Environmental Monitoring Report

Project No. 45207-002
1st Semiannual Report
For the period of July 2015 – June 2016

Bangladesh: Irrigation Management Improvement Project

Prepared by the Bangladesh Water Development Board for the People's Republic of Bangladesh and the Asian Development Bank.

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

Ministry of Water Resources

Bangladesh Water Development Board

ADB Loan: 3135-BAN (SF)

ENVIRONMENT MONITORING REPORT

Period: July, 2015 - June, 2016

June, 2016

ACRONYMS AND ABBREVIATIONS

ADB -	Asian Development Bank
BADC-	Bangladesh Agriculture Development Corporation
BOD-	Biological Oxygen Demand
BOQ-	Bill of Quantity
BWDB -	Bangladesh Water Development Board
CAS-	Catch Assessment Survey
C-IMO-	Construction phase Irrigation Management Operator
COD-	Chemical Oxygen Demand
DAE-	Department of Agricultural Extension
DFR-	Draft Final Report
DO-	Dissolved Oxygen
DoC-	Department of Cooperatives
DOE -	Department of Environment
DOF-	Department of Fisheries
DoPHE -	Department of Public Health Engineering
DTW -	Deep Tube Well
EAP-	Environmental Action Plan
EC-	Electrical Conductivity
ECA-	Environment Conservation Act
ECC-	Environmental Clearance Certificate
ECR-	Environment Conservation Rules
EEC-	European Economic Commission
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 -	Food and Agricultural Organization
FCDI -	Flood Control, Drainage and Irrigation
FD -	Forest Department
FGD -	Focus Group Discussion
FPCO-	Flood Planning Coordination Organization
GAP-	Gender Action Plan
GI-	Galvanized Iron
GKIP-	Ganges Kobodak Irrigation Project
GRM -	Grievance Redress Mechanism
GOB -	Government of Bangladesh
GPP -	Guidelines for People's Participation
GPWM-	Guidelines for Participatory Water Management
GRC -	Grievance Redress Centre
ICC-	Implementation Coordination Committee
IDA-	International Development Agency
IEC -	Important Environmental Components
IEE -	Initial Environmental Examination
IMIP-	Irrigation Management Improvement Project
IMO-	Irrigation Management Operator
IMED-	Implementation, Monitoring and Evaluation Division
IPM -	Integrated Pest Management
ISPAN-	Irrigation Support Project for Asia and Near East
IWM -	Institute of Water Modeling

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
M-IMO-	Management phase Irrigation Management Operator
MIP-	Muhuri Irrigation Project
MOA-	Ministry of Agriculture
MOEF-	Ministry of Environment and Forest
MOM-	Management Operation and Maintenance
MoU-	Memorandum of Understanding
MOWR-	Ministry of Water Resources
Mt -	Metric Ton
NGO -	Non Governmental Organization
NWMP-	National Water Management Plan
NWPo -	National Water Policy
O&M -	Operation and Maintenance
PAP -	Project Affected Person
PD-	Project Director
pH-	Hydrogen Ion concentration in a solution
PHE-	Public Health Engineering
PIU -	Project Implementation Unit
PMDC-	Project Management & Design Consultants
PMU-	Project Management Unit
PMO-	Project Management Office
POPs-	Persistent Organic Pollutants
PPP-	Public Private Partnership
PPTA -	Project Preparation Technical Assistance
PRRA-	Participatory Rapid Rural Appraisal
PSC -	Project Steering Committee
PVC-	Poly Vinyl Chloride
PWD -	Public Works Department
RAP-	Resettlement Action Plan
RCC-	Reinforced Cement Concrete
REB-	Rural Electrification Board
RF-	Resettlement Framework
RSDP -	Resettlement and Social Development Plan
SPS-	Safeguard Policy Statement
SIDA-	Swedish International Development Agency
STW -	Shallow Tube Well
SWMC-	Surface Water Modeling Center
TBIP-	Teesta Barrage Irrigation Project
UNDP -	United Nations Development Program
WARPO-	Water Resources Planning Organization
WUO	Water Users Organization
WUG-	Water Users Group
WUA-	Water Users Association
WMO-	Water Management Organization
WMG-	Water Management Group
WMA-	Water Management Organization
WHO -	World Health Organization

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1st Semiannual Environmental Monitoring Report

Executive Summary

Environmental and Social Safeguard is the most crucial issue in project funding and implementation. ADB is seriously concerned about this issue and strictly ensure that any development project financed by them will not affect the natural and social environment of the borrower/loan recipient country. According to ADB's Safeguard Policy Statement (SPS-2009) borrowers need fulfill the safeguard policy requirements. So the Environment Management Plan (EMP) for the concerned development project must be prepared, implemented, monitored and reported annually /semiannually so that the project does not impart any serious adverse impact on the natural and social environment. Muhuri Irrigation Project (MIP) under IMIP has been categorized as Category-B and an IEE is prepared to full fill the ADB's required. But according to Bangladesh Environment Act (1995) and Environment Conservation Rule-1997 it was categorized as Red Category and a detail Environmental Impact Assessment (EIA) was done to fulfill the GoB requirement as well as ADB's requirement. This 1st semiannual Environmental Monitoring Report is prepared by monitoring the EMP and following the Environmental Monitoring Plan described in that EIA report (Appendix-I & II). To meet ADB's reporting requirements (a) semi-annual Environmental Monitoring Report (in July) during construction and (b) annual Environmental Monitoring Report (in December) during operation are mandatory to submit ADB for disclosure.

The main components of MIP project are (a) rehabilitation of coastal embankment (22.4 km), (b) re-excavation of drainage/irrigation khals (480 km), (c) construction of Electricity distribution lines (180), (d) installation of irrigation water distribution underground pipelines (712 km) and (e) installation of Low Lift Pumps with prepaid meter (950). But only the first two physical works described in (a & b) has been started this year and only 5 km of embankment and 10 km of khals have been completed.

The project is expected to have generally positive impacts on the environment including (i) protection from tidal surge/ flood by construction of coastal embankments & water control structures, (ii) protection from salinity intrusion through water regulating structures thereby preventing land degradation; (iii) increased water use efficiency through retention surface water by storing in reservoir and distribution of both surface & ground water through a profuse networks of irrigation khals (canals) for cultivation in the dry seasons in the project areas; (iv) reduced water logging through drainage khals / structures and control measures and (v) diversification of cropping patterns and obtaining food security by providing year round irrigation water by modern and efficient prepaid metered pumps.

On the other hand, negative impacts identified include (i) possible exacerbation of downstream salinity intrusion due to water extraction from the rivers; (ii) obstruction of fish migration between the rivers and internal water bodies by regulators and other structures (including that past impacts when existing structures were placed); (iii) water quality deterioration due to agriculture intensification; and (iv) temporary impacts during construction of structures and embankments.

These will be mitigated through (i) implementation a continuous salinity monitoring and information sharing program at the project and downstream areas with promotion of coordinated

water extraction; (ii) introducing and promoting fish friendly operation of regulators with provision of fish culture opportunities to professional fisher folks, (iii) introducing integrated pest management and effective soil nutrient management as a part of agriculture extension; and (iv) ensuring safe and environmentally sound construction practices. These were incorporated in the EIA. At the field level contractors are responsible to implement prepared EMP for MIP. C-IMO, PIU and WUA are responsible for monitoring, supervision and enforcing the contractor to comply with the EMP, Environmental health and safety and national and international labor laws. Safeguard cell at PMU is responsible to oversee the whole process and verify the claims and grievances raised by community people/farmers if any and finally prepare and submit safeguard reports to ADB regularly for disclosure.

As the maximum physical works and entire operation works are left to start so most of the environmental parameters /indicators are not monitored. Because most of the adverse impacts will emerges during operation of the project. During this 6 month (January to June, 2016) only 5 km of embankment and 10 km of khals have been completed. So only (a) impacts during construction, (b) environmental health and safety compliance and (c) Felling/ cutting of trees have been monitored and results have been found satisfactory within limited monitoring arrangements except some a few issues stated in appendix-VII.

Project stakeholders of Bangladesh have basic knowledge of environmental compliance about safeguard issues. Proper training on Environmental Monitoring, Environmental Health and Safety compliance, International Labor law and concerned compliances provided to concerned safeguard personnel working in PMU-safeguard cell, C-IMO, PIU, WUA and Construction Contractor will develop their safeguard monitoring, implementation and reporting capacity (International Standard) in near future.

CHAPTER 1: PROJECT BACKGROUND

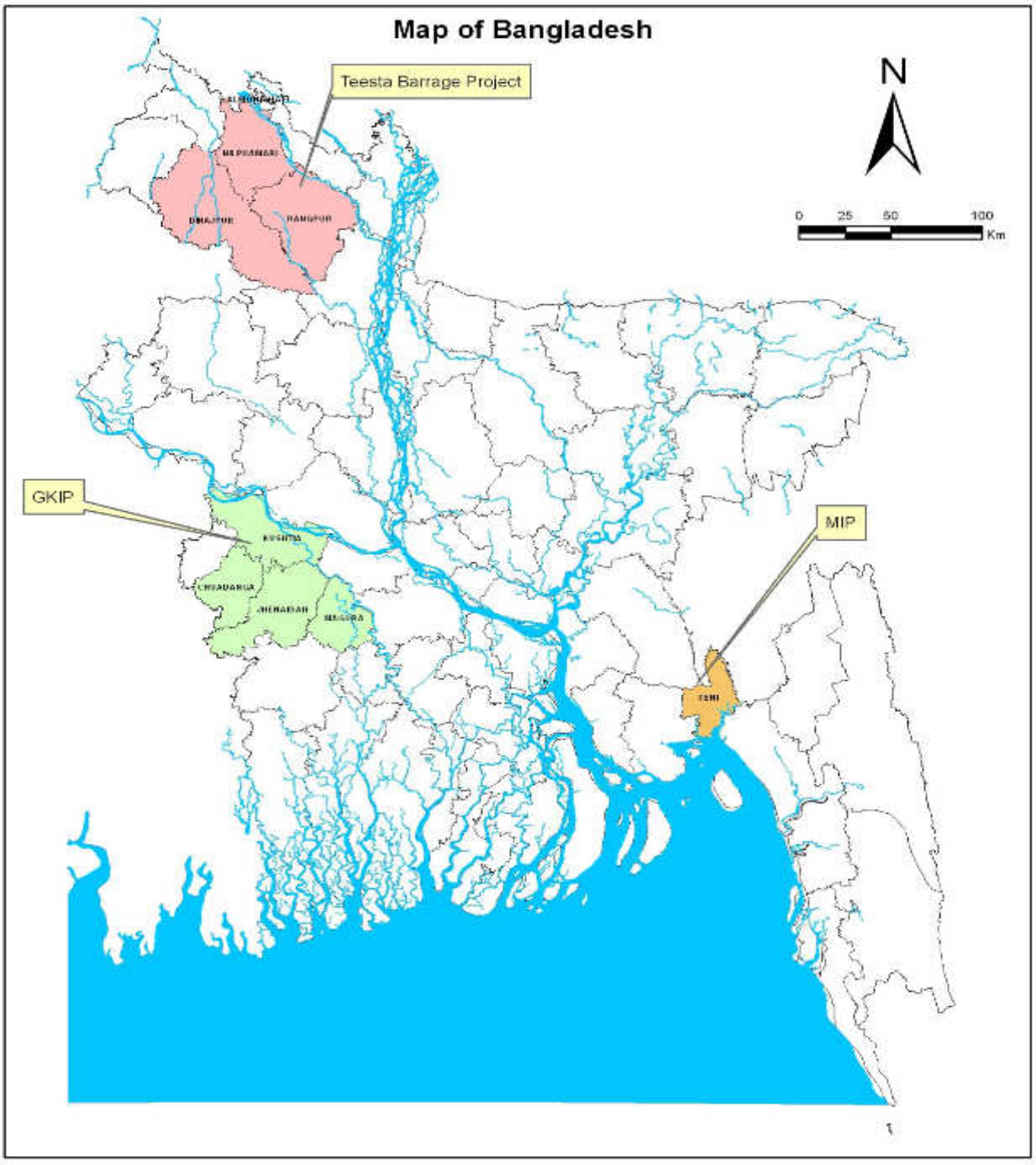
1.1 Background

Bangladesh is most probably the world most densely populated country of South Asia. On an average 1252 people live per km^2. That is about 163 million people live within 147,000 km^2 area. About 1,915,222 new faces (1.19% per annum) are being added to the total population of Bangladesh, but the land for agriculture is decreasing by 1% every year. In Bangladesh, agricultural development and sustainable natural resource management are critical for poverty reduction, as the majority of the poor (85%) live in rural areas and depend on agriculture for their livelihood. Agriculture generates 50% of employment, contributes 20% of gross domestic product, and provides a secure food supply for the whole population. Major causes of poverty are recurrent floods and riverbank erosion, as well as drainage congestion, salinity, cyclones and tidal surges, arsenic contamination, over-exploitation of groundwater, chemical and biological contamination of surface water, and drought. Moreover recent climate risk has made the situation more critical. So climate smart intensive agriculture practices have been inevitable not only for Bangladesh but also for the climate vulnerable part of the globe. At the same time to insure the efficient use of water resources with diversification of crops/cropping pattern is very much essential for obtaining food security. Agriculture growth is driven by a shift from subsistence rice-based cultivation to commercial high-value agriculture commodities, which is instrumental in advancing rural economic growth and contributing to long-term food security. The Government promotes diversification in agriculture by encouraging private agribusiness as well as providing access and improvements to rural infrastructure. The Government's objectives for surface irrigation are, among others: (i) promote peoples participation in conformity with Integrated Water Resources Management principles; (ii) achieving food security of food grains through ensuring year-round sustainable irrigation; (iii) ensuring climate change resilience; (iv) strengthening and capacity building of water resource institutions; (v) command area development and irrigation expansion; (vi) increase beneficiary participation and, where possible, transfer management to beneficiary organizations, local government and the private sector; (vii) introduction of public-private partnerships (PPPs) to provide support to agriculture and for selected-services; and (viii) provide agricultural extension services including irrigation technology and on-farm water management.

