08 mm and does hardly influence the drainage regime when drainage is required in the area after the monsoon.

Due to lack of funding, O&M of the system, operated by the BWDB, left to be desired and at present most of the regulators are not functioning, while most of the drainage channels have silted up.

At the south-west periphery and in the middle of sub-project, there are some depression areas, where a 3-vents regulator on the embankment to remove water logging of these areas is not sufficient. It is not adequate to drain the water from the beel area, preventing proper control of water levels within its command area and thus affecting agriculture.

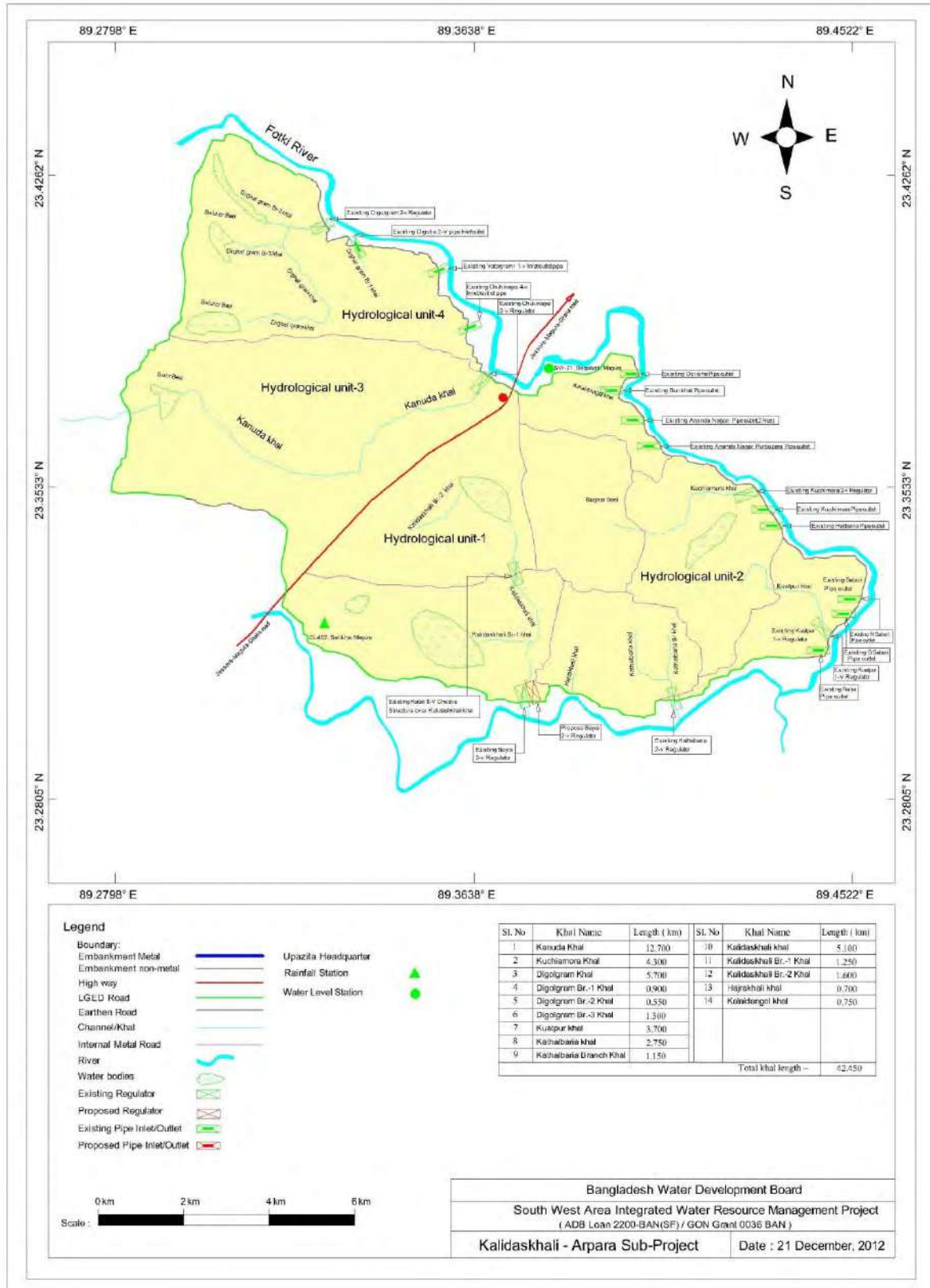


Figure B.5: Existing infrastructure and proposed intervention along with topography of Kalidaskhali-Arpara subproject

B.2.5.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.5)

(i) Rehabilitation of regulators 7 nos., construction of new 3 Vent regulator-1 No. (ii) re-excavation of khals-42.00 km, (iii) Re-sectioning of embankment-16.00 km,

Other infrastructures and facilities: –pipe inlets/outlets-new 2 nos. & rehabilitation-12 nos., Bridge/culverts/WRS- 2 nos., Check and other structures- 4 Nos., WMG offices-17 nos., installing tube wells for delivering safe drinking water-17 nos. to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ *Livelihood asset support through grant to vulnerable destitute.*

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.6: Horai River subproject

B.2.6.1 Description

The proposed Horai River subproject is located in the Southwest region of Bangladesh and is bounded by the Padma River on the north, the Chondona-Barasia River on the west, and in the South and East of the project area is bounded by local metal roads running from Rajapur to the Padma river embankment. The sub-project is located in fully or in parts of the Rajbari Sadar, Baliakandi and Kalukhali Upazila of Rajbari district to constitute a gross area of 18,600 ha. To protect the area against flooding embankments were constructed along the right bank of the Padma River in the 1990s. In addition, to discharge accumulating run-off from monsoon rainfall, channels were excavated and (6) regulators were constructed at different locations to facilitate proper water management within the sub-project. Whereas in other sub-projects tide may have a significant impact on the river water levels and thus also on flooding, in Horai River sub project the tidal effect is about ± 0 mm and does hardly influence the drainage regime when drainage is required in the area after the monsoon.

Due to lack of funding O&M of the system, operated by the BWDB, left to be desired and at present most of the regulators are not functioning, while most of the drainage channels have silted up.

At the south-east periphery and middle part of the sub-project, where a 4-vents regulator on an internal metal road over the Horai River is located, there are some water logged areas. To protect the agriculture of this area new structures are needed, enabling proper control of water levels within its command area and thus improving agriculture. On the other hand, the seasonal exposure of the sub-project to flooding benefits fisheries, recharging and re-stocking seasonal water bodies and expanding the area of capture fishing.

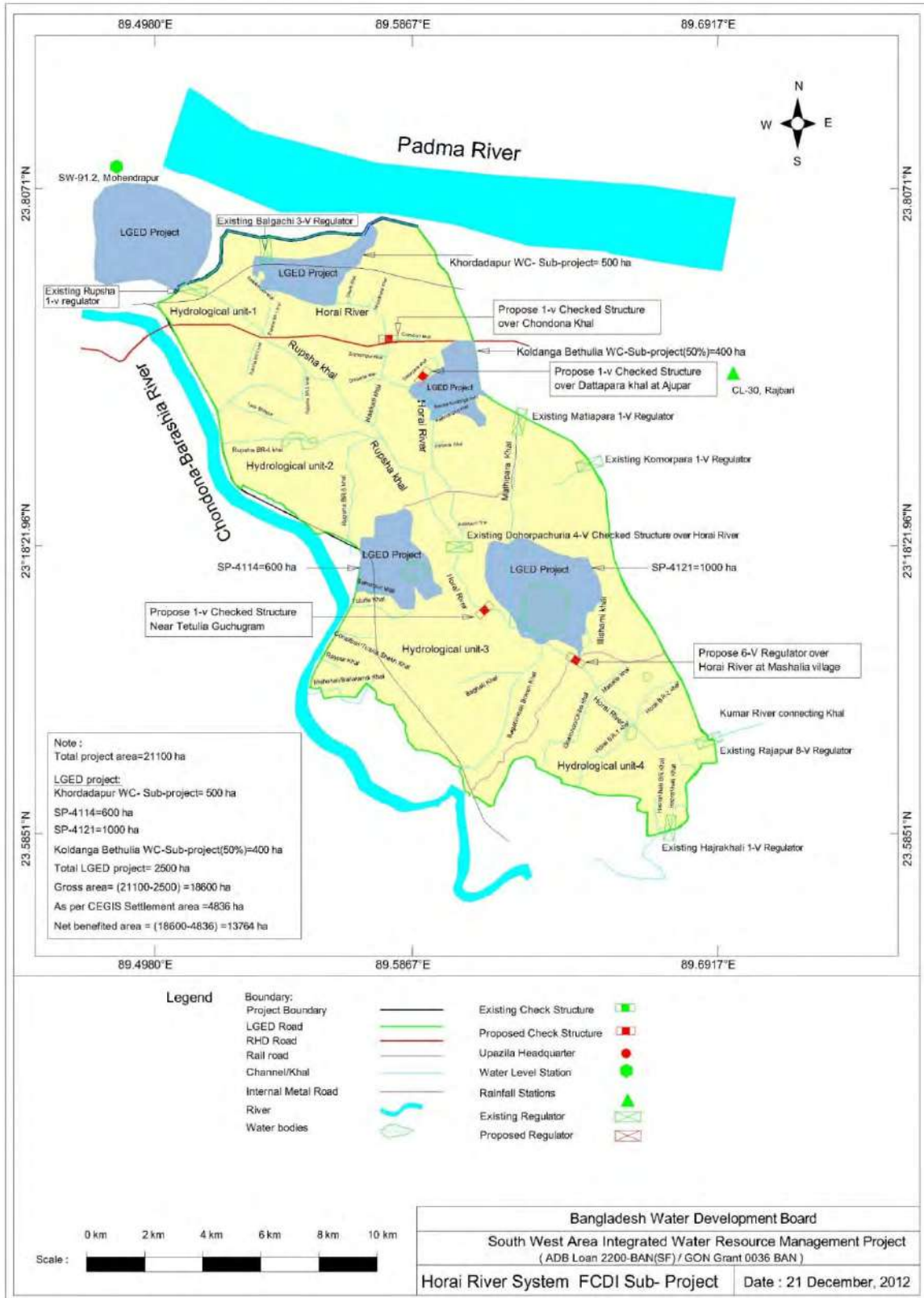


Figure B.6: Existing infrastructure and proposed intervention along with topography of Horai River subproject

B.2.6.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.6)

(i) rehabilitation of regulators- 7 nos. & construction of new 6 vent regulator – 1 No., (ii) check and other structures-3 nos. (iii) re-excavation of khals-110.00 km, (iii) Re-sectioning of embankment-5.7 km, Other infrastructures and facilities: Bridge/culvert/WRS- 3 nos., WMG offices 20 nos., installing tube wells for delivering safe drinking water-20 nos. to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.7 Purulia-Char Bhatpara subproject

B.2.7.1 Description

The proposed Purulia-Char Bhatpara subproject is located in Kashiani Upazila of Gopalganj district having a gross area of 4,156 ha and net cultivable area of 2,871 ha. The area is bounded by the Modhumoti River on the south and west. The main objectives of the project were to control flood and development of drainage facilities in the project area with construction of embankment along the left bank of Modhumoti River to enclose the area. The project was implemented during 1981-83.

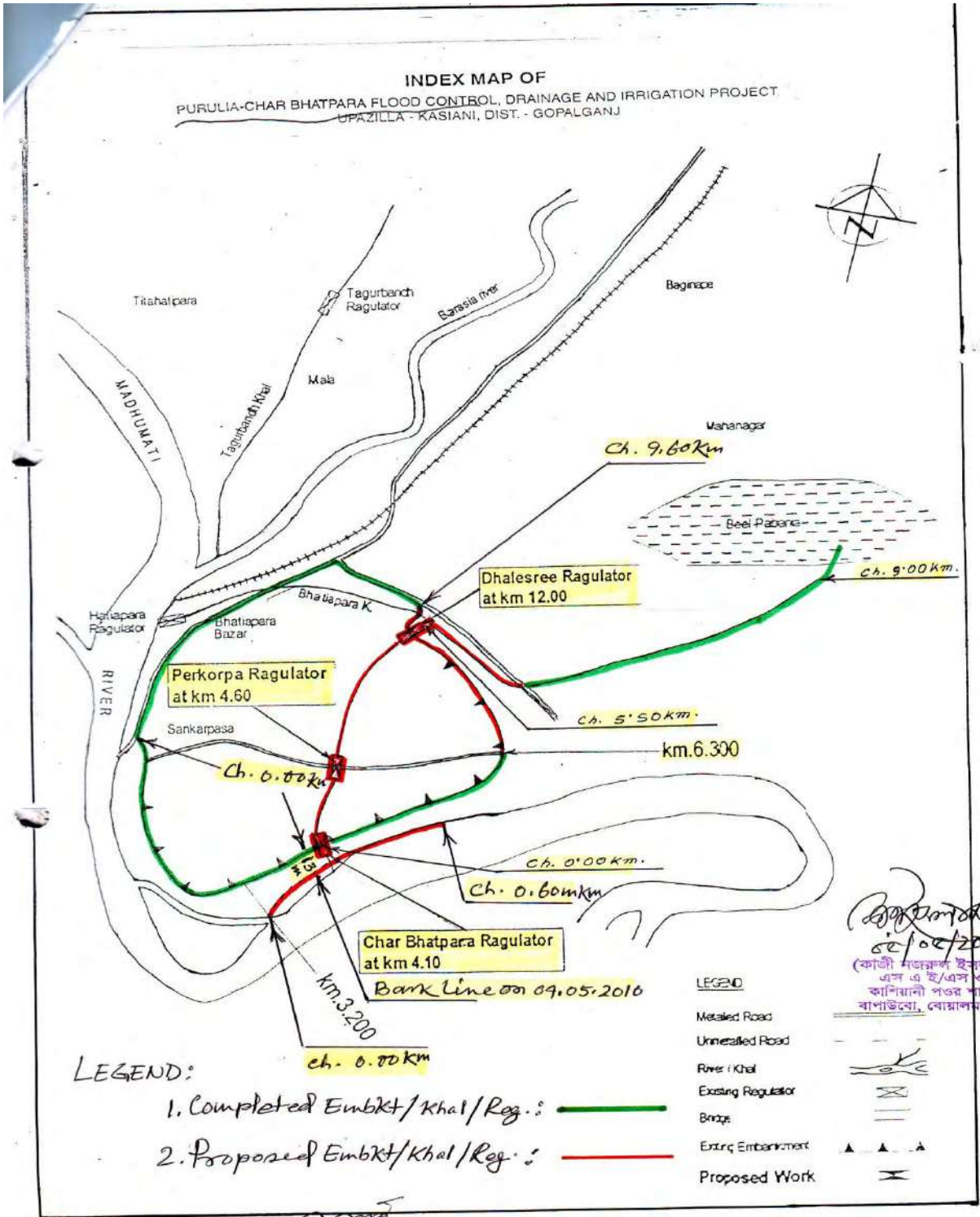


Figure B.7: Existing infrastructure and proposed intervention along with topography of Purulia-Char Bhatpara subproject

B.2.7.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.6)

(i) rehabilitation of regulators 2 nos., (ii) re-sectioning of embankment 3.00 km, (iii) re-excavation of khals-6.00 km,

Other infrastructures and facilities: 3 WMG offices, installing 3 tube wells for delivering safe drinking water to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.8 Bamonkhali-Barnali subproject

B.2.8.1 Description

The proposed Bamonkhali-Barnali subproject is located in Magura Sadar & Salikha Upazila of Magura district and Narail Sadar upazila of Narail district, having a gross area of 16,782 ha and net area of 12,677 ha. The area is bounded by the Nabaganga River on the northeast and Fatki & Chitra Rivers on the southwest. The Project was planned to prevent over spill of flood water into the area by constructing embankment along the surrounding rivers. To remove drainage congestion caused by accumulation of rainfall runoff, the drainage network was improved by excavation & re-excavation of khals with installation of drainage regulators at suitable locations. The project was implemented during the year 1995-96.

