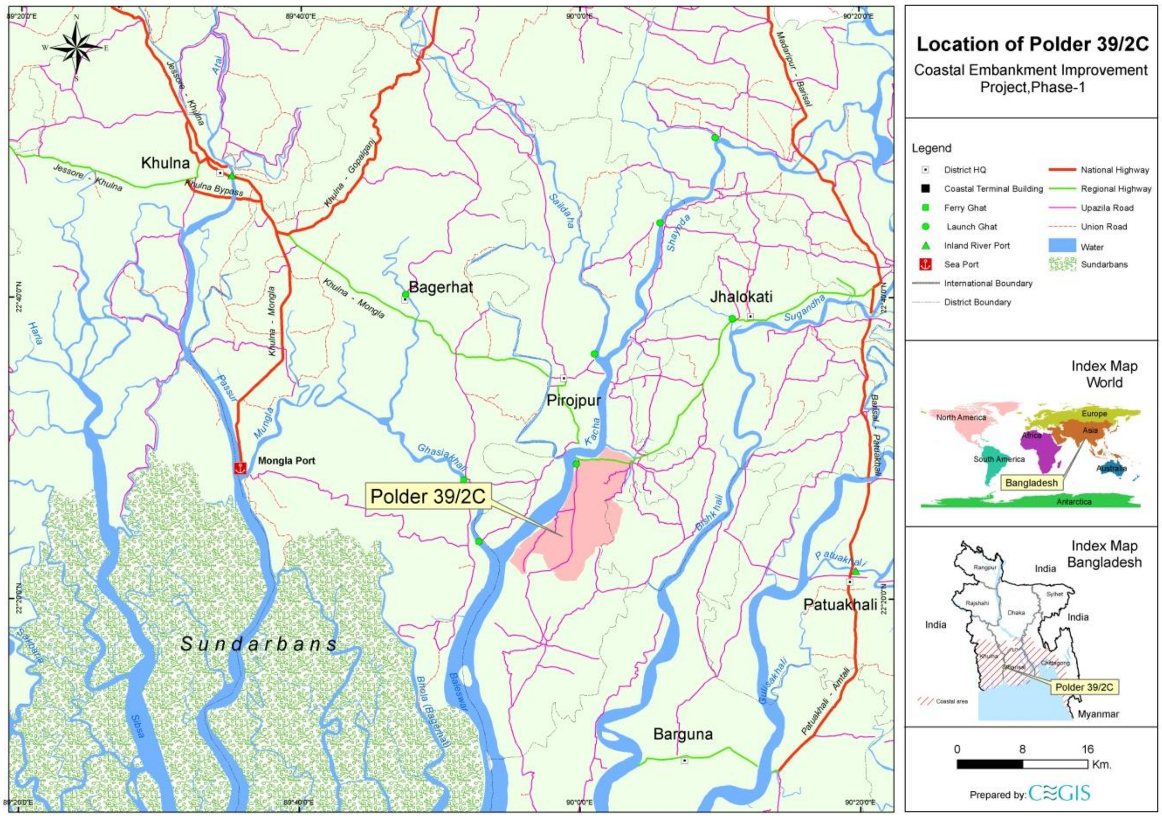
Final Report

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

COASTAL EMBANKMENT IMPROVEMENT PROJECT, PHASE-1 (CEIP-1)



Consultancy Services for Detailed Design, Construction Supervision and Project Management Support

ENVIRONMENTAL IMPACT ASSESSMENT POLDER 39/2C FOR PACKAGE-2

February 2017

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Study Team

A multidisciplinary team from Center for Environmental and Geographic Information Services (CEGIS) conducted the EIA study. The study team comprised of the following professionals:

Sl. No.	Position	Incumbent
1	Water Resources Engineer/Team Leader	Mr. Md. Sarfaraz Wahed
2	River Morphologist	Mr. Pintu Kanungoe
3	Environmental Specialist	Mr. Kazi Kamrull Hassan
4	Socio-economist	Dr. Dilruba Ahmed
5	Soil & Agriculture Specialist	Dr. Anil Chandra Aich
6	Fishery Specialist	Dr. Ashraful Alam
7	Ecologist	Mr. Ashoke Kumar Das
8	GIS/RS Specialist	Ms. Pia Afreena Huq
9	Junior Professional (Water Resources Engineering)	Mr. Fahad Khan Khadim
10	Junior Professional (Morphology)	Mr. Sudipta Kumar Hore
11	Junior Professional (Fishery)	Mr. Md. Ashraful Alom
12	Junior Professional (Ecology)	Mr. Md. Sharif Hossain Sourav
13	Junior Professional (Forestry)	Mr. Md. Mizanur Rahman
14	Junior Professional (Sociology)	Mr. Mobasher Bin Ansari
15	GIS/RS Analyst	Mr. Md Saidur Rahman
16	GIS/RS Analyst	Mr. Hassan Imam Tawfique
17	Enumerator	Mr. Md. Azizur Rahman
18	Enumerator	Mr. Muhammad Shahidur Rahman

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Abbreviations and Acronyms

ASA	Annual Development Plan
AEO	Assistant Extension Officer
AP	Affected Person
ASA	Association for Social Advancement
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BMD	Bangladesh Meteorology Department
BRDB	Bangladesh Rural Development Board
BRAC	Bangladesh Rural Advancement Centre
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CBOs	Community Based Organizations
CCP	Chittagong Coastal Plain
CDS	Coastal Development Strategy
CDP	Coastal Development Partner
CEGIS	Center for Environmental and Geographic Information Services
CEIP	Coastal Embankment Improvement Program
CEIP-I	Coastal Embankment Improvement Project, Phase I
CERP	Coastal Embankment Rehabilitation Project
CMG	Canal Maintenance Group
CES	Consulting Engineering Services
CAFOD	Catholic Fund for Overseas Development
CS	Construction Supervision
CLAC	Central Land Allocation Committee
CZPo	Coastal Zone Policy
DAE	Department of Agricultural Extension
DC	Deputy Commissioner
DCSC	Design,Construction and Supervision Consultants
DCEO	Deputy Chief Extension Officer
DD	Deputy Director
DEA	Department of Agricultural Extension
DEM	Digital Elevation Map
DevCon	DevConsultants Ltd

DOE	Department of Environment
DOF	Department of Fisheries
DPHE	Department of Public Health Engineering
DPM	Design Planning & Management Consultants
DTW	Deep Tubewell
DWM	Directorate of Water Management
EA	Environment Assessment
EAP	Environmental Action Plan
EC	Executive Committee
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECoP	Environmental Code of Practice
ECR	Environment Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration project
EDS	Environmental Data Sheet
EIA	Environmental Impact Assessment
EMG	Embankment Maintenance Group
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EO	Extension Officer
ES	Environmental Screening
ESBN	Estuarine Set Bag Net
ESC	Environmental Social and Communication Unit
FAO	Food and Agriculture Organization
FD	Forest Department
FG	Functional Group
FGD	Focus group Discussion
FRSS	Fisheries Resources Survey System
FWIP	Future-with-Project
FWOP	Future-without-Project
GIS	Geographical Information System
GO	Government Organization
GOB	Government of Bangladesh
GRC	Grievance Redress Committee
GPWM	Guidelines for Participatory Water Management

GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
Ha	Hectare
HTW	Hand Tubewell
HYV	High Yielding Variety
ICZM	Integrated Coastal Zone Management
ICZMP	Integrated Coastal Zone Management Plan
IDA	International Development Association (World Bank)
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
FIDIC	International Federation of Consulting Engineers
ILO	International Labour Organization
IPOE	Independent Panel of Expert
IPCC	Intergovernmental Panel on Climate Change
IS	Institutional Survey
IUCN	International Union for Conservation of Nature
IWM	Institute of Water Modelling
KCC	Khulna City Corporation
KII	Key Informant Interview
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
LCB	Local Competitive Bidding
LCS	Landless Contracting Society
LGI	Local Government Institution
LLP	Low Lift Pump
MC	Main Consultant (for CEIP-I Feasibility study)
MDP	Meghna Deltaic Plain
MOEF	Ministry of Environment and Forest
MOL	Ministry of Land
MOWR	Ministry of Water Resources
MP	Muriate of Potash
MSDS	Project Management Data Sheets
MSL	Mean Sea Level
NCA	Net Cultivated Area
NCR	Non-Compliance Report
NGO	Non-Governmental Organization

NOC	No Objection Certificate
NWRD	National Water Resources Database
OMD	Operation and Maintenance Group
O&M	Operation and Maintenance
PAP	Project Affected Person
PCM	Public Consultation Meeting
PCD	Project Concept Document
PD	Project Director
PIC	Project Implementation Committee
PID	Project Information Document
PIO	Project Implementation Office
PL	Post Larva (Shrimp or prawn seed)
PMU	Project Management Unit
PPE	Personnel Protective Equipment
PRA	Participatory Rural Appraisal
PSC	Project Steering Committee
PWD	Power Works Department
PRSP	Poverty Reduction Strategy Paper
RAP	Resettlement Action Plan
RCB	Reinforced Concrete Box
RCC	Reinforced Concrete Cement
RL	Reduced Levels
RRA	Rapid Rural appraisal
SAEO	Sub-Assistant Extension Officer
SDE	Sub-Division Engineer
SEA	Strategic Environmental Assessment
SEO	Secondary Education Office
SLR	Sea Level Rise
SMG	Structure Maintenance Group
SO	Sectional Officer
SRDI	Soils Resources Development Institute
SSO	Social Service Office
STW	Shallow Tubewell
TAO	Thana Agriculture Officer
TDS	Total Dissolved Solids

TOR	Terms of Reference
TPV	Third Party Validation
TSP	Triple Superphosphate
UFO	Upazila Fisheries Office
UNDP	United Nations Development Program
UZ	Upazila
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WA	Work Assistant
WAO	Women Affairs Office
WARPO	Water Resources Planning Organization
WMA	Water Management Association
WMF	Water Management Federation
WMG	Water Management Group
WMIP	Water Management Improvement Project
WB	World Bank
WMO	Water Management Organization
YDD	Youth Development Department

Glossary

Aila:	Major Cyclone, which hit Bangladesh coast on May 25, 2009
Aman:	Group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.
Arat:	Generally an office, a store or a warehouse in a market place from which Aratdar conducts his business.
Aratdar:	Main actor act as a wholesaler or commission agent or covers both functions at the same time; carries out public auctions and is the main provider of credit in the marketing chain.
Aus:	Group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during June-July. Generally rain-fed, irrigation needed for HYV T. Aus.
B Aus:	When preceding a crop means broadcast (B. Aus)
Bagda:	Shrimp (*Penaeus monodon),* brackish/slightly saline water species.
Baor:	Baor dead arm of a river in the Moribund Delta as in the case of the Ganges; also called oxbow lake. It appears as a saucer shaped depression. The term baor is synonymous to beel, familiar in the southwestern part of Bangladesh.
Bazaar:	Market
Beel:	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Boro:	A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April- May.
Charland:	The chars, otherwise known as charlands, are riverine lands located in the active river basins of the main rivers of Bangladesh. They are located on the banks of the river and islands in the mid-stream of the main channel that are created by the continual shifting of these rivers and emerge from the deposition of sand and silt from upstream.
Golda:	Prawn *(Macrobrachium rosenbergii*), non-saline/fresh water species
Gher:	Farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish.
Haor:	A back swamp or bowl-shaped depression located between the natural levees of rivers and comprises of a number of *beel*s.
Jhupri:	Very small shed for living, made of locally available materials. One type of house used by very poor community members.
Kacha:	A house made of locally available materials with earthen floor, commonly used in the rural areas.

Khal:	A drainage channel usually small, sometimes man-made, through which the water flows. These may or may not be perennial.
Kharif:	Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).
Khas land:	A land holding by the Government.
Kutcha Toilet:	The earthen made latrine consist of a hole without cover.
Perennial Khal:	Water available in the khal all the year round.
Rabi:	Dry agricultural crop growing season; mainly used for the cool winter season between November and February.
Ring Slab:	The simple pit latrine consists of a hole in the ground (which may be wholly or partially lined) covered by a squatting slab or seat where the user defecates. The defecation hole may be provided with a cover or plug to prevent the entrance of flies or egress of odor while the pit is not being used.
Seasonal Khal:	Water not available in the khal all the year round.
Sidr:	Major Cyclone, which hit Bangladesh coast on November 15, 2007.
T. *Aman*:	When preceding a crop means transplanted (T. Aman).
Upazila:	Upazila is an administrative subdivision of a district.
Water-sealed:	A water-sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simply pits dug in the ground in which human waste is deposited. A water-sealed latrine has a bowl fixture that has a set amount of water retained in it. It is operated on the pour to flush system. These types of latrines can connected to a septic tank system.

Conversion Units

1 m^2	= 10.77 ft^2
1 Decimal **(শতাংশ)**	= 435.60 ft^2
1 Decimal **(শতাংশ)**	= 40.47 m^2
1 Katha**(কাঠা)**	= 1.653 Decimal**(শতাংশ)**
1 Bigha**(বিঘা)**	= 33 Decimal**(শতাংশ)**
1 Bigha**(বিঘা)**	= 20 Katha **(কাঠা)**
1 Acre**(একর)**	= 3 Bigha **(বিঘা)**
1 Acre**(একর)**	= 60 Katha **(কাঠা)**
1 Acre**(একর)**	= 100 Decimal**(শতাংশ)**
1 Hectare**(হেক্টর)**	= 247 Decimal**(শতাংশ)**
1 Hectare**(হেক্টর)**	= 7.5 Bigha **(বিঘা)**
1 Hectare**(হেক্টর)**	= 2.47 Acre**(একর)**

Executive Summary

The Government of Bangladesh (GoB) has planned to implement the Coastal Embankment Improvement Project, Phase- 1 (CEIP-1), under which seventeen polders will be rehabilitated and improved in the coastal area of the country. The GoB has obtained financial assistance from the World Bank (WB) for this Project. In accordance with the national regulatory requirements and WB safeguard policies, Environmental Impact Assessments (EIAs) of four polders have already been carried out in the first package. This document presents the EIA report of Polder 39/2C, which is one of the six polders of Package- 2.

Background

The coastal zone in southern Bangladesh adjoining the Bay of Bengal is characterized by a delicately balanced natural morphology of an evolving flat delta subject to very high tides and frequent cyclones coming in from the Bay of Bengal encountering very large sediment inflows from upstream. The coastal zone, in the past, in its natural state, used to face inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges. In 1960s, polderization started in the coastal areas to convert this area into permanent agricultural lands. The polders in this area are enclosed on all sides by dykes or embankments, separating the land from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. These polders are equipped with in-and outlet sluice gates to control the water inside the embanked area.

The polders were originally designed without proper attention to storm surges. However, recent cyclonescaused substantial damage to the embankments, which threatened the overall integrity of the coastal polders. In addition to breaching of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused coastal polders to suffer from water logging**,** which lead to large scale environmental, social and economic degradation.Poor maintenance and inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. As a result, soil fertility and good agriculture production in some areas are declining because of water logging and salinity increase inside the polders.

The above reasons have led the Government to re-focus its strategy on the coastal area from not only to protect against high tides, but also to provide protection against frequent storm surges. The long-term objective of the Government is to increase the resilience of the entire coastal population to tidal flooding as well as other natural disasters by upgrading the entire embankment system. With an existing network of nearly 5,700 km long embankments in 139 polders, the magnitude of such an initiative is daunting and requires prudent planning. Hence, a multi-phased approach of embankment improvement and rehabilitation is adopted over a period of 15 to 20 years. The proposed CEIP-1 is the first phase of this long-term programmatic approach.

EIA study of six polders under Package-II has been carried out. This document presents the EIA report of Polder 39/2C.

Location and Synopsis of Rehabilitation Work

The proposed Polder 39/2C under CEIP-I is located in three upazilas namely, Bhandaria and Mathbaria upazilas under Pirojpur district and Kathalia Upazila under Jhalokati district of Bangladesh. The Pirojpur O&M Division under the southern zone of BWDB is responsible for management of this polder.