Keeping pace with the vision 2020 Government of Bangladesh, with the financial assistance of ADB, has taken initiative to modernise 3 large scale irrigation projects (old projects) of BWDB under Irrigation Management Improvement Project (IMIP). Under IMIP implementation (modernization) of Muhuri Irrigation Project (MIP) at Feni & Chittagong districts and Feasibility studies for modernization of another two old BWDB projects named Ganges Kobotak Irrigation Project (GKIP) at Kustia, Meherpur, Chuadanga and Magura districts and Tista Barrage Irrigation Project (TBIP) at Rangpur, Dinajpur and Nilphamari districts will be completed within 5 years, Fy 2015/16 to 2018/19 (Figure-1). After completion of MIP subproject Government of Bangladesh will go to modernize other two subprojects GKIP and TBIP successfully with the assistance of development partners like ADB. The Program will directly improve the productivity of about 172,000ha of dry season irrigation (comprising: MIP 17,000ha, TBIP 60,000ha and GKIP 95,000ha) and supplementing wet season irrigation to about 451,000ha (comprising: MIP 23,000ha, TBIP 286,000ha and GKIP 142,000ha).

At present modernization of MIP subproject is going on. So safeguard monitoring and/ or Environmental Monitoring Report will be limited to MIP subproject only.

Figure 1. Location Maps of "Irrigation Management Improvement Program (IMIP)"



1.2 Project outputs

The impact of the Project will be sustained high growth in irrigated agriculture. The project's outcome will be efficient and sustainable management the MIP producing higher yields, with expanded irrigated areas, and with a higher cropping intensification including diversification into

higher value crops. The Project will be implemented over 5 years from 2014-15 to 2018-19. The Project will have the following three key components:

Output 1: Performance based irrigation management and agriculture support services are established for 3 large irrigation schemes including: (i) establishing Irrigation Management Operators (IMOs) at the MIP; that will supervise rehabilitation and modernization works and provide long-term sustainable MOM; (ii) establishing efficient management and cost-recovery systems to maximise water use efficiencies and develop sustainable and reliable cost-effective service delivery of irrigation water supply that meets farmer's needs and improves their productivity; (iii) providing agricultural support services through the IMOs that promote efficient water use, crop diversification through sustainable practices, and developing opportunities for more commercial farming or agribusiness; and (iv) assisting with government reforms and institutional strengthening for long-term support of IMOs including: (a) the establishment of a PPP cell within the Bangladesh Water Development Board (BWDB); (b) the establishment of Implementation Coordination Committee (ICC) for MIP that will guide and support the establishment of sustainable and effective management.

Output 2: Irrigation system infrastructure is rehabilitated and modernized: The Project will rehabilitate and modernize irrigation infrastructure including repair of head and cross regulators, canals, ancillary facilities, flood embankments and associated drainage structures. The prime focus will be to provide more efficient and equitable irrigation distribution systems through appropriate technologies including provision of systems for cost recovery such as pre-paid water metering system.

Output 3: The Project is efficiently managed with effective institutional Development including: (i) project management at all levels to ensure the effective and timely delivery of the project outputs, including the highest possible standards of quality control; (ii) planning, feasibility assessment and detailed engineering design for Output 2; and (iii) Undertaking institutional strengthening, enhancing awareness, and providing training of key stakeholders including: (a) working with BWDB, water users associations (WUAs) and local government to redefine their role in the context of a new and changed approach to MOM; (b) working with farmers to ensure clear understanding of the new irrigation management strategies including requirements for cost recovery; and (c) training for farmers in irrigation water management for more efficient water use.

1.3 Project Location

The major area of the Muhuri Irrigation Project (MIP) is situated in six Upazila like Purshuram, Phulgazi, Chhagal Naiya, Feni Sadar and Sonagazi of Feni District; and only a small portion is situated in Mirsharia Upazila of Chittagong District (Figure-. The total land area of the two districts (Feni and Chittagong) is 6,211km^2 and the total population is 7.75 million people. This gives an average population density of 1248 persons per square kilometre; population density in Feni District is 1,300 per sq km and in Chittagong 1,239 persons per sq km. The MIP is on the flood plains of 3 flashy rivers Muhuri, Feni and Selonia river networks between the Indian hills of Tripura state of India to the East and the Bay of Bengal to the West. So during heavy downpour in Indian hills suddenly flashes the area violently and damages houses and property, submerges the crops and land under sand/silt carried with flood water. But during the winter dry part of the year when India withdraws water from rivers the project area suffers from severe scarcity of

water for irrigation. As a result saline water enters into the rivers from Bay of Bengal as fresh water flow in the rivers reduces in dry season. Shallow tube wells with all water bodies almost dry up during the winter season in the project area. The MIP area experiences natural disasters like tropical storms, cyclones and tidal surges after each several years which have been frequent in recent years as a consequence of climate change. The project area of MIP is also prone to earthquake due to the presence of India-Myanmar fault to its eastern periphery.

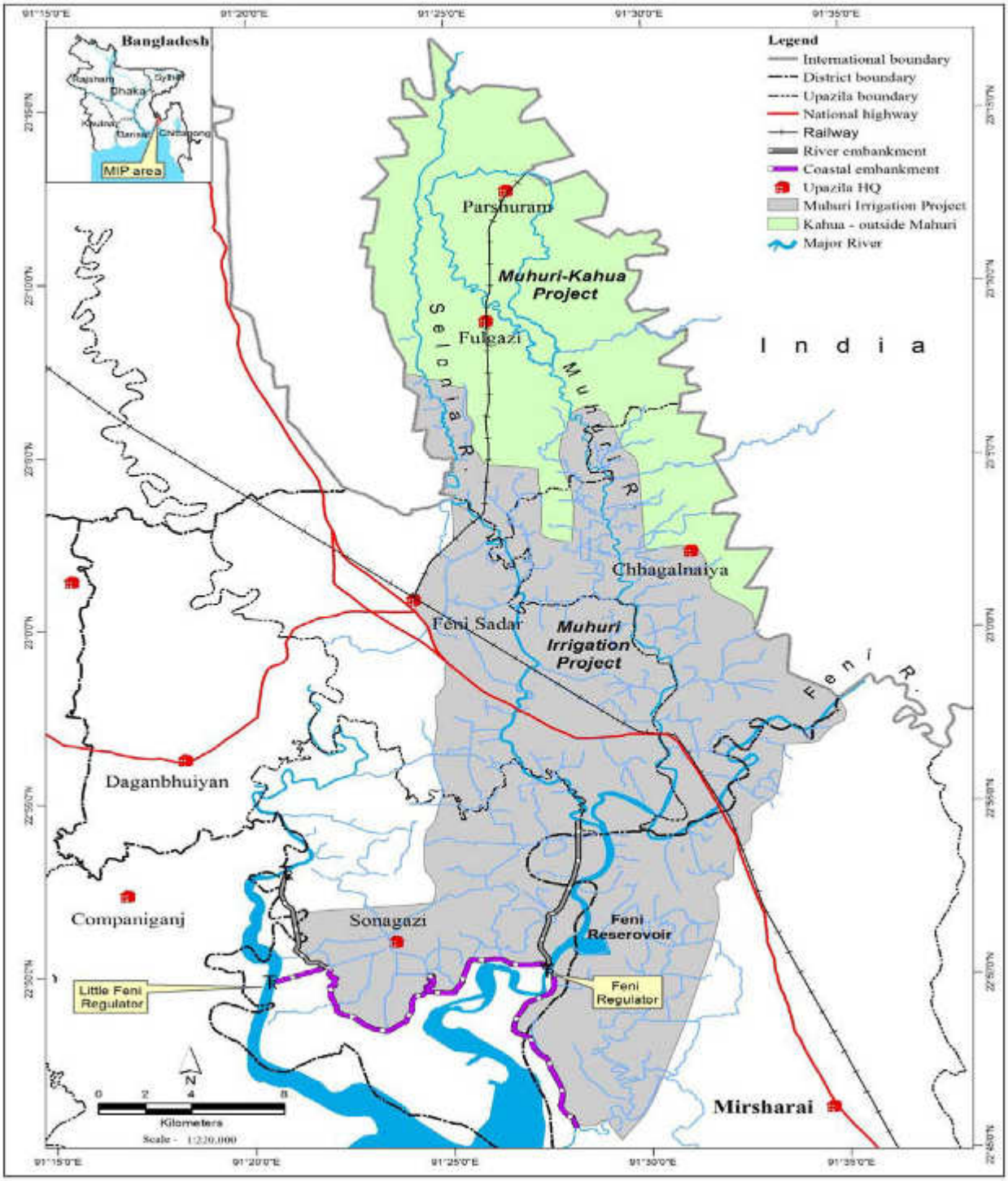


Figure-2: Location of Muhuri Irrigation Project (MIP)

1.4 Project objectives

A. The overall objective of the project is reducing poverty by enhancing food security through increased yield of crops.

B. The specific objectives of the project are-

1. Sustainable operation and maintenance of Muhuri Irrigation Project (MIP) through rehabilitation of the irrigation infrastructures, improvement of irrigation management through innovative approaches for modernization and cost recovery in full for the Level 2 (Secondary canal systems) and the Level 3 (framers' canal system) infrastructures' O&M while the Executing agency will carry out O&M of the Level 1 (Embankment, regulators and primary canal system/rivers) of the MIP with contribution by the GoB.

2. Increasing sustainability of MIP through effective community participation.
3. Controlling floods and using water resources effectively and efficiently.
4. Increasing farmers' income and strengthening livelihood through improved productivity.

1.5 IMIP Implementation Arrangements

The Executing Agency for the Project is the Bangladesh Water Development Board (BWDB) in which a Project Management Unit (PMU) has been established and led by the Project Director (PD). The Project Management and Design Consultant (PMDC) support the PMU and PD. The PMU manages the implementation of the MIP. The PD, PMU manages design and implementation works; and manages the Irrigation Management Operator (IMO). The PD is being supported by a team of planning, design and construction, procurement, accounts and administration staff. A Project Steering Committee (PSC) is established within the Ministry of Water Resources (MoWR) to provide overall coordination of the Project and facilitate inter-ministerial coordination. The PSC is chaired by the Secretary, MoWR. The PD is the PSC's member secretary and all concerned ministries and agencies will be represented.

Also for supporting the PMU there is a new PPP Cell that is providing guidance on tendering, private public partnerships, contract management, negotiating, legal, and communication. BWDB's Chief Monitoring office is supported with a new Monitoring Cell that is providing independent verification of the performance of various stakeholders as well as assessing impacts associated with Project's objectives.

A Safeguards Desk was specially established on 24 December, 2015 at PMU office for overall monitoring, verification and reporting to ADB and DoE. The Safeguard cell is consist of 3 members (1 water resources expert and 1 gender and social compliance expert headed by 1 environmental monitoring expert) to support the Monitoring office with safeguard compliance management.

PMU Safeguard Team

Sl No.	Team members	Designation	Professional degrees	Comments
1	Mr Md Jahangir Alam	Deputy Chief (Agriculture)	M.Sc. in Forestry, M.Sc. in Environmental Sciences	Convener
2	Ms. Shahnaz Parvin	Assistant Chief (Sociology)	M.Sc. in Sociology, M. Sc in Digester Management	Member
3	Ms. Nusrat Alam	Sub-divisional Engineer	B.Sc. in Civil Engineering	Member

PMDC is responsible to support PMU-Safeguard cell, IMO and PIU for developing capacity to monitoring environmental and social compliance issues. Contractor is obliged by bid document/contact agreement to implement the project EMP outlined in IEE/EIA report. IMO is responsible for day to day monitoring and supervising contractor's activities relating to EMP implementation, recording any grievances/complaints raised by society/stakeholders and reporting monthly to PMU. PIU is responsible to enforce the contractor to implement EMP in the field level and report to PMU the progress of implementation status. Safeguard cell will consolidate all reports sent by IMO and PIU, verify those by visiting field and prepare semiannual safeguard report (Construction period)/ annual safeguard report (operation period) and submit it to ADB and DoE for disclosure in their own websites.

An Implementation Coordination Committee (ICC) is established for the project to manage field implementation issues that arise related to conflicts, safeguards, security, and more generally concerns about the performance of the implementing parties. The ICC is chaired by the project's BWDB Chief Engineer, South Eastern Zone, Chittagong and committee members comprise representatives from the offices of the Deputy Commissioner, the Water Users' Associations and the IMO.