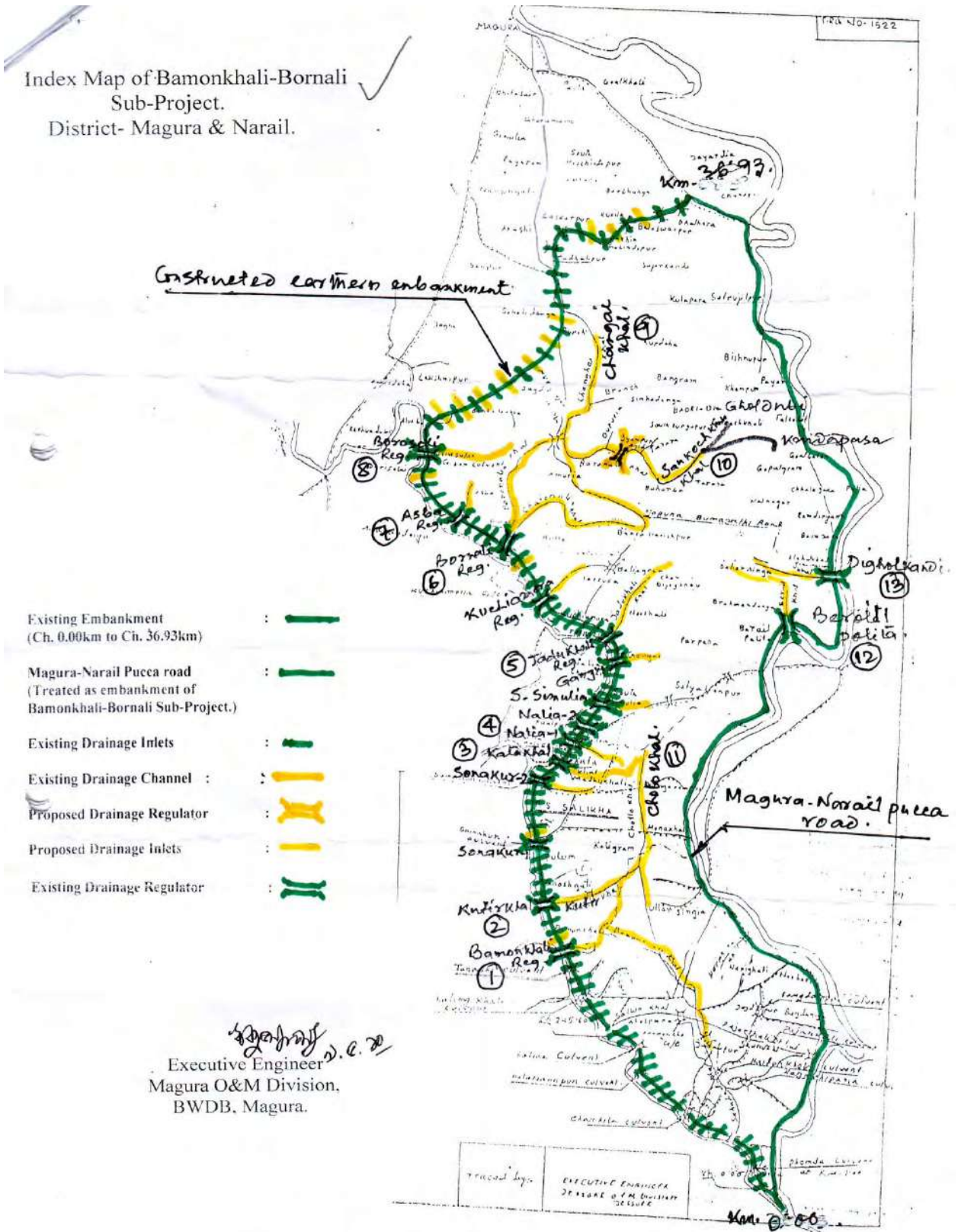


Figure B.8: Existing infrastructure and proposed intervention along with topography of Bamonkhali-Barnali Subproject

B.2.8.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

Major structural measures are follows (Figure B.6)

(i) Rehabilitation of regulators 15 nos., (iii) Re-sectioning of embankment-20.5 km, Khal re-excavation-55.00 km,

Other infrastructures and facilities: (ii) re-habilitation of inlets/outlets-54 nos. & New 15 nos., Check and other structures – 1 no., 10 WMG offices, installing 10 tube wells for delivering safe drinking water to be finalized during implementation on participatory basis.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development

- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.9 Arol-Beel Subproject

B.2.9.1 Description

The Arol-Beel subproject lies between the Kapatakhyia and Bhairab rivers in Jhikargacha, Chougacha and Jessore Upazila of Jessore and Jheniadah Districts, the centre of the sub-project area being about 12 km west of Jessore town. The sub-project was implemented under Bangladesh Water Development Board during the year 1990-1994 in order to improve the drainage facilities and to save crops and properties of the people from water logging and drainage congestion. The project is located in Jessore Sadar Upazila, Jhikargacha & Chowgacha Upazilla of Jessore district. The Gross area of the project is 15,570 ha and Net area is 11,086 ha. The project intervention included excavation of drainage canal-45.00km, Construction of Regulator-4 nos. and construction of RCC bridges-8 nos. The project also provided a limited supplementary irrigation facility to boost up aman crops. The infrastructures implemented under this project are 36.7 km of Drainage canal, 11 nos. of bridges and 4 sluices. The project has been serving its purpose successfully since implementation. But the drainage khals are now almost inactive as they have been silted up badly. The khals have not been re-excavated for a long period after implementation of the project, and also the sluices became inoperative due to lack of proper maintenance. So the project components need to be rehabilitated urgently to restore its benefits.

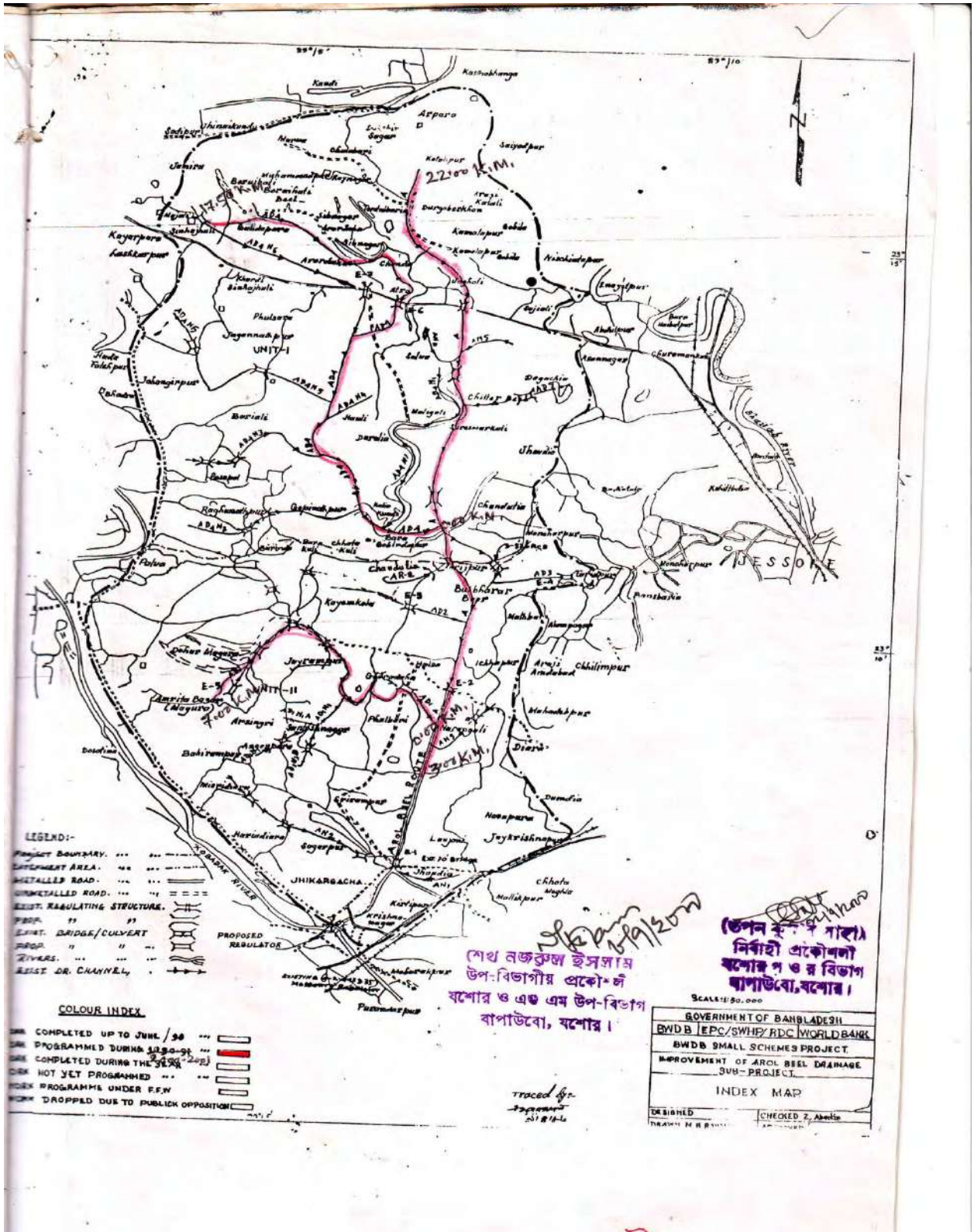


Figure B.9: Existing infrastructure and proposed intervention along with topography of Arol Beel subproject

B.2.9.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

No structural measures will be involved.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

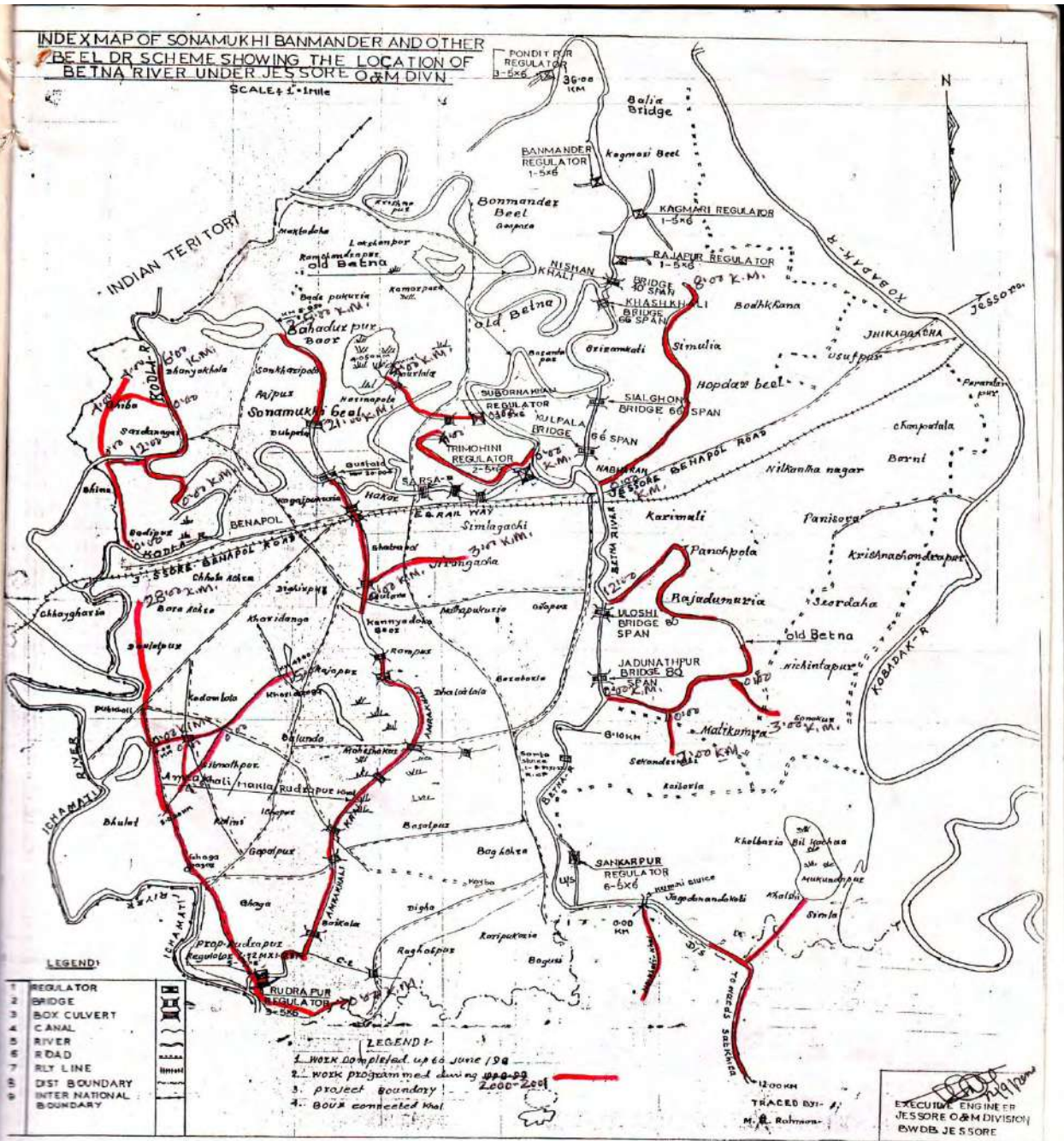
The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

B.2.10 Sonamukhi-Bonmandar subproject

B.2.10.1 Description

The Sonamukhi-Bonmandar subproject area includes part of Sarsha and Jhikargacha Upazila of Jessore district. The gross benefitted area is 9,070 ha and Net area is 6,215 ha. The sub-project was implemented under Bangladesh Water Development Board during the year 1974-1978 in order to save the crops, property etc from the flood and saline water and to improve the drainage facilities. The infrastructures constructed under this project are 18.20 km of FC embankment, 64.60 km of Drainage Canal and 13 nos. Regulators & other structure- bridge/culvert 6 nos.

The project has been serving its purpose successfully since implemented. Due to lack of proper maintenance infrastructures have been damaged, especially earthen embankments became very badly damaged. Project components need to be rehabilitated urgently to restore the project benefits. Again the Betna River which flows through the project area has been silted up very badly since a couple years. Starting from Sarsha of Jessore district the river Betna flows through Jessore and Satkhira district and falls into Bay of Bengal through the Shibsha river systems. The river was all through silted up. Recently the lower part, that is the part in Satkhira district has been re-excavated, while upper part (32.00 km) majority in Jessore district remains silted up, hindering drainage/ water-flow. There is a big public demand to re-excavate the part about 32.00 km of Betna river (26.00 km in Jessore and 6.00 km in Satkhira districts) in order to restore drainage and irrigation facilities. The design bed level of the river are around (-) 0.50 at off-take (Km.0.00), while (-) 1.25 at the downstream (km 32.00).



শেখ নজরুল ইসলাম
উপ-বিভাগীয় অফিসার,
যশোর ও এম এম উপ-বিভাগ
বাগাউবো, যশোর।

Figure B.10: Existing infrastructure and proposed intervention along with topography of Sonamukhi- Bonmandar subproject

B.2.10.2 The Major interventions of the subproject includes

Major interventions of the project include the following activities

(a) Structural Measures

No structural measures will be involved.

(b) Non-structural Measures: (to be finalized during implementation on participatory basis)

Capacity Building

- ❖ Training to be imparted to WMG members on O&M, modern agricultural practices, modern fishery, gender & livelihood up liftment, social audit including financial management.

Agricultural Development

- ❖ Extension and training to improve farm management practices (including water management and IPM) and to encourage crop diversification.
- ❖ Disseminating modern practices through Farmer Field School & demonstration, soil testing & optimum use of fertilizers, HYV rice, Kalikapur model vegetable gardening (BARI).
- ❖ Facilitation of credit support for landless, marginal and small farmers to facilitate adoption of improved agricultural practices.
- ❖ Facilitation of credit support to micro and small rural enterprises to encourage development of non-farm rural sector.
- ❖ Tree and Grass Plantation in embankments and other public lands

Fisheries Development

- ❖ Disseminating modern practices through Field School of Fisheries & demonstration
- ❖ Rehabilitation of small derelict fish ponds.
- ❖ Open water fisheries stocking program
- ❖ Technical training and extension to improve production techniques including fish/rice integrated farming.

Gender & Livelihood Enhancement Plan

- ❖ Support to WMGs on G&L enhancement
- ❖ Income generating Activities
- ❖ Support on skill & business development
- ❖ Livelihood asset support through grant to vulnerable destitute.

Institutional Strengthening

The Project will also support the establishment and strengthening of local water management institutions, including (i) water management organizations (WMOs) following the national Guidelines for Participatory Water Management (GPWM), with the participation of the concerned stakeholders associated with the various water management infrastructures; and (ii) scheme-level joint management committee (JMC), with the participation of the representatives of the line departments, local governments, and WMOs. The JMC will jointly decide on the service delivery and O&M for the large water management facilities at the scheme level (having a command area of over 5,000 ha in principle), whereas WMOs are entrusted to manage smaller individual infrastructure. Furthermore, the Project will support the improved monitoring and information sharing of hydrological data in river water levels and flows, tidal ranges, and salinity to facilitate better water management in the Project area and its vicinities.