The Project aims to enhance protection against natural disasters, increase resilience during and after such disasters and improve agricultural production by reducing saline water intrusion and water logging. The key improvement works to be carried out are: construction of 34 km new embankments; re-sectioning of 15.95 km existing embankment; construction of 10.80 km retired embankments; construction of 13 drainage sluices; construction of 22 flushing inlets; re-excavation of 57.23 km drainage channels; 3.5 km river bank protection works; 4 km slope protection of embankment; eight closure dams; 1.95 km flood wall;construction of Bitumenous road of 11.04 km and 39 km afforestation on the embankment slope. Other components include implementation of a social action plan as well as an environmental management plan. Project implementation includes supervision, monitoring and evaluation of project impacts; project management, technical assistance, trainings, technical studies; and contingent emergency response.

The Bangladesh Water Development Board (BWDB) is the implementing agency of this Project

Regulatory and Policy Framework

The Bangladesh Environment Conservation Act, 1995 (amended in 2002), requires that all development projects shall obtain environmental clearance from the Department of Environment (DoE), Ministry of Environment and Forest (MoEF). Similarly, the World Bank's environmental safeguard policies require an environmental assessment, which needs to carry out for projects being considered by its financing. The present EIA Report fulfils both these requirements.

The construction, reconstruction, expansion of polders and flood control embankment is categorized as Red in accordance with the DoE‘s classification and according to the World Bank safeguard policies, the project has been classified as Category A. The Environmental Impact Assessment (EIA) study has been conducted andEnvironmental Management Plan (EMP) and Resettlement Action Plan (RAP) have been prepared as per GoB regulations and World Bank Policies.

Environmental Baseline and Existing Conditions

The Polder 39/2C lies in the flat agro-ecological zone of the Ganges Tidal Floodplain in the southern region of Bangladesh. The soil texture varies from clay to clayey loam. Around 25%, 68% and 7% of the net cultivable area falls under high land, medium high land and medium low land, respectively. Soils are deficient in nitrogen (N) and phosphorus (P) but the status of sulphur (S) is high to very high and the status of potassium (K) and zinc (Zn) are reasonable. The soil salinity is found very slight during the sampling period (end of June 2015) and the organic matter content is very low-to-low. However, according to Soil Resources Development Institute (SRDI)testing report about 42% Net Cultivable Area (NCA) is strongly to moderately saline. The pH of the soil sampling sites varies from 7.4-7.8.

The gross area of the Polder is about 10,748 ha of which about 79% is available for cultivation. The rest21 % of area isunder settlements including homestead and water bodies. The net cultivated area is around 8,490 ha. The overall cropping intensity is around 149% (which is much below the national average of 191%) giving a total cropped area of 12,650 ha of which rice occupies around 89% and the remaining 11% of land is covered withnon-rice crops. The total annual rice production is about 23,000 metric tonneswhere Aus, Aman and Boro contribute about 41%, 58% and 1%, respectively. The total non-rice production is about 8,650 metric tonnes of which oilseeds, pulses and vegetables are the dominant crops.

Bank erosion due to wave action of the Baleshwar River is a chronic and acute problem. The embankment on the western side of the polder along theBaleshwar River (Kocha)is partly damaged due to riverbank erosion causing frequent entry of tidal water into the polder and damaging crops.

The climate of the Polder area is monsoon tropical. The mean annual temperature is around 26.9^0C and the mean monthly minimum and maximum temperature varies from 10.1^0C to 38.9^0C.

The mean annual rainfall is 1,935 mm with a yearly variation from 1673 mm to 2786 mm. On average, the dry season rainfall is only 17% of the mean annual rainfall. The key air quality parameters were found within the standard values for Bangladesh.

The total fish production of the polder area is around 272Metric Tons (MT).A large volume of the inland fish production (70%) comes from capture fisheries and the remaining from culture fishery. Perennial khals such as *Nodmulla Khal, Hetalia Khal,* and *Bamuner Khal*alongwith other seasonal internal khals areused as feeding and shelter ground of most of the open water fishes. These khals are considered as important fish breeding areas. However, the fish production from capture fisheries tends to decline in the polder area due to siltation of internal khals and over-fishing.

The polder area resembles the characteristics of the Ganges Floodplain. The floodplainsare characterized by mixed vegetations and support the habitat of rich aquatic biodiversity in channels, rivers and tributaries. The aquatic habitats within the polder include internal channels and homestead ponds. Beels and other water bodies support a good amount of free-floating aquatic vegetation. The terrestrial ecosystems are heavily modified by human interventions. Major divisions are (i) agricultural land (ii) settlement/ homestead vegetation (iii) embankment and roadside vegetation and IV) fallow lands.

The population of the polder area is 101,100 of which 49,395are males and 51,705 are females. The estimated total household number is 23,620 and the average household size is 4.3. The density of population is about 835 persons per square kilometres. The literacy rate in the polder area is just below 64% of which male literacy is 63.8% and female literacy is 63.6%. Agriculture is the main occupation in the polder area, followed by fishing. It was revealed from consultation with local people that about 10%of landless/marginal farmers have migrated out of Polder 39/2C in search of improved livelihood.

Potential Impacts and their Mitigation

Pre-construction phase

The potential environmental and social impacts during the pre-construction phase are mainly associated with acquisition ofland for construction of new and retired embankments. Land acquisition will affect homesteads, agricultural and orchards and fish ponds/ghers.Total 1,467 peoples are considered to re-settled/affected, and psychologicalyaffected due to changesin livelihood. Among these, the impacts associated with acquisition of about 111.54 ha of land are very significant.

Construction phase

The potential impacts during the construction phase include air pollution, noise pollution, degradation of landscape, soil erosion, increased siltation in water bodies, loss of agriculture, damage to fish and other aquatic fauna, impediments to land traffic and navigation, and safety & health hazards. The key construction activities that are likely to cause these environmental and social impacts include establishment of labor camps, transportation of equipment and material, material borrowing, excavation, embankment raising, dismantling, repair and construction of regulators, re-excavation of water channels, and associated waste disposal. During construction of regulators Dasher, Juniar, Telikhali, and Chakluia Khals would be at risk of water logging if carried out during the post monsoon season. However, after completion of construction activities, temporary water logging will disappear.

Fish migration between the outside rivers and internal *khals* is likely to be affected temporarilyduring re-excavation of *khals* and construction of closures. Besides, fish migration within the Polder between khals and low-lying areas mightbe affected as well during construction of drainage. Construction of closures will permanently obstruct fish migration if proper fish passes are not provided.

The proposed project activities will have impacts on faunal and floral resources during the construction phase. About 143,364 trees of different species and various sizes would need to cut for new embankments, retired embankments and re-sectioning of existing embankments. Piling of excavated spoils may also damage the vegetation if not handled properly. Construction activities may temporarily disturb terrestrial fauna remaining in the polders such as monitors, jackals, lizards and snakes.

The project during construction phase would temporally increase job opportunities for the local population.It is consider that at least 60% of the labour force will be local. In addition, local business would boost up. As a result consumption of food and other necessities would increase by the external labours of the project.

Potential social impacts include conflicts between local labor and outside labor could arise, if not handled properly. Besides, the presence of outside labor can potentially disrupt the privacy of the local population, particularly women whose mobility can be negatively affected.

The agricultural activities will be increased after implementation of the project. As a result, farmers will use more fertilizers for cultivation, which would contaminate soil and water. About 2,220 MT of chemical fertilizers and 40 MT of pesticides are considered to be applied additionally along with the expansion of cropping, as well as the expected conversion from local lower yielding varieties to high yielding varieties. The increase in runoff from the cropped areas may potentially pollute water bodies and reduce fish production and other aquatic biodiversity.

Replacement of drainage sluices on water channels, which are connected with the peripheral rivers that hindered thefish migration. This can result in a decrease of speciesdiversity and size of fishstocks inside the Polder, thus adversely affecting the fish catch and fishermen’s income.

A Resettlement Action Plan (RAP) has been prepared to address the involuntary resettlement issues arising from acquisition of 111.54 ha of land and loss of other private and or community structures. To address the impacts associated with material and equipment transportation and traffic congestion, the contractor will prepare and implement a traffic management plan, which will ensure that sensitive receptors such as schools and busy markets and bazars are avoided during the peak hours. The contractor will also prepare and implement a pollution control plan, which will be included in the Environmental Action Planto address the air and water pollution. Similarly, the contractor will prepare and implement an occupational health and safety planto cater for safety and public health concerns.

Projectoperation phase

The Project after implementation would provide substantial benefits including protection against natural disasters such as tidal surge, river erosion, and floodingand arrest salinity intrusion. Besides, drainage congestion will significantly reduce. This will increase the cultivated area and lead to increase crop production and create opportunities for employment generation. An estimated additional 23,645 metric tons of rice and 41,558 metric tons of non-rice will be produced annually in the polder area. This will lead to an estimated 640,000 man-days of additional employment in the agriculture sector during operation of the project.

Implementation of afforestation programme will mitigate the felling of trees needed during construction. Foreshore mangrove afforestation is expected to improve protection of embankments from tidal surges, reduce erosion of foreshore land and provides habitats especially for various avifaunas (i.e. Egrets, Herons, Bee-eaters, Sandpipers, Owls/owlets, Kingfishers, Sparrows, Wagtails, Sunbirds, Babblers, Starlings), reptiles (ie. Garden Lizard, monitor lizards, snakes like pit viper), mammals (ie. Bats (flying fox, pipistrelle), rats, mongoose and jackal), and nursery for fish fries and juveniles.

Analysis of Alternatives

Several alternatives were considered during the design phase of the project. These include 'No-Project' alternative and technical alternatives. Several technical alternatives were considered to address each of the problems. The proposed alternatives are embankment strengthening, riverbank protection works, protection of embankment slopes, replacement of drainage sluices and rehabilitation of flushing sluices, etc.

Climate Change Impact

Presently the Polder 39/2C is extremely vulnerable to cyclones, storm surges, wave action, and climate change impacts. The Polder is not in a state to deliver required services, such as: i) protection against tidal inundation, ii) efficient drainage, and iii) minimizing the impact of cyclonic surges.

Cumulative and Reciprocal Impacts

A considerable portion of the polder area is vulnerable to salinity intrusion and water logging. Due to high salinity levels during the dry season and scarcity of ground water during the periods of low rainfall, the irrigation provided in limited area. Due to heavy siltation of channels, navigation, aquatic biodiversityincluding fisheries are also affected. The proposed interventions under CEIP-1are designed to address the above-mentioned problems. If the proposed interventions in Polder 39/2C are not implemented, the present poor state of the polder would persist, and may deteriorate further. Therefore, the 'No-Project' alternative is not a recommended option.The polder is surrounded by Polder 38 (north) and 37 (west). Polder 39/2C hydrologically connected with Polder 37 and Polder 38. Polder 35/1 is also connected with the polder being located downstream of the Kocha River. The design crest level of Polder 35/1 is 6.0-6.5 mPWD whereas the level of Polder 39/2C is 5.0 – 5.5 m. The implementation of CEIP-1in Polder 35/1 would divert storm surges further upstream and downstream. Therefore, during cyclonic events storm water would not be able to enter Polder 35/1 because of its re-sectioned embankments. However, the diverted river water may only generate a small increase in hydraulic pressure on the embankments of Polder 39/2C.The Baleshwar River and Kocha River may also accumulate increased amounts of silt and reduce the depth. This incident would hamper the aquatic balance and increases chances of floods occurring in Polder 39/2C during monsoon and cyclonic events.

Siltation in the rivers or water bodies outside the polder would cause drainage congestion on a more frequent basis. The smaller water bodies and rivers i.e. the Ponadon River would undergo frequent congestion, especially during low tides when the Ponadon River becomes shallower.

Environmental Management Plan

The Environmental Management Plan (EMP) along with implementation mechanism has prepared for the mitigation of impacts. The environmental management budget has been included in the Bill of Quantities (BOQ). Since most of the contractors do not have a clear understanding on the need of environmental management, some tend to quote very low price for implementation of the EMP and are eventually not able to implement the EMP as per design due to lack of resources and expertise. To avoid this problem, a Fixed Budget has assigned for EMP implementation and for training of the contractor on environmental issues. The total cost of EMP implementation for Polder 39/2C has estimated as BDT 43.3 million. The contractor needs to submit a Construction Environmental Action Plan (CEAP) based on the EIA and EMP in line with the construction schedule and national as well as World Bank guidelinesas applicable. The CEAP needs to reviewed by the design and supervision consultant and cleared by BWDB and the World Bank.

Extensive environmental monitoring will be required as per World Bank guidelines. The monitoring program will evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the implementation and performance of the environmental protection and mitigation measures and compliance with pertinent rules and regulations; (iii) any trends in impacts; and (iv)overall effectiveness of the project environmental protection and mitigation measures. The monitoring plan is included in the EMP.The EMP stipulates the registration of monitoring results in suitable database and regular reporting of results.

Institutional Responsibility and Report Requirement

The contractor is responsible for implementing the EMP during the construction phase whereas the design and supervision consultant is primarily responsible for monitoring the implementation of the EMP. The environment specialist to be employed by BWDB will conduct field inspections and surveys on a regular basis. The environment specialist will report to the Senior Environment Specialist at Head Quarter. The M&E consultant will be responsible for independent monitoring and implementation of the EMP, and evaluation of the environmental compliance of the project. DoE will consult if any complicated issue arises during construction and operation stages. BWDB will apply for site clearance/environmental clearance and annual renewal of environmental clearance certificate from DoE. WMOs will traine to ensure adequate water and environmental management practices during project operation. The Environmental Management Unit of BWDB, strengthened through CEIP-1, will ensure and oversee the environmental management during project operation.

BWDB will prepare a Half Yearly Monitoring Report on environmental management and will share this with the World Bank for review during construction phase. A third party monitoring firm will carry out the effectiveness of screening, monitoring and implementation of the EMP along with the project component activity monitoring annually. The Annual Environmental Audit Report prepared by the third party monitoring firm will shared with the safeguards secretariat.

The project activity will be implemented through systematic organizational structure adopted by BWDB headquarter and field level.The Project Management Unit will implement the project and the Project Steering Committee under the Ministry of Water Resources will oversee and monitor overall activities. The Environmental, Social and Communication Unit (ESCU) to beestablishedfor implementation and management of the EMP, will structured to provide co-ordination, technical support and services during the environmental screening and preparation of EA,andimplementation of the environmental mitigating measures. At least one of the two environmental specialists must be on board. The specialists will prepare sub-project specific environment screening report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. The ESCU will review the EMP and ensure quality of the environmental screening.

Stakeholder Consultation,ParticipationandDisclosure

Several public consultation meetings were conducted with the participation of local people, representatives of local government (Union Parishad) and representatives of the BWDB. Local people showed interest in the project and opined that project implementation would be important for their survival and maintain a healthy environment in the polder. They also expressed that if the monitoring plan were implemented during the pre-construction, construction, post-construction and operation periods, they would help the implementing agency spontaneously. Public disclosure meetings have also conducted for disclosing the impact of the EMP.

1 Introduction

1. The Government of Bangladesh (GoB) is planning to implement the Coastal Embankment Improvement Project-Phase I (CEIP-I)(hereafter referred to as the 'project'), under which seventeen polders will be rehabilitated and improved in the coastal area of the country by three packages. The GoB has obtained financial assistance from the World Bank (WB) for the CEIP. The CEIP includes the rehabilitation and improvement activities of 17 polders, and will implementin three packages. Polders 32, 33, 35/1 and 35/3 are included in thePackage-1I of which the EIAs havecompleted and theEnvironmental Management Plans prepared. Polders 43/2C, 47/2, 48, 40/2, 41/1 and 39/2C are included in Package-II, whereas, polders 14/1, 15, 16, 17/1, 17/2, 23 and 34/3 are included in Package-III. For the location of the polders, refer Map 1.1. In accordance with the national regulatory requirements and WB, safeguard policies.EIA studies of the six polders under Package-II have carried out. This document presents the EIA report of Polder 39/2C.