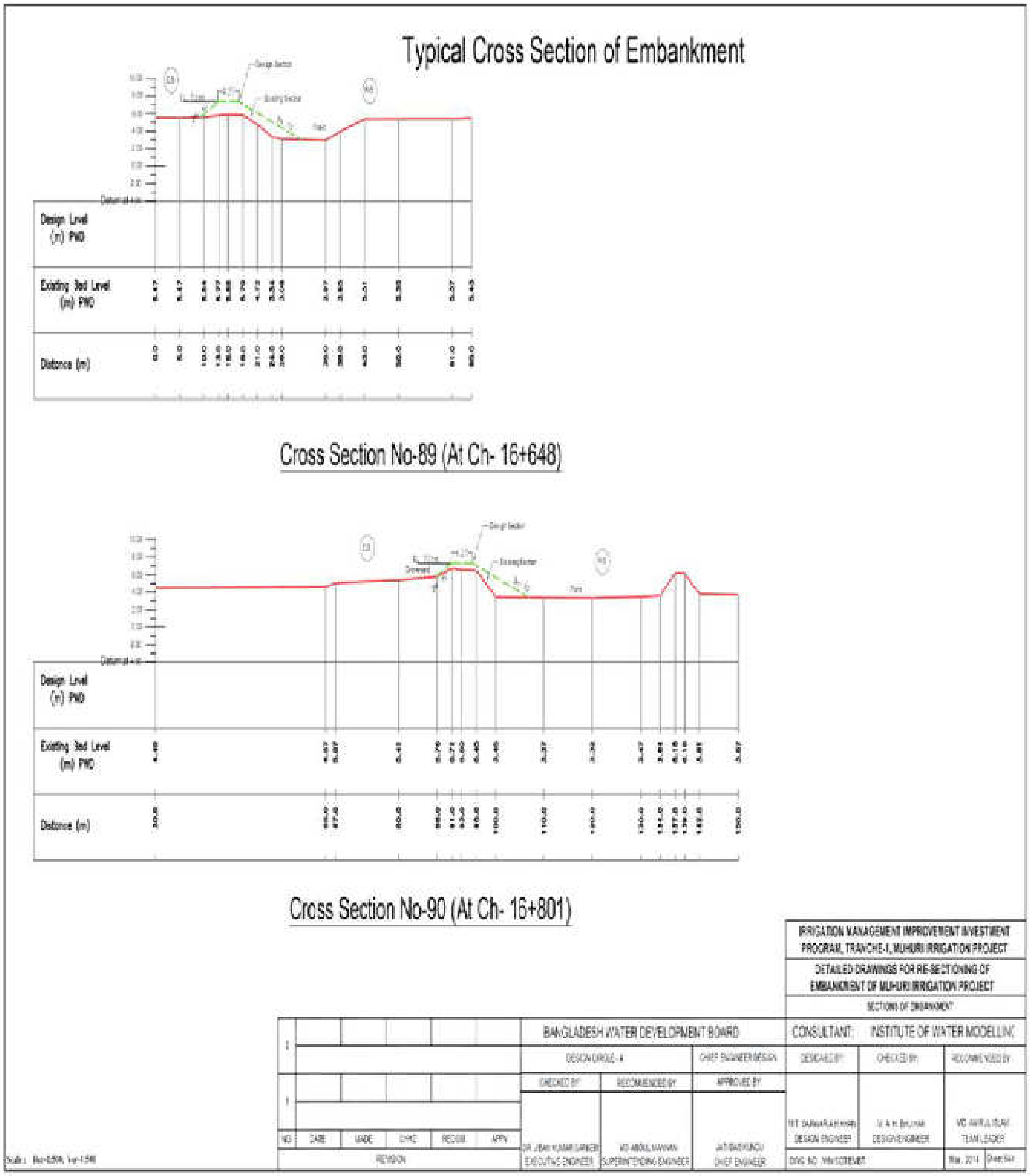
1.6 Physical progress of project activities

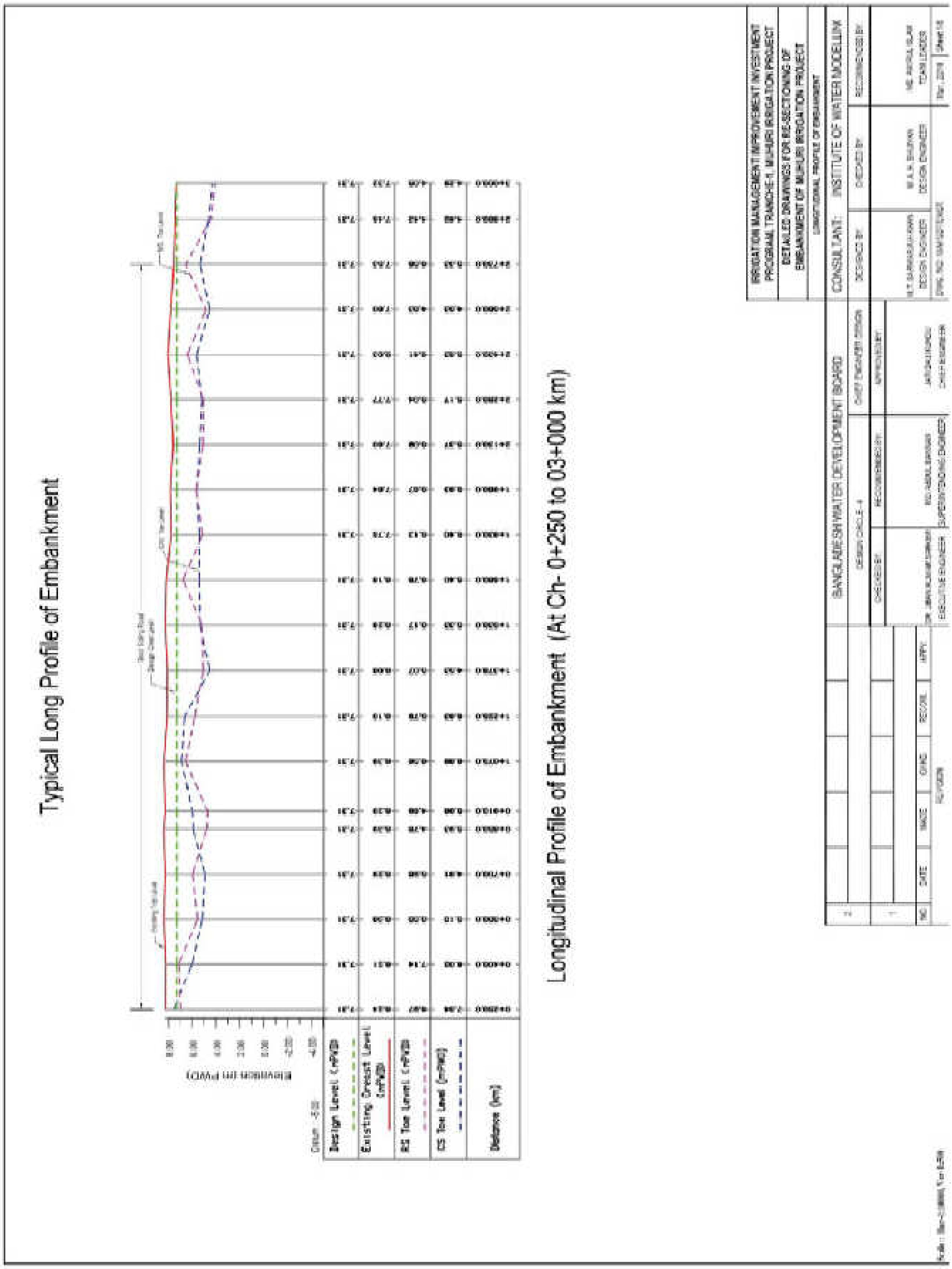
The IMIP will modernize Muhuri Irrigation Project (MIP) which has been being implemented from 2014-2015 and is going to be completed in 2019-2020.

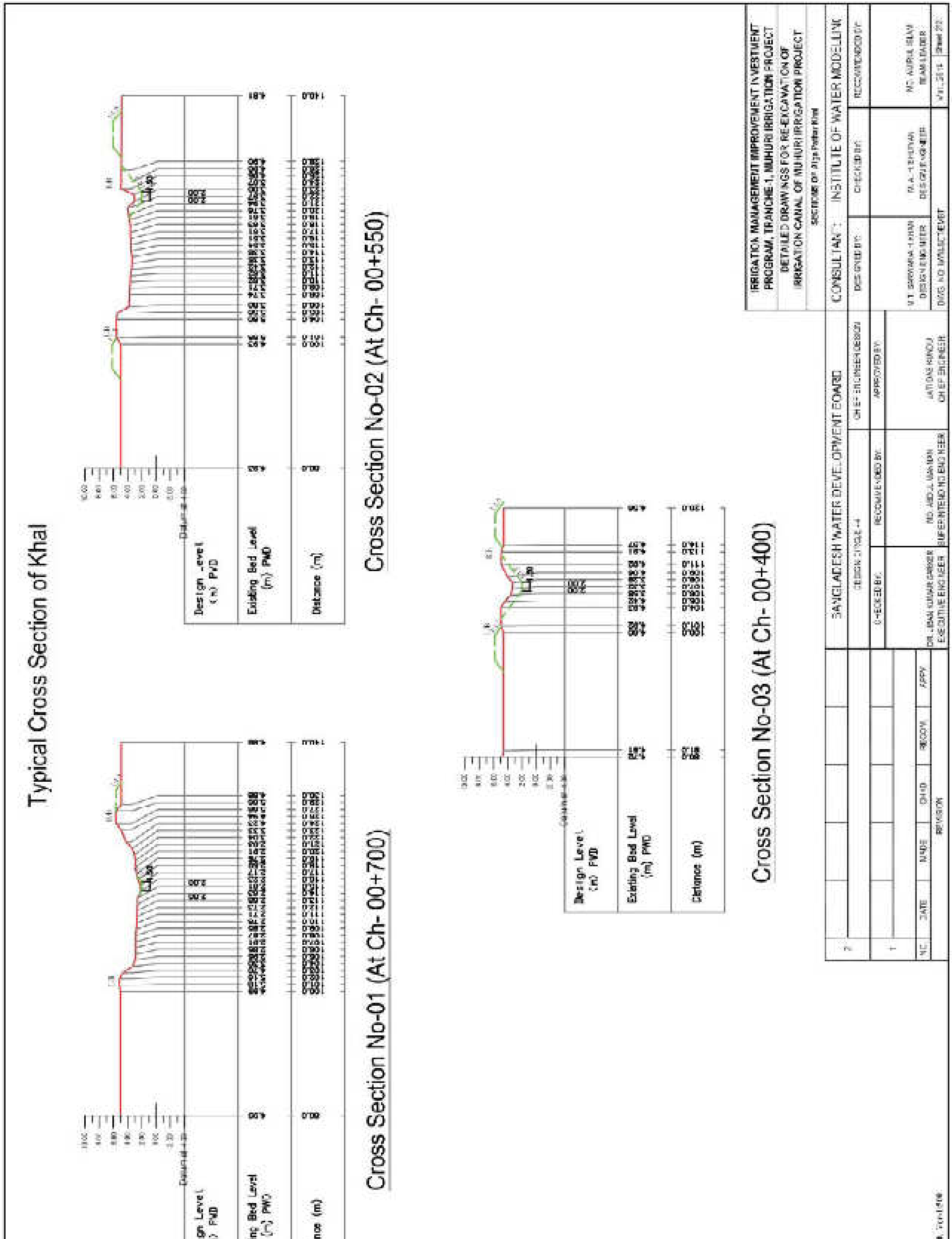
This Project will also undertake feasibility study of (i) Ganges-Kobadak Irrigation Project (GKIP), dry season irrigated area of about 96,000 ha; and (ii)Teesta Barrage Project (TBP), dry season irrigation area about 60,000 ha; for formulation of Development Project Proposal (DPP) later on under the financial assistance of the Asian Development Bank (ADB).

The Project targets are rehabilitation of the water infrastructures of the MIP for gross 60,258 ha area in Purshuram, Phulgazi, Chhagyal Niayyia, Feni Sadar and Sonagazi Upazila of Feni District and Mirsarai Upazila of Chittagong District. The net cultivable area of the project is 28,663 ha; net irrigated area of 17,900 ha (with surface water and ground water) in the pre-project condition; but the "With-Project" irrigated area will be 23,600 ha.

The main physical works under MIP are rehabilitation of coastal embankment, re-sectioning of drainage/irrigation canals, rehabilitation of water control structures like regulators/sluices/reservoirs, installation of low lift pumps (LLPs) with underground pipes & prepaid meters and upgrading of electricity distribution systems. This 1st semi-annual safeguard monitoring report will contains the physical works/activities of Muhuri Irrigation Project (MIP) part only. The design (cross section) of major physical structures is given below.

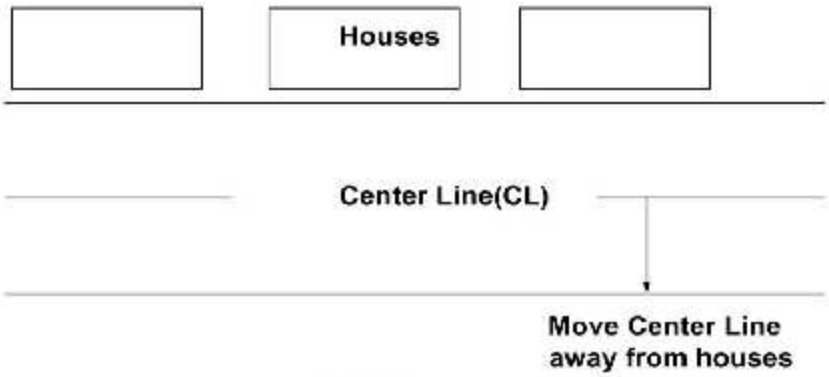



Typical Long Profile of Embankment
Longitudinal Profile of Embankment (At Ch- 0+250 to 03+000 km)
Design Level (mPWD)
Existing Crest Level (mPWD)
RS Toe Level (mPWD)
CS Toe Level (mPWD)
Distance (km)
BANGLADESH WATER DEVELOPMENT BOARD
CONSULTANT: INSTITUTE OF WATER MODELLING



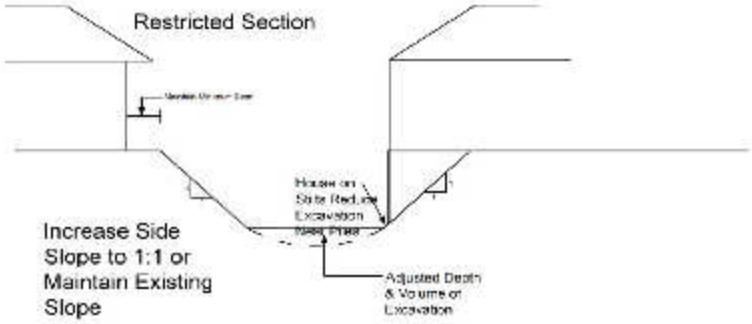
Typical Cross Section of Khal
Cross Section No-01 (At Ch- 00+700)
Cross Section No-02 (At Ch- 00+550)
Cross Section No-03 (At Ch- 00+400)
Design Level (m) PWD
Existing Bed Level (m) PWD
Distance (m)
BANGLADESH WATER DEVELOPMENT BOARD
CONSULTANT: INSTITUTE OF WATER MODELLING

If there is house on one side of the embankment/khal the re-sectioning should be done by adjusting the centre line and increase the slope behind the house.