Annex C: REA Checklist**Rapid Environmental Assessment (REA) Checklist****Instructions:**

- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Chief Compliance Officer of the Regional and Sustainable Development.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) Indigenous Peoples planning, (iii) poverty reduction, (iv) participation, and gender and development.
- Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

Country/Project Title: Bangladesh/ Southwest Area Integrated Water Resources Planning and Management Project- Additional Financing

Sector Division: Water Resources

SCREENING QUESTION	Yes	No	Remarks
A. Project Sitting			
Is the project area adjacent to or within any of the following environmentally sensitive areas?			
i. Cultural heritage site		√	None
ii. Protected Area		√	None
iii. Wetland	√		Wetland like beel, pond, gher, khal/ river and drainage canal are associated with the project due to construction of FCD/I structures.
iv. Mangrove		√	None
v. Estuarine		√	None
vi. Buffer zone of protected area		√	None
vii. Special area for protecting biodiversity		√	None
B. Potential Environmental Impacts (related to Irrigation/ drainage)			
Will the Project cause...			
i. Loss of precious ecological value (e.g. result of encroachment into forests/swamps lands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, regional flooding, and drainage hazards)?		√	

SCREENING QUESTION	Yes	No	Remarks
ii. Conflicts in water supply rights and related social conflicts?	√		The project will increase the total area that will be drained converting some natural areas previously under water as wetlands into agricultural lands with more time available for cultivations. This draining of additional area will reduce available area during the dry period for the capture fisheries and people involved in this type of fishing in the subproject. -Water supply to fulfil the needs of different users during dry period is critically important
iii. Impediments to movements of people and animals?		√	
iv. Potential ecological problems due to increase soil erosion and siltation, leading to decreased stream capacity?		√	
v. Insufficient drainage leading to salinity intrusion?		√	
vi. Over pumping of ground water, leading to Stalinization and ground subsidence?		√	
vii. Impairment of downstream water quality and therefore, impairment of downstream beneficial uses of water?		√	
viii. Dislocation of involuntary resettlement of people?		√	
ix. Potential social conflicts arising from land tenure and land use issues?		√	
x. Soil erosion before compaction and lining of canals?	√		Rainfall during re-excavation of khal and re-sectioning/ construction of retired embankment may cause soil erosion.
xi. Noise from construction equipment?	√		Noise will be created from construction equipments
xii. Dust?	√		Dust will be generated for earth works in khal re-excavation and embankment re-sectioning/ construction
xiii. Labour-related social problems especially if workers from different areas are hired?		√	
xiv. Water-logging and soil Stalinization due to inadequate drainage and farm management?		√	
xv. Leaching of soil nutrients and changes in soil characteristics due to excessive application of fertilizer and pesticides?		√	
xvi. Reduction of downstream water supply during peak seasons		√	
xvii. Soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides?	√		There will be possibility of soil pollution, polluted farm runoff and groundwater, and public health risks due to excessive application of fertilizers and pesticides
xviii. Soil erosion (furrow, surface)?	√		There will be Soil erosion (furrow, surface)
xix. Scouring of canals?	√		There will be scouring of canals
xx. Logging of canals by sediments?	√		There will be logging of canals by sediments
xxi. Clogging of canals by weeds?	√		There will be clogging of canals by weeds
xxii. Seawater intrusion into downstream freshwater systems?		√	
xxiii. Introduction of increase in incidence of waterborne or water related diseases?		√	

Annex D: Flora and Fauna of the project area

D Flora and Fauna of the project area

D.1 Flora

List of flora available in the subproject influencing areas are given in Table 1. Of the total 130 floral species found in the project influencing area, 8 species are found rare locally.

Table 1: Floral species available in the project influencing area 129(Rare 8)

Local Name	Scientific Name	Availability
Fruit and Timber Tree Species: 75(5)		
Mehogani	<i>Swietenia mahagoni</i>	Common
Babla	<i>Acacia auriculiformis</i>	Common
Akashmoni	<i>Acacia moniliformis</i>	Common
Babla	<i>Acacia nilolica</i>	Common
Hargozakata	<i>Acanthus illicifolius</i>	Common
Bel	<i>Aegle marmelos</i>	Fairly common
Koroi	<i>Albizia procera</i>	Common
Sirish	<i>Albizia lebbek</i>	Common
Debdaru	<i>Polyalthia longifolia</i>	Fairly common
Grajan	<i>Dipterocarpus turbinatus</i>	Common
Supari	<i>Areca catechu</i>	Common
Kanthal	<i>Artocarpus heterophyllus</i>	Common
Barta, Bankatal	<i>Artocarpus lacucha</i>	Fairly common
Nim	<i>Azadirachta indica</i>	Fairly common
Jowa bans	<i>Bambusa tulda</i>	Fairly common
Dumur	<i>Ficus hispida</i>	Fairly common
Jhau	<i>Casuarina littoria</i>	Fairly common
Shimul	<i>Bombax ceiba</i>	Common
Tal	<i>Borassus flabellifer</i>	Common
Bet	<i>Calamus viminalis</i>	Fairly common
Ponyal	<i>Callophylluminophyllum</i>	Rare
Akanda	<i>Calotropis gigantea</i>	Fairly common
Swetakand	<i>Calotropis procera</i>	Fairly common
Ghoranim	<i>Melia semparvirens</i>	Fairly common
Pepe	<i>Carica papaya</i>	Common
Bandarlathi, Sonali	<i>Cassia fistula</i>	Fairly common
Kalkasunde	<i>Cassia sophera</i>	Rare
Chandanbeto	<i>Chenopodium ambrosioides</i>	Rare
Chorekanta	<i>Chrysopogonaciculatus</i>	Fairly common
Jarul	<i>Lagerstremia speciosa</i>	Fairly common
Patipata	<i>Clyngynedichotoma</i>	Rare
Narikel, Dab	<i>Cocos nucifera</i>	Common
Patabahar	<i>Codiacumvariegatum</i>	Common
Bilati gab	<i>Diospyros discolor</i>	Fairly common
Kalokoroi	<i>Albizia lebbeck</i>	Fairly common
Sishoo	<i>Dalbergia sisoo</i>	Common
Krishnachura	<i>Delonix regia</i>	Common
Karanja	<i>Derris indica</i>	Fairly common
Gab	<i>Diospyros peregrina</i>	Fairly common
Mandar	<i>Rrythrina variegata</i>	Common
Eucalyptus	<i>Eucalyptus citriodora</i>	Fairly common
Segun	<i>Tectona grandis</i>	Common
Swetkerui	<i>Euphorbia thymifolia</i>	Fairly common
Bot	<i>Ficussltissima</i>	Common
Hizal	<i>Barringtonia acutangula</i>	Rare
Am	<i>Mangifera indica</i>	Common
Amlaki	<i>Embelica officinalis</i>	Common
Gamari	<i>Gmenlina arborea</i>	Fairly common
Bichi kola	<i>Musa sapientm</i>	Common
Dalim	<i>Punica grantum</i>	Fairly common
Khajur	<i>Phoenix sylvestris</i>	Common
Debdaru, Saralgoch	<i>Polyalthia longifolia</i>	Common
Karanja, Karamcha	<i>Pongamia pinnata</i>	Fairly common

Local Name	Scientific Name	Availability
Peyara	<i>Psidium quajava</i>	Common
Veranda	<i>Ricinus communis</i>	Fairly common
Nalkhagra	<i>Saccharumspontaneum</i>	Common
Raintree	<i>Samanea saman</i>	Common
Jam	<i>Syzygium grandis</i>	Common
Tetul	<i>Tamarindus indicus</i>	Common
Baroi	<i>Zizyphus jujuba</i>	Common
Lichu	<i>Lichi chinensis</i>	Common
Sobeda	<i>Achras sapota</i>	Common
Kamranga	<i>Averrhoa carmobola</i>	Fairly common
Amrah	<i>Spondias pinnate</i>	Fairly common
Dewa	<i>Areocarpus lacucha</i>	Fairly common
Ata	<i>Anona squamosa</i>	Common
Kodbel	<i>Feroria elephantum</i>	Fairly common
Jambura	<i>Citrus grandis</i>	Common
Kadam	<i>Anthocephalus chinesis</i>	Fairly common
Shishu	<i>Dalbergia sisso</i>	Common
Akanda	<i>Calotropis gigantea</i>	Common
Chalta	<i>Dilleniaindica</i>	Fairly common
Telakochu	<i>Coccineacordifolia</i>	Fairly common
Kul/ Boro	<i>Zizyphus mauritiana</i>	Common
Jiga	<i>Lannea coromandelcia</i>	Common
Vegetables and Grasses: 20(0)		
Tomato	<i>Lycopersicon lycopersicum</i>	Common
Dheras	<i>Abelmoschusesculentus</i>	Common
Mankachu	<i>Alocasia indica</i>	Common
Mistialu	<i>Ipomoea batata</i>	Fairly common
Lau	<i>Lagenaria siceraria</i>	Common
Sim	<i>Lablab purpureus</i>	Common
Barbati	<i>Vigna chinensis</i>	Common
Jhinga	<i>Luffa aculangala</i>	Common
Sajna	<i>Moringa oleifera</i>	Fairly common
Begun	<i>Solanum melongena</i>	Common
Korolla	<i>Momordicacharantea</i>	Fairly common
Puishak	<i>Basella alba</i>	Common
Kachamarich	<i>Capsicum annum</i>	Common
Gajor	<i>Daucus carota</i>	Fairly common
Ghaspata	<i>Euphorbia hirta</i>	Common
Kewakata	<i>Pandanusfoetidus</i>	Fairly common
Kachu	<i>Colocasiaesculenta</i>	Fairly common
Kumra	<i>Cucurbita maxima</i>	Common
Durba, Durbaghas	<i>Cynodon dactylon</i>	Common
Chalkumra	<i>Benincasa hispida</i>	Common
Aquatic Macrophytes: 14(3)		
Hogla	<i>Typha angustata</i>	Rare
Halencha	<i>Enhydro fluctuans</i>	Fairy common
Kalmi	<i>Ipomoea aquatica</i>	Common
Dholkalmi	<i>Ipomoea fistulosa</i>	Common
Ghechu	<i>Aponageton sp.</i>	common
Kochuripana	<i>Eichornia crassipes</i>	Common
Topapana	<i>Pistia stratiotes</i>	Common
Khudipana	<i>Lemna minor</i>	Common
Duck weed	<i>Spirodella sp.</i>	Common
Duck weed	<i>Wolffia arrhiza</i>	Common
Shapla	<i>Nymphae anouchali</i>	Common
Cheicha	<i>Scripus articulatus</i>	Common
Jalpadma	<i>Nelumbium speciosum</i>	Rare
Panikula	<i>Dysophylla stelatlata</i>	Rare

D.2 Fauna

A total of 103 species were identified during field survey among them 49 Fish, 3 Amphibian, 11 Reptilian, 30 Avian, and 10 Mammalian species were identified. The list of those species with their availability in the project area is given in Table 2.

Table 2: Faunal species found in the project influencing area 103 (22)

Bangla Name	English Name	Scientific Name	Availability
FISHES:49(12)			
Kuchia	Mud eel	<i>Monopterusuchia</i>	Rare
Potka	Puffe fish	<i>Tetradoncutcutia</i>	Common
Kakila	Freshwater gars	<i>Xenentodoncancila</i>	Rare
Shol	Snakehead	<i>Channa striatus</i>	Common
Taki	Snakeheads	<i>Channa punctatus</i>	Common
Gazar	Mural snakehead	<i>Channa marulius</i>	Rare
Chela		<i>Onyga sterphulo</i>	Common
Mola		<i>Amlypharyngodom mola</i>	Common
Rui	Major carp	<i>Labeo rohita</i>	Common
Kalibous	Major carp	<i>Labeo calbasu</i>	Common
Catla	Major carp	<i>Catla catla</i>	Fairly common
Mrigal	Major carp	<i>Cirrhinus mrigala</i>	Fairly common
Tatkini	Minor carp	<i>Cirrhinus reba</i>	Common
Silver carp	Silver carp	<i>Hypophthalmich thesmolitrix</i>	Common
Grass carp	Grass carp	<i>Ctenopharyngodonidellus</i>	Common
Carpio	Common carp	<i>Cyprinus carpio</i>	Common
Tit punti	Barb	<i>Puntisticto</i>	Common
Punti	Barb	<i>Puntiu stigma</i>	Common
Sharpunti	Silver barb	<i>Puntiusarana</i>	Fairly common
Thaipunti	Thaibarb	<i>Puntiusgonionotus</i>	Common
Gutum		<i>Lepidocephalusguntea</i>	Fairly common
Shingi	Stinging catfish	<i>Heteropneustesfossilis</i>	Common
Magur	Catfish	<i>Clariasbatrachus</i>	Common
Boal	Giant catfish	<i>Wallagoattu</i>	Common
Kanipabda	Butter catfish	<i>Ompokbimaculatus</i>	Rare
Pangas	River catfish	<i>Pangasiuspangasius</i>	Common
Ayre	Catfish	<i>Mistusaor</i>	Common
Nona-tengra	Catfish	<i>Mystugulio</i>	Common
Guni/Ghuittatengra	Catfish	<i>Mystustengra</i>	Common
Chitol	Feather backs	<i>Natopteruschitola</i>	Rare
Foli	Feather backs	<i>Natopterusnotopterus</i>	Rare
Chapila	Herrings	<i>Gudusiachapra</i>	Common
Kachki		<i>Coricasoborna</i>	Common
Baim	Spiny eel	<i>Mastacembelusarmatus</i>	Fairly common
Gochibaim	Spiny eel	<i>Mastacembeluspandalus</i>	Rare
Tarabaim	Spiny eel	<i>Macrogathusaculeatus</i>	Rare
Koi	Climbing perch	<i>Anabas testudineus</i>	Common
Meni	Mud perch	<i>Nandusnandus</i>	Common
Telapia	Tilapia	<i>Oreochromisniloticus</i>	Common
Chiring		<i>Pseudapocrypteslanceolatus</i>	Common
Baila	Goby	<i>Glossogobiugiuris</i>	Fairly common
Sadachewa		<i>Trypauchen vagina</i>	Rare
Lalchewa		<i>Odontamblyopusrubicundus</i>	Rare

Bangla Name	English Name	Scientific Name	Availability
Poa	Jew fish	<i>Pamapama</i>	Fairly common
Bara/Namachanda	Glass perch	<i>Chandanama</i>	Rare
Chotochanda	Glass perch	<i>Chandaranga</i>	Fairly common
Elisha	Hilsashad	<i>Tenualosailisha</i>	Fairly common
Bashpata	Sole	<i>Cynoglossyslingula</i>	Rare
Bata	Mullet	<i>Rhinomugilcorsula</i>	Fairly common
AMPHIBIANS: 3(0)			
Sonagang	Bullfrog	<i>Ranatigrina</i>	Common
Kuno bang	Toad	<i>Bufo melanostictus</i>	Common
Gech bang	Tree frog	<i>Rhacophorus maculatus</i>	Common
REPTILES: 11(2)			
Kochchop	Tortoise	<i>Kachugatecta</i>	Fairly common
Tiktikee	Wall lizard	<i>Hemidactylus</i>	Common
Ghorial	Ghorial	<i>Gavialis gangeticus</i>	Rare
Kalogui	Monitor lizard	<i>Varanus bengalensis</i>	Fairly common
Daraj sap	Rat snake	<i>Ptyas mucosus</i>	Fairly common
Gokhra sap	Cobra	<i>Naja naja</i>	Common
Korikaitta	Roofed turtle	<i>Kachugatectatecta grey</i>	Fairly common
Majharikaitta	Medium roofed turtle	<i>Kachuga tentoria</i>	Fairly common
Kasim	Flap – shell turtle	<i>Lissemys punctata</i>	Rare
Dora sap	C.K. Watersnake	<i>Xenochrophis piscator</i>	Common
Matia sap	C. Watersnake	<i>Enhydrysenhydryis</i>	Common
BIRDS: 30(5)			
Bhubancheel	Black kite	<i>Milvus migrans</i>	Rare
Sadacheel	Black – wing kite	<i>Elanus caeruleus</i>	Rare
Mala gugu	Ring dove	<i>Streptopelia decaocto</i>	Common
Teya	Perakeet	<i>Psittacula krameri</i>	Common
Kokil	Koel	<i>Eudynamis scolopacea</i>	Common
Suichora	Common bee eater	<i>Merops leschenaulti</i>	Fairly common
Bulbul	Red-vented bulbul	<i>Pycnonotus jacosus</i>	Fairly common
Doyal	Magpic robin	<i>Copsychus saularis</i>	Fairly common
Tuntune	Tailor bird	<i>Orthotomus sutorius</i>	Common
Finga	Black drongo	<i>Dicurus macrocercus</i>	Fairly common
Patikak	House crow	<i>Corvus splendens</i>	Common
Darkak	Jungle crow	<i>Corvus macrorhynchos</i>	Common
Bhatsalik	Common myna	<i>Acridothera tristis</i>	Common
Go Salik	Pied myna	<i>Sturnus contra</i>	Common
Jhutsalik	Jungle myna	<i>Acridothera fuscus</i>	Common
Chorui	House sparrow	<i>Passer domesticus</i>	Common
Pancowri	Little cormorant	<i>Phalacrocorax carto</i>	Rare
Borobok	Great egret	<i>Bubulcus ibis</i>	Common
Sadabik	Little egret	<i>Egretta garzetta</i>	Common
Kali bok	Black bittern	<i>Ixobrychus flavicollis</i>	Common
Lalbok	Cinnamon bittern	<i>Ixobrychus cinnamomeus</i>	Common
Kanibok	Pond heron	<i>Ardeola grayii</i>	Common
Shonkhocheel	Brahminy kite	<i>Haliastur indus</i>	Rare
Balihans	Lesser whistling teal	<i>Dendrocygna javanica</i>	Common
Chokha	Ruddy Shelduck	<i>Tadorna ferruginea</i>	Fairly common
Dahuk	Water hen	<i>Gallinix cinerea</i>	Common
Pecha	Spotte owlet	<i>Athena brama</i>	Common