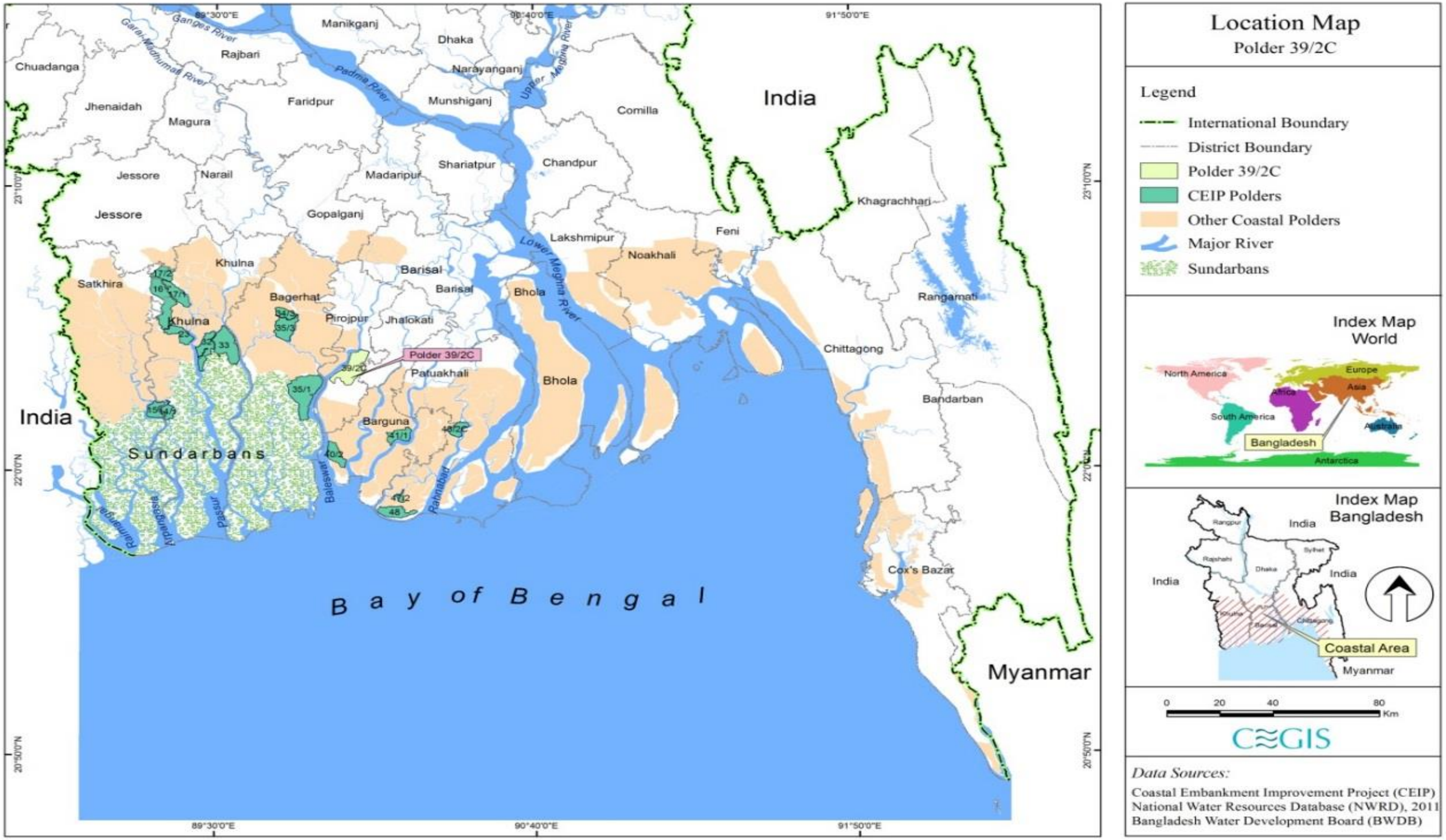
1.1 Background

2. The coastal region of Bangladesh consists of 19 districts adjoining the Bay of Bengal. The region is characterized by a delicately modified ecosystem of an evolving flat delta subject to high tides, salinity intrusion and frequent cyclones coming from the Bay of Bengal and encountering very large sediment inflows from upstream.

3. In the 1960s, polderization started in the coastal zone of the country to convert this area into permanent agricultural lands (refer Map 1.1 for coastal polders) to increase the agriculture production. The polders in this area are enclosed on all sides by dykes or embankments, separating the land from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. Without embankment the coastal communities would be exposed to diurnal tidal flooding. The poldered lands are slightly higher than sea level. These polders are equipped with inlet and outlet sluice gates to control the water inside the embanked area.

4. The coastal embankment system of Bangladesh was designed without attention to storm surges. Recent cyclones have substantially damaged the embankments and threatened the integrity of the coastal polders. In addition to breaching due to cyclones, siltation of peripheral rivers surrounding the embankments has caused failures of the drainage systems, creating water logging inside the polders. This has led to large-scale environmental, social and economic degradation. Poor maintenance and inadequate management of the polders have also contributed to internal drainage congestion and heavy internal siltation, which comes from connected rivers andfrom top soil erosion. Soil fertility and agriculture production are declining in of waterlogged areas. Other areas suffer from salinity increase due to incursion of seawater into the polders.

5. The above reasons have led the Government of Bangladesh (GoB) to readjust its strategy on the coastal area from only ensuring protection against high tides to providing protection against frequent storm surges as well. The long-term objective of the GoB is to increase the resilience of the entire coastal population to tidal flooding as well as natural disasters by upgrading the whole embankment system. With an existing network of nearly 5,700 km long embankments in 139 polders, the magnitude of such a project is daunting and requires prudent planning. Hence, a multi-phased approach forembankment improvement and rehabilitation is adopted fora period of 15 to 20 years. The proposed CEIP-I is the first phase of thislong-termprogram.



Map 1.1: Coastal Polders

1.2 Project Overview

6. Polder 39/2C is located in Bhandaria and Mathbaria upazilas of Pirojpur district as well as a part of Kanthalia upazila of Jhalokati district of southern Bangladesh (Map 1.2). The Polder covers a gross area of 10,748 hectare (ha) with net cultivable area of about 8,490 ha.The overall cropping intensity is around 149% (which is much below the national average of 191%) giving a total cropped area of 12,650 ha. The Project aims to enhance protection against natural disasters, increase resilience during and after such disasters, and improve agricultural production by reducing drainage congestion, thereby facilitate an increase in cropping intensity. To meet these objectives, the following key improvement and rehabilitation works will be carried out in Polder 39/2C under Package-II ofCEIP-1:

- CEIP Design Crest Level : 5.50 m PWD &5.00 m PWDInterior-dyke
  : 4.5 mPWD Marginal dyke
- Total number of Drainage sluice : 13 nos.
- Total number of Flushing inlets : 22 nos.
- Bank protection works : 3.50 km
- Slope Protection works : 4.00 km
- Re excavation of Drainage channels : 574.23 km
- Re-sectioning of existing embankment : 15.95 km
- Retirement of existing/eroded embankment : 10.80 km
- Construction of new Embankment : 34 km
- Construction of Closure : 8 nos.
- Construction of flood wall : 1.20 km
- Gross protected area : 10,748 ha.
- Cultivable area : 8,490 ha.
- Land acquisition : 111.54 ha.
- Afforestation (embankment slope) : 11.27haembankment slope.

7. When completed, the entire polder 39/2C will protectby 61.5 km of embankments. 18.5 km of the embankment towards the Baleshwar River to the west will have a crest level of 5.5PWD (Public Works Datum). 7.3 km of embankment to the north will have a crest level of 5.0PWD, while 33.6km of embankment to the east towards the Pona River will have a crest level of 4.5PWD(Refer Map 4.1).

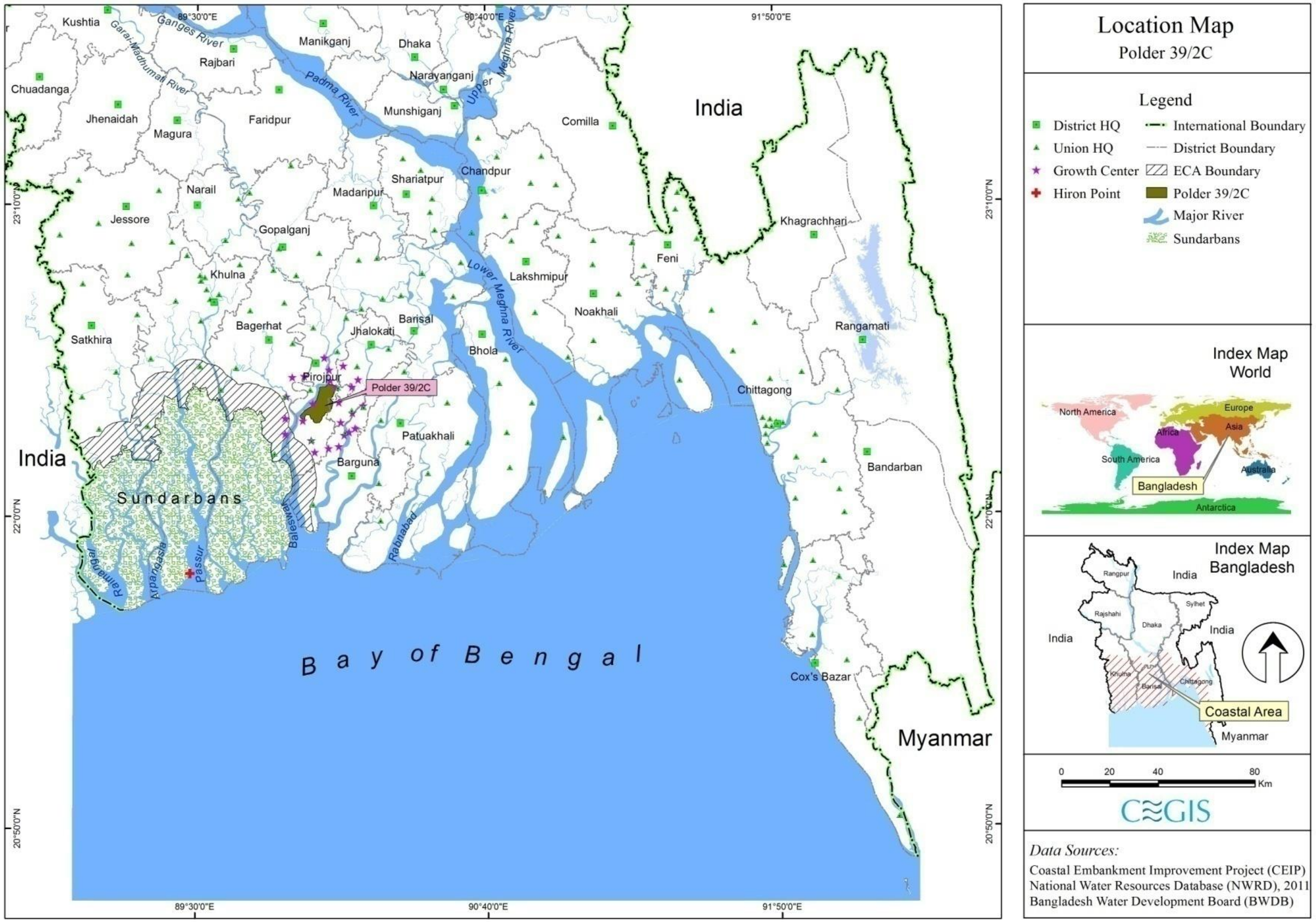
8. Other components of the CEIP-1will include implementation of social action plan and environmental management plan; supervision, monitoring and evaluation of project impacts; project management, technical assistance, trainings, and technical studies; and contingent emergency response.

9. The BWDB is the implementing agency of the Project.

10. Detailed information is presented in the project description chapter of the report.

1.3 Regulatory and Policy Framework

11. The Bangladesh Environment Conservation Act, 1995 (amended in 2002), requires that all development projects shall obtain environmental clearance from the Department of Environment (DoE), Ministry of Environment and Forest (MoEF). Similarly, the World Bank's environmental safeguard policies require an environmental assessment to carry out for projects being considered for its financing. The latest EIA fulfils both of these requirements.



Map 1.2: Location of Polder 39/2C

1.4 Objectives of the Study

12. The objective of the EIA study for Polder 39/2C is to identify and assess the potential environmental impacts of the proposed project interventions, evaluate alternatives, and design appropriate mitigation, management, and monitoring measures to be addressed in the Environmental Management Plan (EMP)[1]. In compliance with the national regulatory and WB environmental policies and guidelines (for further details refer Chapter 3).

13. The specific objectives of the EIA study are to:

- Comply with the national regulatory and WB policy frameworks (further discussed later in the document);
- Determine and describe the existing environmental and social settings of the Project area (the Project area is defined as the entire area inside the polder, project influence area outside the polder i.e. the embankments, borrow pits and spoil disposal areas if located outside the polder; earth collection areas if located outside the polder and access routes to the polder);
- Identify and assess the potential environmental and social impacts of the Project;
- Identify mitigation measures to minimize the negative impacts and enhancement measure to enhance the positive impacts; and
- Prepare an EMP including a detailed monitoring plan.

1.5 Scope of work

14. The scope of work of the present EIA study for Polder 39/2C includes the following:

i. Carry out detailed field investigation of required parameters of the environmental and social baseline, especially on critical issues.

ii. Determine the potential impacts of the project through identification, analysis and evaluation on sensitive areas (natural habitats; sites of historic, cultural and conservation importance), settlements and villages/agricultural areas or any other identified Important Environmental and Social Component (IESCs).

iii. Determine the cumulative environmental impacts of the project that may occur inside and outside the project area.

iv. Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.

v. Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.

vi. Determine the capital and recurrent costs of the measures, and institutional, training and monitoring requirements to effectively implement these measures. The consultant is required to identify all significant changes likely to generat by the project activities. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing of fish migration routes, destruction of local habitats, and water logging.

[1]WB Operation Policy 4.01. 2011 Revision

vii. Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical models due to climate change developed by a number of reputed organizations. The developed models may be available from the main consultant and implementing agency;

viii. Prepare (a) an estimate of economic costs of the loss of ecological services, environment damage and economic benefits, where possible, from the direct positive impacts that the project is likely to cause.And (b) an estimate of financial costs on the mitigation and enhancement measures that the project is likely to require, and financial benefits, if any.Tthe damage/ cost and benefits should be estimated in monetary value where possible, otherwise describe in qualitative terms.

ix. Describe alternatives that examined in course of developing the proposed project and identify other alternatives that could achieve the same objectives. The concept of alternatives extends to the siting and design, technology selection, rehabilitation/construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts, vulnerability, reliability, suitability under local conditions, and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which may mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any mitigating measures. Include the alternative of not constructing the project to demonstrate environmental conditions without it.

x. Identify the specific reciprocal impact of climate change on polder. Check the suggested polder height with respect to the SLR and high tide. The sub consultant will ensure that the design will minimize the negative impact on the environment due to polder rehabilitation activities. For example, adequate fish passes should provided to ensure free movement of fish or drainage facility should provided to avoid water logging in the surrounding area.

xi. Prepare a detailed Environmental Management Plan along with respective EIA separately to monitor the implementation of mitigating measures and the impacts of the project of other inputs (such as training and institutional strengthening) needed to conduct it during construction and operation. Include an estimate of capital and operating costs in the plan and a description of other inputs (such as training and institutional strengthening) needed to implement the plan.

xii. Ensure to address occupational health and safety for the construction workers in the EMP;

xiii. Develop Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage;

xiv. Prepare the EIA report.

1.6 Structure of the Report

15. The report comprised the following chapters:

Chapter 1 (Introduction) describes the background of the project, objectives of the study, scope of works with a list of EIA study team.

Chapter 2 (Approach and Methodology) presents the detailed approach and procedure employed to conduct the EIA study. The Chapter also describes data sources and methodology of data collection, processing and impact assessment.

Chapter 3 (Policy, Legislative and Regulatory Framework) reviews the national legislative, regulatory and policy framework relevant to the EIA study. The Chapter also includes a discussion on the WB safeguard policies and their applicability for the Project.

Chapter 4 (Description of the Project) provides the simplified description of the project and its phases, key activities under three phases, man-power, equipment, and material requirements, implementation arrangements, implementation schedule, and other related aspects.

Chapter 5 (Environmental Baseline and Existing Conditions) describes the existing environmental and social settings in respect of ***Physical Environment, Biological Environment and Socio-cultural environment*** aspects of the project area.

Chapter 6 (Environmental Impacts and Mitigation Measures) identifies the environmental impacts that may potentially be caused by various project phases, and also proposes appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts.

Chapter 7 (Analysis of Project Alternatives) discusses various alternatives considered during the feasibility and design stage of the project, and their environmental and social considerations.

Chapter 8 (Climate Change Impact): discusses the climate change aspects from local perspectives and the likely impacts on the project area and its surroundings.

Chapter 9 (Cumulative and Reciprocal Impacts) presents analysis of cumulative impacts of the proposed Project and other projects in the area. In addition, induced impacts are also covered in the chapter.