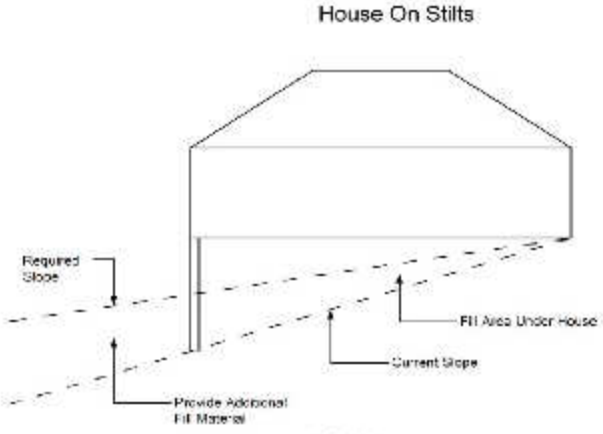
PS-01

If there is house on both sides of the embankment then adjusted design section as per drawing should be followed



PS-02

If there is house on the stilts of the embankment and the existing side slope steeper than the design slope, then the bank should be profiled to design slope including placing, compacting under the houses as per drawing.



PS-03

The progress of physical works of MIP as on June 2016 is illustrated in Table 1.1 below.

Sl No	Name of the component	Quantity as per RDPP	Unit	Progress up to June, 2016	% of progress	Comments
1	Rehabilitation of Coastal Embankment	22.6	Km.	5	22.12	Started
2	Rehabilitation of Sluices	4	Nos.	-	-	Not started
3	Construction of Sluices (2 x 2 Vents)	2	Nos.	-	-	Not started
4	Rehabilitation of Water Control Structures	3	Nos.	-	-	Not started
5	Construction of Water Control Structures (2x 2 Vents, 2 x 4 Vents, 1 x 7 Vents)	5	Nos.	-	-	Not started
6	Re-excavation of Khals	460	Km.	10	2.17	Started
7	Repair of BWDB Office	1	No.	-	-	Not started
8	Farmer Canal System (For Irrigation of 17000 ha.)	17000	ha.	-	-	Not started
	(a) Installation of Low Lift Pump (LLP)	950	Nos.	-	-	Not started
	(b) Installation of Pre-paid Meter	800	Nos.	-	-	Not started
	(c) Installation of uPVC Pipe (160mm-280mm Diameter size)	680	Km.	-	-	Not started
	(d) Installation of RCC Pipe (300mm Diameter size)	20	Km.	-	-	Not started
	(e) GI Pipe (100mm-280mm Dia)-	12	Km.	-	-	Not started
9	Upgrading of Electricity Distribution System (For Irrigation. of 17000 ha. area) with 1 substation	180	km	-	-	Not started

The Loan agreement was signed on 14 August, 2014 and activated on 16 September, 2014. The physical works/construction like rehabilitation of Coastal embankment and excavation /re-excavation of drainage/irrigation canals are going on. Tender for construction works of Farmers canal system (contract package No: CW-3) is under evaluation process. A MoU has already been signed between BWDB and REB (Rural Electrification Board) for construction of 180 km electricity distribution system with installation of 1 substation. Implementation of construction works will go in full swing in the Fy 2016/2017.

Photographs showing the different phases of construction works of MIP

Survey works of khal

Original status of the Khal

Silted up Khal in MIP Area

Excavation of khal heaping spoil earth on the Banak

Excavation of khal being monitored

Opening of Excavation works

Re-sectioning of Coastal Embankment

Indication of construction works

Completion of Khal Excavation

1.7 scope of Safeguard monitoring

Among 3 subunits (large scale irrigation projects of BWDB) of IMIP only MIP subunit is being implemented within this tranche of project period Fy: 2014/2015 to 2018/2019. So this 1st annual Environmental safeguard report includes only the environmental monitoring of MIP. Categorization of MIP for different safeguard issues and reporting requirements for each category are described below.

(a) Environment Safeguards: According to ADB's Safeguard Policy Statement (2009) MIP (Muhuri Irrigation Project) under IMIP was categorized B for environment and an initial environmental examination (IEE) was prepared as the negative impacts are typical to any construction activities involving earth works which can easily be mitigated through adoption of measures described in the environmental management plan (EMP). But according to Bangladesh Environment Act (1995) and Environment Conservation Rule-1997 it was categorised-Red as under MIP modernization process natural water flow will be controlled by construction of water control structures. To meet the requirement of DoE (Department of Environment), Bangladesh an Environmental Impact Assessment (EIA) was conducted. Consultations were undertaken with affected stakeholders and a suitable grievance redress mechanism had been proposed to resolve any project related grievances. To meet ADB's reporting requirements (a) semi-annual Environmental Monitoring Report (in July) during construction and (b) annual Environmental Monitoring Report (in December) during operation are mandatory to submit ADB for disclosure.

Physical works of excavation of Khal (canal) and rehabilitation of coastal embankment under only 2 contract packages: CW-1 & CW- 2 actually started in the year 2006. So this safeguard monitoring report is a semi-annual report for duration January, 2016 to June, 2016.

(b) Social Safeguards: The MIP was originally classified as Category A for involuntary resettlement safeguard but is now re-categorized as C since the requirement for temporary relocation and resettlement initially envisaged can be avoided through: (i) modified designs by reducing the cross sections (steeper side slopes) allowing for some increase in hydraulic in populated area; and (ii) removing the embankment rehabilitation from the construction program. A resettlement framework (RF) has been prepared for the entire MFF that would guide the preparation of resettlement plans for the subsequent tranches, if required. The RF follows the Government's laws and regulations and ADB's SPS (2009), and prescribes for entitlement to compensation for land acquired and lost assets at replacement cost as well as resettlement assistances. To meet ADB's reporting requirements (a) a semi-annual Social safeguard Monitoring Report (in June) during construction phase and (b) an annual Social safeguard Monitoring Report (in December) during operation phase are mandatory to submit ADB for disclosure.

Most of physical works specially rehabilitation of coastal embankments, reconstructions /re-sectioning of drainage /irrigation canal is being conducted on old/degraded coastal embankment/canals. So there is no scope of land acquisition or resettlement of houses/structures etc in MIP area as well as the implementation/monitoring of Resettlement Action Plan (RAP). Moreover 25% of earth works of MIP subunit is supposed to be done by WMO (Water management organizations) and remaining 75% by contractors. There was a scope of employment for the female labour (30% of total labour force) but due

to some religious norms, especially in Muslim community in the MIP area, women are not interested to outdoor works. So implementation of Gender Action Plan (GAP) faces difficulty in MIP area. It can be implemented in PMU, PIU, IMP and WMO offices. Semi-annual social safeguard monitoring report will be prepared and submitted to ADB separately for disclosure.

(c) Indigenous Peoples Safeguard: The MIP is categorized as C for the Indigenous Peoples safeguard. There are no Indigenous Peoples as defined for operational purposes by ADB's SPS (2009) in the Project 1 areas and the areas under the subsequent tranche of the Program. As the subsequent tranche is also categorized as C, an Indigenous Peoples Planning Framework has not been prepared. So there is no scope of reporting on Indigenous Peoples Safeguard under MIP.

CHAPTER 2: ENVIRONMENTAL MANAGEMENT PLAN

2 Environment Management Plan

Management of Important Environmental Impacts (IECs) comprises 3 components like-

(a) Environmental mitigation plan: Plan containing suggestion on mitigation measures to minimize possible negative impacts,

(b) Compensation plan: Plan suggesting measures required for providing compensation for well assessed negative impacts which cannot be mitigated,

(c) Environmental monitoring plan: Plan for detecting changes that may take place due to the planned interventions in the project.

Environmental Management Plan (Appendix-I) for MIP suggested in the concerned EIA report unveils that during the preconstruction phase there are no adverse impacts as well as no mitigation/monitoring plan. But during construction and post construction phase there may have some adverse impacts which need to be mitigated. The EIA report does not shows any issues may be compensated. So this 1st semi-annual EMR includes no compensation plan for MIP. The proposed EMP of MIP has been described below (Table- 2.1) in brief.

Table-2.1: EMP for MIP under IMIP

Sl No	Expected Project Actions		Potential Impacts	Proposed mitigation measures as per EMP	Responsible agency	Estimated cost (in Tk)	Status up to 30 June, 2016
Possible impacts on Water Resources							
1	*Construction*	Construction of cross bundh (dam) across khals	Temporary obstruction of water flow in some khals	Mitigation measures not needed as the Impacts are insignificant.	Not applicable	Not applicable	➢ Minimized the impacts locally.
2	*Post construction*	Risk of drying out of wetlands through drainage khals.	Loss of wet lands with aquatic lives	Possible wet lands/pockets will be disconnected from the drainage khals	IMO, BWDB	Not applicable	➢ Only 10 km of khals has been excavated which is not linked to wetlands.

3		Distribution of irrigation water through buried pipelines system	Reduced rate of percolation of water to ground water storage during irrigation season.	Retention of water in wetlands /pockets / canals/ Ponds to recharge ground water storage.	WUA, IMO & BWDB	Not applicable	No impacts found.
4		Increased extraction of ground water by farmers.	Lowering of ground water table and drying of house hold tube wells.	Restriction of installation of deep tube wells within the command area of MIP	WUA, IMO & BWDB	Not applicable	No impacts found.
Possible impacts on Land Resources							
1	*Construction Phase*	Re-excavation of khals as per design	Risk of sliding down of steep canal banks and loss of community people and properties	Strictly maintenance of design instructions to avoid such situations.	Contractor, IMO, BWDB		Canals (10 km) have been constructed following the design strictly.
2		Disposal of spoil earth from excavation of khals.	Dumping of excess spoil earth on private land/crops	Disposal of Excess spoil earth to designated place must be ensured after filling low land or raising homestead /court yard by land owners will.	Contractor (be enforced by IMO, BWDB)	Included in the BoQ	Heaps of spoil has been found on private lands (IMO Report). Farmers are interested to use spoil earth for raising their lands.

3		Borrowing soil for re-sectioning of embankment	Risk of unauthorised extraction of soil from private land.	Soil may be extracted from fellow land by paying royalty to the agreed land owner. Extraction of Soil from agricultural land any way must be prohibited.	Contractor (be enforced by IMO, BWDB)	Included in contractor bill	No unauthorised extraction of soil from private land has been noticed during rehabilitation of 5 km of embankment.
4		Construction of labour shed	Risk of constructing labour shed on private land and unauthorised prohibition from cultivation	Construction of labour shed on private land must be prohibited unless authorised by land owner	Contractor (be enforced by IMO, BWDB)	Included in contractor bill	No labour shed has been noticed to be constructed on the site (IMO Report).
	Post construction phase	Indiscriminate application of agrochemicals like fertilizers and pesticides by farmers.	Reduction of land fertility followed by land productivity and loss of biodiversity	Conducting integrated farming training to farmers to reduce such adverse impacts.	IMO, BWDB & DAE	Included in the IMO contract	Integrated farming training to farmers will be started after completion of construction works.
Impacts on Agricultural Resources							
1	*Construction Phase*	Installation of underground uPVC pipe for replacing field canal for irrigation water distribution.	Risk of leaving heaps of spoil earth on private agricultural land and temporary interruption of cropping	Spreading of excess spoil earth on farmer's land evenly according to farmers will must be insured.	Contractor (be enforced by IMO, BWDB)	Included in contractor's bill	Installation of uPVC pipe has not been started.

2	*Post construction phase*	Cropping intensification / diversification	Non diversification may impact project target negatively.	Training of stakeholders on modern farming practices/ crop diversification shall be ensured	IMO, BWDB, DAE	To be included in IMOs contract	Training of stakeholders on modern farming practices/ crop diversification will be stated after completion of construction works.
Impacts on Ecological Resources							
1	*Construction Phase*	Keeping the khal dry about 3 months for excavation	Risk of dying some aquatic non fishery animals though the residual impact is non significant.	No feasible mitigation measures are applicable but any ecologically important species spotted during the operation should be released safely to nearby water bodies.	Contractor, IMO, BWDB, WUA,	Not applicable	No important species of wild life has not been noticed during construction of 10 km khal (Canal).
2	*Post construction phase*	Felling of trees from canal bank or embankment during re-sectioning	Risk of reduction of vegetation cover and habitats for wild animals	Removal of trees from canal bank or coastal embankment should be avoided. 3 saplings should be planted for 1 tree felled for unavoidable reason.	BWDB, WUA, DoF	Annual O&M budget of BWDB, DoF	Coastal Embankment has been commenced to re-sectioning by keeping the trees intact on the site.

Impacts on Society							
1	*Construction Phase*	Re-sectioning of Embankment	Land communication by vehicle on the embankment will be hindered.	Impact is temporary. The embankment will be re-sectioned segment by segment to ensure the proper shape promptly.	Contractor, IMO, BWDB,	Included in the BoQ estimate	Top surface of embankment was smoothed promptly.
2		Disposal of excess spoil earth on private lands during excavation of khals.	Farmers will use the spoil earth to raise their land and homestead	Impact is expected positive. If any complains rises those will be mitigated by compensating the land owners	Contractor	Included in the BoQ	Villagers are interested to use spoil earth. No complaint of excess spoil dumping on private lands was found.
3		Earth work and structural works during implementation of the project	Increased opportunity for employment specially for socially disadvantaged class	Social safeguard measures provided for enhancement program	Contractor, BWDB, IMO, WUA	Included in the BoQ	Labour intensive part i.e., earth work by WUG has not been started yet. Contractor's part of construction has been commenced and 20 persons for operation of crane and excavators etc got employed

4		Movement of construction vehicle/equipment/operation of machines	Air/Sound pollution by generation of Noise, dusts, fumes etc.	(a)Regular water sprinkling to reduce the dust, (b) prohibiting operation of machines in the night near the human habitats (c) conducting regular maintenance of machineries to reduce noise.	Contractor, IMO, BWDB	Included in the BoQ	Dust was not noticed significantly as canal bed was wet.
5		Ingress of imported external labour force.	Social disquiet or disturbance by external manpower breaking peace of local people.	External labour force will be kept under strict supervision and will be compelled them to obey local customs and disciplines of the state.	Contractor (be enforced by IMO, BWDB)	Included in the contractor's bill	Almost all labours are locally recruited and there was no complaint in this issue.
6		Sanitation of workforce.	Risks of out breaking of diseases /epidemics	Proper sanitation facilities and safe drinking water supply will be ensured. Infected person will be isolated & treated if any.	Contractor (be enforced by IMO, BWDB)	Included in the contractor's bill	Workers are mostly recruited from nearby villages. So labour sheds, toilet facilities and drinking water were managed locally. No complaint raised from the labourers.