Bangla Name	English Name	Scientific Name	Availability
Kath thokra	Wood pecker	<i>Dinopium javanese</i>	Rare
LokkiPecha	Bran owl	<i>Tyto alba</i>	Common
Machranga	White-throated kingfisher	<i>Halcyon pileata</i>	Fairly common
MAMMALS: 10(3)			
Badur	Flying fox	<i>Pteropus giganteus</i>	Common
Bezi	Mongoose	<i>Herpestes edwardsi</i>	Common
Bagdasha	Large civet	<i>Viverrazibela</i>	Rare
Indur	L. bandicoot rat	<i>Bandicotabengalensis</i>	Common
Chika	I. shrew	<i>Suncus murinus</i>	Common
Khaksial	Fox	<i>Vulpes bengalensis</i>	Fairly common
Katbirali	Squirrel	<i>Callosciurus pygæugethrus</i>	Common
Sushuk	Gangetic dolphin	<i>Platanista gangetica</i>	Rare
Shial	jackal	<i>Canis aurcus indicus</i>	Common
Udd	Otter	<i>Lutra lutra</i>	Rare

Annex E : Tree Plantation Plan

E.1. Objectives

The environmental, economic and socio-cultural values of tree are immense. Tree is an important renewable resource for accumulating and storing organic carbon. Trees absorb carbon dioxide and release oxygen in daytime by photosynthesis, thus clean air from noxious carbon-di-oxide gas. Trees of strip plantations intercept dust with leaves and twigs keeping ambient air dust free. Tree plantation has other general advantages like improvement of environment, ecology and economy therefore, planting tree along both sides of the embankment and other available spaces in the project area would enhance environment, economy and help alleviating rural poverty through resource generation. In addition, dense tree cover at both sides of the embankment will act as a barrier from cyclonic storm and add aesthetic value to a great extent.

It is estimated that there are xx nos. of various trees of different sizes present along 282km long embankment of 11 subprojects of the project and the same needs to be felled for this project. As per the Forest Act 1927, Amendment 2000 (Protected, village Forests and Social Forestry) for every tree felled will be compensated with twice the number of trees to be planted. The compensatory plantation of the trees will be estimated to be 2*(xx) numbers.

A Tree Plantation Plan (TPP) has been prepared for planting 126,900 plants (as in Table E.1) to compensate the loss of 2*(xx) trees/plants as well as to build additional tree stock.

E.2 Land-base for plantation and plant requirement for plantation

The most important land-base for plantation of the project is the spaces (embankment slope and berm) remain both sides of the embankment under the control of BWDB, Government of Bangladesh. In planning plantations along the embankment, two rows (each at the top and bottom end) of each side will be planted with hedge plants; in between two hedge rows there will be at least two rows of tree plantation at 2m * 2m spacing with suitable local species. Some other important land bases for plantation are homestead and other private land, bank of pond/khal/ditch/gher, compounds of community structures/institutions, etc. Table E.1 presents the plant requirement for plantation on BWDB land along the embankment. Plantation on other land bases will be patronized developing need-based local entrepreneurs in the locality.

E.3 Selection and Planning of Tree Species

Site specific species selection for carrying out plantation is very important for achieving the goal. Considering different physiographic situations at different locations of the embankment under different subprojects of the project species selection has been made.

Species selected for plantation are categorized into four as (i) Fruit/ multipurpose, (ii) Timber & Fuel wood, (iii) Medicinal and (iv) Palm. Species distribution in plantations as well as species composition under different categories has been presented in sub-sections E.4.

E.4 Species selection and plantation along the alignment

Species of following categories has been selected for plantation on both sides of the embankment. Species distribution at different spots will be based on specific locality where proportionate of Fruit/ multipurpose, Timber & Fuel wood, Medicinal and Palm. Species will be 40%, 40%, 10% and 10% respectively. Total 126,900 plants to be planted under different categories of which Fruit/ multipurpose 50,760, Timber & Fuel wood 50,760, Medicinal 12,690 and Palm 12,690 (as presented in Table E.2).

- ❖ Fruit/ multipurpose: Aam (*Mangifera indica*), Jam (*Syzygium cumini*), Kathal (*Artocarpus heterophyllus*), Koitbel (*Feronia limonia*), Tentul (*Tamerindus indica*),
- ❖ Timber & Fuel wood: Debdaru (*Polyalthia longifolia*), Silkoroi (*Albizia procera*), Mehogani (*Swietenia mahagoni*), Segun (*Tectona grandis*), Babla (*Accacia nilotica*), Khoyababla (*Pitheclobium dulce*),
- ❖ Medicinal: Neem (*Azadirachta indica*), Arjun (*Terminalia arjuna*), Bel (*Aegle marmelos*),
- ❖ Palm: Coconut (*Cocos nucifera*), Palmira palm (*Borassus flabellifer*), Date palm (*Phoenix sylvestris*),

Table E.1: Plant requirements for plantation on the slopes of the embankment

i	Total length in meter	282
ii	Less: 10% for different structures and utilities	28.2
iii	Length available for plantation	254
vi	No. of plant to be planted (both sides) 2 rows each side at 2m*2m spacing	126,900
v	No. of plant required for covering mortality (both sides)	12,690
vi	Total plant requirement (considering mortality)	139,590

Table E.2: Type of plants for plantation on the slopes of the embankment

Tree Species	Total Plant	No. of Trees
Fruit/ multipurpose (40%)	126,900	50,760
Timber & Fuel wood (40%)		50,760
Medicinal (10%)		12,690
Palm (10%)		12,690
Total:		126,900

E.5 Institutional Arrangement

The Forest Department (FD) is generally responsible for the plantation of all the government owned lands. It is a common practice in Bangladesh that the FD performs the task by them. The FD will be encouraged to involve the PAPs through WMO. The FD will provide all technical and other supports in planning and developing the plantations. The successful experience of the Roads and Highways Department, Local Government Engineering Department and Bangladesh Water Development Board and NGOs are to be considered while implementing the TPP.

Nurseries of the FD in respective upazilas of the subprojects can be used for raising the suitable saplings of the tree species for the plantation area. There are a number of private sector nurseries in the project district which may be also contacted for raising saplings as well. The FD will also assist the PAPs through the WMO in developing the tree plantation surrounding their housing space in all possible ways. The PIU will be responsible for overall coordination (with the FD and WMO), implementation and supervision of the program. It is recommended that BWDB, Faridpur should start dialogue with the FD for the tree plantation development program in the pre-construction stage, so that setting up of nurseries for making at least 126,900 plants available for planting in the early stage of the project.

The tasks of the FD are as follows:

- ❖ Training of the local people particularly the PAPs on tree plantation;
- ❖ Preparation of the tree plantation programs in accordance with this plan and get them approved by the FD ;
- ❖ Development of nurseries for raising seedlings;
- ❖ Procurement of seedlings of approved species and / or FD nurseries for plantation;
- ❖ Plantation of seedlings after preparation of the land with fertilizers and installing fences for the protection of saplings;
- ❖ Maintenance of the saplings by employing adequate number of the trained PAPs;
- ❖ Distribution of saplings among the PAPs settled in and outside of the PIA and training of these PAPs on plantation and maintenance of sapling in the homesteads.
- ❖ Assist PIU in procurement and distribution of saplings and other inputs to the PAPs and conduct sample trace studies on the effectiveness of the program in plantation.

E.6 Tree Plantation Budget

The budget for the proposed tree plantation development plan is given in Table E.3. The budget also includes maintenance for first 3 years of plantation to ensure that all planted saplings will survive and provision for an additional plantation. The plantation along the embankment will be carried out immediately after completion of the construction activities during Operation Stage (preferably at the beginning of monsoon period). The budget also includes procurement and development of all facilities required to establish a nursery such as, collection of suitable soils, decomposing cow dung, procurement of fertilizers etc. The budget also includes measures required for maintenance of plantation, such as watering, weeding, fertilizer application, replacing of dead saplings, etc. for first 3 years. Total approx. budget for tree plantation is 41.409 million BDT.

Table E.3: Cost Estimates for Tree Plantation along the embankment of the project

Sl. No.	Tree Plantation Area	Unit Rate (BDT)	No. of Plant	Amount (BDT)
1	Tree plantation	100	126,900	12,690,000
2	Maintenance for 3 years	200	126,900	25,380,000
3	Provision of 10% tree Mortality	100	12,690	1,269,000
Sub Total				39,339,000
4	Service/ Supporting costs 5% of total			2,070,474
Grand Total:				41,409,474

Annex F: Implementation Schedule

PRELIMINARY OVERALL IMPLEMENTATION SCHEDULE														
Sl No.	Activity/Name of Sub-project	Area (ha)	District	O&M Division (BWDB)	WMG (No.)	Civil Works Costs (Lakh Taka)	Annual Implementation Schedule							
							2015	2016	2017	2018	2019	2020	2021	2022
								Year -1	Year -2	Year -3	Year -4	Year -5	Year -6	Year -7
	Start up													
1	Beel Sukunia	9,681	Faridpur	Faridpur	17	1,750.60								
2-3	Daduria Beel & Kandor Bee	3,301	Faridpur	Chenchuri Beel	6	872.61								
4	Alfadanga-Boalmari	8,011	Faridpur	Chenchuri Beel	15	3,422.34								
5	Chatlar-Fakurhat	10,268	Faridpur	Chenchuri Beel	9	2,393.15								
6	Kalidaskhali-Arpara	13,197	Magura	Magura	28	2,718.46								
7	Horai River	18,600	Rajbari	Rajbari	31	4,282.29								
8	Purulia Char Bhatpara	4,156	Gopalganj	Chenchuri Beel	7	293.58								
9	Bamonkhali Barnali	16,782	Magura/Narail	Magura	30	1,197.63								
10	Arol Beel	15,570	Jessore	Jessore	30	1,546.13								
11	Sonamukhi Banmandar	9,070	Jessore	Jessore	15	1,723.05								
	Total	108,636			188									
ADB Loan:														
(Draft) DPP to ADB		Feb.2015												
Loan Effectiveness		Nov. 2015												
Activity Closing date		June 2022												
Loan Closing date		Dec. 2022												

Annex G: Involvement of Resources

Abstract of Involvement of resources for implementing “SAIWRPMP-Additional Financing”

SP Sl. No	Name of Subproject	Earthwork: Khal re-excavation		Earthwork: Emb. Re-sectioning		Earthwork: Retired embankment		Bank protective work / Regulator construction								
		Length Km.	Qty. '000 M ³	Length Km.	Qty. '000 m ³	Length Km.	Qty. '000 M ³	Location (length in km)	Length-km/Vent	Geo-textile filter-m ²	Geo-textile - bag-nos.	MS rod Bill et M tons	Cement —m ton	Sand Fm-1-50 m ³	Shingles m ³	Remark
1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16
1	Beel Sukunia-i. Rehabilitation	16.00	185.81	18.42	82.257											
	ii. New Regulator							Joydhap	6-vent				172.00	514.00	786.00	1572.00
2-3	Daduria Kandor Beel	7.55	46.51	15.6	32.692											
4	Alfadanga Boalmari	34.37	258.05	60.020	46.985	1.5	137.51	Halencha	0.640	9041.45	266500		783.00	1669.00	3338.00	
								Grida	1.000	14127.00	416405		1223.00	2608.00	5216.00	
5	Chatlar Fakurhat	61.29	736.07	11.45	137.511			Durgapu & Chandrapara	0.400	5651.00	166562	-	489.00	1043.00	2086.00	
6	Kalidaskhali Arpara	42.45	524.29	57.62	711.650											
7	Horai River	109.35	1695.45	67.68 *	78.589											* Re-sectioning: emb.61.68(61.99 2-top carpeted.; 5.688 earthen
8	Purulia charbhatpara	6.00	64.286	3.00	60.000											
9	Bamonkhali Barnali	55.14	295.043	20.50	136.667											
10	Arol Beel	45.00	480.00	0.00	0.00											
11	Sonamukhi Bonmandar			0.00	0.00											
	i. Khal re-excavation	64.60	792.00													
	ii. Betna river	32.00	724.00													
TOTAL		332.15	3805.51	254.47	1286.492	1.5	137.51		2.040 km	28819.45	849467.00	172.00	3009.00	6106.00	12212.00	

Annex H: Participants' List of Stakeholders' Consultations

Annex H1: Participants' List of FGD

Focus Group Discussion (FGD):

Name of Project: Kandora-Daduria

Date: 08/12/2014

Location: Bonchaki, P.O:Boalmari, Upozila-Boalmari, Dist:faridpur

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	ফোন: কামরুল মিক্তা 01723323956	স্বাধীক মিক্তা	বনচাকী	মো: কামরুল
2.	ফোন: সফাত	স্বাধীক মিক্তা	বনচাকী	মো: সফাত
3.	আব্দুল বক মিক্তা	স্বাধীক মিক্তা	স্বাকাদর নগর	মো: আব্দুল বক
4.	ইসরাইল মিক্তা	স্বাধীক মিক্তা	বামচন্দ্রপুর	ই.ই.ই.ই.
5.	আজহার বক মিক্তা	মল্লিকউদ্দিন স্বাধীক	বনচাকী	আজহার
6.	ফোন: বাকির	স্বাধীক মিক্তা	বনচাকী	মো: বাকির
7.	মো: মালু	মিক্তা	বনচাকী	মালু
8.	নব্বিন মিক্তা	স্বাধীক মিক্তা	বনচাকী	নব্বিন
9.	মো: হুমায়ূন 01735922642	আব্দুল মিক্তা	বনচাকী	হুমায়ূন
10.	ফোন: হুমায়ূন 01727688799	মো: হুমায়ূন	বনচাকী	হুমায়ূন
11.	ফোন: হুমায়ূন 017650315283	স্বাধীক মিক্তা	বনচাকী	হুমায়ূন
12.	ফোন: মোস্তাফিজ	স্বাধীক মিক্তা	চব্বিশকার নগর	মো: মোস্তাফিজ
13.	ফোন: মোস্তাফিজ 01734131458	স্বাধীক মিক্তা	চব্বিশকার নগর	মো: মোস্তাফিজ
14.	ফোন: কামরুল মিক্তা 01765928576	স্বাধীক মিক্তা	বামচন্দ্রপুর	কামরুল
15.	ফোন: মিক্তা 01742295218	স্বাধীক মিক্তা	বনচাকী	মিক্তা
16.	ফোন: মিক্তা 01710623402	স্বাধীক মিক্তা	বনচাকী	মিক্তা
17.	ফোন: মিক্তা 01933882859	স্বাধীক মিক্তা	বনচাকী	মিক্তা
18.	ফোন: মিক্তা 01718-292795	স্বাধীক মিক্তা	বনচাকী	মিক্তা
19.	ফোন: মিক্তা 01720962304	স্বাধীক মিক্তা	বনচাকী	মিক্তা
20.	ফোন: মিক্তা 01715110857	স্বাধীক মিক্তা	বনচাকী	মিক্তা

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	আব্দুল হক	হুদা আলী খান	বনচাঁকী	আব্দুল হক
22.	আনায়েব	উদ্দীন হোসেন	কলমারাম	আনায়েব
23.	হাসিনা খানম	বদিউজ্জামান	পানাইল	হাসিনা খানম
24.	হাসিনা	হুদা আলী খান	চরকান্দো নগর	হাসিনা
25.	লিজা	হোসেন আলী	বনচাঁকী	লিজা
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Signature: Md. Ferdous Rahman

Date: 08/12/2014

Vill - Gopalpur
 Union - Gopalpur
 UPZ - Alfadanga
 Dist - Faridpur

Focus Group Discussion (FGD):