Chapter 10 (Environmental Management Plan) includes an estimate the impacts and costs of the mitigation measures, a detailed EMP with proposed work programs, budget estimates, schedules, staffing and training requirements and other necessary support services to implement the mitigation measures, phase wise monitoring, etc. Besides, the EMP specifies the implementation arrangements for the mitigation measures identified during the EIA study. The EMP also includes the environmental monitoring plan.

Chapter 11 (Stakeholder Consultations and Disclosure) provides details of the consultations held with the stakeholders at the project site and framework for consultations to be carried out during construction phase. The Chapter also includes the disclosure requirements for the EIA.

2 Approach and Methodology

16. This Chapter presents the detailed approach and methodology followed to conduct the EIA study for rehabilitation of Polder 39/2C. The Chapter alsodescribes the data sources and methodology of data collection, processing and approach used in the impact assessment.

2.1 Overall Approach

17. The EIA study for the rehabilitation of Polder 39/2C has been carried out following the approved Terms of Reference (ToR) of DoE dated 05/06/2013 (Appendix-H) and the Environmental Management Framework (EMF) for CEIP-1. The overall approach of the study is shown in **Figure 2.1** below.

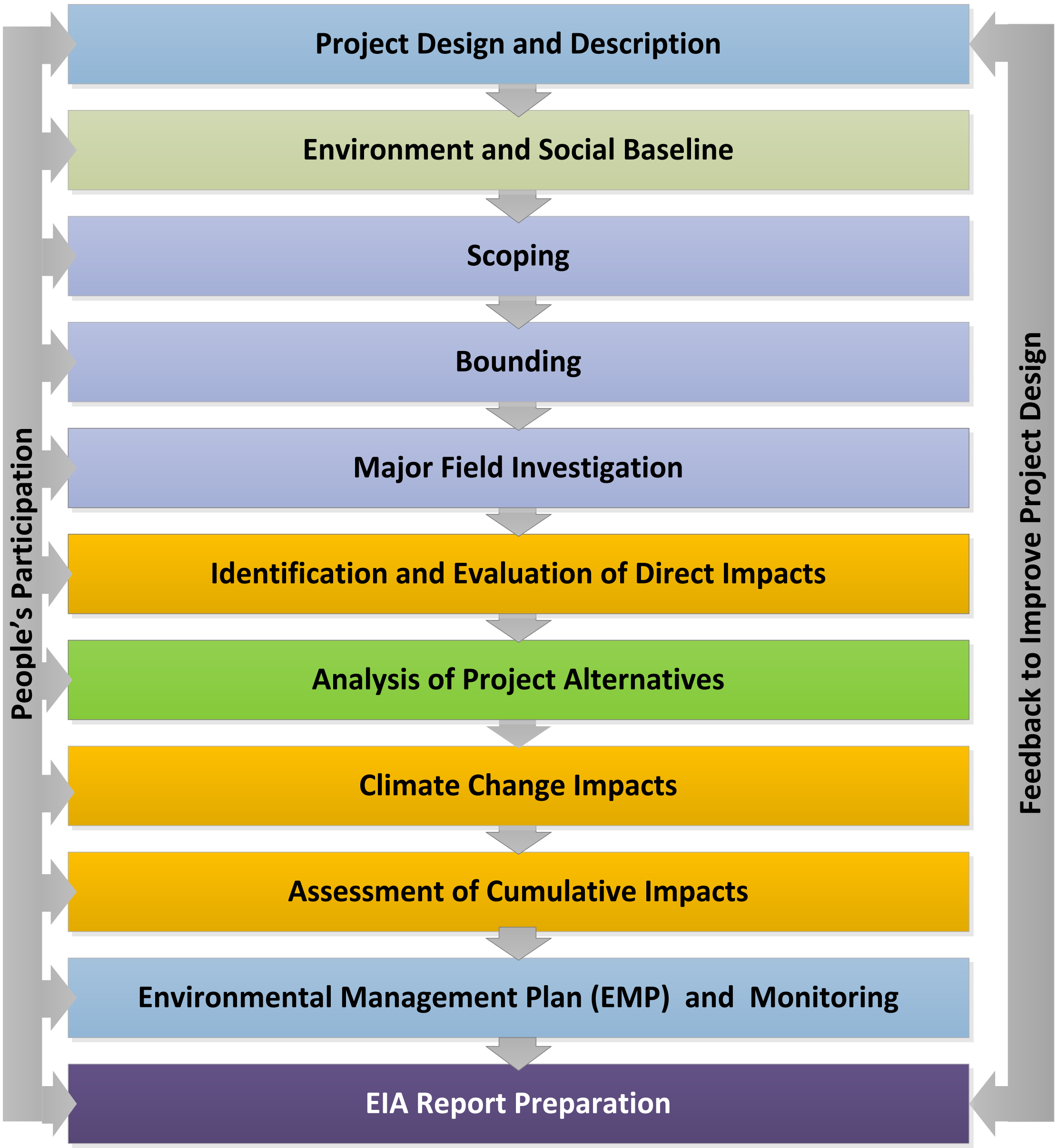


Figure 2.1: Overall approach of the EIA study

2.2 Methodology

18. The detailed methodology followed for the EIA study is described below.

2.2.1 Project Area of Influence

19. At the beginning of the study, the Project area of influence was broadly delineated considering the external river system of the polder. This included the area inside the polder where most of the Project interventions would take place, and the area immediately outside the polder embankments (this area could be used for staging of construction works, material stockpiling, and/or earth borrowing), access routes for the polder, borrow as well as spoil disposal areas if located outside the polder, and labor camps/contractor facilities if located outside the polder. The area of influence is bounded by Baleshwar River (Kocha) to the west, Bahar Khal to the east, Pona River to the north and Tushkhali - Mirukhali Bharani khal to the south.It is noted that project area includes polder area whereas study area includes both project area, area immediately outside the polder embankments and peripheral rivers.

2.2.2 Analysis of the Project Design and Description

20. Detailed information about the Polder 39/2C including objective, nature and location of proposed and existing interventions, construction works, and other related aspects were obtained from the Main Consultant of CEIP-1

21. The Water Resources Engineer of the EIA study team interpreted this information for the multi-disciplinary team members for assessing the potential environmental and social impacts of the proposed interventions.

22. Since the location of most of the project interventions are already fixed, alternative design options of the interventions were analyzed considering environmental, social, and technological criteria to identify suitable alternatives and appropriate mitigation measures for negative environmental impacts. **Figure 2.2** shows the different aspects to be addressed in the Project Design and Description step of the EIA studies.

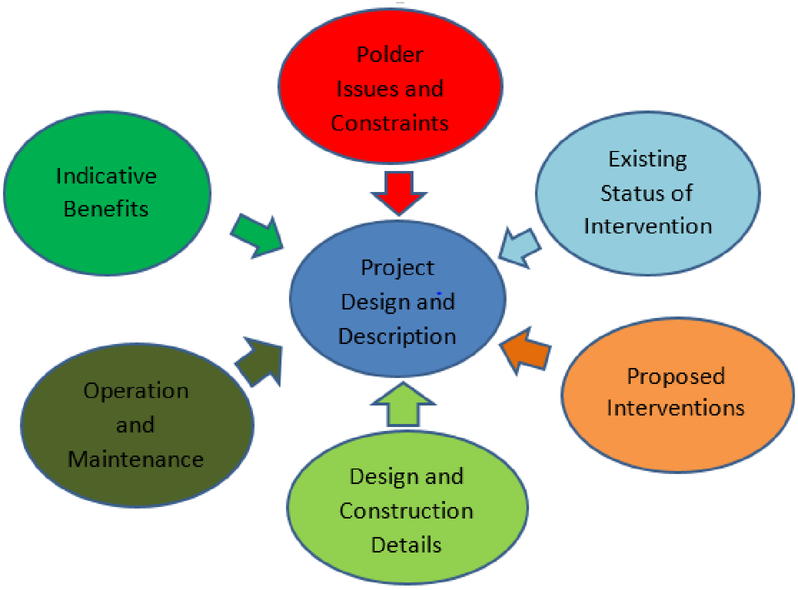


Figure 2.2: Aspects to be addressed in the Project Design and Description

2.2.3 Analysis of the Project Alternatives

23. Analysis of site alternatives that were not considered relevant as the Project mostly entails outright rehabilitation works of infrastructure where their spatial domains are already fixed. However, the possible alternatives of proposed interventions were analyzed on a qualitative basis, considering their environmental, social, technical and economic suitability. This would rationalize the selected interventions, and identify pathways for better design alternatives, if available. Figure 2.3 outlines the approach followed in the alternative analysis.

24. In the process, all design alternates or alternatives in project interventions were compared, and different possible construction alternatives related to project implementation such as, the materials to be used, workforce procurement sources, locations of stock yards, sources for material procurement, transportation routes, modes of material and manpower mobilization, scheduling etc., were analyzed.

Figure 2.3: Concept of Alternative analysis to be used in the EIA study

2.2.4 Data Collection for Environmental Baseline

25. A reconnaissance field visit was conducted in the polder area to identify the existing environmental settings of the polder area. Subsequent to this, Rapid Rural Appraisals (RRAs), Participatory Rural Appraisals (PRAs), Focused Group Discussions (FGDs) and interviews with key informants were conductedto collect data and information on the environmental and social aspects of the polder area. Local knowledgeable persons including community representatives, traders, teachers, farmers, fishermen and political leaders were interviewed individually to reflect upon the problems regarding the polder. They were also requested to highlight possible solutions that the project should bring about as per their indigenous knowledge and experiences.

26. The baseline condition of the polder area was determined according to the information collected from secondary and primary data sources through literature review, field investigations and consultations with different stakeholders. The baseline settings were established with respect to the physical, biological and socio-cultural environment conditions including identification of problems in respect of the proposed project sites and adjoining area. A checklist was developed and approved by the DSC Consultant and used to register the information obtainedfrom different stakeholders.

Physical Environment

27. Field visits at different stages of the study were arranged to the polder area and primary data on water resource components were collected. Local knowledgeable persons and community representatives were interviewed during field visits, and the multidisciplinary EIA study team members made observations pertaining to their individual areas of expertise.

Water Resources and Metereology

28. Water resource data related to river hydrology and morphology, surface and ground water availability, drainage pattern, ground and surface water quality and water use were collected from secondary sources. Primary data on water quality, drainage pattern, salinity, etc., were collected and analysed. Observations by the professionals of the multi-disciplinary team were backed up by feedback from the local people. Major river systems were identified for hydrological and morphological investigation through historical and current image data collection and analysis. Specific areas or points of interest were selected for collecting data on special hydrological and morphological aspects, water availability, drainage pattern, water quality (surface and ground water), tidal flood, risk of erosion and sedimentation.Meteorological data such as temperature, rainfall, evapo-transpiration, wind speed and humidity were collected from the National Water Resources Database (NWRD) of Water Resources Planning Organization (WARPO), and subsequent analyses. The NWRD contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD). Moreover, these parameters have been used in Model study by IWM for storm surges analysis.

29. The topographical and geological data were collected from Geological Survey of Bangladesh and NWRD.

Land Resources

30. The agro-ecological region of the project area was identified using secondary sources including Food and Agriculture Organization (FAO) and United Nations Development Program (UNDP) information. The land type and soil texture data was collected from Upazila[2] Land and Soil Resources Utilization Guide of Soils Resources Development Institute (SRDI). The secondary data of these parameters wereverified during field visits through physical observation as well as consultations with the local people and officials of the Department of Agriculture Extension (DAE).

Biological Environment

Agricultural Resources

31. Land use information was prepared from satellite image classification with field verification. Data on agricultural resources including existing cropping patterns, crop variety, crop calendar, crop yield, crop damage, and agricultural input used were collected from DAE and other secondary and primary sources. Agriculture data was collected through extensive field surveys with the help of questionnaires and consultations with local people and concerned agricultural officials. Crop production was determined using the following formula:

32. Total crop production = damage free area × normal yield + damaged area × damaged yield.

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[2] Upazila is an administrative subdivision of a district.

33. The crop damage (production loss) was calculated using the following formula:

Crop production loss = Total cropped area ×normal yield ¯ (damaged area ×damaged yield+ damage free area × normal yield)

The crop damage data was collected from the field for the last three years.

Ecological Resources

34. The ecological component of the EIA study focused on terrestrial and riverine ecology including flora, amphibians, reptiles, migratory and residentbirds, and mammals. The field activities included collection of ecosystem and habitat information, sensitive habitat identification, identifying ecological changes and potential ecological impact. The land use information on different ecosystems was generated through analysis of recent satellite imagery.

35. Field investigation methods included physical observation; transect walk, habitat survey and consultations with local people. Public consultation meetings were carried out through FGD and Key Informants Interview (KII) methods. Inventory of common flora and fauna and their status was developed based on field surveys and from thespecies databaseof Bangladesh National Herbarium and the Red List of International Union for Conservation of Nature (IUCN).

Fish and Fisheries

36. Primary data were collected from the fishermen community, fishermen households and local key informants while secondary data were collected from Upazila Fisheries Offices (UFOs) during field visits.

37. A fish habitat classification was made on the basis of physical existence and was categorized into capture and culture fish habitats. The capture fish habitats included rivers, khals, and tidal floodplains, borrow pits, and beels. The culture fish habitats included homestead culture fish ponds, commercial fish farms, and shrimp ghers.

38. Information on post-harvest activities, forward and backward linkages, fishermen livelihood information, fisheries management issues, potential fish recruitment, fish culture infrastructure and fishermen vulnerability were also collected.

39. Secondary information from UFOs and literature were blended with primary data from individual habitats to estimate fish production.

Livestock Resources

40. Data on the present status of livestock (cow/bullock, buffalo, goat and sheep) and poultry (duck and chicken) in the polder area was collected during field survey in consultation with the local people through PRAs and RRAs. Livestock resources data were collected from secondary sources from Upazila Livestock Office.

Socio-cultural Environment

41. The steps for collecting socio-cultural data are as follows:

- Secondary data collected from Bangladesh Bureau of Statistics (BBS), 2011.Review of the relevant literatures from BWDB and main consultant;
- Primary data collection through reconnaissance field visits and discussions with BWDB officials and local stakeholders;
- PRA /RRA, FGDs, KII were carried out for primary data collection;
- Institutional surveys conducted for primary data collection from district and upazila level.

42. Demographic information, such as population, occupation and employment, literacy rate, drinking water, sanitation, and electricity facilities were collected from secondary sources. Data on income, expenditure, land ownership pattern, self-assessed poverty status, migration, social overhead capitals and quality of life, disasters, conflicts of the study area, information on Non-governmental Organizations (NGOs), cultural and heritage features of the project area were collected mainly from primary sources through PRA and FGDs and public consultations.

2.2.5 Climate Change

43. Climate change is caused by several factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as global warming. In Bangladesh, climate change is an extremely crucial issue, and according to the new Climate Change Vulnerability Index (CCVI) (Maplecroft 2013) and Germanwatch Global Climate Risk Index, the country ranks first among the sixteen extremelyvulnerable nations, to be highly impacted in the coming decades. In the coastal areas, the consequences of climate change are more staggering. Climate change directly contributes to changes in temperature and precipitation, which eventually is considered to lead to sea level rise and increased tidal flooding. Climate change also affects the frequencies and intensities of cyclonic storm surge events. Increase in salinity intrusion, river erosion, drainage congestion and water logging are other associated impacts of climate change. Consequently, it is important to consider the potential environment and socio-economic impacts in a Climate Change perspective. Figure 2.4 below shows a process diagram of possible climate change impacts in the coastal areas of Bangladesh.

44. Following thedata compilation on status of the Environmental and Social baseline condition, analysis was made to underscore the major climate change issues in the polders.