7	*Post construction phase*	Implementation of planned activities in the project	Income generating activities of agriculture farming will be increased, poverty will be reduced	Impact is positive. Access to micro credit Agriculture support services provided by IMO	DoC, NGOs DEBD, IMO, WUA, DAE	Not Applicable	The project is still under implementation. Agricultural support services will be available after completion of physical works

2.1 Environmental Monitoring Plan

Environmental Monitoring Plan which was prepared under Environmental Impact Assessment (EIA) process of Muhuri Irrigation Project (MIP). The contractors, IMO, PIU and Safeguard cell have the obligation to follow this Environmental Monitoring Plan (Appendix-2) during the construction and operation phase of the project. Before preparation of EIA report BWDB prepared an IEE report which full fill the requirement of ADB's safeguard requirement. But in order to full fill the environmental and social compliance requirement of GoB specially DoE (Department of Environment), EIA is compulsory for this red category project of MIP. According to ADB's SPS (2009) meeting the country's (Borrower) environmental and social compliance is mandatory. In this back ground Environmental Management Plan and concerned Environmental Monitoring plan prepared in the EIA report of MIP is compulsory to follow for BWDB, IMO, PIU and WUA and ensure Environmental and Social compliance of MIP under IMIP. The Environmental Monitoring Plan prepared under EIA report is attached in Appendix-2.

2.2 Implementation Arrangement of Environmental Monitoring Plan

According to Approved DPP of IMIP Environmental and Social Safeguard compliance of MIP will be implemented/monitored by 4 stakeholder groups of MIP such as IMO, PIU, WUA, PMU (Safeguard Cell) and PMDC. Responsibilities and scope of work of each stakeholder group have been described below.

(a) **IMO** is responsible to conduct the day to day monitoring and supervising the implementation of environmental and social safe guard issues and keeping concerned records of activities like progress, complaints and grievances from labours, community peoples, farmers, etc and any breach of Bangladesh Environmental law, labour law, Occupational Health and Safety measures by contractors. IMO is also responsible to consolidate those daily records as monthly reports and submit it to PMU-Safeguard cell. In the management/personnel set up of IMO a Key person designated as Safeguard and Public Relation Officer for (50 person month) mainly responsible for (Job description mentioned in the ToR for IMO). But IMO did not deploy any Safeguard and Public Relation Officer till August, 2016. As a result PMDC faced difficulty to train and build up capacity for safeguard monitoring. Moreover entire day to day environmental and social safeguard monitoring process of by IMO has been hampered. No public complaints or grievances were recorded

properly. There is none in IMO to monitor the contractor's responsibility to comply concerned issues like international labour law, Occupational health and safety measures and social safeguard compliance etc.

(b) **PIU** director is primarily responsible to insure the implementation of EMP by contractors and enforce them to implement EMP and record & report quarterly to PD, PMU in case of any grievances raised and breaches in implementation of EMP by contractors. But PIU submits no reports on safeguard issues in any form till August, 2016. Though some monthly progress reports were submitted to PD-IMIP but all those contain no issues on safeguards of MIP.

(c) **PMU** (Safeguard cell) is responsible to foresee the entire safeguard implementation process, consolidate those monthly reports, validate those complaints and grievances, inform PD-IMIP for necessary actions and finally prepare & submit Semi-annual Safeguard Report to ADB and DoE for disclosure.

(d) PMDC has the responsibility to strengthen PMU-Safeguard Cell, PIU, IMO, contractors and developing their capacity for implementation/Monitoring/supervision/reporting of safeguard issues of MIP project by providing necessary training and demonstrations etc.

2.3 Implementation status of Environmental Monitoring Plan

The physical progress/construction works of MIP is very less till June, 2016. But most of the environmental monitoring indicators are concentrated in construction and operation phases of MIP. MIP (Muhuri Irrigation Project) is basically rehabilitation by modernization of old irrigation project of BWDB. So the environmental adverse impacts which are supposed to happen had happened 30 years back when MIP first implemented in 1986 with aid of IDA, SIDA and EEC. Now that old and degraded irrigation project is just being rehabilitated on the same place. So it is expected that environment will be impacted very less by rehabilitation process. According to EIA study report of MIP major environmental impacts may specially be imparted on land, water and fishery resources. Present status of environmental monitoring is described in the Table2.1.

Table 2.1: Environmental Monitoring Plan & Status

Sl No	Environmental Parameters to be Monitored	Methods	Frequency	Responsibility	Monitoring Status (Jan,2016 to June, 2016)
1	Effectiveness of Flood protection embankment (Coastal Embankment)	Maintain embankment with proper crest, side slopes and at design height by routine repairs of any damage	Pre-monsoon every year	BWDB	➢ work to maintain proper crest, side slope, design height etc. under the project (programmed: 23.4 km) commenced in Jan, 2016; partial work was completed till Jun, 2016 ➢ Further work will commence in next pre-monsoon. ➢ effectiveness of flood

					protection will be monitored in next year's pre-monsoon
2	Operational status of regulators /Sluices /water control structures	Operate and carry out maintenance of components of structures	On Routine	BWDB, IMO, WMA	➢ operation and maintenance was done in the reporting period
3	Optimize reservoir and water resources	Operate Feni Regulator to fill up river reservoir	Every year on routine	BWDB	➢ Carried out properly in the reporting period.
4	Conveyance of water through khals	Maintain proper design of khals by siltation	Once in five years cycle/when needed	BWDB, IMO, WUA	➢ First phase de-siltation of khals started in Jan, 2016. ➢ in the reporting period 10 km out of programmed 460 km was de-silted
5	Surface water availability	Record water level and discharge data of Feni, Muhuri and Khalidas pahalia Rivers	Record gauge data and discharge; Conduct data analyses and flow assessment	BWDB, IMO	➢ BWDB recorded gauge data in the reporting period ➢ IMO will conduct data analysis and flow assessment from the next reporting period
6	Surface water Quality- -DO, -pH, -BOD, -COD, -Arsenic and -POPs from Pesticides used in the crops)	Collect water samples from canals, wetlands, reservoirs and assess water quality parameters.	Annually in the month of March -DO, -pH, -BOD, -COD. Finally (fifth year) in the month of March- -Arsenic &	BWDB, IMO	➢ Not due in March, 2016 (covering the reporting period).

			- POPs		
7	Ground Water Availability	Collect water level data from wells, assess lowering of water tables and record recharge level to determine mining	Annually in pre-monsoon	BWDB, IMO, BADC & PHE	➢ Will be done in the next reporting period.
8	Ground Water Quality	Collect water samples from some representative tube wells and testing samples to assess salinity, Arsenic etc.	Annually in pre-monsoon	BWDB, IMO, BADC & PHE	➢ Will be done in the next reporting period
9	Disposal of spoil earth for construction of regulator and re-excavation of khals	Physical verification at construction sites /Khals /Costal embankments	Frequently during construction phase.	BWDB, IMO	➢ In the reporting period re-sectioning of khals was commenced from Jan, 2016. Disposal of spoils was carried out properly
10	Crop yield	Crop cutting /harvesting and weighing at site	Mainly for Boro and Aman crops in every season	BWDB, IMO, WUA, DAE	➢ Not applicable for the reporting period.
11	Crop damage	Indentify /estimate crop damaged area before harvesting	Seasonally for each crop.	BWDB, IMO, WUA, DAE	➢ No damage took place in the reporting period.
12	Fish habitat condition	Physical observation of natural /manmade fish	Annually in dry season	DoF (Department of Fisheries)	➢ Not applicable for the reporting period. ➢ Will be done from the next reporting period.

		habitats			
13	Species diversity	CAS (Catch Assessment Survey) in rivers, khals Fish market survey (FMS) at district and Upazila levels under MIP area	semi-annually (once in dry season and another in rainy season)	DoF	➢ Will be done in the next reporting period.
14	Fish production	CAS in Rivers and Khals /wetlands	As per DoF standards	DoF	➢ will be done from the next reporting period
15	Vegetation species composition and density in homestead platforms	Quadrate Method	Once in 2 years at pre-selected locations	FD (Forest Departm ent)	➢ First phase survey will be carried out in due course in 2018.
16	Status of planted trees in the fore shore of Embankment and canal bank	Physical observation	Once in every year	FD	➢ Will be done from year 2017.
17	House hold income	House hold socio-economic survey	Before commencem ent of construction phase and once after five years of project completion.	BWDB, IMO, DAE	➢ Though physical works commenced from Jan, 2016 household socio-economic survey could not be done. However, first-phase of construction phase will be carried out
18	Land protection	Inspect vulnerable areas along the banks of rivers (Feni, Muhuri, Kalidas Pahalia rivers) within the project	Annually during construction and post construction phases of the project work.	BWDB, WUA	➢ Will be done in next reporting period.

CHAPTER 3: RESULTS OF ENVIRONMENTAL MONITORING

3 Results of environmental monitoring and compliance measures

As the physical progress/construction works till June, 2016 is very limited to (a) Re-sectioning of 5 Km of Costal Embankment out of 22.4 km and (b) Re-excavation of 10 km of khals out of total 480 km, (c) Forming 31 WUOs (Water Users Organization) out of 44 WUOs and adverse environmental and social impacts of MIP are mostly concentrated to construction and operation phases so the time to monitor those possible impacts has not come. MoU between BWDB and the other project partners like DoF, DAE, FD, DoC and DoPHE etc who will also monitor concerned Environmental parameters has not been conducted till June, 2016. More over the main monitoring personnel of IMO specially the Safeguard and Public Relation Officer who is responsible to day to day monitoring of those environmental social safeguard compliance not deployed in the field yet. So the quantitative environmental monitoring parameters specially water quality parameters, Soil fertility parameters, vegetation coverage's, wild life habitats and biodiversity loss etc following according to the items mentioned in the table head of the Table: 3.1 given bellow is beyond the scope of this 1st Semi-annual Safeguard Report.

Table3.1: Actual Observation of Monitoring Results

Monitoring parameter	Method of monitoring	Location	Frequency of monitoring	Baseline results	Monitoring Results	National Standard	Remarks
Surface Water Quality – DO, – pH, – BOD, – EC, Salinity ($CaCO_3$, -SO_4, NO_3, Cl-, Ca, Fe, Mg, K, Na, Zn, B) – Arsenic, etc	Sampling and testing	canals, wetlands and ponds within project area	Annually after completion of physical works	Baseline of Surface water Quality of MIP is attached in Appendix- III	Will be monitored during operation	Stated in Appendix-IV	
Ground Water Quality -Salinity ($CaCO_3$, -SO_4, NO_3, Cl-, Ca, Fe,	Sampling and Testing	Tube wells within project area	Annually after completion of physical works	Baseline of Surface water Quality of MIP is attached in Appendix- III	Will be monitored during operation	Stated in Appendix-IV	

Mg, K, Na, Zn, B), -Arsenic etc							
Soil Fertility	Sampling and Testing	Top soils of crop field within the project area.	Annually after completion of physical works		Will be monitored during operation	Not specified	
Vegetation Coverage	Quadrate & review of FD plantation records.	Homesteads, village groves, cropland forest and plantation on canal banks and coastal embankment within project area.	Annually after completion of physical works	Baseline Land use of MIP is attached in Appendix- V	Monitored only the planted trees on canal banks and coastal embankments and estimated about 2000 trees (10cm-30cm DBH) will be cut.	Not Applicable	
Wildlife habitat Loss -Wetland -Terrestrial	Physical observation and estimation	Wetlands, Village groves, Plantations on canal banks and Coastal embanks within the project area	Biannually after completion of physical works	Baseline Land use of MIP is attached in Appendix- V	Will be monitored during operation	Not Applicable	
Biodiversity loss -Aquatic -Terrestrial	Sampling and estimating	Wetlands, Village groves, Plantations on canal banks and Coastal embanks within the project area	Biannually after completion of physical works	Baseline Biodiversity of MIP is attached in Appendix- VI	Will be monitored during operation	Not Applicable	
Compliance of Labor	Physical observati	Construction and	Day to day during	poor and destitute	Labors are ignorant	Child labor are	

laws (National and International)	on & Questionnaire and Contractors records	operation site within the project area	construction works and monthly during operation	women are present in the MIP area but Religious norms prohibit them to work in outdoor	about the labor laws and reluctant to raise any complaint	prohibited, Minimum age -18 yrs	
Environmental Health & Safety compliance	Physical observation & Questionnaire and Contractors records	Construction and operation site within the project area	Day to day during construction works and monthly during operation	No health & safety measures were found to be provided by contractors specially labor shed, temporary toilets, helmets, first aid, gloves etc (C-IMO report in Appendix-VII). Labors are not used to /reluctant to use helmet & gloves.	Labors are ignorant about the health and Safety compliance and reluctant to use safety measures like helmet & gloves etc but interested to use sanitation and first aid which was not provided / very limited on the construction site	Contractor should ensure laborer's health and safety issue like providing of labor shed, sanitation facilities, like first aid, drinking water, helmets, gloves fire fighting facilities etc.	
Social safety Compliance	Physical observation & Questionnaire and Contractors records	Construction and operation site within the project area	Day to day during construction works and monthly during operation	Labors are mainly track drivers, crane operator, excavator operators, work assistants, helpers etc. Those are locally (nearby areas) recruited.	Women are not willing to work outdoor. No social safety measures found in the construction site.	Abuse of labor, force laboring, unauthorized over time laboring, Sexual harassment, assault are prohibited. Separate latrine & labor shed for female labor should	

				No social conflicts or Noise pollution were recorded.		be ensured, Local labor should be preferred to avoid social conflict and HIBs,	

There is a major gap between C-IMO & PMU and also between PMU and PMDC about the responsibility of IMO and PMDC about safeguard monitoring, implementation, capacity development and Reporting. PIU is ignorant about its scope of works and responsibilities. PMDC thinks that they have no environmental and social safeguard responsibility about MIP. IMO thinks that PIU will do everything on this issue and they could not conduct the day to day monitoring and reporting to PD, PMU monthly.