Name of Project: Alfadanga-Boalmara

Date: 8.12.2014

Location: Alfadanga, Gopalpur

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	শ্রী: নওব্বল ইসলাম 01716611091	শ্রী: আজিজাৎ হোসেন	Gopalpur	[Signature]
2.	শ্রী: মোহাম্মদ হান্নান 01739789303	শ্রী: আব্দুল গনি হান্নান	"	[Signature]
3.	শ্রী: হান্নান নওয়াজ হান্নান 01716967622	শ্রী: আজাহার হান্নান	"	[Signature]
4.	শ্রী: হুমায়ুন কামিল 01715213276	শ্রী: মোঃ মুহাম্মদ রহমান	"	[Signature]
5.	শ্রী: মোহাম্মদ হান্নান 01931308113	শ্রী: আলতাফ হান্নান	"	[Signature]
6.	শ্রী: হুমায়ুন 01720322724	শ্রী: মোঃ হুমায়ুন	"	[Signature]
7.	শ্রী: হান্নান হান্নান 01729140300	শ্রী: হুমায়ুন হান্নান	"	[Signature]
8.	শ্রী: মোহাম্মদ হান্নান হান্নান 01714566278	শ্রী: আব্দুল গনি হান্নান	"	[Signature]
9.	শ্রী: মোহাম্মদ হান্নান হান্নান 01715424308	শ্রী: হুমায়ুন হান্নান	"	[Signature]
10.	শ্রী: আব্দুল হান্নান 01735116022	শ্রী: আব্দুল হান্নান	"	[Signature]
11.	শ্রী: মোহাম্মদ হান্নান [Signature]	শ্রী: মোহাম্মদ হান্নান	"	[Signature]
12.	শ্রী: মোহাম্মদ হান্নান হান্নান [Signature]	শ্রী: হান্নান হান্নান	"	[Signature]
13.	শ্রী: মোহাম্মদ হান্নান 01714051367	শ্রী: আব্দুল হান্নান	"	[Signature]
14.	শ্রী: মোহাম্মদ হান্নান 01732655667	শ্রী: মোহাম্মদ হান্নান	"	[Signature]
15.	শ্রী: হুমায়ুন হান্নান 01813348820	শ্রী: হুমায়ুন হান্নান	"	[Signature]
16.	শ্রী: হান্নান হান্নান	শ্রী: হান্নান হান্নান	"	[Signature]
17.	শ্রী: হান্নান হান্নান	শ্রী: হান্নান হান্নান	"	[Signature]
18.	শ্রী: হান্নান হান্নান	শ্রী: হান্নান হান্নান	"	[Signature]
19.	শ্রী: হান্নান হান্নান	শ্রী: হান্নান হান্নান	"	[Signature]
20.	শ্রী: হান্নান হান্নান	শ্রী: হান্নান হান্নান	"	[Signature]

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	সুপারিয়া বেগম	স্বামী: লেহাঙ্গা (খ)	Gopalpur	সুপারিয়া
22.	হামিদা বেগম	স্বামী: মো: মোছা	"	হামিদা বেগম
23.	হালুয়া বেগম	স্বামী: মক. আলী	"	হালুয়া
24.	জুলেখা বেগম	স্বামী: মুনহুট খাঁ	"	জুলেখা
25.	তাহমিনা	স্বামী: হাবিদ আলী	"	তাহমিনা
26.	বুবিয়া	স্বামী: মফস ইমরান	"	বুবিয়া
27.	রাবেয়া বেগম	স্বামী: মুনহুট হাবিবুর রহমান	"	রাবেয়া
28.	হামিদা	স্বামী: আমান আলী	"	হামিদা
29.	হালুয়া	স্বামী: মিরাজ খাঁ	"	হালুয়া
30.	সুইদি	স্বামী: নাহিদ আলী	"	সুইদি
31.	বিক্রম	স্বামী: মাহাজারান	"	বিক্রম
32.	আতর বেগম	স্বামী: মাজেদ মিয়া	"	আতর
33.	মাম জামালুজ্জামান টুটু	আলহাজ্জ মোস্তাফিজ	"	মাম জামালুজ্জামান টুটু ১১/১১/১৪
34.	রক্তিমালতা ইসলাম	স্ব: মাম জামালুজ্জামান	"	রক্তিমালতা ইসলাম
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Signature:

Date:

Focus Group Discussion (FGD):

Name of Project: Chatler-fakuchat

Date: 9.12.2014

Location: Gandi; Upzila: Vanga, Union: Tuzapure, Dist: Faridpur

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1	শ্রী. আব্দুল রশিদ মিয়া	শ্রী. আব্দুল হক মিয়া	ডা.লাই মিয়া	
2	শ্রী. জাহাঙ্গীর মিয়া	শ্রী. আলমগীর উদ্দিন	জান্নী নীচা	
3	উত্তম মিস্ত্রী 01712742501	কোমল মিস্ত্রী	কোনাল	
4	মদীন গাভ্রী 01765426518	ই. রাম হান	"	
5	শ্রী. 01728493555	শ্রী. কান্না সার্বর	"	
6	শ্রী. আমাছার মল্ল	শ্রী. ইয়াক মল্ল	"	
7	শ্রী. আব্দুল মল্ল 01921238208	শ্রী. ইয়াক মল্ল	"	
8	শ্রী. আমদুল হক 01722320705	শ্রী. শামস হক	"	
9	শ্রী. জাহাঙ্গীর কামাল	শ্রী. কামাল	"	
10	শ্রী. মিয়া কামাল	শ্রী. মিয়া কামাল	"	
11	শ্রী. ইমদ আলী	শ্রী. ইমদ আলী	"	
12	জাহাঙ্গীর	শ্রী. মিলন হক	"	
13	আব্দুল আলী খান	ইমদ আলী খান	ইমদ আলী	
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Md. Ferdous Rahman
Ferdous
 09/12/2014

Focus Group Discussion (FGD):

Name of Project: Arpara - Kalidash Khali

Date: 15/12/19

Location: Kuadpur

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	সুনীল বিশ্বাস 01839723024	শ্রী কালী শর্মা	সুকল বাড়িয়া	
2.	আজিত শর্মা 01789349342 মো: ৯৯৭৭৯২৯৯৯	শ্রী জটিন্দ্র শর্মা	কুমারপুর	
3.	০১৮৩৯-৭২৩০২৯	শ্রী হুমায়ুন	মুর্শিদাবাদ	
4.	০৯১৩৬৬৬৬৬৬৬৬৬৬	শ্রী গোপাল শর্মা	কুমারপুর	০৯১৩৬
5.	ইমতিয়াজ	শ্রী জাহিদ ইমতিয়াজ		
6.	আমাল 01914329298	শ্রী হামিদ	দেবপুরকাড়া	০৯৯৯
7.	নুসরাত	আজিত শর্মা	কুমারপুর	
8.	শ্রী শ্রী শর্মা	শ্রী শ্রী শর্মা	কুমারপুর	
9.	শ্রী শ্রী শর্মা	শ্রী শ্রী শর্মা	কুমারপুর	শ্রী শ্রী শর্মা
10.	সুকল	মো: জুয়াদার	দেবপুরকাড়া	২০০০০০
11.	মদন কুমার	শ্রী মদন কুমার	নারীয়াড়া	মদন
12.	শ্রী শ্রী বিশ্বাস 01718641821	শ্রী শ্রী বিশ্বাস	নারীয়াড়া	
13.	নিব্বাল শর্মা 01726033263	শ্রী শ্রী বিশ্বাস	কুমারপুর	
14.	শ্রী শ্রী বিশ্বাস 01724341666	শ্রী শ্রী বিশ্বাস	কুমারপুর	শ্রী শ্রী বিশ্বাস
15.	সুকল	ইমতিয়াজ	দেবপুরকাড়া	১১১১১১
16.	লক্ষণ শর্মা	শ্রী শ্রী বিশ্বাস	কুমারপুর	১১১১১১
17.	শ্রী শ্রী বিশ্বাস ০১৭২৫ ৫৫৬৪৭১-	শ্রী শ্রী বিশ্বাস	কুমারপুর	১১১১১১
18.	শ্রী শ্রী বিশ্বাস	শ্রী শ্রী বিশ্বাস	কুমারপুর	শ্রী শ্রী বিশ্বাস
19.	শ্রী শ্রী বিশ্বাস 01829593719	শ্রী শ্রী বিশ্বাস	কুমারপুর	শ্রী শ্রী বিশ্বাস
20.	শ্রী শ্রী শর্মা	শ্রী শ্রী শর্মা	কুমারপুর	১১১১

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	আব্দুল হান্নান 01793195129	এমি আমজাদ	বুলাপাতি	আব্দুল হান্নান
22.	রবুল কা	ইস: রুহুল অরকাণ	কুমারপুর	মেনকা
23.	আব্দুল বারী অরকাণ	আব্দুল নাসির অরকাণ	কুমারপুর	তা কু না
24.	সীতা বারী	ইস: নিরমল হোসেন	কুমারপুর	সীতা
25.	চাঞ্চনা রায়	শ্রীমতি: অনন্তিকা	কুমারপুর	চাঞ্চনা
26.	সীতা রায়	শ্রীমতি: কালি রায়	কুমারপুর	সীতা
27.	মনা	শ্রীমতি: ইস: আব্দুল হান্নান অরকাণ	কুমারপুর	মনা
28.	পার্বী	শ্রীমতি: ইস: আব্দুল হান্নান	কুমারপুর	পার্বী
29.	সখী	ইস: ইনামত হোসেন	কুমারপুর	সখী
30.	ভাগীরথী হোসেন	ইনামত হোসেন	কুমারপুর	ভাগীরথী হোসেন
31.	উত্তম	আব্দুল হান্নান	কুমারপুর	উত্তম
32.	প্রকাশ হোসেন	নিরমল হোসেন	কুমারপুর	প্রকাশ হোসেন
33.	মুতাসিম হোসেন 01725556471	মুতাসিম হোসেন	কুমারপুর	মুতাসিম হোসেন
34.	শ্রীমতি: সখী 01724-050558	শ্রীমতি: সখী	কুমারপুর	শ্রীমতি: সখী
35.	কালচান রায়	আদিত্য কুমার	কুমারপুর	কালচান রায়
36.	আব্দুল কুমার হোসেন	ইলিয়াস হোসেন	কুমারপুর	আব্দুল কুমার হোসেন
37.				
38.				
39.				
40.				

Signature: Md. Ferdous Rahman

Date: 15/12/2014

Focus Group Discussion (FGD):

Name of Project: Horcai Révere

Date: 11-12-2014

Location: Malipara, Uni: Ramkantopura, Upz: Rajbari Sadar, Dist: Rajbari

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1	স্বাঃ মোঃ কবির (মালি) 01710911068	স্বাঃ মোঃ কবির (মালি)	মালি পাহাড়া গ্রাম: রামকান্তপুর	[Signature]
2	স্বাঃ জহিরউদ্দিন মালি	স্বাঃ আবদুল আলী	মালি	[Signature]
3	স্বাঃ কিয়াম আলী মালি	স্বাঃ আব্দুল মালি	মালি	[Signature]
4	আবদুল আলী মালি	স্বাঃ মুহাম্মদ আলী	মালি	[Signature]
5	আব্দুল মোব্বিন	স্বাঃ হুমায়ুন মোব্বিন	আব্দুল মোব্বিন	[Signature]
6	আব্দুল মালি	স্বাঃ আব্দুল মালি	মালি	[Signature]
7	আব্দুল মালি 01728957462	স্বাঃ কালাম আলী	মালি	[Signature]
8	আব্দুল মালি	স্বাঃ আব্দুল মালি	মালি	[Signature]
9	স্বাঃ আলী মালি	স্বাঃ মুহাম্মদ আলী	মালি	[Signature]
10	স্বাঃ মালি মালি 01399323240	স্বাঃ কালাম আলী	মালি	[Signature]
11	স্বাঃ আলী মালি 01716935565	স্বাঃ আব্দুল আলী	মালি	[Signature]
12	স্বাঃ আব্দুল মালি 01715-083072	স্বাঃ মালি মালি	মালি	[Signature]
13	স্বাঃ মালি মালি 01918532323	স্বাঃ কালিমউদ্দিন মালি	মালি	[Signature]
14	স্বাঃ মালি 02922040046	স্বাঃ মালি মালি	মালি	[Signature]
15	স্বাঃ মালি মালি 01758326965	স্বাঃ আব্দুল মালি	মালি	[Signature]
16	স্বাঃ আলী মালি	স্বাঃ কালিমউদ্দিন মালি	মালি	[Signature]
17	স্বাঃ আলী মালি 01934737576	স্বাঃ আব্দুল মালি	মালি	[Signature]
18	স্বাঃ মালি মালি	স্বাঃ আব্দুল মালি	মালি	[Signature]
19	স্বাঃ মালি 01722484854	স্বাঃ আব্দুল আলী	মালি	[Signature]
20	স্বাঃ মালি মালি 01964086081	স্বাঃ মালি মালি	মালি	[Signature]

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Md. Ferdous Rahman

Fieldwork

11/12/2014

Focus Group Discussion (FGD):

Name of Project: Horzai Revez UPazila: Baliakandi Date: 13-12-14

Location: Sozusail

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	স্বাঃ (বরুণেন দাস) ০১৭২২-১৭৭২৭৪	স্বাঃ কামরুজ্জামান (মহম্মদ দাস)		
2.	আব্দুল জালিল কোন্ডা	স্বাঃ কাওালগি কোন্ডা	অরুণাঙ্গল	জালিল
3.	ছাকিকন	স্বাঃ পনকজ সাল্লা	অরুণাঙ্গল	১০০৮
4.	সাবরাম কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	১৫৭১৫
5.	কোন্ডা সানিদ ০১৩১৫-৫৬২৫২৫	স্বাঃ আবদুল হুসেন	নরুল হাট	
6.	স্বাঃ আলিম আলিম ০১৬৭২৩১৭৭৫	স্বাঃ আবদুল কোন্ডা	অরুণাঙ্গল	আলিম আলিম
7.	নামন	স্বাঃ আবদুল হুসেন	অরুণাঙ্গল	নামন
8.	স্বাঃ সানিদ কোন্ডা	স্বাঃ জালিল কোন্ডা	অরুণাঙ্গল	১১১১৫
9.	স্বাঃ সানিদ কোন্ডা ০১৪৭৭৬৩৭৩৭২	স্বাঃ আবদুল কোন্ডা	অরুণাঙ্গল	সানিদ
10.	স্বাঃ ছাকিকন ০১৭১৫-৭২২৫১৫	স্বাঃ ছাকিকন	নরুল হাট	
11.	স্বাঃ সানিদ কোন্ডা	স্বাঃ আবদুল কোন্ডা	অরুণাঙ্গল	সানিদ
12.	স্বাঃ সানিদ কোন্ডা	স্বাঃ আবদুল কোন্ডা	অরুণাঙ্গল	সানিদ
13.	স্বাঃ আবদুল কোন্ডা ০১৭১৫-১৫১৫	স্বাঃ আবদুল কোন্ডা	অরুণাঙ্গল	আবদুল কোন্ডা
14.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
15.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
16.	স্বাঃ সানিদ কোন্ডা ০১৪২৩২৭৬৬২২	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
17.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
18.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
19.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ
20.	স্বাঃ সানিদ কোন্ডা	স্বাঃ সানিদ কোন্ডা	অরুণাঙ্গল	সানিদ

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	বাহিনী	শ্রী হোসেন্দার কোশ	সরুয়াইল	বাহিনী
22.	নাহিদা 01932912917	আব্দুল মাতিন	সরুয়াইল	নাহিদা
23.	কালিয়া	আনিক বিক্রাম	সরুয়াইল	কালিয়া
24.	আমিরুন	শ্রী আব্দুল হোসেন	সরুয়াইল	আমিরুন
25.	জাব্বা	শ্রী বরমান আলী	সরুয়াইল	জাব্বা
26.	আব্বাস হামিদা	শ্রী নজর আলী	সরুয়াইল	হামিদা
27.	আদজা	শ্রী নর হামিদা	সরুয়াইল	আদজা
28.	আকিরন	শ্রী আলতাফ কোশ	সরুয়াইল	আকিরন
29.	বরমা	আব্বাস	সরুয়াইল	বরমা
30.	আলবু	শ্রী আলিউদ্দিন	সরুয়াইল	আলবু
31.	আল জা	শ্রী আব্বাস আলী	সরুয়াইল	আল জা
32.	আব্বাস আব্বাস	শ্রী নজর আলী	বরুয়া	আব্বাস
33.	আব্বাস বরমা	শ্রী মিরাজ হোসেন	বরুয়া	আব্বাস
34.	আব্বাস	শ্রী কলু হামিদা	সরুয়াইল	আব্বাস
35.	আব্বাস বরমা	শ্রী নূর উদ্দিন	বরুয়া	আব্বাস
36.	আব্বাস বরমা	শ্রী বরমান	বরুয়া	আব্বাস
37.	আব্বাস	শ্রী মুন্সুর	বরুয়া	আব্বাস
38.	আব্বাস	শ্রী বাবুল কোশ	সরুয়াইল	আব্বাস
39.	আব্বাস	শ্রী আব্বাস হোসেন	সরুয়াইল	আব্বাস
40.	আব্বাস	শ্রী আব্বাস	বরুয়া	আব্বাস

Signature:

Date:

Focus Group Discussion (FGD):

Name of Project: Horai River sub-project.