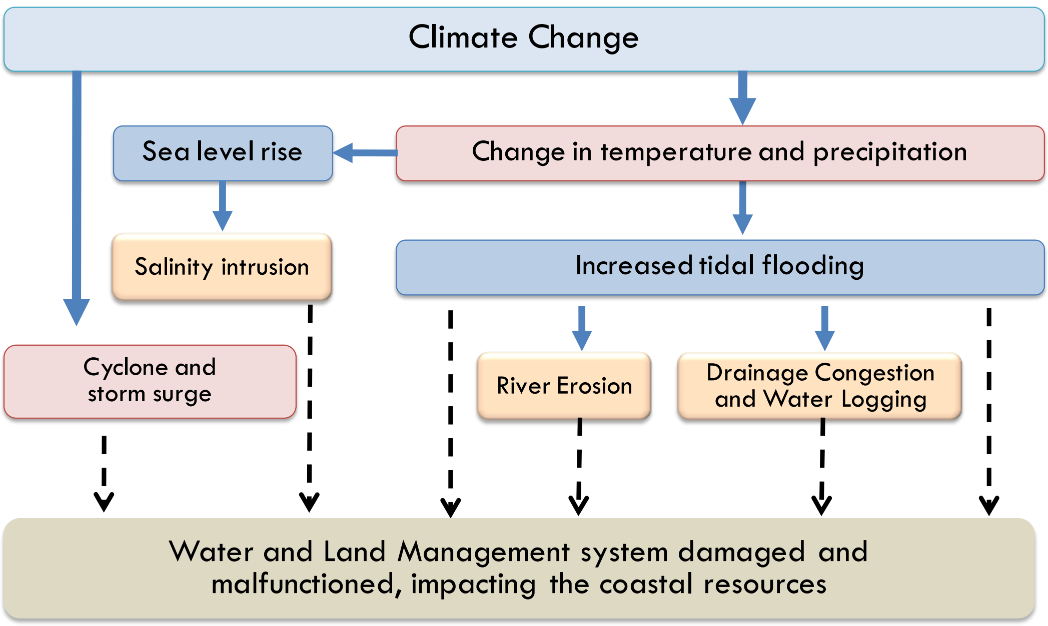

Figure 2.4: Typical process diagram of climate change impacts in coastal areas

45. During field level consultations, the major local and regional issues in connection with climate change and variability were identified. Besides, data on different meteorological parameters such as rainfall, temperature, sunshine hours, humidity and wind speed were collected from the adjacent weather stations of Bangladesh Meteorological Department (BMD). The historical variations of the information were used to develop an understanding of climate

science for the polders. Afterwards, the qualitative field findings were compared with the analyzed historic information on climate science, from which the regional and local climate change vulnerability may be inferred. Moreover, intensive reviews of existing literatures and national reports were made to validate the identified climate change issues and concerns.

2.2.6 Scoping

46. A two-stage structured scoping process was followed toidentify the IESCs, which would potentially be impacted by the proposed Project. In the first stage a preliminary list of the components which could be impacted by the Project was prepared. In the second stage village scoping sessions were held where opinions of the stakeholders were obtained on their perception about the environmental and social components which could be impacted by the project interventions. With the help of the professional judgments of the multidisciplinary EIA team as well as the opinions of the stakeholders, the preliminary list of the important environmental and social components was finalized.

2.2.7 Assessment and Scaling of Impacts

47. At this stage, attempts were made to assess the impacts of the proposed interventions of the polder quantitatively.Alternatively, impacts were assessed qualitatively when quantification was not feasible. The impacts of proposed interventions, considering the climate-change scenario for 2050, were estimated on the basis of differences between the future-without-project (FWOP) condition and the future-with-project (FWIP) condition. The FWOP conditions were generated through trend analysis and consultations with the local people. This reflected conditions of IESCs in absence of the proposed interventions under the polder area. Changes expected to be brought about due to proposed interventions under the Project were assessed to generate the FWIP conditions. Comparison and projection methods were used for impact prediction.

48. Cumulative impact assessment of a certain Polder is a two-way approach. Initially, the impact due to improvement/development works of Polder has been assessed (e.g., drainage improvement due to re-excavation of khals inside the polder). In this regard, some parameters like existing and design crest level of the embankment; hydrological condition, geographical position of polders, etc., have been considered to quantify the impact assessment. Finally, the impacts for development works of other adjacent polders have been considered for cumulative impact assessment.

49. Drainage modelling of the coastal polder has been carried out by IWM to find out the design parameters for drainage canal systems, drainage regulator, riverbank, slope protection works. Climate resilient coastal embankment crest level has been design considering the combined effects of cyclone storm surge effects and cyclone induced wind wave. The model has been developed and simulated considering climate change condition. The impact of proposed interventions on drainage, flooding, river dynamics has also been analyzed through modeling. The model results have been utilized in the EIA study.

Methodology

50. The assessment of effects and identification of residual impacts take account of any incorporated mitigation measures adopted due to any potential impact of project activities, and will be largely dependent on the extent and duration of change, the number of people or size of the resource affected (receptor) and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below was applied to define both beneficial and adverse potential impacts.

51. The criteria to determine significance are generally specific for each environmental and social aspect/receptor. Generally, the magnitude of each potential impact is defined along with the sensitivity of the receptor

Magnitude

52. The assessment of magnitude has been undertaken in two steps. Firstly, the key issues associated with the Project are categorized as beneficial or adverse. Secondly, potential impacts have been categorized as major, moderate, minor or negligible based on consideration of the parameters such as:

- Duration of the potential impact;
- Spatial extent of the potential impact;
- Reversibility;
- Likelihood; and
- Legal standards and established professional criteria.

53. The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in **Table2.1**.

Table 2.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 15 years)	Medium Term Lifespan of the project (5 to 15 years)	Less than project lifespan	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baselineconditions	Baseline requires a year or so with some interventions to return to baseline conditions	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

Sensitivity

54. The sensitivity of a receptor has been determined based on review of the absorption capacity of the receptor (including proximity / numbers / vulnerability) and presence of features on the site or the surrounding area. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in **Table 2.2**.

Table2.2: Criteria for Determining Sensitivity

Sensitivity Determination	Definition
Very High	Vulnerable receptor with little or no capacity to absorb proposed changes or minimal opportunities for mitigation.
High	Vulnerable receptor with little or no capacity to absorb proposed changes or limited opportunities for mitigation.
Medium	Vulnerable receptor with some capacity to absorb proposed changes or moderate opportunities for mitigation.
Low / Negligible	Vulnerable receptor with good capacity to absorb proposed changes or/and good opportunities for mitigation

Assigning Significance

55. Following the assessment of magnitude and sensitivity of the receptor the significance of each potential impact was established using the potential impact significance matrix shown in **Table 2.3**.

Table 2.3: Assessment of Potential Impact Significance

Magnitude of Potential impact	Sensitivity of Receptors			
	Very High	High	Medium	Low / Negligible
Major	Critical	Major	Moderate	Negligible
Moderate	Major	Major	Moderate	Negligible
Minor	Moderate	Moderate	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Mitigation Measures

56. Subsequent to the impact assessment discussed above, appropriate mitigation measures have been proposed to avoid, offset, mitigate/reduce, or compensate for the identified impacts. Generally, impacts having moderate to critical consequence significance per the **Table2.3** require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance are considered not to need any mitigation measures.

57. Generally, preference is given to the avoidance of the impact with the help of options available for nature, siting, timing, method/procedure, or scale of any Project activity. If avoidance is not possible, appropriate mitigation and control measures are proposed to reduce the consequence significance of the predicted impact, where feasible. Finally, if mitigation is not possible, compensatory measures are proposed.

Assessment of Residual Impacts

58. The final step in the impact assessment process is to determine the significance of the residual impacts, which would be experienced even after implementing the mitigation/compensatory measures. Ideally, all of the residual impacts should be of negligible to low significance. No residual impacts having major or critical significance are generally acceptable.

Identification of Enhancement Measures

59. Wherever feasible, enhancement interventions, that may increase the positive benefits of the Project should be identified and included in the Project design/implementation. Identification of enhancement measures is based on experience from implementation of similar projects, applying expert judgment and from consultation with stakeholders.

2.2.8 Preparation of Environmental Management and Monitoring Plan

60. An EMP for the proposed Project was prepared comprising the mitigation/ enhancement measures with institutional responsibilities, environmental monitoring plan, training and capacity building plan, and reporting and documentation protocols (Refer Chapter 10).

2.2.9 EIA Report Preparation

61. At the end of the study, the present report was prepared incorporating all the findings of the EIA.

3 Policy, Legislative and Regulatory Framework

62. This Chapter presents a review of the national policy, legal, and regulatory framework relevant to the environmental and social aspects of the Project. Also reviewed in the Chapter are the WB environmental and social safeguard policies and guidelines.

3.1 National Environmental Laws

63. The key national environmental laws relevant to environmental management are briefly discussed below.

3.1.1 Bangladesh Environment Conservation Act (ECA), 1995 and all its subsequent amendments

64. The Environmental Conservation Act (ECA) of 1995 is the main legislative framework relating to environmental protection in Bangladesh. This umbrella Act includes laws for conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution. This Act has established the Department of Environment (DoE), and empowers its Director General to take measures as he considers necessary which includes conducting inquiries, preventing probable accidents, advising the Government, coordinating with other authorities or agencies, and collecting and publishing information about environmental pollution. According to this act (Section 12), no project shall be established or undertaken without obtaining, in a manner prescribed by the accompanying Rules, an Environmental Clearance Certificate (ECC) from the Director General of DoE.

65. In accordance with this Act, the CEIP-1will need to be cleared by DoE before commencing the project following procedures given in the Environment Conservation Rules (ECR) 1997 (discussed below). Also, the Ecologically Critical Areas in the coastal zone, defined by DoE under this act, will be considered while planning and designing of the CEIP-1project interventions.

66. The present EIA has been carried out in compliance with this Act.

Bangladesh Environment Conservation Act (ECA), (Amendments) 2010

67. The ECA 1995 was amended in 2010, which provided clarification of defining wetlands as well as Ecologically Critical Areas and included many important environmental concerns such as conservation of wetlands, hill cutting, ship breaking, and hazardous waste disposal. This amendment empowered the government to enforce more penalties than before. Moreover, affected persons were given provision for putting objections or taking legal actions against the polluters or any entity-creating nuisance to affected person.

3.1.2 Bangladesh Environment Conservation Rules (ECR), 1997

68. The Environment Conservation Rules, 1997 were issued by the Government of Bangladesh in exercise of the power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered:

- Declaration of ecologically critical areas
- Classification of industries and projects into four categories
- Procedures for issuing the Environmental Clearance Certificate
- Determination of environmental standards.

69. The Rule 3 defines the factors to be considered in declaring an area 'ecologically critical area' (ECA) as per Section 5 of ECA95. It empowers the Government to declare an area 'ECA', if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical

state or condition due to environmental degradation. The Government is also empowered to specify which of the operations or processes shall not be carried out or shall not be initiated in the ecologically critical area. Under this mandate, MoEF has declared the Sundarbans (10km bordering the Sundarban), Cox's Bazaar - Teknaf Sea Shore, Saint Martin Island, Sonadia Island, Hakaluki Haor, Tanguar Haor, Marzat Baor and Gulshan - Baridhara Lake as ECA and prohibited certain activities in those areas **(Map 3.1)**. Beside these, the government of Bangladesh recently declared four rivers around Dhaka (the Buriganga River, Turag River, Shitalakha River and Balu River) and River Dwaki at Jaflong in Sylhet as ECA.

Map 3.1: Location of Polder 39/2C from Ecologically Critical Area (ECA) of Bangladesh

70. Rule 7 classifies projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categoriesare**Green, Orange A, Orange B, and Red**.

71. All existing and proposed projects, that are considered low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed projects falling in the Orange-A, Orange-B and Red Categories, firstly a site clearance certificate and thereafter an environmental clearance certificate will be required. A detailed description of these four categories of projects has been given in Schedule-1 of ECR'97. Apart from the general requirements, for every Red category proposed project, the application must accompanied with feasibility report, Initial Environmental Examination (IEE), and an Environmental Impact Assessment (EIA) based on approved ToR by DoE, as well as an Environmental Management Plan (EMP). As per ECR'97, water resources development projects, such as the present CEIP-1is considered asacategory 'Red'.

72. The ECR'97 describes the procedures for obtaining the ECC from the DoE for different types of proposed projects. Any person or organization wishing to establish a project must obtain an ECC from the Director General, DoE. The application for such certificate must be in the prescribed form together with the prescribed fees laid down in Schedule 13, through the deposit of a Treasury Chalan in favour of the DG, DoE. The fees for clearance certificates have been revised in 2010. Rule 8 prescribes the duration of validity of such certificate (three years for green category and one year for other categories) and compulsory requirement for renewal of certificate at least 30 days before expiry of its validity.

3.1.3 The Forest Act, 1927 & Amendment Act 2000

73. According to the Act the Government (Forest Department) can prohibit certain activities in the declared Reserved Forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber etc.

"26. Acts prohibited in such forests. -

(1) Any person who, in a reserved forest-

(a) Kindles, keeps or carries any fire except at such seasons as the Forest-Officer may notify in this behalf;

(b) Trespasses or pastures cattle, or permits cattle to trespass;

(c) causes any damage by negligence in felling any tree or cutting or dragging any timber;

(d) quarries stone, burns lime or charcoal, or collects, subjects to any manufacturing process, or removes any forest produce other than timber; or who enters a reserved forest with firearms without prior permission from the Divisional Forest Officer concerned, shall be punishable with imprisonment for a term which may extend to six months and shall also be liable to fine which may extend to two thousand taka, in addition to such compensation for damage done to the forest as the convicting Court may direct to be paid."

74. The proposed intervention should not carry out any such activities that may cause damage or adversely impact on the natural resources including wildlife of the Sundarban Reserve Forest.

3.1.4 Bangladesh Environment Court Act, 2010

75. Bangladesh Environment Court Act, 2010 has been enacted to resolve the disputes and establishing justice over environmental and social damage raised due to any development

activities. This act allows government to take necessary legal action against any parties who creates environmental hazards/damage to environmentally sensitive areas as well as human society. According to this act, government can take legal actions if any environmental problem occurs due to CEIP-I interventions.

3.1.5 National Water Act, 2013

76. The National Water Act 2013 is based on the National Water Policy, and provides the legal framework for integrated development, management, abstraction, distribution, usage, protection and conservation of water resources in Bangladesh. The Act provides for the formation of a high-powered National Water Resources Council (henceforth termed as the Council) headed by the Prime Minister. An Executive Committee under the Ministry of Water Resources will implement the decisions taken by the Council.

77. As per this Act, all forms of water (e.g., surface water, ground water, seawater, rainwater and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. Private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act.

78. The Act addresses the water needs in irrigation and urban areas in the context of available surface water, groundwater, and rainwater.

79. The management of water resources within the territory of the country in rivers, creeks, reservoirs, flood flow zone, and wetlands has been assigned to the Executive Committee under the Ministry of Water Resources.

80. Draining of wetlands that support migratory birds has been prohibited by the Act. Consequently, without prior permission from the Executive Committee, building of any structure that can impede the natural flow of water has been prohibited.

81. A few activities like dredging of rivers for maintaining navigability, land reclamation projects by filling wetlands, and flood control and erosion control structures will be exempted pending prior permission.

82. The Act provides provisions for punishment and financial penalty for non-compliance, including negligence to abide by government policy, ordinance, and non-cooperation with government officials, refusal to present necessary documents, providing false information, affiliation with perpetrators, and protection measures for water resources management. The maximum penalty for violations is set to five years of imprisonment and/or a monetary penalty of Taka10,000.00 (Ministry of Law, Justice and Parliamentary Affairs, 2013).

3.1.6 National River Protection Commission Act 2013

83. The National River Protection Commission Act helps the government take legal action to protect rivers from encroachment, pollution and unscrupulous use of rivers as well as other water bodies. The Act will help prevent building infrastructures by encroaching rivers through a National River Protection Commission.

84. This Act, consisting of 4 Chapters, creates the National River Protection Commission. It establishes composition, duties and responsibilities of the above mentioned Commission, entitled to: manage and control water and environmental pollution, caused by industrial pollution of rivers, construction of illegal structures and to prevent irregularities and restore the normal flow of the river, to control flood and drainage; hydrology, the use of surface and ground water; and to examine the equipment.

85. The Commission is formed with a chairman and four experts on river, environment, river survey and law (human rights) under the act for a three-year term. As per the Act, the

Commission works for creating public awareness for protecting rivers, conducting researches on river protection, ensuring river management, and taking up both short- and long-term plans for protection of rivers.

3.1.7 The Embankment and Drainage Act 1952

86. The Embankment and Drainage Act consolidates the laws relating to embankment and drainage and make better provisions for the construction, maintenance, management, removal and control of embankments and watercourses or better drainage of lands and for their protection from floods, erosion or other damage by water.

87. According to the Section 4 (1) every embankment, watercourse and embanked tow-path maintained by the Government or the Authority, and all land, earth, pathways, gates, berms and hedges belonging to or forming part of, or standing on, any such embankment or water-course shall vest in the Government or the Authority, as the case may be.