Discussion several times with the C-IMO about the deployment issue of Safeguard and Public Relation Officer reveals that replacement of that Key person is under processing.

CHAPTER 4: RECOMMENDATION AND CONCLUSION

4 Recommendation and Conclusion

The safeguard team of PMU recommends the following measures/corrective actions to overcome the present non compliance/limited compliance issues of MIP under IMIP.

1. During the meeting of ADB mission the concerned Environmental Safeguard officer of ADB Resident Mission in Dhaka, Bangladesh should call all 4 groups like IMO, PMDC, WUA,PMU and PIU and clarify the Safeguard responsibility of each parties in MIP or send all a written notice clarifying their safeguard responsibilities.
2. The qualitative and quantitative parameters like water quality, biodiversity, soil fertility, Occupational health and Safety as well as social safety compliance are clearly stated in the EIA report of MIP. Environment Division of ADB resident Mission should fix the mandatory parameters and their methods, frequencies and standards on above mentioned indicators discussing the issue with the BWDB, DOE and WUA leaders.
3. Proper training on Environmental Monitoring, Environmental Health and Safety compliance, International Labor law and concerned compliances should be provided to concerned safeguard personnel working in PMU-safeguard cell, C-IMO, PIU, WUA and Construction Contractor in order to develop safeguard monitoring, implementation and reporting (International Standard) capacity.
4. Labors working in construction and operation are ignorant about environmental and social compliance, health and safety right etc. Field based training workshops for contractors specially the labor leaders, WUO should be conducted for raising awareness on Environmental compliance measures, safeguard, health and safety measures, issues mandatory for contractors to comply international labor laws etc.
5. Donor and DoE, Bangladesh should enforce BWDB to comply the above mentioned issues strictly.
6. Many trees have been found to remove by contractors during site preparation for re-sectioning of embankments and re-excavation of khals. According to EMP 3 saplings should be planted for each tree cut/removed and FD should take the responsibility. Though BWDB has a general MoU with FD but who will take the responsibility and bear the cost of replanting/care and maintenance of trees on the rehabilitated canal banks and embankment is not clearly defined. So all this responsibility should go to construction contractor who has removed those trees and gained some revenue from sale of those trees. WUGs are also interested and have the right to planting trees/care and maintenance and sharing the benefit with BWDB and/or FD if they participate in the project. The responsibility should be clearly defined.

The physical/construction works are expected to be completed within 1 year and installation of electricity distribution line and irrigation pumps with that time. So the operation of MIP project will be started very soon (to the end of this year) and then monitoring of almost all environmental parameters will be conducted well. The 2nd Safeguard Monitoring Report to be submitted on December, 2016 will be more enriched with information and results.

Appendix-I

ENVIRONMENTAL MANAGEMENT PLAN

9.1 Introduction

Environmental Management Plan (EMP) for **"Irrigation Management Improvement Project For Muhuri Irrigation Project"** includes the followings features:

i) Environmental Mitigation Plan containing suggestion on mitigation measures to minimize any negative impacts;

ii) Compensation plan suggesting measures required for providing compensation for negative impacts which cannot be mitigated, if any; and

iii) Environmental Monitoring Plan for detecting changes that may take place due to the planned interventions in the project.

EMP features for the pre-construction, construction and post-construction phases in respect of water, land, agriculture, fisheries and ecological resources; and socio-economic conditions have been mentioned in the following sections. However, it is mentioned that the BWDB will appoint a Consulting Firm of international repute, called IMO (Irrigation management Operator) for the IMIP For MIP during the period of implementation of the Project; a note on the Roles and Responsibilities of IMO and other parties involved in implementation of the Project is given in **Annexure A.**

9.2 EMP For Water Resources

Environmental Management Plan for water resources of the Project is presented in Table 9.1.

Table 9.1. EMP for Water Resources

Action	Resource Impact	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
1	2	3	4	5
Pre-construction Phase				
No action on water resources	None.	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
Khals will re-excavated	Augmentation of water resources; impact is positive.	Not applicable	Not applicable.	Not applicable
Putting cross bundh across khals	Temporary obstruction of flow in some khals; temporary negative impact.	Insignificant negative impact; mitigation measure not needed.	Not applicable.	Not applicable.

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Action	Resource Impact	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
1	2	3	4	5
Intrusion of saline water from outfall river into the project will be stopped (by new regulators/repairing old regulators).	Impact is positive.	Not applicable.	Not applicable.	Not applicable.
Post-construction Phase				
Risk of drying of low land through khals by drainage	Less wet land	Essential low land/pockets will not be linked with khals.	BWDB, IMO.	Not applicable.
Increased efficiency of surface water distribution in the field through buried pipeline	Reduced rate of water percolation underground in the irrigation season; but ground water table will be at the same level of water level in the khals. Negative impact will be very insignificant.	Water will be kept in the low lands/pockets/ponds in the post monsoon; and will not be used for irrigation.	WMA, BWDB, IMO.	Not applicable.
Increased extraction of ground water by farmers.	Ground water Table will lower down, mining of water might result	Commissioning of Tube wells will not be allowed to interfere with zone of influence any nearby TW.	BWDB, IMO, WMA.	Not applicable.

9.3 EMP For Land Resources

EMP in respect of Land Resources is mentioned in Table 9.2.

Table 9.2. EMP For Land Resources

Action	Resource Impact	Mitigation Measure	Responsible Agency	Estimated cost
Pre-construction Phase				
No action on land resources	None.	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
Re- excavation of khal as per design	Steep bank might slide down causing loss of unauthorized property loss.	Design includes instructions to avoid such problem.	Contractor, BWDB, IMO.	Not applicable.
Disposal of spoil earth of khals	Spoil earth will be used for canal side road; but there might be excess spoil to be disposed of.	Excess spoil will be used for filling low land or homestead courtyard by land owners at will; or will be carried away to designated place of	Contractor (to be enforced by BWDB, IMO)	Included in the BoQ.

Action	Resource Impact	Mitigation Measure	Responsible Agency	Estimated cost
		disposal (Please see **Note** below this Table).		
Borrow soil for embankment re-sectioning	Spoil earth will be borrowed from BWDB land; but some quantity of spoil earth make be taken from private land.	Cultivated land's earth will not be borrowed unless the land owner wants to dig a pond; spoil earth from private land will be borrowed on agreement with and payment of royalty to the land owner.	Contractor (to be enforced by BWDB, IMO)	Included in contractor's bill.
Construction of labor shed	Labor shed may be constructed on private land forcing land out of cultivation	BWDB land will be used for labor shed; compensation shall be paid to land owner(s) if private land is used in unavoidable circumstances.	Contractor (to be enforced by BWDB, IMO)	To be included in contractor's bill.
Post-construction Phase				
Application of agro chemical fertilizer by farmers by over-dose	Productive fertility of land will reduce	Impart training to farmers on integrated manure practice.	BWDB, IMO, DAE	To be included in IMO contract

NOTE:

Spoil soil disposal

(i) Spoil earth (excavated material of khal) should primarily be used in embankment/khal bank road construction if it satisfies the specification. Excess spoil, if any, should be spread evenly over the nearby low land as directed by the Engineer. Furthermore, if some spoil earth still remains excess after embankment/road construction and filling nearby low land, it should be disposed by cart/truck in a specified place as directed by the Engineer.

(ii) Excavated soil material shall be placed to form a roadway (on BWDB's acquired land), the roadway shall *be of un-compacted material but shall be shaped to 1:2 side slopes with a leveled top. The top width of the roadway will be 4.5m minimum but will depend on the volume of material excavated. Maximum height of material to be deposited shall not exceed 2.0 meters.*

(iii) The contractor shall not deposit any material on land not owned by the BWDB except with permission of the landowner. The limit of the BWDB land shall be determined by the Engineer, landowner and the contractor. If necessary, reference to Mouza maps will determine the land boundary of BWDB's land.

(iv) Excavated material placed on agricultural land must be spread and leveled unless specifically required otherwise by the landowner.

Excavation cost in any reach of khal cannot be paid until placing of excavated soil materials has been completed satisfactorily.

9.4 EMP for Agriculture Resources

EMP in respect of Agriculture Resources is mentioned in Table 9.3.

Table 9.3. EMP for Agriculture Resources

Action	Impact on Resource	Mitigation Measure	Agency	Estimated cost (BDT)
1	2	3	4	5
Pre-construction Phase				
No action	Not applicable	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
Lay underground uPVC pipe replacing field canals for irrigation water distribution	Heaping spoil earth on land interrupting production for some days; nature of negative impact is temporary and insignificant.	Excess spoil earth after back filling shall be spread evenly on the land to the requirement of farmers	Contractor (to be enforced by BWDB, IMO).	included in contractor's bill.
Post-Construction Phase				
Crop intensification /diversification	Non-diversification will negatively impact project target	Training of stakeholders on modern cultivation; crop diversification.	BWDB, IMO, DAE	To be included in IMO's contract

9.5 EMP For Livestock Resources

EMP in respect of Livestock Resources is mentioned in Table 9.4.

Table 9.4. EMP for Livestock Resources

Action	Impact on Resources	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
1	2	3	4	5
Pre-construction Phase				
None	None.	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
None	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Post-Construction Phase				
Agricultural land coverage will increase	Livestock food will increase; impact is positive	Not applicable.	Not applicable.	Not applicable.

9.6 EMP For Fisheries Resources

EMP in respect of Fisheries Resources is mentioned in Table 9.5.

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Table 9.5. EMP for Fisheries Resources

Action	Impact on Resources	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
1	2	3	4	5
Pre-construction Phase				
None	None.	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
Drying khal for about three months for re-excavation	Reduction of fish habitat; however, for small duration; negative impact is insignificant.	There will be no residual impact; mitigation measure not needed.	Not applicable.	Not applicable.
Post-Construction Phase				
Expansion of water body due to project intervention (re-excavation of khals)	Fish habitat will expand; resource will increase; impact is positive.	Not applicable.	Not applicable.	Not applicable.

9.7 EMP for Ecological Resources

It may be mentioned that ecology refers to the study of relationship between organisms/species including human and its surroundings. Thus in general terms, it is the environmental elements/resources that encircle the organism, and herein Environmental Management Plan of ecological resources is mentioned in Table 9.6.

Table 9.6: Environmental Management Plan of Ecological Resources

Action	Impact on Resources	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
1	2	3	4	5
Pre-construction Phase				
None	Not applicable.	Not applicable.	Not applicable.	Not applicable.
During Construction Phase				
Khals will be dried during re-excavation	Some aquatic animals, not consumed by humans, might die; however, residual impact will be insignificant.	No feasible option/measure applicable. However, any important species spotted in the operation will be released in the nearby water body.	Contractor, IMO, BWDB, WMA.	Not applicable.
Post-construction Phase				
Improvement of environment by	Ecological resources	Routine re-excavation of	BWDB, IMO.	To be included in the contract

Action	Impact on Resources	Mitigation Measure	Responsible Agency	Estimated cost (BDT)
expansion of water body due to re-excavation of khals	including aquatic species, and to some extent, terrestrial species will increase. The impact will be positive.	khals.		of IMO.
Cutting tress on khals bank	Reduction of vegetation cover; impact negative; but very limited.	Trees will not be cut unless unavoidable; re-plantation will be done at 1:3 proportions.	BWDB, WMA, DoF	Annual O&M Budget of BWDB, DoF.

Remarks: IMO means Irrigation Management Operator to be engaged by BWDB for management of irrigation in the project.

9.8 EMP Measures For Socio-Economic Condition

EMP in respect of Socio-economic condition is mentioned in Table 9.7.

Table 9.7: EMP measures for Socio-economic condition

Action	Impact on Sector	Mitigation Measure	Responsible Agency	Estimated Cost (BDT)
Pre-construction Phase				
None.	Not applicable	Not applicable.	Not applicable.	Not applicable.
Construction Phase				
Re-sectioning of embankment	Land communication by vehicle on the embankment will hinder; but negative impact will be insignificant.	Embankment re-sectioning will be done segment by segment and completed in proper shape promptly.	Contractor, IMO, BWDB.	Included in the BoQ estimate.
Disposal of excess spoil earth in re-excavation of khals	Excess spoil earth will be used by farmers for raising low land for cultivation; or raising homesteads platform; impact will be positive.	Not applicable.	Not applicable.	Not applicable.
Earthwork and structural work in project implementation	Increased opportunity for employment; especially for socially disadvantaged class	Social safeguard measure (as per project design) provided for enhancement	BWDB, IMO, WMA	Included in the project investment/BoQ
Movement of construction	Generation of noise; dust, fume	Water will be sprayed to	Contractor (to be enforced by	Included in the BoQ

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Action	Impact on Sector	Mitigation Measure	Responsible Agency	Estimated Cost (BDT)
vehicles/ operation of machines		control dust; machines will not run in the night near the human adobe; maintenance of vehicles will be regular and good	BWDB, IMO)	
Ingress of imported external labor force	Social disquiet or disturbance by external manpower breaking peace of local people	External labor force will remain under strict supervision; and shall obey local customs; and country's laws	Contractor (to be enforced by BWDB, IMO)	Included in Contractor's bill
Sanitation of work force	Outbreak of diseases/ epidemics	Proper sanitation facility with water supply; remove any ill person promptly from site	Contractor (to be monitored by BWDB, IMO)	Included in Contractor's bill.
Post - construction Phase				
Implementation of planned activities in project	Income generating activities of agricultural farming will increase; poverty will be reduced; thus impact will be positive.	Access to micro credit. Motivation of stakeholders for increasing agricultural production.	Not applicable.	Department of Cooperatives/NGOs. BEDB, IMO, WMA, DAE.