Date: 13-12-14

Location: Sorusaal (মরুমাঠ)

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	নজর আলী মোল্লা	মৃত জবেদ আলী মোল্লা	মরুমাঠ	নাজর আলী মোল্লা
2.	মো: রবিউল শেখ	মৃত: কাশেম আলী শেখ	নূরচর	রবিউল
3.	মো: মাহিউদ্দিন শেখ	মো: খুরাব শেখ	নূরচর 0857-845946	মাহিউদ্দিন
4.	মো: শাহাব মন্ডল	মো: শালিম মোল্লা	নূরচর 0174-871386	শাহাব
5.	মো: ইব্রাহিম শেখ	মো: আব্দুল জলিল শেখ	মরুমাঠ	ইব্রাহিম
6.	মো: আব্দুল মালেক শেখ	মৃত: কায়েম উদ্দিন শেখ	মরুমাঠ 01759418465	আব্দুল মালেক
7.	মো: আরুণ মোল্লা	মৃত ময়ূব আলী মোল্লা	মরুমাঠ	আরুণ
8.	মো: আমদুল শেখ	মৃত বিনায়েত শেখ	মরুমাঠ	আমদুল
9.	মো: মুশী	মৃত ইব্রাহিম শেখ	মরুমাঠ	মুশী
10.	মো: মকীর	মৃত মাহিউদ্দিন মোল্লা	মরুমাঠ	মুশী
11.	মো: শাহাব মন্ডল	মৃত মাহিউদ্দিন মন্ডল	নূরচর 01743-531808	মো: শাহাব মন্ডল
12.	মো: জুফের মকীর	মো: তায়েব আলী মকীর	মরুমাঠ	জুফের
13.	মো: নাজের আহমেদ	মো: দলিমউদ্দিন	মো: জুফের 01731-501588	নাজের আহমেদ
14.	মো: মোহাম্মদ শেখ	মৃত আব্দুল করিম শেখ	মরুমাঠ	মোহাম্মদ
15.	মো: মিরাজ শেখ	মৃত হারু শেখ	মরুমাঠ	মিরাজ
16.	মো: মাহিউদ্দিন (মরুমাঠ)	মৃত মো: মাহিউদ্দিন	মো: মাহিউদ্দিন 01747-804983	মো: মাহিউদ্দিন
17.	মো: মনির শেখ	মো: তায়েব আলী শেখ	মরুমাঠ	মনির
18.	মো: খুরাব শেখ	মো: খুরাব শেখ	মরুমাঠ 01850-808244	খুরাব
19.	মো: মাহিউদ্দিন মোল্লা	মো: মাহিউদ্দিন মোল্লা	মরুমাঠ 01934535074	মাহিউদ্দিন
20.	মো: মাহিউদ্দিন	মো: মাহিউদ্দিন	মরুমাঠ 01757-314906	মাহিউদ্দিন

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	ছানোমন	মৃত বাশাহা মোহা	শরুপাটন 01743-283647	ছানোমন
22.	মো: জিয়া রহমান	মো: জিয়া রহমান	নতুনচর 01722-544028	মো: জিয়া রহমান
23.	মো: জিয়া রহমান	মো: জিয়া রহমান	মুন্সিগঞ্জ	মো: জিয়া রহমান
24.	মো: মোজাহার	মৃত বেদরউদ্দিন	বাগোশ্রাম	মোজাহার
25.	মো: মাহেদ মুন্সি	মৃত মাহেদ মুন্সি	শরুপাটন 01749644529	মাহেদ
26.	মো: মাহেদ মুন্সি	মৃত মাহেদ মুন্সি	শরুপাটন	মাহেদ মুন্সি
27.	মাহেদ	জয়নাম মোহা	নতুনচর	মাহেদ
28.	ফরিদ	মৃত হানিফ মোহা	বাগোশ্রাম	ফরিদ
29.	মখুজা	মৃত মোজাহার মোহা	শরুপাটন	মখুজা
30.	নয়ন	মাহাজান মুন্সি	শরুপাটন	নয়ন
31.	বিল্লাল	আমীর মোহা	শরুপাটন	বিল্লাল
32.	মো: সুজন কলিতা	মো: সুজন কলিতা	শরুপাটন 01778-192622	সুজন
33.	রুনিয়া	খুরশিদ মন্সি	নতুনচর	রুনিয়া
34.	কমলা	স্বামী: বিল্লাল	শরুপাটন	কমলা
35.	কাহিনুর বেগম	স্বামী: মাহেদ মুন্সি	শরুপাটন	কাহিনুর
36.	আনসা	স্বামী: আবুল	শরুপাটন	আনসা
37.	মো: বাশাহা মোহা 01952526282	মিকবাহ মোহা	নতুনচর	বাশাহা
38.	হালিমা	স্বামী: মাহেদ মুন্সি	শরুপাটন	হালিমা
39.	নুসরাত	স্বামী: মাহেদ মুন্সি	শরুপাটন	নুসরাত
40.	মিকজান	স্বামী: মাহেদ মুন্সি	শরুপাটন	মিকজান

Signature: Md. Ferdous Rahman

Date: 13/12/2014

Focus Group Discussion (FGD):

Name of Project: Purulia Chauhatpara

Date: 06.12.2014

Location: Village: Vadulia Ghonapara, Union: Ratal

Participants of FGD: Upazila: Kashicore District: Gopalganj.

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1	(মম. কামাল হোসেন) ০২৭২২১৭৬৬০২	(মম. হাবিবুল্লাহ)	কোমলপুর	(মম. কামাল হোসেন)
2	বিদ্যাধার কামাল ০২৭৬০৬২৫৭৫২	শ্রী হুমায়ুন কামাল	কোমলপুর	বিদ্যাধার
3	মম. কামাল হোসেন ০১৬৫৩৬৪২৩৩৭	শ্রী: মনোজ হোসেন (মম. হোসেন)	কোমলপুর	মম
4	রুমি বিদ্যাধার	মহমদ হোসেন	কোমলপুর	রুমি বিদ্যাধার
5	হোসেন হোসেন	মিলিমা হোসেন	কোমলপুর	হোসেন
6	চন্দ্রা রানী হোসেন	শ্রী মনোজ হোসেন	কোমলপুর	চন্দ্রা
7	স্বপ্না কামাল হোসেন ০২২৬ ৬৬৬৭৬৬	শ্রী: মনোজ হোসেন - (মম. হোসেন)	কোমলপুর	স্বপ্না
8	হোসেন রানী হোসেন	শ্রী: মনোজ হোসেন	কোমলপুর	হোসেন
9	দিপালী	কামাল হোসেন	কোমলপুর	দিপালী
10	সুমন	কামাল হোসেন	কোমলপুর	সুমন
11	সুমন হোসেন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
12	কামাল	শ্রী: মনোজ হোসেন	কোমলপুর	কামাল
13	সুমন হোসেন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
14	সুমন হোসেন হোসেন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
15	সুমন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
16	সুমন হোসেন হোসেন	কামাল হোসেন	কোমলপুর	সুমন
17	সুমন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
18	সুমন হোসেন হোসেন	শ্রী: মনোজ হোসেন	কোমলপুর	সুমন
19	সুমন হোসেন	সুমন হোসেন	কোমলপুর	সুমন
20	সুমন হোসেন	সুমন হোসেন	কোমলপুর	সুমন

Focus Group Discussion (FGD):

Name of Project: Purulia charvatParza

Date: 6/12/14

Location: Vill = Vadulia GchonaParza Un = Rataik

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1	মিঃ ব্রজেন	গোবিন্দ	ভাটুলিয়া	মিঃ ব্রজেন
2	মুন্সামমা	শ্রী প্রমথন	ভাটুলিয়া	
3	সুবর্ণী	কমলা কান্ত	ভাটুলিয়া	সুবর্ণী
4	সুভাষা	শ্রীঃ ভোলাচন্দ্র	ভাটুলিয়া	সুভাষা
5	লক্ষী বানী বিশ্বাস	শ্রী বিজয়নাথ	ভাটুলিয়া	লক্ষী
6	জোয়াব জোয়া 01734800669	জোয়াব জোয়া	ভাটুলিয়া	জোয়া
7	মোঃ মাহমুদ হুসেইন 01724201157	মোঃ মাহমুদ হুসেইন	ভাটুলিয়া	মোঃ মাহমুদ হুসেইন
8	মোঃ বরুণ মোহন 019855776113	মোঃ বরুণ মোহন	ভাটুলিয়া	বরুণ
9	মোঃ মাহমুদ হুসেইন 019182708012	মোঃ মাহমুদ হুসেইন	ভাটুলিয়া	মাহমুদ হুসেইন
10	মোঃ জে	মোঃ জে	ভাটুলিয়া	মোঃ জে
11	মোঃ মাহমুদ হুসেইন	মোঃ মাহমুদ হুসেইন	ভাটুলিয়া	মোঃ মাহমুদ হুসেইন
12	মিঃ ব্রজেন	শ্রী ব্রজেন বিশ্বাস	ভাটুলিয়া	মিঃ ব্রজেন
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Focus Group Discussion (FGD):

Name of Project: Puzulia Charvhat Parza

Date: 6/12/19/

Location: Gchona Parza / Chapta

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	জালাল আহমেদ	হুত. বাহা হাব উদ্দিন মিয়া	ঘোনাপাড়া,	জালাল আহমেদ
2.	(আবদুল মালেক) Fx আবুল কালাম উজ্জ্বল 02928462280	হুত আবদুল আলম উজ্জ্বল	গ্রাম: চাপতা, স্টাফ: চাপতা,	আবুল কালাম
3.	মালিক মোস্তাফিজ	আবদুল মাকসুম মোস্তাফিজ	ঘোনাপাড়া	মালিক
4.	সকিনা খাতুন	সফদুল রহমান	চাপতা	সকিনা খাতুন
5.	রাহিম মোস্তাফিজ 02266286206	মো: মালিক মোস্তাফিজ	ঘোনাপাড়া	রাহিম
6.	মো: নজরুল 0292000000	জাহাঙ্গীর	ঘোনাপাড়া	Masrurul Islam
7.	মো: কবির হুসাইন 0292820000	সফদুল হুসাইন	চাপতা	কবির
8.	আবদুল মোস্তাফিজ	আবদুল হুসাইন	ঘোনাপাড়া	আবদুল
9.	মো: জালাল মোস্তাফিজ 0292260000	আবদুল মোস্তাফিজ	ঘোনাপাড়া	জালাল
10.	মো: আবদুল উদ্দিন খান 0292260000	মো: মোস্তাফিজ আলী খান	ঘোনাপাড়া	আবদুল
11.	আবদুল রহমান খান 0292260000	হুত: রহমান খান	চাপতা	আবদুল রহমান
12.	সফদুল রহমান আবদুল 0292000000	হুত: আবদুল রহমান সফদুল	ঘোনাপাড়া	সফদুল
13.	মিজান কবির	হুত: মোস্তাফিজ কবির	ঘোনাপাড়া	মিজান কবির
14.	হুসাইন মালিক মোস্তাফিজ 02929602028	আবদুল সফদুল হুসাইন	চাপতা	হুসাইন মালিক
15.	হান্নান	আবদুল হান্নান	চাপতা	হান্নান
16.	মো: বাবুল আলী	মিজানুল ইসলাম	ঘোনাপাড়া	বাবুল আলী
17.	আবদুল মোস্তাফিজ	মোস্তাফিজ মোস্তাফিজ	চাপতা	আবদুল মোস্তাফিজ
18.	সফদুল কবির	আবদুল আলী কবির	ঘোনাপাড়া	সফদুল কবির
19.	ডেবিড সফদুল কবির 02926090882	সফদুল মালিক কবির	চাপতা	ডেবিড
20.	আবদুল মোস্তাফিজ	সফদুল মোস্তাফিজ	ঘোনাপাড়া	আবদুল মোস্তাফিজ

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	ହେମାକ୍ଷିତ	ଜାମିତି ଆନିକ୍ଷ	ଇକ୍ସମୁଲ ପୁର	ହେମାକ୍ଷିତ
22.	ଲାସନୀ	ଭାରତୀୟ ହୋମେନ	ଇକ୍ସମୁଲ ପୁର	ଲାସନୀ
23.	ଜ୍ୟୋତ୍ସ୍ନା	ଜାମି: ଭାରତୀୟ ହୋମେନ	ଇକ୍ସମୁଲ ପୁର	ଜ୍ୟୋତ୍ସ୍ନା
24.	ଆସାନା ଘାଟୁନ	ଜାମି: ଭାକୁଳ କାଠିକ	ଧନେନି	ଆସାନା
25.	ଶ୍ରୀମା	ଜାମି: ଚନ୍ଦ୍ରବିଜୟ	ଇକ୍ସମୁଲ ପୁର	ଶ୍ରୀମା
26.	ଫାତମା	ଜାମି: ନାମାନ	ଜୟନଗର	ଫାତମା
27.	ଜୟନ୍ତୀ	ଜାମି: ଇନ୍ଦ୍ରକାନ୍ତ	"	ଜୟନ୍ତୀ
28.	ଆସିନା	ଜାମି: ହରିକାନ୍ତ	ଇକ୍ସମୁଲ ପୁର	ଆସିନା
29.	ଆସିନା	ଜାମି: ଭାନୁ ବଞ୍ଚର	ଜୟନଗର	ଆସିନା
30.	ବେନେନା	ଜାମି: ଭଗବତ	ଜୟନଗର	ବେନେନା
31.	ବେନେନା	ଜାମି: ଶିବାନ	ଜୟନଗର	ବେନେନା
32.	ଆସିନା ଆସିନା ଘାଟୁନ	ପି: ଭଗବତ	ଇକ୍ସମୁଲ	ଆସିନା
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Margenda Akters
 Ma
 29/11/2014

Focus Group Discussion (FGD):

Name of Project: Bamankhali Barnali

Date: 01.12.2014

Location: Maijpara Union, Vill: Baranbar,

Participants of FGD: UP2: Narail Sadar, Dist: Narail

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	কমল আশিন মিকদার 01724027768	শ্রী জামিল মিকদার	বোলাসারা	মো: কমল আশিন মিকদার
2.	নিকবন মল্লা 01745656634	শ্রী: নান মিয়া মল্লা	"	নিকবন মল্লা
3.	সুপ্রভাটিন জামান 01720519425	শ্রী: আবুল হাওর	"	মো: সুপ্রভাটিন জামান
4.	মো: বাবুল মল্লা 01727300634	আকবর মল্লা	"	মো: বাবুল মল্লা
5.	মো: বাবুল মল্লা 01718447197	সুপ্রভাটিন	"	মো: বাবুল মল্লা
6.	মো: দার শাহ 01710170225	শ্রী: লক্ষ্মণ শাহ	"	পাঠান
7.	মো: সোহাগ মল্লা 01783553375	শ্রী: হুসন মল্লা	"	SOKIYAL
8.	মো: আব্বাস মল্লা 01963422188	মো: আব্বাস মল্লা	"	Sukib
9.	মো: আব্বাস মল্লা 01746-480249	মো: আব্বাস মল্লা	"	সুপ্রভাটিন
10.	মো: আব্বাস মল্লা	শ্রী: নূরুল হক মল্লা	"	আব্বাস
11.	মো: আব্বাস মল্লা	শ্রী: আব্বাস মল্লা	"	সুপ্রভাটিন
12.	মো: আব্বাস মল্লা 01725847026	শ্রী: আব্বাস মল্লা	"	সুপ্রভাটিন
13.	মো: আব্বাস মল্লা 01724027768	শ্রী: আব্বাস মল্লা	"	সুপ্রভাটিন
14.	মো: আব্বাস মল্লা 01731278280	মো: আব্বাস মল্লা	"	সুপ্রভাটিন
15.	এম এম. মাহবুব মুর্শেদ 01717425518	মো: মাহবুব মুর্শেদ	বোলাসারা	মো: মাহবুব মুর্শেদ
16.	মো: মাহবুব মুর্শেদ 01717425518	মো: মাহবুব মুর্শেদ	বোলাসারা	মো: মাহবুব মুর্শেদ
17.	মো: মাহবুব মুর্শেদ 01721535906	শ্রী: মাহবুব মুর্শেদ	বোলাসারা	মো: মাহবুব মুর্শেদ
18.	মো: আব্বাস মল্লা 01728431141	শ্রী: আব্বাস মল্লা	"	মো: আব্বাস মল্লা
19.	মো: আব্বাস মল্লা	শ্রী: আব্বাস মল্লা	"	মো: আব্বাস মল্লা
20.	মো: আব্বাস মল্লা 01944-244574	শ্রী: আব্বাস মল্লা	বোলাসারা	মো: আব্বাস মল্লা