88. The section 56 (1) states that, persons will be subject to penalty (Tk. 500 or imprisonment) if he/she erects, or causes of wilfully permits to be erected, any new embankment, or any existing embankment, or obstructs of diverts, or causes or wilfully permits to be obstructed or diverted, any water course. This section could be applied to the person causing damage to the protective works.

3.1.8 The Inland Water Transport Authority Ordinance, 1958 (E.P. Ordinance No. Lxxv of 1958)

89. This is an Ordinance to set up an Authority for the development, maintenance and control of inland water transport and certain inland navigable waterways in Bangladesh. The Authority is mandated to perform any other function such as, carrying out river conservancy work, including river training for navigation purposes and aiding navigation; drawing up programs on dredging requirements and priorities for the efficient maintenance of existing navigable waterways; and reviving dead or dying rivers, channels, or canals, including developing new channels and canals for navigation.

3.1.9 The Ground Water Management Ordinance, 1985 (Ordinance No. xxvii of 1985)

90. This is an Ordinance to manage ground water resources for agricultural production. This Act authorizes the Thana Parishad to grant license for installing tube wells under its jurisdiction. The Thana Parishad may grant the license if the Parishad is satisfied that the installation of the tube well applied for:

a) Will be beneficial to the areas where it is to be installed, or

b) Will not have any adverse effect upon the surrounding areas, or

c) Is otherwise feasible.

3.1.10 The Constitution

91. Article 18A of the Constitution of the People's Republic of Bangladesh very clearly states: “The State shall endeavour to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens."

92. This provision justifies that the state has been given responsibility to protect and improve the environment

3.2 Relevant National Policies, Strategies and Plans

3.2.1 National Environment Policy, 1992

93. The National Environment Policy (NEP) is one of the key policy documents of the Government. The policy addresses 15 sectors in all, in addition to providing directives on the legal framework and institutional arrangements. Coastal and marine environment is one of the key sectors covered in this policy. The policy declarations that have particular bearing on the Integrated Coastal Zone Management (ICZM) are listed below.

- Sustainable use of coastal and marine resources and preservation of coastal ecosystem
- Prevention of national and international activities causing pollution in coastal and marine environment
- Strengthening research in protection and development of coastal and marine resources and environment
- Exploration of coastal and marine fisheries to a maximum sustainable limit

94. Regarding water resource development, flood control and irrigation sector, the policy seeks to:

- ensure environmentally-sound utilization of all water resources;
- ensure that water development activities and irrigation networks do not create adverse environmental impact;
- ensure that all steps are taken for flood control, including construction of embankments, dredging of rivers, digging of canals, etc., be environmentally sound at local, zonal and national levels;
- ensure mitigation measures of adverse environmental impact of completed water resources development and flood control projects;
- keep the rivers, canals, ponds, lakes, *haors*, *baors* and all other water bodies and water resources free from pollution;
- ensure sustainable, long-term, environmentally sound and scientific exploitation and management of the underground and surface water resources; and
- conduct environmental impact assessment before undertaking projects for water resources development and management.

95. The Policy is applicable to the Package 2 under CEIP-1and the proposed interventions are required to comply with all the policy directives emphasizing particularly on reducing adverse environmental impacts. The EIA studies of the coastal polders are required to clearly address the potential impacts and propose mitigation measures.

3.2.2 National Forest Policy, 1994

96. The Forest Policy 1994 recognizes the importance of biodiversity for environmental sustenance. The policy is explicitly mentioned that habitats for the wildlife and vegetation will be conserved through afforestation and by bringing forestlands under Protected Areas. The policy targets to bring 20% of the total land area of the country under forest cover, and at least 10% of which under protected areas by 2015. It also declared that measures would be taken to improve degraded forests. The Policy, at the same time, advocated social forestry, which includes agro forestry, woodlot plantations, and strip plantations in vacant public and private lands of the country. Afforestation could directly contribute to climate change mitigation efforts and efforts to improve forest quality add to forest resilience.

3.2.3 National Environment Management Action Plan, 1995

97. The National Environment Management Action Plan (NEMAP, 1995) identifies the main national environmental issues, including those related to the water sector. The main water related national concerns include flood damage, riverbank erosion, environmental degradation of water bodies, increased water pollution, shortage of irrigation water and drainage congestion; various specific regional concerns are also identified.

3.2.4 National Water Policy, 1999

98. Endorsed by the GoB in 1999, the National Water Policy (NWP) aims to provide guidance to the major players in water sector for ensuring optimal development and management of water. According to the policy, all agencies and departments entrusted with water resource management responsibilities (regulation, planning, construction, operation, and maintenance) are required to enhance environmental amenities and ensure that environmental resources are protected and restored in executing their tasks.

99. The policy has several clauses related to water resource development projects for ensuring environmental protection. Some of the relevant clauses are:

- Clause 4.5b: Planning and feasibility studies of all projects will follow the Guidelines for Project Assessment, the Guidelines for People's Participation (GPP), the Guidelines for Environmental Impact Assessment, and all other instructions that may be issued from time to time by the Government.
- Clause 4.9b: Measures will taken to minimize disruption to the natural aquatic environment in streams and water channels.
- Clause 4.9e: Water development plans will not interrupt fish movement and will make adequate provisions in control structures for allowing fish migration and breeding.
- Clause 4.10a: Water development projects should cause minimal disruption to navigation and, where necessary, adequate mitigation measures should be taken.
- Clause 4.12a: Consider environmental protection, restoration and enhancement measures consistent with National Environmental Management Action Plan (NEMAP) and the National Water Management Plan (NWMP).
- Clause 4.12b: Adhere to a formal environment impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects, in each water resources development project or rehabilitation program of size and scope specified by the Government from time to time.
- Clause 4.12c: Ensure adequate upland flow in water channels to preserve the coastal estuary ecosystem threatened by intrusion of salinity from the sea.
- Clause 4.13b: Only those water related projects will be taken up for execution that will not interfere with aquatic characteristics of those water bodies.

100. Most of the above clauses will be applicable to the Package 2 under CEIP-I. The Project design and present EIA study will be required to comply with these requirements.

3.2.5 National Water Management Plan, 2001 (Approved in 2004)

101. The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, envisions establishing an integrated development, management and use of water resources in Bangladesh over a period of 25 years. WARPO has been assigned to monitor the national water management plan. The major programs in the Plan have been organized under eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster

Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs, and 84 sub-sectoral programs have been identified and presented in the investment portfolio. Most of the programs are likely to be implemented in coastal areas.

102. The CEIP-I has been designed in line with this Plan and addresses its key objectives for the water resource management in the coastal areas.

3.2.6 Coastal Zone Policy, 2005

103. The Government has formulated the Coastal Zone Policy that provides a general guidance to all concerned for the management and development of the coastal zone in a manner so that the coastal people are able to pursue their life and livelihoods within secure and conducive environment.

104. The coast of Bangladesh is known as a zone of vulnerabilities as well as opportunities. It is prone to natural disasters like cyclone, storm surge and flood. In this regard, for reducing risk, the policy emphasizes the improvement of coastal polders and seeks to enhance safety measures by combining cyclone shelters, multi-purpose embankments, road system and disaster warning system.

105. The CEIP-1 addresses some aspects of this Policy particularly those relating to the polder improvements.

3.2.7 Coastal Development Strategy, 2006

106. The Coastal Development Strategy (CDS) focuses on the implementation of the coastal zone policy. The CDS was approved at the second meeting of the Inter-Ministerial Steering Committee on ICZMP held on 13 February 2006. Nine strategic priorities, evolved through a consultation process, guide interventions and investments in the coastal zone:

- ensuring fresh and safe water availability
- safety from man-made and natural hazards
- optimizing use of coastal lands
- promoting economic growth emphasizing non-farm rural employment
- sustainable management of natural resources: exploiting untapped and less explored opportunities
- improving livelihood conditions of people especially women
- environmental conservation
- empowerment through knowledge management
- creating an enabling institutional environment

107. The proposed interventions under CEIP-1 are in line with this strategy and support most of the above listed priorities.

3.2.8 National Land Use Policy (MoL, 2001)

108. The National Land Use Policy (NLUP), enacted in 2001, aims at managing land use effectively to support trends in accelerated urbanization, industrialization and diversification of development activities. The NLUP urges that increasing the land area of the country may not be possible through artificial land reclamation processes, which are cost-effective only in the end. Therefore, land use planning should be based on the existing and available land resources. The policy suggests establishing land data banks where, among others, information on accreted

riverine and coastal chars will maintain. Among the 28 policy statements of NLUP, the following are relevant to coastal area:

- forests declared by the Ministry of Environment and Forests will remain as forest lands;
- reclassification of forest lands will be prevented; and
- effective green belts will be created all along the coast.

  CEIP- I is designed in accordance with this Policy and will comply with the above listed requirements.

3.2.9 National Agriculture Policy, 2013

109. The National Agriculture Policy, 2013 approved by the Government focuses on agriculture production, alleviating poverty through generating jobs and ensuring food security. The Policy outlined nine specific objectives. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture.

110. The government will pursue a programme for agro-ecologically disadvantaged regions in the hilly area, drought-prone area, Barind tract, char land, haor-baor and the coastal belt with appropriate technological support.

111. To increase water productivity and enhance irrigation efficiency through optimal use of available water resources the government will facilitate dissemination of water management technology. Modern irrigation, drainage and water application systems will be introduced for expanding irrigation coverage including difficult or disadvantaged areas, i.e. in char, hilly, Barind tract, drought-prone and saline areas.

112. The proposed CEIP-1 is expected to contribute to achieve the objectives of the agriculture policy.

3.2.10 Master Plan for Agricultural Development in Southern Region of Bangladesh, 2013

113. The Master Plan for Agriculture Development in the Southern Region of Bangladesh has been prepared by the Ministry of Agriculture in collaboration with the Ministry of Fisheries & Livestock and Ministry of Water Resources, and with technical assistance from FAO. The Plan covers three hydrological regions- south central, southwest and southeast of the coastal zone covering 14 districts. The objective of the Plan is to provide a road map for integrated agricultural development in the coastal districts of Bangladesh, aiming at sustainable food security, poverty reduction and livelihood development for the poor. The Plan particularly focus on, among others: (i) increasing agricultural production and productivity; (ii) improving water management, (iii) infrastructure development for surface water irrigation; (iv) improving productivity of brackish water shrimp and capture fisheries; and (v) promoting smallholder poultry and dairy development. The Plan formulated a set of programmes and activities across all branches of agriculture and other related fields. The Plan is for 2013 to 2021.

114. The proposed CEIP-1is expected to contribute to achieve the objectives of the Master Plan for Agriculture Development in the Southern Region of Bangladesh.

3.2.11 National Fisheries Policy, 1996

115. The National Fisheries Policy (NFP), 1996 recognizes that fish production has declined due to environmental imbalances, adverse environmental impact and improper implementation of fish culture and management programs. The policy particularly focuses on coastal shrimp, aquaculture and marine fisheries development.

116. The policy suggests following actions:

- Shrimp and fish culture will not be expanded to the areas which could damage mangrove forest in the coastal region
- Biodiversity will be maintained in all natural water bodies and in marine environment
- Chemicals harmful to the environment will not be used in fish shrimp farms
- Environment friendly fish shrimp culture technology will be used
- Expand fisheries areas and integrate rice, fish and shrimp cultivation
- Control measures will be taken against activities that have a negative impact on fisheries resources and vice-versa
- Laws will be formulated to ban the disposal of any untreated industrial effluents into the water bodies.

117. The CEIP-I integrates the guidelines of NFP in design and implementing the proposed interventions.

3.2.12 National Livestock Development Policy, 2007

118. The National Livestock Development Policy has been prepared to address the key challenges and opportunity for a comprehensive sustainable development of the livestock sub-sector by creating an enabling policy framework. Among 60 or more policy statements, the following two policy statements address the coastal zone:

- Specific areas will be identified to implement programs for fattening of cattle and livestock. For this purpose, the Chittagong Hill Tracts, the coastal areas and the islands will be included under the fattening of livestock and cattle program.
- Special programs will be taken up for the production of grass in the Chittagong Hill-tracts and the coastal areas.

119. As livestock is one of the key assets in coastal livelihoods, and protection of livestock from cyclones and tidal surges should be emphasized along with security of human life. The proposed CEIP-1 interventions will contribute to the safety of livestock and thus increase livestock productivity in coastal areas.

3.2.13 Standing Orders on Disaster, 2010

120. The Standing Orders on Disaster is designed to enhance capacity at all tiers of government administrative and social structures for coping with and recovering from disasters. The document contains guidelines for construction, management, maintenance and use of cyclone shelters. Accordingly, to the guideline, geographical information system (GIS) technology will be applied at the planning stage to select the location of cyclone shelter considering habitation, communication facilities, and distance from the nearest cyclone centre. The advice of the concerned District Committee is to be obtained before final decision. The cyclone shelters should have easier communication facilities so that in times of distress delay does not occur to go there. For this reason, the road communication from the cyclone shelters should not only link up with city or main road but also with neighbouring village areas. Provision of emergency water, food and sanitation and shelter space for livestock during period should also be kept in view for future construction of shelters.

121. Improvement of coastal polders under CEIP-1 will provide better communication facilities in the coastal areas, which is crucial for emergency response to disasters.

3.2.14 National Adaptation Programme of Action (NAPA)

122. In 2005, the Ministry of Environment and Forest (MOEF) prepared the National Adaptation Program of Action (NAPA) for Bangladesh. The basic approach for the NAPA preparation was in accordance with the sustainable development goals and objectives of the country where it has recognized the necessity of addressing climate change and environmental issues and natural resource management. The NAPA is the beginning of a long journey to address adverse impacts of climate change including variability and extreme events and to promote sustainable development of the country. There are 15 adaptation strategies suggested to address adverse effects of climate change. Among the 15 adaptation strategies the following strategies address the coastal region for reducing climate change induced vulnerability.

- Reduction of climate change hazards through coastal afforestation with community participation.
- Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise.
- Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains
- Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future.
- Promoting adaptation to coastal crop agriculture to combat increased salinity.
- Promoting adaptation to coastal fisheries through culture of salt tolerant fish special in coastal areas of Bangladesh.

123. The CEIP-1 broadly contributes toward achieving the aims and objectives of the NAPA.

3.2.15 Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009

124. The GoB has prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP), 2009. The BCCSAP is built on six pillars: (i) food security, social safety and health; (ii) comprehensive disaster management; (iii) infrastructure; (iv) research and knowledge management; (v) mitigation and low carbon development; and (vi) capacity building. Five programs have been suggested related to improvement of the water management infrastructures in coastal areas of Bangladesh under pillar 3 (Infrastructure) of BCCSAP, including:

- Repair and maintenance of existing flood embankments
- Repair and maintenance of existing coastal polders
- Improvement of urban drainage
- Planning, design and construction of river training works
- Planning, design and implementation of resuscitation of the network of rivers and *khals* through dredging and de-siltation work.

125. CEIP-1 is relevant to the above-mentioned programs and will contribute towards achieving the objective of other pillars of the BCCSAP, such as (i), (ii), (iii) and (iv).

3.2.16 The Acquisition and Requisition of Immovable Property Ordinance, 1982

126. This Ordinance is the basic instrument governing land acquisition in Bangladesh. It is restricted to “legal” owners of property as supported by records of ownership such as deeds, title or agreements to compensating for land as well as any business, structure, trees and crops on the land. The owners of acquired land receive cash compensation at market value with a premium of 50 per cent on the assessed price. The law specifies methods for calculation of market value of property based on recorded prices obtained from relevant Government departments such as Registrar (land), Public Works Department (structures), Department of Forest (trees), Department of Agriculture (crops) and Department of Fisheries (fish stock).

127. The Ministry of Land (MOL) is authorized to deal with land acquisition. The MOL delegates some of its authority to the Commissioner at Divisional level and to the Deputy Commissioner at the District level. The Deputy Commissioners (DCs) are empowered by the MOL to process land acquisition under the Ordinance and pay compensation to the legal owners of the acquired property. *Khas* (government owned land) lands should be acquired first when a project requires both *khas* and private land. If a project requires only *khas* land, the land will be transferred through an inter-ministerial meeting following the acquisition proposal submitted to DC or MOL as the case may be. The DC is empowered to acquire a maximum of 50 standard *bigha* (6.75 ha) of land without any litigation where the Divisional Commissioner is involved for approval. Acquisition of land more than 50 standard *bigha* is approved from the central land allocation committee (CLAC) headed by the chief executive of the Government of Bangladesh proposed by the MOL.