Appendix-II

9.9 Environmental Monitoring Plan

Environmental Monitoring activities should be carried out in order to record the response of the project to the natural system and social system during implantation of the planned interventions. The information will be required to delineate problems, if any, that might exist/remain in order to ascertain and adopt proper measure for sustainability of the project.

9.9.1 Environmental Monitoring Plan for Water Resources

Environmental Monitoring Plan for Water Resources of the project should be carried out as suggested below in Table 9.8.

Table 9.8: Environmental Monitoring Plan for Water Resources effects

Indicator	Method	Frequency	Responsible Agency
1	2	3	4
Post-Construction			
Flood protection embankment effectiveness	Maintain embankment with proper crest, side slopes and at design height by routine repairs of any damage	Pre-monsoon ever year	BWDB
Operational Status of Regulators/Sluices/Water Control Structures	Operate and carry out maintenance of components of the structures	On routine	BWDB, IMO, WMA
Optimize reservoir and water resources	Operate Feni Regulator to fill up river reservoir	Every year on routine	BWDB
Conveyance of water through khals	Maintain proper design of khals by de-siltation	Once in five years' cycle (or as needed).	BWDB, IMO, WMA
Surface water availability	Record water level and discharge data of Feni, Muhuri and Kalidas Pahalia Rivers	Record gauge data and flow measurement as per BWDB standard; make analysis and assessment of flow	BWDB, IMO
Surface water quality	**Record water level and discharge data of Feni, Muhuri and Kalidas Pahalia Rivers**	**Every year in the month of March**	**BWDB, IMO**
Ground water availability	Collect water level data from wells, assess lowering of water table; and record recharge level to determine mining	Every year in the pre-monsoon	BWDB, IMO, BADC, PHE
Ground water quality	Collect water samples from some sample Tube wells and test samples to assess salinity, arsenic etc.	Once every year in pre- monsoon	BWDB, IMO, PHE

9.9.2 Environmental Monitoring Plan of Land Resources

Environmental Monitoring Plan for Land of the project should be carried out as suggested below in Table 9.9.

Table 9.9: Environmental Monitoring Plan for Land Resources

Indicator/ Item	Method	Frequency of Data Collection	Responsible Agency
1	2	3	4
Disposal of spoil earth for construction of regulator and re-excavation of khals	Physical verification at construction/khal sites	Frequently during construction phase	BWDB, IMO

9.9.3 Environmental Monitoring Plan for Agriculture Resources

Environmental Monitoring Plan for Agriculture resources should be carried out as suggested below in Table 9.10.

Table 9.10: Environmental Monitoring Plan for Agriculture

Indicator/ Item	Method	Frequency of Data Collection	Responsible Agency
Crop yield	Crop cutting/harvesting; taking weight at site	Mainly for Boro and Aman crops in every season	BWDB, IMO, WMA, DAE
Crop damage	Identify crop damaged area before harvesting	For each crop	BWDB, IMO, DAE, WMA

9.9.4 Environmental Monitoring Plan for Fisheries Resources

Environmental Monitoring Plan for Fisheries Resources is given in Table 9.11.

Table 9.11: Environment Monitoring Plan of Fisheries

Indicator	Method	Frequency	Responsible Agency
1	2	3	4
Fish habitat condition	Physical observation of natural habitat and any man made habita	Once every year in dry season	DF (Department of Fisheries
Species diversity	Catch Assessment Survey (CAS) in rivers, khals of project; and Fish Market Survey (FMS) at District and Upazila levels	Once in dry season and once in wet season every year	DoF
Fish production	CAS in rivers and khals	As per DoF standard	DoF

9.9.5 Environmental Monitoring Plan of Ecological Resources

Environmental Monitoring Plan for Ecological Resources is given in Table 9.12.

Table 9.12: Monitoring plan of Ecological Resources

Indicator	Method	Frequency	Responsible Agency
1	2	3	4
Vegetation species composition and density in homestead platforms	Quadrate	Once in 2 years at pre-selected locations	Forest Department (FD)
Status of planted trees in the fore- shore of embankment.	Physical observations.	Once in every year.	Forest Department(FD)

9.9.6 Environmental Monitoring Plan of Socio-economic Condition

Environmental Monitoring Plan for Socio economic Resources are given in Table 9.13.

Table 9.13: Environmental Monitoring Plan of Socio-economic condition

Indicator	Method	Frequency	Responsible Agency
1	2	3	4
Household income	Household socio-economic survey	Before commencement of construction-phase and once after five years of project completion	BWDB, IMO, DAE

9.9.7 Environmental Monitoring Plan for Land Protection

Environmental Monitoring Plan for Land Protection is given in Table 9.14.

Table 9.14: Environmental Monitoring Plan of Land Protection

Indicator	Method	Frequency	Responsible Agency
1	2	3	4
Land Protection	Inspect vulnerable areas along the banks of rivers (Feni, Muhuri, Kalidas Pahalia Rivers) within the project	Every year during construction and post-construction phases of the project work	BWDB, WMA

9.10 Cost Estimate for Environmental Monitoring Plan

9.10.1 Water Resources

9.10.2 Land Resources

9.10.3 Agriculture Resources

9.10.4 Fisheries Resources

9.10.5 Ecological Resources

In respect of the above matters/issues (Sub-Sections 9.10.1 to 9.10.5), warranting pertinent cost involved for environmental monitoring, it is pointed out that the project has been envisaged for an economic life tenure of 30 years; first 5 (five) years for implementation and remaining 25 years to operation and maintenance. The envisaged plan indicated that during the period of implementation, the Secondary and Tertiary khal systems including the on-farm irrigation operation and maintenance will be entrusted to the Irrigation Management Operator (IMO), a selected consulting firm of international repute; and after implementation the Executing Agency (EA) will lease the system out for operation and maintenance for the subsequent period. As such, cost of environmental monitoring will remain vested with the IMO during implementation and to another consulting firm to be hired in the period of operation and maintenance after completion of planned interventions. Cost of environmental monitoring will remain inherent in the contract price of the IMO in the initial period of 5 years; and for the remaining period of project life the cost will be borne (in kind) by the consulting firm to be hired for operation and maintenance of the system of irrigation, and irrigation management improvement, a continuous process.

However, the investment cost of the project is about BDT 250 crore for the physical work components; and at this moment it is assumed reasonably that the total cost of environmental monitoring will be about BDT 250 lakh or about @1% of investment cost of physical works; providing about BDT 10 lakh annually over 25 years period of operation and maintenance.

Appendix-III

5.4.7 Water Quality/Salinity

Some sampling of water quality is presented below in Table 5.3. Iron in water from the shallow tube wells is quite high and farmers report some problems; in some cases they use a mixture of tube well water and river water. The surface water is good quality for the purpose of irrigation.

The sediment load of the two eastern rivers coming down from the hills of India is very high during the rainy season. This is likely to be attributed to deforestation in the upstream sections of the respective catchments. With respect to ground water, arsenic contamination is the prime concern in the Region. The Southeast region is one of the hot-spots for this problem. The shallow aquifer has high arsenic concentrations in Chandpur, Noakhali and Lakshmipur districts. The most affected aquifers lie beneath the Meghna floodplains. Water Quality data in the Muhuri Irrigation Project is presented in Table 5.3.

Table 5.3. Water Quality in Muhuri Irrigation Project (MIP)

Parameter	Limit for irrigation	Groundwater Shallow Tube well			Surface Water: Khal of Muhuri River		
		SP1	SP2	SP3	Dharmo Khal	Korly a	Highay Borrowp it Khal
	Water Quality mg/l						
Total Hardness (as $CaCO_3$)	60	36	45	44			
Chloride (Cl^-)	<150	26	69	32	15	12	9
Nitrate (NO_3)	5	0.33	0.71	0.61	0.62	0.96	0.7
Sulphate (SO_4)	250	1	<1	1	<1	2	1
Arsenic (As)	0.1	0.007	0.018	0.007			
Calcium (Ca)		9	10	9	14	12	13
Iron (Fe)	<1.5 recommend <4 upper limit	3.8	4.1	4.2			
Magnesium (Mg)		6	8	7	8	7	7
Potassium (K)		3.3	4.1	4	3.2	3	3.1
Sodium (Na)	70	50.6	87.3	53.7	25.7	21.3	22.5
pH	6.5-8.4	6.45	6.86	6.98	7.75	8.07	7.21
Zinc (Zn)	1	<.08	<0.08	<.08			
Boron (B)	0.5	0.2	0.2	0.22			
EC(µs/cm)	750	247	426	308	173.8	142.8	144.1

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Appendix-IV

Table 2.5. Bangladesh standard for industrial project effluent

Sl. No.	Parameters	Unit	Place fordetermination of standards		
			Inland surface water	Public sewerage tom treatment at second stage	Irrigated Land
1	2	3	4	5	6
1	Ammonical Nitrogen	mg/l	50	5	75
2	Ammonia (as free ammonia)	,,	5	5	15
3	Arsenic (as)	,,	0.2	0.05	0.2
4	BOD_5 at 20^0C	,,	50	250	100
5	Boron	,,	2	2	2
6	Cadmium (as CD)	,,	0.50	0.05	0.05
7	Chloride	,,	600	600	600
8	Chromium (as total Cr)	,,	0.5	1.0	1.0
9	COD	,,	200	400	400
10	Chromium (as hexavalent Cr)	,,	0.1	1.0	1.0
11	Copper (as Cu)	,,	0.5	3.0	3.0
12	Dissolved Oxygen (DO)	,,	4.5 – 8	4.5 – 8	4.5 – 8
13	Electro-conductivity (EC)	Micro mho/cm	1200	1200	1200
14	Total Dissolved Solids	,,	2,100	2,100	2,100
15	Fluoride (as F)	,,	2	15	10
16	Sulfide (as S)	,,	1	2	2
17	Iran (as Fe)	,,	2	2	2
18	Total Kjeldahl Nitrogen (as	,,	100	100	100
19	Lead (as Pb)	,,	0.1	1.0	0.1
20	Manganese (as Mn)	,,	5	5	5
21	Mercury (as Hg)	,,	0.01	0.01	0.01
22	Nickel (as Ni)	,,	1.0	2.0	1.0
23	Nitrate (as elemnentary N)	mg/l	10.0	Not yet Fixed	10
24	Oil and Grease	,,	10	20	10
25	Phenolic Compounds (as C_6H_5OH)	,,	1.0	5	1
26	Dissolved Phosphorus (as P)	,,	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)	Degree	5	10	10
31	Total Dissolved Solids	,,	2,100	2,100	2,100
32	Temperature	°C	40	40	40 summer
33	Suspended Solids (SS)	mg/l	150	500	200
34	Cyanide (as Cn)	,,	0.2	2.0	0.2

Source: Schedule-10, ECR 1997, adopted from the book of compilation of Environmental Law-2003

Notes:

(1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector- wise industrial effluent or emission."

(2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.

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Appendix-V

5.5 Land Resources/Land Use

Land Use

The crop estimates over the last 10 years show a reducing trend of production. The current area of rice cropping has been assessed using satellite imagery and inventory and questionnaires to the pump operators. The land use based on 2011 satellite imagery is shown for the Muhuri Irrigation Project (MIP) as well as the Muhuri Kahua Project (MKP) in Table 5.4.

Table 5.4. Estimated Land Resources/Land Use in MIP & MKP

ID	Class name	Muhuri Area (ha)	Muhuri Kahua Area outside Muhuri (ha)	Total Area (ha)
1	Boro Rice	11,843	6,108	17,951
2	Fallow	9,773	7,136	16,909
3	Other Crops	3,160	539	3,700
4	Settlements	15,265	7,168	22,433
5	Water	2,286	634	2,919
6	Gher	1,385		1,385
7	Hill Forest/grassland	8	92	100
8	Mudflat/mangrove	50		50
9	Rail/road	123	54	177
Total		**43,892**	**21,731**	**65,623**

5.5.1 Agro-ecological Regions

The physiographic unit of the project at upstream is: Chittagong Coastal Plain (AEZ# 23), sub-regions are Piedmont Plains and River Flood plain (23a) and Young Tidal Floodplain(23b) with general soil type Non-Calcareous Grey Floodplain Soils(non-saline) in both of the sub-region soils. The soil texture in both of the sub-region soils is loamy. The landscape of the area-comprised of mainly medium high land to high land. The soil type pre-dominates with Non-Calcareous Grey floodplain soils (no-saline).

The project area is covered with only the Meghna Floodplain Agroecological region. The project area is located within six Upazilas namely: Phulgazi, Purshuram, Chhagayal Niyyia, Feni Sadar and Sonagazi of Feni District; and Mirsarai Upazila of Chittagong District.

The soil Texture Family of the project area is "loamy". This type of soil has low permeability and suitable for transplanted paddy. Agro-ecological region is presented in Map 5.5.1.

Appendix-VI

5.9.2 Terrestrial Ecosystem

Terrestrial ecosystems of the study area are classified in following categories.

- Settlement/Homesteads
- Crop fields
- Roads and embankments

Terrestrial Flora

The study area is occupied by homestead vegetation, crop field vegetation; and roads and embankment-side vegetations characterizing the terrestrial flora.

Homestead Vegetations

Homestead vegetations possess maximum plant diversity and population in this area. Vegetation density and population vary in different parts of the project according to land levels and land use. Homestead vegetations are dominated by tall rain tree, mango tree, jackfruit tree, betel nut tree, coconut tree etc.

Crop Field Vegetation

Major parts of crop fields of the project are used for rain-fed Aman paddy, Aus paddy and irrigated Boro rice. Farmers also cultivate different types of rabi crops which include vegetables, oil seeds, chilies. These crops provide vegetation cover to the cultivable land in different seasons. Other tahn the cultivated variety of crops, remaining field area is infested with various species of weeds. However, crop field contribute feeding habitat for various faunal species.