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	মো: আবুল হকাম আবুল 01722-872757	মো: মোহাম্মদ হোসেন	শ্রীহরিপুর	Abul
22.	মো: ইজাহার আমিন	মৃত: জয়নাল মাকসুদ	u	ইজাহার আমিন
23.	মো: আব্দুল হালিম 01729-849736	মো: আবুল হালিম	u	Abul
24.	সমিহা সানা রাসম	স্বামী: বাবুল হাফিজ	u	সমিহা
25.	মোছা: মোছা আশরাফ	স্বামী: মোছা আবুল হোসেন	u	আশরাফ
26.	সুফিয়া	মিঃ: মাহমুদুল হক	u	সুফিয়া
27.	সুফিয়া	মিঃ: মাহমুদুল হক মাতা: লুৎফা বেগম	u	সুফিয়া
28.	সুফিয়া আশরাফ	স্বামী: আবুল হোসেন		সুফিয়া আশরাফ
29.	সুফিয়া আশরাফ	স্বামী: আবুল হোসেন		সুফিয়া
30.	মো: মোছা আশরাফ			মোছা
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Focus Group Discussion (FGD):

Name of Project: Barmankhali Barzali

Date: 1-12-14

Location: Amuria

Union: Kuchiamorza

Upz: Magura Sadar Dist: Magura

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	আব্দুল হামিদ	আব্দুল আলম	আমুড়িয়া	আব্দুল হামিদ
2.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
3.	মো: মিল্লি	হুমায়ুন	"	মো: মিল্লি
4.	আব্দুল হামিদ	শাহেদুল ইসলাম	"	আব্দুল হামিদ
5.	মো: আব্দুল হামিদ 01729978171	আব্দুল হামিদ	"	আব্দুল হামিদ
6.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
7.	আব্দুল হামিদ 01932998846	আব্দুল হামিদ	"	আব্দুল হামিদ
8.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
9.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
10.	মো: আব্দুল হামিদ 018223925122	আব্দুল হামিদ	"	মো: আব্দুল হামিদ
11.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
12.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
13.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
14.	মো: আব্দুল হামিদ 01771979127	আব্দুল হামিদ	"	আব্দুল হামিদ
15.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
16.	আব্দুল হামিদ 0183971135	আব্দুল হামিদ	"	আব্দুল হামিদ
17.	আব্দুল হামিদ 01865986186	আব্দুল হামিদ	"	আব্দুল হামিদ
18.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
19.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ
20.	আব্দুল হামিদ	আব্দুল হামিদ	"	আব্দুল হামিদ

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	মো: বেদাধিকারী 01774 928636	শ্রী. বসন্তা/ন	আমুড়িয়া	বেদাধিকারী
22.	মো: কামাল 01725 032186	শ্রী. কামাল		কামাল
23.	শ্রী. কামাল 01773 976493	শ্রী. মোহাম্মদ		কামাল
24.	শ্রী. কামাল 01713 915627	শ্রী. কামাল		কামাল
25.	মো: কামাল	মো: কামাল		কামাল
26.	মো: কামাল	মো: কামাল		কামাল
27.	মো: কামাল	মো: কামাল		কামাল
28.	কামাল 01857 006221	কামাল		কামাল
29.	মো: কামাল	মো: কামাল		কামাল
30.	মো: কামাল 01856 506267	মো: কামাল		কামাল
31.	মো: কামাল 01713 914288	মো: কামাল		কামাল
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Focus Group Discussion (FGD):

Name of Project: বামনঘাণী বর্নাণী

Date: ০১ - ১২ - ২০১৭

Location: চৌধুরাণী, উপ-কানিধা, পি: অশ্বাশ্বমপুর, অসুড়া

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	মো: বহিমা খাতুন (মো: ০২৭২৮২২৬৫৬৪)	মো: কামরুজ্জামান	গ্রাম: পুন্ড্র, পো: পুন্ড্র, কানিধা, অসুড়া	[Signature]
2.	ব্রজা ইয়াসমিন ০২৭৪৬০২৬০৭০	মোহাম্মদ আলী	গ্রাম-চৌধুরাণী, "	ব্রজা
3.	আব্দুল মান্নান ০২৮৫৪৭৪৪৮০২	শ্রী. আব্দুল মান্নান মোল্লা	গ্রাম- চৌধুরাণী, "	আব্দুল মান্নান
4.	নামিতা আশা ০২৭৫২০৬০৬৭০	শ্রী. বাহাদুর আলী আশা	গ্রাম - ১	নামিতা
5.	মো: সুবেদ আলী	মো: শফিক আলী বিহার	গ্রাম- বামনঘাণী, পো-শফিক	[Signature]
6.	বাহিনুর ০২৮৪৬৭০৭০২২০	শ্রী: কল্যাণীয়া সিবদান	গ্রাম- চৌধুরাণী	বাহিনুর
7.	মো: ব্রজা খাতুন ০২৮২৮৪৫৩৪৬৭০	মুন্ডুর মোল্লা	গ্রাম-চৌধুরাণী	ব্রজা
8.	জহুর আলী	শ্রী শাহজাহান আলী বিহার	গ্রাম- বামনঘাণী, পো-শফিক	জহুর আলী
9.	সুলতান	শ্রী বশির আলী	গ্রাম- বামনঘাণী, পো-শফিক	সুলতান
10.	মির্জা খাতুন ০২৭৬৫৫২৮৬৩	মো: মাহমুদ আলী বিহার	গ্রাম- চৌধুরাণী, পো-পুন্ড্র	মির্জা
11.	মহম্মদ হুসাইন ০২৭৬৫২০৪৬৪৪	মাহম্মদ হুসাইন	গ্রাম- চৌধুরাণী, পো-পুন্ড্র	মহম্মদ হুসাইন
12.	বাহিনুর আশা ০২৭২৬৫৫৬৬৭০	শ্রী মাহম্মদ আলী আশা	গ্রাম- চৌধুরাণী, পো-পুন্ড্র	বাহিনুর আশা
13.	মো: নবীহা হুসাইন	নাজিব মোল্লা	গ্রাম- চৌধুরাণী, পো-পুন্ড্র	নবীহা হুসাইন
14.	মো: মোল্লা আলী হুসাইন	মো: আলী হুসাইন	গ্রাম- চৌধুরাণী, পো-পুন্ড্র	মো: মোল্লা আলী হুসাইন
15.	আব্দুল মান্নান ০২৭২৬৫৫০৫৭৬	মুন্ডুর আলী	গ্রাম - ১	আব্দুল মান্নান
16.	নবীহা হুসাইন ০২৭৬০২৪৬৬৬৬	মোহাম্মদ মোল্লা	১	নবীহা হুসাইন
17.	আব্দুল মান্নান ০২৮৬০২৪০২৮০	মোহাম্মদ আলী বিহার	গ্রাম- বামনঘাণী, পো-শফিক	আব্দুল মান্নান
18.	মো: মোল্লা আলী ০২৭২২৬৪২৭৬৬	শ্রী. মোল্লা আলী	গ্রাম, চৌধুরাণী	মো: মোল্লা আলী
19.	মাহম্মদ হুসাইন ০২৮৫২০৭৫৫০৪	মাহম্মদ হুসাইন	চৌধুরাণী	মাহম্মদ হুসাইন
20.	মো: মোল্লা আলী (মো: ০২৭৬০২৪৬৬৬৬)	শ্রী মাহম্মদ আলী বিহার	বামনঘাণী, পো-শফিক	মো: মোল্লা আলী

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
21.	ପିତ୍ର ବଞ୍ଚନା ବିକାଶ (ଫୋନ)	କୃତ ହାଜାମି ଲୋକ ବିକାଶ	ବାଇସମାଲୀ ଓଡ଼ିଶା ଗଞ୍ଜାମ ଜିଲ୍ଲା	ପିତ୍ର ବଞ୍ଚନା ବିକାଶ
22.	ପ୍ରମୋଦ ଡେବୁ	ଶୁକ୍ଳପାଦ ଡେବୁ	ବାଇସମାଲୀ ଓଡ଼ିଶା ଗଞ୍ଜାମ ଜିଲ୍ଲା	ପ୍ରମୋଦ ଡେବୁ
23.	ସବିତେଶ	କୃତ ଡେବୁ	ବାଇସମାଲୀ ଓଡ଼ିଶା ଗଞ୍ଜାମ ଜିଲ୍ଲା	ସବିତେଶ
24.	ଶ୍ରୀନାଥ	ଶୁକ୍ଳପାଦ	ବାଇସମାଲୀ	ଶ୍ରୀନାଥ
25.	ଅହମଦ	ଆବୁଲ ଖାଲିକ	ଘୋଷଗଡ଼ି	ଅହମଦ
26.	ଡା. ଅକ୍ଷୟ ବଞ୍ଚିନୀ	ଆନନ୍ଦ ଚନ୍ଦ୍ର ଅହମଦ	ଘୋଷଗଡ଼ି, ଗଞ୍ଜାମ	ଅକ୍ଷୟ
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Focus Group Discussion (FGD)

Name of Project: Arial Beel Date: 15-11-2013
 Location: Vill: Salua, Union: Fulshara, Upzila: Chocagram, Dist: Jessore
 Participants of FGD:

Sl. No.	Name of Respondent with mobile no. (if any)	Father's Name	Address	Signature
1	মো: মুজিব মোল্লাহ 01731790244	মো: মুজিব মোল্লাহ	সালুয়া গ্রাম সালুয়া মজরা	
2	মো: জামিল আহমেদ 01740514008	মো: মীর হোসেন বিক্রম	সালুয়া গ্রাম মুন্সি মজরা	
3	মো: মুনীর হোসেন 01753103894	মো: মোসলেম আহমেদ	"	
4	সাবিতা 01758841039	মো: নাজিমুদ্দিন (স্বামী)	"	
5	সাজিদা 01714850298	মো: সাজিদুল বিক্রম	"	
6	মো: আলতাফ হোসেন 01723456564	মুন্সি: আমজাদ আলী	"	
7	আজমুল ইসলাম 01725537345	মুন্সি: শামিমুদ্দিন	"	
8	মো: মীর আহমেদ 01719626892	মুন্সি: মীর আহমেদ	"	
9	আলমাসাই ওয়াদদার 01726933715	মুন্সি: বদর উদ্দিন	"	
10	মো: বরুণ হোসেন 01725535855	মো: নূর বকর	"	
11	মো: মানবুল ইসলাম 01740878226	মো: আহি কবির ইসলাম	"	
12	মো: জাহেদা রমান 01728915316	মো: আবদুল আল মাসুদ	"	
13	মো: রুশনু কুদ্দুস 0122316190	মো: আব বকর	"	
14	মো: সাইজান মাসুদ 01746102431	মুন্সি: মুদদার আলী মাসুদ	"	
15	মো: আবদুল আমাদ 01720459847	মুন্সি: মিদদার আলী বিক্রাম	"	
16	মো: হাদিসা 01764243846	মুন্সি: মিসাদিক খোন্দকার	"	
17	মো: আরু জাহেদ 01749851058	মো: আবদুল হাকিম	"	
18	মো: মাহবুব আলী 01729905073	মুন্সি: কালু মীরদার মো: মাহবুব আলী	"	
19	মো: মাহবুব 01717125545	মুন্সি: কালু মীরদার	"	
20	মুন্সি: মুনীর 01719663209	মুন্সি: আমানুল্লাহ মাসুদ	"	

Focus Group Discussion (FGD):

Name of Project:

Date:

Location:

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1	আবুউদ্দীন	শ্রী: মিন (সোহাওয়ার)	সোহাওয়ার গ্রাম সোহাওয়ার মাজার	আবুউদ্দীন
2	তরিকুল ইসলাম 01672366129	শ্রী: রুজব আলী	~	তরিকুল
3	রুশা আক্তার	শ্রী: মাহমুদ মন্ডল (স্বামী)	~	রুশা আক্তার
4	শ্রী: কানাম 01623722968	শ্রী: মাহুউদ্দীন	~	কানাম
5	রেকসনা আক্তার 01749159844	শ্রী: আব্দুল মান্নান	~	রেকসনা
6	শ্রী: মাহুউদ্দীন	শ্রী: রুজব আলী মন্ডল	~	আবুউদ্দীন
7	শ্রী: আবদুল হান্নান 01255416656	শ্রী: সোহান মন্ডল	~	হান্নান
8	রেকসনা 01768095280	শ্রী: মাহুউদ্দীন (স্বামী)	~	রেকসনা
9	ফাহোজা 01746102431	শ্রী: মাহুউদ্দীন (স্বামী)	~	ফাহোজা
10	আব্দুল ইসলাম 0177039948	শ্রী: রুজব আলী	~	আব্দুল ইসলাম
11	শ্রী: হাফিজ আলী 01742-882611	শ্রী: মাহুউদ্দীন বিশ্বাস	~	হাফিজ আলী
12	হান্নান	মাহুউদ্দীন মন্ডল	~	হান্নান
13	শ্রী: আনায়েব হাফিজ 01739914828	শ্রী: মাহুউদ্দীন ইসলাম	~	আনায়েব
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15/11/2014

Focus Group Discussion (FGD):

Name of Project: ~~Bhawalhati Bherkali~~ Arsal Beal Date: 29-11-19

Location: Vill: Dohore Magura; Union: Magura; Upazila: Thikargacha Dist: Jessore.

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	স্বাঃ আকলিয়া আতুন 01767898381	স্বাঃ বঃমান আলী	বড়র বাড়ি	আকলিয়া
2.	হালিমা আতুন 01988890059	ছানিকউদ্দিন	ডব্ব বাড়ি	হালিমা
3.	সামিমা আতুন	বঃর আলী	"	সামিমা
4.	আনোয়ারা	বাবর আলী	"	আনোয়ারা
5.	বিজিয়া	শিবাজুল ইসলাম	"	বিজিয়া
6.	কারিম	আব্দুল বিজিয়া	"	কারিম
7.	আব্দুল মঈন 01732099890	মুঃ আব্দুল মঈন	"	আব্দুল মঈন
8.	আব্দুল আলী	মুঃ আব্দুল আলী	"	আব্দুল আলী
9.	স্বাঃ জালালউদ্দিন 01763985396	মুঃ আব্দুল	"	জালাল
10.	স্বাঃ মঃ আলী 01731135427	মুঃ মুনালী মঈন	"	স্বাঃ মঃ আলী
11.	স্বাঃ আব্দুল আলী 029 ৩৩ ২২০৪৩৬	মুঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
12.	স্বাঃ আব্দুল আলী ০১৭৩৩৩০ ৫৫৩৩৬	মুঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
13.	স্বাঃ আব্দুল আলী ০১২৩০১৭৩৩ ২২	মুঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
14.	স্বাঃ আব্দুল আলী	মুঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
15.	আব্দুল আলী	স্বাঃ আলী	"	আব্দুল আলী
16.	আব্দুল আলী	মুঃ আব্দুল আলী	"	আব্দুল আলী
17.	স্বাঃ আব্দুল আলী ০২৩২৫৫৩৬২২	স্বাঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
18.	স্বাঃ আব্দুল আলী ০১৭৬২৩৫২৪৬০	স্বাঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
19.	স্বাঃ আব্দুল আলী ০২৭৪৬.৫৫৬৪২৪	স্বাঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী
20.	স্বাঃ আব্দুল আলী ০১৭২৪৩৫০০৩৭	স্বাঃ আব্দুল আলী	"	স্বাঃ আব্দুল আলী

Focus Group Discussion (FGD):

Name of Project: Sonamukhi - Bammandere

Date: 3/12/2014

Location: সাতিপাড়া, জয়ালখুনা, ঝারনা

Participants of FGD:

Sl. No.	Name of Respondent with mobile no (if any)	Father's Name	Address	Signature
1.	ইয়াবুল আলী 01731623640	হুত মোহাম্মদ আবদার	সাতিপাড়া জয়ালখুনা	ইয়াবুল আলী
2.	আব্দুল কাদের	হুত বাবু ঢালী	"	৭০/৬/১৪
3.	আহমদ	হুত নূরুল আলী	"	আহমদ
4.	আব্দুর রহিম	হুত ইনসাদ আলী	"	আব্দুর রহিম
5.	আব্দুর রহমান	হুত মুহাম্মদ আলী	"	আব্দুর রহমান
6.	কওদর আলী	হুত কোদর আলী	"	৫৩/৬/১৫
7.	আলী কাদের	দিলারী আলী	"	৭০/৬/১৪
8.	আহমদ আলী	আব্দুর আলী	"	আহমদ
9.	ইয়াবুল আলী	আব্দুর রহিম	"	ইয়াবুল আলী
10.	আব্দুর আলী 01951418470	হুত বাবু ঢালী	"	আব্দুর আলী
11.	আব্দুর আলী 01931279426	হুত আব্দুল আলী	"	আব্দুর আলী
12.	আহমদ	হুত আব্দুর আলী	"	আহমদ
13.	আব্দুর আলী 01950224047	আব্দুর আলী	"	আব্দুর আলী
14.	ইউনুস 01951418470	দাবিদ আলী	"	ইউনুস
15.	আব্দুর আলী 01951418470	আব্দুর আলী	"	আব্দুর আলী
16.	আব্দুর আলী	হুত আব্দুর আলী	"	আব্দুর আলী
17.	আব্দুর আলী	হুত আব্দুর আলী	"	আব্দুর আলী
18.	আব্দুর আলী	আব্দুর আলী	"	আব্দুর আলী
19.	আব্দুর আলী 01988470982	আব্দুর আলী	"	আব্দুর আলী
20.	আব্দুর আলী 01951418470	হুত আব্দুর আলী	"	আব্দুর আলী

Annex H2: List of Other Stakeholders Consulted

SL. No.	Name	Occupation/ Institution	Address & Contact No.
1	Md. Bazlul Haque	Government Service, Department of Public Health Engineering(DPHE)	Superintending Engineer, DPHE, Faridpur, Phone/Cell: 0631-66139
2	Mir Abdus Sahid	Government Service, DPHE	Executive Engineer, DPHE, Jessore, Phone/Cell: 0421-63728
3	Mohammad Al Amin	Government Service, DPHE	Executive Engineer, DPHE, Narail, Phone/Cell: 0481-62348
4	Munshi Md. Hasanuzzaman	Government Service, DPHE	Executive Engineer, DPHE, Magura, Phone/Cell: 0488-62469
5	A.H.M.Khalequr Rahman Hasnat	Government Service, DPHE	Executive Engineer, DPHE, Rajbari, Phone/Cell: 0641-65428
6	Bidhan Chandra Dey	Government Service, DPHE	Executive Engineer, DPHE, Gopalganj, Phone/Cell: 0668-55590
7	Md. Shahidul Islam	Government Service, Department of Agriculture Extension (DAE)	Upazila Agriculture officer, Narail Sadar, Phone/Cell: 01712782415
8	Md. Zahidul Rahaman	Government Service, DAE	Upazila Agriculture officer, Jikargacha, Jessore, Phone/Cell: 01718233201
9	A .K.M Shahabuddin Ahmed	Government Service, DAE	Upazila Agriculture officer, Chaugacha, Jessore, Phone/Cell:
10	Md: Khalid Shaifulla	Government Service, DAE	Upazila Agriculture officer, Jessore Sadar, Phone/Cell: 01712592991
11	Mr. Haripada Mandal	Government Service, Department of Fisheries	District Fisheries officer, Narail, Phone/Cell: 01922755646
12	Md: Enamul Haque	Government Service, Department of Fisheries	Upazila Senior Fisheries officer, Narail Sadar, Phone/Cell: 01716601578
13	Mr. Monish Mandal	Government Service, Department of Fisheries	District Fisheries Office, Jessore, Cell: 01715346829
14	Md: Shafuiddin	Government Service, Department of Fisheries	Upazila Fisheries officer, Chaugacha, Jessore, Phone/Cell: 01726160444
15	Md: Monirul Islam	Government Service, Department of Fisheries	Upazila Fisheries officer, Jikargacha, Jessore, Phone/Cell: 01712583614
16	Mr. Bishwajit Bayragi	Government Service, Department of Fisheries	Upazila Fisheries officer, Jessore Sadar, Phone/Cell: 01711068069
17	Md. Moyeen Uddin Khan	Government Service, Bangladesh Forest Department	Divisional Forest Officer, Jessore Social Forest Division, Cell: 01818619161
18	Ms. Amita Mandal	Government Service, Bangladesh Forest Department	Assistant Conservator of Forests, Jessore Social Forest Division, Cell: 01711385277
19	Alhaj Ajar Ali S/O. Eusuf Ali	Social Work	Kagajpukur Bazer, Sharsha, Jessore. Cell: 01739085807
20	Sujon Rahman S/O. Md. Majanur Rahman	Gher Owner	Boalia, Bazer. Cell : 01921111959
21	Md. Abdul Basar	Fisherman	Sakharipata, Bahadurpur, Jessore Cell : 01917586496
22	Indrojit Biswas	Fisherman	Bejiatola, Jhikorgacha, Jessore Cell: 01866535431
23	Tulsi Das	Fisherman	Sadipur, Jhikorgacha, Jessore Cell:01918384255
24	Provas Biswas	Fisherman	Kuchimara, Amulia, Magura Cell: 01916758479
25	Apurba Biswas	Fisherman	Modhya Pollima, Narail Cell: 01734620361
26	Bishna Pada Biswas	Fisherman	Bhatiapara Bazar, Kashiani, Gopalganj Cell: 01725367292
27	Gpal Chandra Biswas	Fisherman	Bhatiapara Bazar, Kashiani, Gopalganj Cell: 01796420876
28	Bijan Sarkar	Fisherman	Kashiani Bazar, Kashiani, Gopalganj Cell: 01724907569
29	Abdul Jalil	Farmer	Krishna nager, Jhikargacha, Jessore
30	Md. Mofazzal	Farmer	Cell: 01777284092
31	Md. Sohag Hossain	Farmer	Cell. 01924666415
32	Nil Komal Shikdar	Farmer	Purulia, Kashiani, Gopalganj Cell: 01759156101
33	Liakat Hossain Miaah	Farmer	Dhalashari, Kashiani, Gopalganj.

SL. No.	Name	Occupation/ Institution	Address & Contact No.
			Cell: 01923819978
34	Nazrul Islam S/O. Lutfar Rahman	Farmer	Borashpur, Kashiani, Gopalganj Cell: 01751753825
35	Wadud Matabbar	Farmer	Purbo Hasemdia, Kashiani, Gopalganj
36	Amin Zomaddar S/O. Khalik Zomadder	Farmer	Sankochnali, Kashiani, Gopalganj Cell: 01724639352
37	Kalam Bapari S/O. Abdul Hasem Bapari	Farmer	Ghoradah, Pandanga, Faridpur Cell: 01745331265
38	Budruddin bapari S/O. Abdul Wahab Bapari	Farmer	Cell: 01720-254153
39	Abdul Mannaf	UP Chairman	Dihi, Sharsha, Jessore Cell:01711010431
40	Kamal Hossain	UP Chairman	Lakhanpru, Sharsha, Jessore Cell:01744935899
41	Mijanur Rahman	UP Chairman	Bahadurpur, Sharsha, Jessore Cell:01721856877
42	Bazlur Rahman	UP Chairman	Benapole, Sharsha, Jessore Cell:01736824381
43	Abdul Gaffar	UP Chairman	Putkhali, Sharsha, Jessore Cell: 01711309035
44	Ainal Haque	UP Chairman	Ulashi, Sharsha, Jessore Cell:01925828079
45	Sohrab Hossain	UP Chairman	Sharsha, Jessore Cell:01711191046
46	Elias Kabir	UP Chairman	Bagachra, Sharsha, Jessore Cell:01711117428
47	Alim Reza Bappi	UP Chairman	Nijampur, Sharsha, Jessore Cell:01734215123
48	Abdur Rahim Molla	UP Chairman	Matipara, Rajbari Sadar, Rajbari Cell: 01710911068
49	David Suranjan Biswas	UP Chairman	Bhadulia Ghonapara, Kashiani, Gopalganj Cell: 01718375442
50	Ramandho Pawl	UP Member	Bahadurpur, Baliakandi, Rajbari. Cell: 01723296622

Annex I: National Environmental Quality Standards of Bangladesh

At present there are environmental standards in operation in Bangladesh, promulgated under the ECR of 1997. There are standards prescribed for varying water sources; ambient air; noise; odour; industrial effluent and emission discharges; and vehicular emissions, etc. The standards, commonly known as Environmental Quality Standards (EQS), are legally binding. The Bangladesh standards for ambient air, noise, odour, sewage, industrial effluent and emission are furnished here in (Tables I.1 to I.7).

Table I.1: National Standard for Inland Surface Water
(BOD = biological oxygen demand, mg/l = milligram per litre),

Best Practice based classification	pH	BOD (mg/l)	Dissolved Oxygen (mg/l)	Total Coliform Number/100
a. Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activity	6.5-8.5	3 or less	5 or more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5-8.5	6 of less	6 or more	5000 or less
d. Water usable by fisheries	6.5-8.5	6 of less	5 or more	---
e. Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation	6.5-8.5	10 or less	5 or more	1000 or less

Notes: (1). In water used for phisiculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
(2). Electrical conductivity for irrigation water – 2250 μ mhos/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Source: Department of Environment (DOE)

Table I.2: National Standard for Drinking Water

Parameter	Unit	Standards	Parameter	Unit	Standards
1. Aluminum	mg/L	0.2	26. Hardness (as CaCO ₃)	mg/L	200 – 500
2. Ammonia (NH ₃)	mg/L	0.5	27. Iron	mg/L	0.3 – 1.0
3. Arsenic	mg/L	0.05	28. Kjeldhl Nitrogen (total)	mg/L	1
4. Barium	mg/L	0.01	29. Lead	mg/L	0.05
5. Benzene	mg/L	0.01	30. Magnesium	mg/L	30 – 35
6. BOD5 20°C	mg/L	0.2	31. Manganese	mg/L	0.1
7. Boron	mg/L	1.0	32. Mercury	mg/L	0.001
8. Cadmium	mg/L	0.005	31. Manganese	mg/L	0.1
9. Calcium	mg/L	75	32. Mercury	mg/L	0.001
10. Chloride	mg/L	150 – 600*	33. Nickel	mg/L	0.1
11. Chlorinated alkanes			34. Nitrate	mg/L	10
carbontetrachloride	mg/L	0.01	35. Nitrite	mg/L	<1
1.1 dichloroethylene	mg/L	0.001	36. Odor	mg/L	Odorless
1.2 dichloroethylene	mg/L	0.03	37. Oil and grease	mg/L	0.01
tetrachloroethylene		0.03	38. pH	--	6.5 – 8.5
trichloroethylene		0.09	39. Phenolic compounds	mg/L	0.002
12. Chlorinated phenols			40. Phosphate	mg/L	6
pentachlorophenol	mg/L	0.03	41. Phosphorus	mg/L	0
2.4.6 trichlorophenol	mg/L	0.03	42. Potassium	mg/L	12
13. Chlorine (residual)	mg/L	0.2	43. Radioactive materials (gross alpha activity)	Bq/L	0.01
14. Chloroform	mg/L	0.09	44. Radioactive materials (gross beta activity)	Bq/L	0.1
15. Chromium (hexavalent)	mg/L	0.05	45. Selenium	mg/L	0.01
16. Chromium (total)	mg/L	0.05	46. Silver	mg/L	0.02
17. COD	mg/L	4	47. Sodium	mg/L	200
18. Coliform (fecal)	n/100ml	0	48. Suspended particulate matters	mg/L	10
19. Coliform (total)	n/100 ml	0	49. Sulfide	mg/L	0
20. Color	Hazen unit	15	50. Sulfate	mg/L	400
21. Copper	mg/L	1	51. Total dissolved solids	mg/L	1000
22. Cyanide	Mg/L	0.1	52. Temperature	°C	20-30
23. Detergents	mg/L	0.2	53. Tin	mg/L	2
24. DO	mg/L	6	54. Turbidity	JTU	10
25. Fluoride	mg/L	1	55. Zinc	mg/L	5

BOD = biological oxygen demand, mg/l = milligram per litre, ml = millilitre

Notes: In coastal area 1000. Reference: Bangladesh Gazette, Addendum, August 28, 1997.

Source: Department of Environment (DOE)

Table I.3: Bangladesh Standards for Ambient Air Quality Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Micrograms /cubic meters)

Sl. No.	Area	Suspended Particulate Matters (SPM)	Sulfur Dioxide (SO ₂)	Carbon Monoxide (CO)	Oxides of Nitrogen (NO _x)
Ka	Industrial and mixed	500	120	5000	100
Kha	Commercial and mixed	400	100	5000	100
Ga	Residential and rural	200	80	2000	80
Gha	Sensitive	100	30	1000	30

Notes:

- (1) Sensitive area includes national monuments, health resorts, hospitals, archaeological sites, educational institutions and other government designated areas (if any).
- (2) Any industrial unit located not in a designated industrial area will not discharge such pollutants, which may contribute to exceed the ambient air quality above in the surrounding areas of category 'Ga' and 'Gha'.
- (3) Suspended particulate matters mean airborne particles of diameter of 10 micron or less.

Source: Department of Environment (DOE). Schedule-2, Rule 12, Environment Conservation Rules of 1997 (Page 3123, Bangladesh Gazette, 28 August 1997).

Table I.4: Bangladesh Standards for Noise

Sl. No.	Area Category	Standards Values (all values in dBA)	
		Day	Night
Ka	Silent zone	45	30
Kha	Residential area	50	40
Ga	Mixed area (basically residential and together used for commercial and industrial purposes)	60	50
Gha	Commercial area	70	60
Umma	Industrial area	75	70

Notes:

1. Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2. Night time is reckoned as the time between 9 p.m. to 6 a.m.
3. Silent zones are areas up to a radius of 100 meter around hospitals, educational institutions or special establishments declared or to be declared as such by the Government. Use of vehicular horn, other signals and loudspeakers is prohibited in silent zones.

Source: Department of Environment (DOE). Schedule 4, Rule-12, Environment Conservation Rules, 1997. (Page 3127, Bangladesh Gazette, 28 August 1997)

Table I.5: Bangladesh Standards for Odour

Notes:

Parameters	Unit	Values
Acetaldehyde	PPM	0.5-5
Ammonia	PPM	1-5
Hydrogen Sulfide	PPM	0.02-0.2
Methyl Disulfide	PPM	0.009-0.1
Methyl Mercaptan	PPM	0.02-0.2
Methyl Sulfide	PPM	0.01-0.2
Styrene	PPM	0.4-2.0
Trimethylamine	PPM	0.005-0.07

- (1) Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters): $Q = 0.108 \times H^2 \text{ cm}$, Where Q – gas emission rate (Nm³/hour), H – effective height of the outlet (m), cm – above mentioned standard (ppm)
- (2) Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Source: Department of Environment (DOE). Schedule –8, Rule-12, Environment Conservation Rules, 1997. (Page 3130, Bangladesh Gazette, 28 August 1997).

Table I.6: Bangladesh Standards for Sewage Discharge

mg/l = milligram per litre

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	35
Suspended Solids (SS)	mg/l	100
Temperature	oC	30
Coliforms	number/100ml	1000

Notes: (1). These standards are applicable for discharge into surface and inland water bodies.

(2). Chlorination is to be done before final discharge.

Source: Department of Environment (DOE). Schedule-9, Rule-13, Environment Conservation Rules, 1997 (Page-3131 of Bangladesh Gazette of 28 August 1997)

Table I.7: Bangladesh Standards for Industrial and Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public Sewer to Secondary Treatment Plant	Irrigable Land
1	Ammonical nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD ₅ at 20°C	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µsiemens/cm	1200	1200	1200
14	Total dissolved solids	mg/l	2100	2100	2100
15	Flouride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total kjeldahl nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet set	10
24	Oil and grease	mg/l	10	20	10
25	Phenolic compounds (as C ₆ H ₅ OH)	mg/l	1.0	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	(to be specified by Bangladesh Atomic Energy Commission)			
28	PH		6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	Mg/l	5	10	10
31	Total dissolved solids	Mg/l	2100	2100	2100
32	Temperature	°C (summer)	40	40	40
		°C (winter)	45	45	45
33	Suspended solids	Mg/l	150	500	200
34	Cyanide	Mg/l	0.1	2.0	0.2

Notes:

These standards will be applicable for all industries other than those which are specified under 'industrial sector specific standards'.

These standards will have to be compiled from the moment of trial production in case of industries and from the moment of the very beginning in case of projects.

These standards will have to be met at any point of time and any sampling. In case of need for ambient environment condition, these standards may be made stringent. Inland surface water will include drains, ponds, tanks, water bodies, ditches, canals, rivers, streams and estuaries. Public sewer means leading to full-fledged joint treatment facility comprising primary and secondary treatment. Land for irrigation means organized irrigation of selected crops on adequate land determined on the basis of quantum and characteristics of waste water. If any discharge is made into public sewer or on land which does not meet the respective definitions in notes 5 and 6 above, then the inland surface water standards will apply.

Source: Department of Environment. Schedule -10, Rule-13, Environment Conservation Rules, 1997 (Page 3132 – 3134 of Bangladesh Gazette of 28 August 1997) (translation from original Bengali).