128. The landowner needs to establish ownership by producing record-of-rights in order to be eligible for compensation under the law. The record of rights prepared under Section 143 or 144 of the State Acquisition and Tenancy Act 1950 (revised 1994) are not always updated and as a result legal landowners have faced difficulties trying to “prove” ownership. The affected person (AP) has also to produce rent receipt or receipt of land development tax, but this does not assist in some situations as a person is exempted from payment of rent if the area of land is less than 25 *bighas* (3.37 ha).

3.2.17 The East Bengal State Acquisition and Tenancy Act, 1950 (Revised 1994)

129. The State Acquisition and Tenancy Act (Sections 86 and 87) also define the ownership and use right of alluvium (*payosti* or reformation in situ or original site) and diluvion land (*nadi sikosti*) in the country. In legal terms, eroded lands (*sikosti*) inside the alluvion-diluvion (AD) line (i.e. including submerged land or underwater land) are considered *khas* land once declared by concerned Deputy Commissioner (DC) demarcating the AD Line.[3]

3.2.18 Bangladesh Water Act, 2013

130. The Water Act 2013 is based on the National Water Policy, and designed for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh.

131. As per this Act, all forms of water (e.g., surface water, ground water, sea water, rain water and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. The private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act. A worthwhile initiative is the requirement for permits/licenses for large scale water withdrawal by individuals and organizations beyond domestic use. Without prior permission issued by the Executive Committee, no individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they will be allowed to build any structure that impede the natural flow of rivers and creeks.

3 The Assistant Commissioner of Lands (AC Land) in respective districts demarcates the AD Line each year in areas where rivers frequently erode their banks. According to law, if the land classified by an AD Line re-appears within 30 years from the date of erosion, the original owner(s) can claim the land. The original private owners cannot claim any eroded land if developed by the government through land filling for use in public purpose.

3.2.19 Guidelines for Participatory Water Management 2014

132. Guidelines for Participatory Water Management 2014 prepared under "Bangladesh Water Development Board Act 2000". The Rules relate to formation and functions of water management organizations (WMOs) in water resources projects.

133. Guidelines for Participatory Water Management (GPWM) in Bangladesh provides following:

134. Participation is an important voluntary process in which local stakeholders influence policy formulation, alternative plans/designs, investment choices and management decisions affecting their communities and establish the sense of ownership.

135. Give the local stakeholders a decisive voice at all stages of water management.

136. Participation of local stakeholders to prepare production plans on agriculture, fishery, forestry and livestock development and environmental management plan based on the feasibility study by the implementing agencies.

137. According to this rule, every water management group shall will form cluster groups including landless men and women of the project area for infrastructure development or maintenance related activities of which 30percent will be women.

3.2.20 Constitutional Right of the Tribal Peoples Rights

138. The Constitution of Bangladesh does not mention the existence of cultural and ethnic minorities in Bangladesh. The only protective provision for the ethnic minorities that the policy makers often refer to in the context is Article 28 (4) which states that: "nothing shall prevent the state from making special provision in favour of women and children or for the advancement of any backward section of the citizens". The above provision is an ambiguous one and it does not define who or what constitutes "backward". However, the Government recognizes existence of "tribal peoples" and the need for special attention and in general; tribal people are essentially viewed as backward, poor and socio-economically & culturally inferior. Towards this end, a special program was initiated in 1996-97 by the Prime Minister's Secretariat aimed at improving the socio-economic situation of the indigenous people of Bangladesh, resident outside the Chittagong Hill Tracts.

3.2.21 Ethnic Minority Rights in PRSP 2005

139. Relevant strategic suggestions in the Poverty Reduction Strategy Paper (PRSP) 2005 to preserve the cultural, social and economic identity and interests of the ethnic populations in and outside CHT are as follows:

- Effective recognition of ethnic minority communities and their specific needs in all relevant government policies and programs towards improving the socio-economic conditions of these communities.
- Proper actions for protecting the rights of ethnic minority people, particularly their rights to land and forests.
- Transfer of land administration in CHT to the hill districts councils in accordance with the 'Hill District Councils Acts of 1989'.
- Provide education to ethnic minority people with a curriculum that allows learning in their own language at the primary level.
- Strengthen their competence in job markets through affirmative actions at higher levels of education and skill training to promote their inclusion in mainstream economic life.

- Scale-up efforts to provide health care, clean water and sanitation facilities to ethnic minority areas in general and to the more disadvantaged groups among them in particular.
- Increase and utilize properlythe fund available in the Prime Minister's office for the development of the ethnic minority people of the plain lands.
- Provide wider access to electrification and telecommunications for ethnic minority communities, particularly in the Hill Tracts.

3.2.22 Acquisition and Requisition of Immovable Property Ordinance, 1982

140. The principal legal instrument governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance, 1982(Ordinance II of 1982 with amendments up to 1994) and other land laws and administrative manuals relevant to land administration in Bangladesh. According to the Ordinance, whenever it appears to the GoB that any property in any locality is needed or is likely to be needed for any public purpose or in the public interest, the Government can acquire the land provided that the property is not used by the public for the purpose of religious worship, graveyard and cremation ground. The 1982 Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines (a) market value of acquired assets on the date of notice of acquisition (based on the registered value of similar property bought and/or sold in the area over the preceding 12 months), and (b) 50% premium on the assessed value (other than crops) due to compulsory acquisition. The 1994 amendment made provisions for payment of crop compensation to tenant cultivators. Given that people devalue land during title transfer to minimize tax payment, compensation for land paid by DC including premium largely remains less than the actual market price.

141. The Ordinance, however, is not adequate to deal with the adverse impacts associated with land acquisition and involuntary displacement. Land is acquired under this ordinance but its provisions do not fully satisfy the requirements of the WB's OP 4.12 on Involuntary Resettlement. There are no other policies in Bangladesh to complement the acquisition law in ways to assess, mitigate and monitor the adverse impacts that the affected persons may suffer. The law does not cover project-affected persons without title or ownership record, such as informal settler/squatters, occupiers, and informal tenants and leaseholders (without registration document) and does not ensure replacement value of the property acquired. The Ordinance has no provisions for resettlement of the affected households/businesses or any assistance for restoration of livelihoods of the affected persons. As a result, land acquisition potentially diminishes the productive base of affected farm families and infringes impoverishment risks to those physically or economically displaced due to undertaking of infrastructure projects.

142. As the legal framework falls short of the provisions of the World Bank OP 4.12 on Involuntary Resettlement, the project proposes added mechanisms to meet the Bank's requirements:

Avoid or minimize resettlement: The law only implicitly discourages unnecessary acquisition, as lands acquired for one purpose cannot be used for a different purpose. However, there are no mechanisms to monitor if this condition is actually adhered to.

Eligibility for compensation: The law stipulates compensation only for the persons who appear in the land administration records as the owners. It does not recognize the rights of those, such as squatters, who do not possess legal title to the lands they live in or make a living from.

Compensation: The law provides compensation for lands and other objects built and grown on them (structures, trees and orchards, crops and any other developments like ponds, built amenities, etc.). No provisions are there to assess and restore lost income stream or income sources that acquisition causes to the affected persons, be they legal titleholders or others like squatters, tenants and employees of affected businesses.

Compensation standards: Although the law stipulates 'market prices' of the acquired lands as the just compensation, the legal assessment method usually results in prices that are far below the actual market prices[4]. Certain pricing standards, which are regarded as unrealistic, are used to assess other losses like structures and various built amenities, trees, crops and the like.

Relocation of households and other establishments: No legal obligation is there to relocate, or assist with relocation of, those whose homesteads have been acquired or whose place of residence or livelihoods has been affected. Such persons/households, be they titleholders or squatters, are left on their own.

Ensuring payment of compensation: Lands are legally acquired and handed over to the project execution agency as soon as the acquisition authority identifies the owners (or 'awardees'), by examining the records, and sends a legal notice advising them to claim the compensation (or 'awards'). It is the obligation of the affected landowners to prove, by producing an array of documents that the acquired lands legally belong to them. As gathering these documents is a long, expensive and cumbersome process, many landowners may remain unable to claim their awards[5].

Socioeconomic rehabilitation: The law shows no concern whatsoever about the long-term socioeconomic changes the affected persons and households might undergo in the post-acquisition period. There is no provision in the law except compensation toensure economic rehabilitation and social reintegration of the displaced persons.

143. These shortfalls in the legal provisions have been widely recognized as not fulfilling the requirements of the OP 4.12, ever since Bangladesh started to address resettlement issues in the Bank-financed projects in the early 1990s starting with the Jamuna Multipurpose Bridge Project. All infrastructure agencies in Bangladesh using finance from international development financing institutions like the World Bank, the ADB, JICA, and DFID are now undertaking resettlement of project affected persons as an integral part of development projects.

3.2.23 Other Relevant Acts

144. There are a number of other laws and regulations applicable, which are relevant for the project. These are presented in the **Table 3.1** below.

[4] According to the law, the 'market price' is calculated by averaging the sales prices recorded in the previousone year, in terms of land characteristics by land administration units or *mauzas*. But it is a widely acceptedfact that prices determined as such hardly reflect the true market value of the lands. As the sale/acquisitionprices are grossly under-reported to evade on sale taxes, assessment of legal compensation almost always fallfar too short of the real market prices.

[5] In the present land administration system, which is widely accepted as antiquated, land transactions, especially in the rural areas, often remain incomplete. Even after the sale/purchase deeds are legally executed, the sellers continue to remain as owners in the legal records until mutations are completed. As the transaction process is cumbersome and involves costs beyond those mandated by the law, and the practice that lands can be used with the deeds alone, most land transactions do not follow the process beyond deed execution. Many land purchasers are even not aware of the mutation or its significance.

Table 3.1: Laws and Acts

Act/Law/Ordinance	Brief description	Responsible Agency
The Vehicle Act (1927) and the Motor Vehicles Ordinance (1983)	Provides rules for exhaust emission, air and noise pollution and road and traffic safety	Road Authority
Rules for Removal of Wrecks and Obstructions in inland Navigable Water Ways (1973)	Rules for removal of wrecks and obstructions	BIWTA
The Water Supply and Sanitation Act (1996)	Regulates the management and control of water supply and sanitation in urban areas.	MoLG, RD&C
The Ground Water Management Ordinance (1985)	Describes the management of ground water resources and licensing of tube wells	Upazila Parishad
The Private Forests Ordinance (1959)	Deals with the conservation of private forests and afforestation of wastelands.	MoEF
The Protection and Conservation of Fish Act (1950)	Deals with the protection/conservation of fishes in Government owned water bodies	DoF
The Embankment and Drainage Act (1952)	Describes the protection of embankments and drainage facilities	MoWR
The Antiquities Act (1968)	Describes the preservation of cultural heritage, historic monuments and protected sites	DoArch
Acquisition and Requisition of Immovable Property Ordinance (1982)	Describes procedures and provides guidelines to acquisition and requisition of land	MoL
Bangladesh Labor Law (2006)	Deals with occupational rights and safety of factory workers; provision of comfortable work environment and reasonable working conditions	MoL

3.3 International Treaties Signed by GoB

145. Bangladesh has signed most international treaties, conventions and protocols on environment, pollution control, biodiversity conservation and climate change, including the Ramsar Convention, the Bonn Convention on migratory birds, the Rio de Janeiro Convention on biodiversityconservation and the Kyoto protocol on climate change. An overview of the relevant international treaties and conventions signed by GoB is shown in **Table 3.2** below.

Table 3.2: Treaty or Convention and Responsible Agency

Treaty	Year	Brief Description	Relevant Department
Protection of birds (Paris)	1950	Protection of birds in wild state	DoE/DoF
Ramsar Convention	1971	Protection of wetlands	DoE/DoF
Protocol Waterfowl Habitat	1982	Amendment of Ramsar Convention to protect specific habitats for waterfowl	DoE/DoF
World Cultural and Natural Heritage (Paris)	1972	Protection of major cultural and natural monuments	DoA
CITES convention	1973	Ban and restrictions on international trade in endangered species of wild fauna and flora	DoE/DoF
Bonn Convention	1979	Conservation of migratory species of wild animals	DoE/DoF
Prevention and Control of Occupational hazards	1974	Protect workers against occupational exposure to carcinogenic substances and agents	MoH

Treaty	Year	Brief Description	Relevant Department
Occupational hazards due to air pollution, noise & vibration (Geneva)	1977	Protect workers against occupational hazards in the working environment	MoH
Occupational safety and health in working environment (Geneva)	1981	Prevent accidents and injury to health by minimizing hazards in the working environment	MoH
Occupational Health services	1985	To promote a safe and healthy working environment	MoH
Convention on oil pollution damage (Brussels)	1969	Civil liability on oil pollution damage from ships	DoE/MoS
Civil liability on transport of dangerous goods (Geneva)	1989	Safe methods for transport of dangerous goods by road, railway and inland vessels	MoC
Safety in use of chemicals during work	1990	Occupational safety of use of chemicals in the work place	DoE
Convention on oil pollution	1990	Legal framework and preparedness for control of oil pollution	DoE/MoS
Vienna Convention	1985	Protection of the ozone layer	DoE
London Protocol	1990	Control of global emissions that deplete ozone layer	DoE
UN framework convention on climate change (Rio de Janeiro)	1992	Regulation of greenhouse gases emissions	DoE
Convention on Biological Diversity (Rio de Janeiro)	1992	Conservation of bio-diversity, sustainable use of its components and access to genetic resources	DoE
International Convention on Climate Changes (Kyoto Protocol)	1997	International treaty on climate change and emission of greenhouse gases	DoE
Protocol on biological safety (Cartagena protocol)	2000	Biological safety in transport and use of genetically modified organisms.	DoE

3.4 Implication of GoB Polices, Acts and Rules on CEIP and their Classification

146. The environmental legislative basis for approval of the CEIP-1project is the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). DoE), under MoEF is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every project, in consideration of their site and impact on the environment, will be classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). According to the categorization, all construction/reconstruction/expansion of flood control embankment/polder/dykes etc. falls under Red Category. Therefore,the CEIP-1Project intervention in polder 39/2Cfalls under the '**Red**' category.

147. It is the responsibility of the proponent to conduct an EIA of the development proposal. The responsibility to review EIAs for issuing Environmental Clearance Certificate (ECC) rests on DoE. The procedures for "Red" Category include submission of:

- An Initial Environmental Examination (IEE)
- An Environmental Impact Assessment (EIA)
- An Environmental Management Plan (EMP)

148. Environment clearance has to be obtained by the respective implementing agency or project proponent (private sector) from DoE. The environmental clearance procedure for Red Category projects can be summarized as follows:

149. Application to DoE →Obtaining Site Clearance →Applying for Environmental Clearance →Obtaining Environmental Clearance → Clearance Subject to annual renewal.

3.4.1 Detailed Steps of In Country Environmental Clearance Procedure

150. Legislative bases for EIA in Bangladesh are the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). Department

151. Environment (DoE), under the Ministry of Environment and Forest (MoEF), is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Environment Conservation Act 1995, no industrial unit or project will be established or undertaken without obtaining, in the manner prescribed by the Environment Conservation Rules 1997, an Environmental Clearance Certificate from the Director General. Therefore, every development projects/industries, which are specified under the Schedule 1 of the Environmental Conservation Rules 1997, require obtaining site clearance and environmental clearance from DoE. For ‘Red’ category, it is mandatory to carry out an EIA including an EMP and where necessary develop a Resettlement Plan for getting environmental clearance from DoE. The application procedure for obtaining site clearance and environmental clearance for the sub-projects of Red category is shown in Figure 3.1.