Roads and Embankment-sides Vegetations

Major part all roads in the project area have got good vegetation cover comprising various types of local trees. However, the vegetation cover in the embankment is thin; Babla (*Acacia*) is the successive tree found in some area's embankment sides which were planted by BWDB as the first step to keep cattles away from it as the tree is adorned with thorns with very much menacing feeling when hurt by it; and subsequently the Department of Forest (DoF) complemented the campaign. But in the foreshore of the embankment in Sonagazi and Mirsarai Upazilas, the vegetation cover is reasonably thick with selected and planted tree species raised by the DoF. Raintree Koroi (Albizia lebbeck), Sissoo (Dalberzia sissoo) are common species of trees in the road side vegetation.

Terrestrial Fauna

Faunal diversity of terrestrial habitat is moderate inside the project area. Among the amphibians is Common Toad ('Bufo melanostictus') that live at moist and cool places of homesteads platforms. Terrestrial reptiles include snakes and lizards. Common Wolf snake (Lycodon aulicus,), Stripped Keelback (Amphiastma stolatum) Garden Lizard (Calotes versicoor) and House Lizard (Hemidactylus brooki) are also sightedin the project area in the northern and in the southern parts.

Bird population is concentrated in dense homesteads forest, density is thick in the northern portion of the project where land elevation is higher with thick vegetation cover but density is thin in the southern part of the project with thin density of vegetation. Common birds in the area are Sparrow (Passer domesticus), Common myna (Acridotheres tristis), Asian pied Starling (Sturnus contra), House Crow ('Corvus splendens,), etc.

Mammals in the area include mongoose, mouse and bats; big mammals are however, rarely sighted. Common species are House rat (Rattus raitus,), Common mongoose (Herpestes edwardsi), Indian flying fox (Pteropus giganteus) and Indian Pipistrelli (Pipistrellas coromandra).

5.9.3 Aquatic Ecosystem

Major wetland types of project are:

- Homestead ponds
- Rivers and Khals

Use of homesteads ponds are confined to domestic purposes. Some ponds are used for fresh water fish culture. Homestead ponds lack in aquatic vegetations. But the homesteads ponds contribute to maintain soil moisture as well as plant health of surrounding areas vegetations.

Within the project are situated Feni, Muhuri and Kalidas Pahalia Rivers which have perennial inflow throughout the year. Numerous lateral khals are connected to the rivers from the land/high lands. Many small khals have lost their connectivity with the river due to siltation. However, the secondary khals, which are bigger in size, are still connected to the rivers; the khals in the monsoon drain into the rivers while in dry season the khals are used as routes to deliver water from the rivers to the fields for irrigation.

Aquatic Flora

The area is not rich in Aquatic floral diversity as the rivers and the khals act as routes of drainage of water into the Lower Meghna River of the rain fall run off and also water that come into the water

bodies from outside Bangladesh's border. Existence of aquatic plant population is concentrated in stagnant water of borrow pits and ditches on the road-sides. Water hyacinth (*Eicchornia crassipes*), Topa pana (*Pistia stralеotes*) etc. are common free floating species of aquatic flora.

Aquatic Fauna

The rivers and khals are the bulk of area to provide habitats for the aquatic fauna, nevertheless the homesteads ponds, of the project area. Life cycle of the aquatic or wetland related fauna is dependent on the ecosystem's natural fluctuations pertinent to water levels in the rivers/khals (homesteads ponds water level drops or rises slowly causing smaller impact). As a matter of fact fish of various species is the most prominent portion and common aquatic fauna biodiversity in the project.

Amphibians, such as, Skipper Frog (*Euphylictis cyenophlyctis*) and Indian Bull Frog (*Hoplobacirachus tigerinus*) species are sighted in the iccinity of most of the water bodies. Green frog (*Euphlyctis hexadaclylis*) amphibian is seen only in the wet season; but the abundance of the same is insignificant.

Population of aquatic reptiles including 2-3 types of turtle species are exisistent in the project as reported by the people. Among the snakes, Stripped Keelback (Xenocraphis piscator), Glossy marsh Snake (*Gerardia prevostiana*) and Common wolf snake (*Lycodon aulicus*) are not reported in the locality but are existent in the northern part of the project which is hilly in terrain as gathered from the people.

Population of birds, dependent on water are naturally concentrated along the rivers banks, and internal secondary khals feeding on fish. Such water dependent bird species are: Great Egret (*Casmerodious albus*), Little Egret (Egrettagarzetta), Yellow Bittern (Ixobrychus sinensis), Little Cormorant (*Phalacrocorax nigger*) etc.; however, not thick in density. Indian Grey Heron (*Ardea cinerea*) is also existent with thin density.

5.9.4 Ecosystem Services

Output of Ecosystem Services

Principal contributions from the ecosystem in the project are: food of various type and form, fuel woods, thatching materials and timber. Staple food grains come from crop field vegetations. Paddy is the main crop grown in the project. Almost the full amount of domestic fuel comes from homestead vegetations. Coconut (*Cocos nucfera*) and mangos are grown in maximum homesteads but jackfruit is grown in the northern hilly area of the project.

Table 5.15: Diversity of fish species in the project area

Scientific Name	Local Name	Fish Habitat		
		River	Khal	Fish pond
Labeo bata	Bata	P	P	P
Latescal earfter	Bhetki	P	P	A
Mugil persa	Persa	P	P	A
Metapenaeaus monocerus	Harina	P	P	A
Setipinna phasa	Phesa	P	P	P
Mystus cavasius	Gulsha	P	P	A
Puntius spp	Punti	A	P	P
Scatophagus argus	Paira/chitra	P	A	A
Eleutheronema tetradactylum	Tailla	P	P	A
Acanthopagrus latus	Datina	P	P	A
Labeo boga	Bhangan	P	A	A
Raiamas bola	Bhola	P	A	A
Anabas testudineus	Koi	A	A	P
Heteropneustes fossilis	Jiol	A	A	P
Clarius batrachus	Magur	A	A	P
Mastacembelus spp	Baim	P	A	A
Channa striatus	Shol	A	A	P
Channa marullus	Gojar	A	A	P
Labeo rohita	Rui	A	P	P
Catla catla	Catla	A	P	P
Cirrhinus mrigala	Mrigal	A	P	P
Cyprinus carpio	Carpio	A	P	P
Telapia mossambica	Telapia	A	P	P
Hypophthalmiehthys molitrix	Silver carp	A	P	P
Ctenopharyng odonidellus	Grass carp	A	P	P
Puntius sarana	Sarpunti	A	P	P
Scylla spp.	Kakra	P	P	A
Monopterus cuchia	Kuicha	P	P	A

Note: A=Absent, P=Present.

Following Table 5.22: shows Species of Conservation Significance

Fish species variety those are locally unavailable for last 10 years or have become rare as reported by the local fishermen and elderly people are given in the following Table 5.16.

Table 5.16: List of species of conservation significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
1	2	3	4
Lates calcarifer	Bhetki	√	
Labeo boga	Bhangan		√
Scatophagus argus	Paira	√	
Acanthopagrus latus	Datina	√	
Clarias batrachus	Kain		√
Channa striatus	Shol	√	
Channa punctatus	Lata/Lathi/Taki	√	
Channa marulius	Gojar		√
Rhinomugil corsula	Khorkulla	√	
Pangasius pangasius	Pungus		√

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Appendix-VII

Muhuri Irrigation Project – Six monthly Environmental Monitoring Report - June 2016

Earthwork (Khal Excavation)		
Objective	*Photos – please provide site photos related to the excavation work*	*Proposed action / comment from officer undertaking on-site environmental monitoring*
Kilometers of khal re-excavated until end of June 2016 Approximately 7km (partly completed)	  	A general briefing on khal construction supervision has been prepared and provided to C-IMO site engineers. The briefing gives a guide for supervision/monitoring the ongoing khal re-excavation program on daily and weekly basis and for reporting to C-IMO office, Feni. The briefing gives specific instruction on social and environmental safeguard issues. Short-comings in implementing the EMP and social safeguards have been reported to the PIU, with a request for BWDB to remind the contractor of his obligations. The contractor has been instructed to obtain cadastral maps and demark the boundaries between BWDB and private land (instruction by ADB Mission, June 2016) Promotion of EMP actions to increase with mobilization of Safeguards and Public Relations Specialist in August 2016. Contractor reports he is unable to mobilize women workers for the hand excavation work because of cultural restrictions.
Average number of laborers working each day (male and female) 20 for cross-dam at Ichakhali Khal (short-term)		
Equipment and machines used for excavation 12 excavators		
Are excavated materials/spoil transported with proper procedures? At this time there has been no transportation away from the excavation site.		
Are excavated spoils placed or dumped as per EMP? No. EMP requires spoil to be reshaped into roads and if excess spread over paddy or removed. Spoil currently remains where placed from excavation.		
If mechanical excavator is used, are the operators equipped with Personnel Protective Equipment (helmets, gloves, masks)? Yes. But this equipment is not used by the operators		
Number of trees removed; size of tree bole 2000 of 6 to 10 cm diameter		*Is there any violation observed? Please mention.* The excavated spoil seems to extend into private lands and paddy fields. Landholders have complained of resultant impacts on their activities. There is heap of soil beside the khals. There is no labor shed; latrine and sign board (except Icakhali khal
Is there any problem of high noise generated from equipment, truck or other vehicle? Yes, but not much. Most work is away from dwellings		
Any problem of dust generation from vehicle movement Mot much. Currently little vehicle movement.		

General Manager/Deputy General Manager
C – IMO, Feni. Date: 19 July 2016

(additional pictures attached)

GENERAL BRIEFING ON-
CONSTRUCTION SUPERVISION OF KHAL REEXCAVATION FOR FIELD /SITE ENGINEERS.

This briefing outline is prepared for the Field/site Engineers to help supervise/monitor the ongoing khal re-excavation program on daily and weekly basis and reporting as such to Feni IMO office. This will work as a guide for field monitoring activities.

1. Preparatory works:
   a) Social & environmental site review of selected khal with the contractor to a) identify any changes in design needed to avoid impacts on existing buildings and infrastructure to extent possible/practical (could require steepening banks and/or narrowing bed for short reaches); b) decide on environmental management actions needed, such as maintaining drainage into khals, small deviations in khal alignment to minimize the number of trees removed and to estimate the number of trees under pre-work conditions (see item 7).
   b) Meeting with local landholders to inform about the work, reach agreement on actions which may impact on them (moving/lifting shacks, disposal of excess earth, disposal of water bailed out of khal, etc.)
   c) Selected khal and its reaches should be cleaned-bushes, debris, aquatic plants etc. to be removed before starting the re-excavation works. If there are water in the khal, bailing out water to be made (see item 4).

Note: see resettlement plan and environmental management plan in PAM

2. Tools and Equipment Requirements:

The field/ site Engineers (both C-IMO and contractor) should be equipped with:

   a) Note book,
   b) Measuring tapes (100 m);
   c) Compass (use mobile phone?)
   d) Calculators,
   e) Approved design/drawing, cross section/long section data, cutting chart and other survey data;
   f) GPS (hand held unit or mobile phone app?)

3. Profiling (Boundary and define Khal marking as per design criteria)
   a) Pegging and flagging: Khal profiles should be erected using full bamboo poles and pegs with flags at the top.
   b) In each section/ reach should be clearly marked with bamboo post with flags-
      - center line post (1),
      - slope posts at bed level (2),
      - top banks (2);
   c) The pegging should be made through entire khal at every 200-300 m intervals;

4. Cross dam for bailing out water-
    a) Build cross dam for bailing out water;
    b) the khal should be dry while excavating manually/ by machines (excavators);
    c) After completion of work, all cross dams must be removed from the khal.

5. Model Section

Design section with-

a) Bed level, depth, slope and other parameters should be achieved for 50-100 m and as such excavation progress.
b) After achieving the model section, as per design, it needs to be approved by the Competent Engineer (XEN/CRE? I think so.).

6. Spoil Management
    a) Set- set back distance 2.0 m at the top bank,
    b) 2 m top road with 1:2 slope, as per design should be made;
    c) Spoil to be smoothed and compacted and depth not greater than 1.5 m
    d) Borrow pits for embankment material ... 8m away from berm, dug on BWDB land or with agreement of landholders, these pits could be used for fish ponds to reduce potential mosquito issues
    e) Fill not to be placed on hard surface roads, not to block drainage channels

7. Environmental and Resettlement Management
    a) No settlements (houses, shops, small installation, TW etc.) should be disturbed. Where necessary, by agreement such houses, shops, etc. might be raised or relocated at the contractor expense.
    b) Care must be taken at all bridges crossing and roads adjacent to the khals to ensure these are not destabilized,
    c) Minimize the number of trees to be cut/uprooted; if absolutely necessary they can be removed, the C-IMO is to estimate and report on the number of trees removed. The Department of Forestry, together with local landholders, is to plant three for each tree cut/uprooted.
    d) All such installation, trees should be listed before work is initiated,
    e) Excess spoil disposal may be arranged with local landholders who have the rights to this material, it may be spread on fields, used around houses, etc.
    f) Wetland areas are to be preserved,
    g) Agreements reached between the contractor and local landholders must be recorded in writing and witnessed by the C-IMO site engineer;

REPORTING TEMPLATE

(This reporting template should be submitted to Feni IMO Office on weekly basis)

Name of Work/Khal: _____

Name of Contractors: _____

1. Contractor's Engineer/Representative present at the site? Y/N
2. Contractor 's site register kept at the site? Y/N
3. Design drawing, cutting chart etc. available at site? Y/N
4. Khal lay out/profiling set up properly? Y/N
5. Model Section achieved: (what length)? Y/N
6. Model Section is approved by Engineer? Y/N
7. Khal bed is dry/slushy soil/full of water please mentioned?
8. Cross dam is built and bailing out water is in progress? Y/N
9. How many pumps working for bailing out of water? _____
10. Excavated soils (spoil) are placed in proper shape (as per design)? : Y/N
11. How many excavators are engaged in the work?
    a) Long boom: _____
    b) Medium boom: _____
    c) Short boom: _____
12. Is there any disturbance in the existing settlement? Y/N
13. How many trees affected by this excavation? _____
14. Size of the trees affected: _____
15. Is the list of affected settlement/trees prepared? Y/N
16. Approximate Progress of work: (%) _____
17. Describe any issues related to excavation (seepage, caving of soil from side slope/side collapse, etc.)-