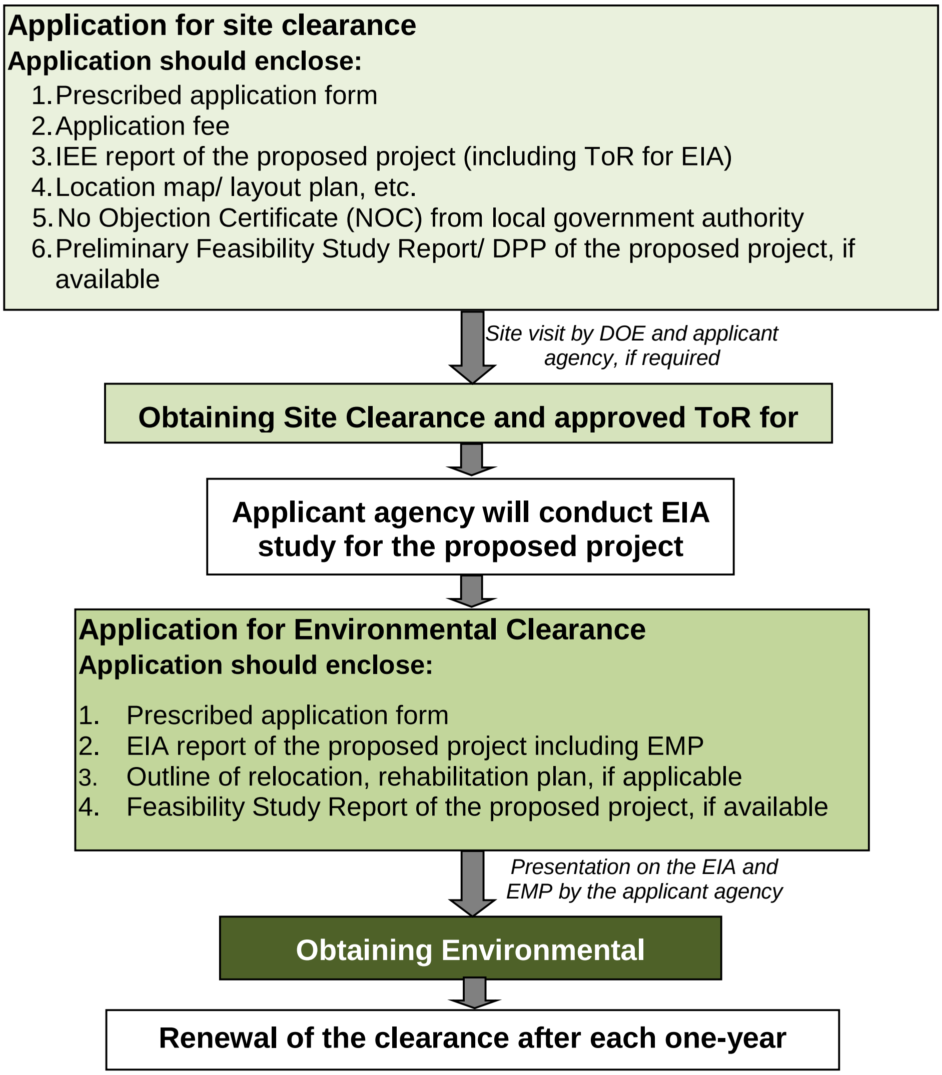

Figure 3.1: Process of obtaining Clearance certificate from DoE

3.5 World Bank's Environmental Safeguard Policies

152. Developers seeking financing from the WB are required to comply with the applicable environmental and social safeguards, operational policies (OPs) and Bank Procedures (BPs). A summary of the relevant safeguards policies considered for the Project is provided below.

3.5.1 Environmental Assessment (OP 4.01)

153. **EA requirement**. The World Bank requires environmental assessment (EA) of projects proposed for Bank support to ensure that they are environmentally sound and sustainable, and thus to improve decision-making. The Bank Policy OP 4.01 considers that EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project's potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. EA takes into account the natural environment (air, water and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples and physical cultural resources); and trans-boundary and global environmental aspects. The Bank Policy also

envisages that the borrower Government is responsible for carrying out the EA and the Bank advises the borrower on the Bank's EA requirements.

154. The present EIA has been carried out in compliance with this OP.

155. **EA classification**. The World Bank classifies the proposed project into one of the four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. These categories are defined below.

Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

156. The proposed CEIP-1 has been classified as Category A, since some of the potential impacts are likely to be significant and diverse.

3.5.2 Natural Habitats (OP 4.04)

157. The Policy describes the conservation of natural habitats, like other measures that protect and enhance the environment, to be essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank also supports, and expects borrowers to apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. The Bank-promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.

158. The WBOP 4.04 is triggered for the proposed Project. However, the proposed activities will be undertaken in an area where natural habitat has already been modified to farmlands and built-up area. Furthermore, appropriate control measures have been incorporated in the environmental management plan (EMP) (provided later in the document) to prevent any potential impacts of the Project on the nearby foreshore area.

3.5.3 Water Resources Management (OP 4.07)

159. Through this Policy, the Bank seeks to support operations that provide potable water, sanitation facilities, flood control, and water for productive activities in a manner that is economically viable, environmentally sustainable, and socially equitable. The Bank assists borrowers in many priority areas, among which developing a comprehensive framework for designing water resource investments, policies, and institutions is very important. Within this framework, when the borrower develops and allocates water resources, it considers cross-

sectoral impacts in a regional setting (e.g., a river basin). Restoring and preserving aquatic ecosystems and guarding against overexploitation of groundwater resources are given priority to the provision of adequate water and sanitation services for the poor. Furthermore, special attentions are needed by the borrowers to avoid the water logging and salinity problems associated with irrigation investments by (i) monitoring water tables and implementing drainage networks where necessary, and (ii) adopting best management practices to control water pollution.

160. The proposed Project seeks to address several of the Policy objectives particularly those relating to flood control and water resource management for productive activities.

3.5.4 Physical Cultural Resources (OP 4.11)

161. The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. The specific aspects of the Policy are given below. [6]

- The Bank normally declines to finance projects that will significantly damage non-replicable cultural property, and will assist only those projects that are sited or designed to prevent such damage.
- The Bank will assist in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is best relocated in order that sites and structures can be preserved, studied, and restored intact in situ. In other cases, structures can be relocated, preserved, studied, and restored on alternate sites. Often, scientific study, selective salvage, and museum preservation before destruction is all that is necessary. Most such projects should include the training and strengthening of institutions entrusted with safeguarding a nation's cultural patrimony. Such activities should be directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are to be internalized in computing overall project costs.
- Deviations from this policy may be justified only where expected project benefits are great, and the loss of or damage to cultural property is judged by competent authorities to be unavoidable, minor, or otherwise acceptable. Specific details of the justification should be discussed in project documents.
- This policy pertains to any project in which the Bank is involved, irrespective of whether the Bank is itself financing the part of the project that may affect cultural property.

162. This OP is not triggered since no cultural or archaeological resources are known to exist in the vicinity of the Project nor have any such resources been identified during field investigations. However, 'chance find' procedures will be implemented in the EMP.

3.5.5 Forestry (OP 4.36)

163. This Policy recognizes the need to reduce deforestation and promote sustainable forest conservation and management in reducing poverty. The Bank believes that forests are very much essential for poverty reduction and sustainable development irrespective of their location in the world. The Bank assists borrowers with forest restoration activities that maintain or enhance biodiversity and ecosystem functionality. The Bank also assists borrowers with the establishment and sustainable management of environmentally appropriate, socially beneficial, and

[6] Excerpts from the OPN 11.03. WB Operational Manual. September 1986.

economically viable forest plantations to help meet growing demands for forest goods and services. The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical natural habitats. Furthermore, the Bank does not finance projects that contravene applicable international environmental agreements.

164. Though this OP is triggered during the concept development stage, the proposed Project is not located in any forested area and will therefore not have any direct impact on forests.

3.5.6 Projects on International Waterways (OP 7.50)

165. Projects on international waterways may affect the relations between the WB and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. A borrower must notify other riparian of planned projects that could affect water quality or quantity, sufficiently far in advance to allow them to review the plans and raise any concerns or objections.

3.5.7 Pest Management (OP 4.09)

166. Through this OP, the WB supports a strategy that promotes use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides. Rural development and health sector projects have to avoid using harmful pesticides. Other pesticides can be used, but only as an element of an Integrated Pest Management Plan (IPMP) that emphasizes environmental and biological controls.

3.5.8 Indigenous Peoples (OP 4.10)

167. For purposes of this Policy, the term ‘Indigenous Peoples’ is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees:[7]

- self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and
- An indigenous language, often different from the official language of the country or region.

168. The OP defines the process to be followed if the project affects the indigenous people.

169. No indigenous people - with a social and cultural identity distinct from the dominant society that makes them vulnerable to being disadvantaged in the development process – are known to exist in the Project area. Therefore this OP is not triggered.

170. However, if such groups are identified during the Project implementation, the proponents will develop an Indigenous People Development Plan, in compliance with the OP and get it approved by the Bank.

[7] Excerpts from the OP 4.10. WB Operational Manual. July 2005.

3.5.9 Involuntary Resettlement (OP 4.12)

171. The WB's experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks: production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed; and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.[8]

172. The overall objectives of the Policy are given below.

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

173. Since the proposed Project will involve land acquisition as well as displacement of houses and other assets, a Resettlement Action Plan (RAP) has been prepared, under a separate cover, in accordance with this Policy.

3.5.10 Projects in Disputed Areas (OP 7.60)

174. Projects in disputed areas may raise a number of delicate problems affecting relations not only between the Bank and its member countries, but also between the borrower and one or more neighbouring countries. In order not to prejudice the position of either the Bank or the countries concerned, any dispute over an area in which a proposed project is located is dealt with at the earliest possible stage.

175. The Bank may proceed with a project in a disputed area if the governments concerned agree that, pending the settlement of the dispute, the project proposed for country A should go forward without prejudice to the claims of country B. [9]

176. This OP is not triggered since no part of the Project area is located in any disputed territory.

3.5.11 Safety of Dams (OP 4.37)

177. The Policy seeks to ensure that appropriate measures are taken and sufficient resources provided for the safety of dams the WB finances. However this OP is not relevant since the proposed Project does not involve construction of dams.

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[8] Excerpts from WB OP 4.12. WB Operational Manual. December 2001.

[9] Excerpts from the OP 7.60. WB Operational Manual. November 1994.

3.5.12 Public Disclosure of Information (BP 17.50)

178. This BP deals with the World Bank policy on disclosure of information. It is a mandatory procedure to follow by the borrower and Bank and supports public access to information on environmental and social aspects of projects.

179. Once finalized, the EIA report will be disclosed to the public and will be available on the official website of the BWDB. EIA will also sent to the WB InfoShop.

3.5.13 Environment, Health and Safety Guidelines

180. The Environment, Health, and Safety (EHS)[10] Guidelines contain the performance levels and measures that are generally considered achievable in new facilities or project by existing technology at reasonable costs. These Guidelines will be applicable to the Project.

3.6 Implications of WB Policies on CEIP

181. The project interventions for Polder 39/2C fall under Category A, due to the complexity of environmental issues associated with project activities involving major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is of high ecological sensitivity and vulnerability, certain negative environmental impacts may occur during the implementation and operational phase on overall polder system. There may be localized impact on the natural habitats especially on the fish spawning site and protected areas, during the implementation of the civil works.

182. The environment assessment (OP/BP 4.01), natural habitats (OP/BP 4.04) and forests (OP/BP 4.36) policy have been triggered for the proposed operation. Although no direct impacts on physical cultural resources are expected, screening mechanism incorporated into the EA process will identify subprojects with archaeological, paleontological, historical, religious, or unique natural values, chance and find procedure will followed to address physical cultural resources (OP/BP 4.11). The interventions under the proposed Project may result in an increased availability of irrigation water through cleaning and excavation of watercourses in the Polder. This increased water availability can in turn potentially increase the usage of chemical fertilizers and pesticides. During regular environment monitoring during operational phase if the water and soil pollution is observed, the proponent will be responsible for preparing Pest Management Plan with prior approval from Bank. No Project activities are to carryout in the rivers except some transportation. However, this will not have any effect whatsoever on the upper riparian water usage or availability. Hence, International Waterways (OP 7.5) is not expected to trigger.

[10] Environmental, Health and Safety Guidelines. IFC/WB Group, April 30, 2007.

4 Description of the Project

183. The project activities, construction methodology, construction schedule, and the institutional arrangements for implementation of the Project are describ in this chapter.

4.1 Project Background

184. The Bangladesh low-lying Delta is formed by the interaction of the very large summer discharges of both water and sediment from the Ganges, Brahmaputra (Jamuna) and Meghna Basins with tides in the Bay of Bengal, which can vary in range from 3 m in the west to nearly 6 m in the northeastern corner of the Bay near Sandwip.

185. The Coastal Zone of Bangladesh has been defined as the area within which the river flows are influenced by the tide. Given the high tidal range and the very low river gradients, the tide reaches very far landwards, particularly in the dry season. If the upstream freshwater inflows are reduced in the dry season, salinity can also intrude upstream within the river system, which comprises a number of very large estuaries.

Coastal Embankment Project

186. The Coastal Embankment Project (CEP) was initiated in the 1960s to reclaim or protect areas in the coastal zone that lay below the highest tide levels for periodic inundation by saline water. These landscan beused for agriculture by providing drainage structures capable of evacuating excess water during low tide. This system worked well for many years and 1.2 million hectares came under protection of the embankment system bringing immense benefits.

187. However, there have been unintended consequences of this project. The very act of preventing the high tides from spreading over the land and confining them within the river channels initially increased the tidal range by about 30 per cent, which might have had an immediate beneficial impact on drainage. However, the reduction of upstream and overbank storage also decreased the tidal cubature (i.e., the volume of water displaced during a tidal cycle).

188. The reduction in cubature induced sedimentation or more correctly a reduction in cross sectional areas of the rivers of all types – the large rivers such as the Pussur which have sandy bottoms and clay/silt banks and the smaller rivers which have an excess of silt and clay. The consequent choking of smaller rivers resulted in drainage congestion within some internal polders, and navigation problems in some.

189. The embankment system was originally designed to keep out the highest tides, without any consideration of possible storm surges. Recent cyclonic storm damages and the anticipation of worse future situations because of climate change, has caused this strategy to revise. Additional problems have also been identified – the direct impact of sea level rise on salinity intrusion into the coastal zone as well as on polder drainage.

The CEIP Initiative

190. It is well recognized that infrastructural interventions in the coastal areas by embankments and cyclone shelters have significantly reduced its vulnerability to natural disasters at least partially and thus the poor people have some assurance of safety to their lives and crops. However, some effectiveness of the infrastructures in most cases has compromised through poor and inadequate maintenance and sometimes by shifting the embankments towards country-sides. With the occurrence of the frequent storms in the recent period, the Coastal Embankment Systems (CES) has weakened and calls for systematic restoration and upgrading.

191. After cyclone SIDR struck the coastal area causing severe damage to the infrastructure, lives and properties of the coastal belt, GOB obtained an IDA/credit for Emergency Cyclone Recovery and Restoration Project (ECRRP, 2007) and proceeds from this credit would used to meet the expenses for preparation of the proposed Coastal Embankment Improvement Project-Phase I (CEIP-1).

192. It had been apprehendedthat undertaking the rehabilitation of coastal embankment system under one or two localized projects will not bring any convincing change in such a vast area. To resolve this multi-dimensional problem a strategic approach in the name of Coastal Embankment Improvement Programme (CEIP) felt necessary. It incorporates a longer-term perspective in a programme spread over a period of 15-20 years, composed of at least 3-4 sub-phases.

193. The Polder 39/2C is one of the polders to be rehabilitat under the CEIP-1.

194. Polder OverviewPolder 39/2C is located in three upazilas namely, Bhandaria and Mathbaria upazila of Pirojpur district and Kanthalia upazila of Jhalokati district of Bangladesh (Figure 4.1). The administrative and management control lies with Pirojpur BWDB O&M Division under the Southern zone of BWDB. The polder covers four Unions under Bhandaria Upazila namely Nadmulla, Telikhali, Daowa and Ikri, a part of Mirukhali union under Mathbaria upazila and part of Chenchri union under Kanthalia Upazila. The polder surrounded by the mighty river Baleswar (Kocha) to the west, Bahar Khal to the east, Baleswar (Kocha) and Pona River to the north and in Mirukhali-Amua-Bharani and Pona Don to the south **(Map 4.1**).The polder covers an area of 10,748 ha of which net area available for cultivation is 8,500 ha.

195. About 28 km of embankment has constructed out of a total of 60.03 km. No sluices have been constructed and all the internal khals were kept open to the surrounding rivers. Since the peripheral boundary not covered by embankments, the people of the area are suffering from tidal inundation twice a day. It becomes disastrous during high spring tides and monsoon due to flooding and drainage congestion in the low-lying areas.

4.2 Objectives of Improving Polder 39/2C under CEIP- 1

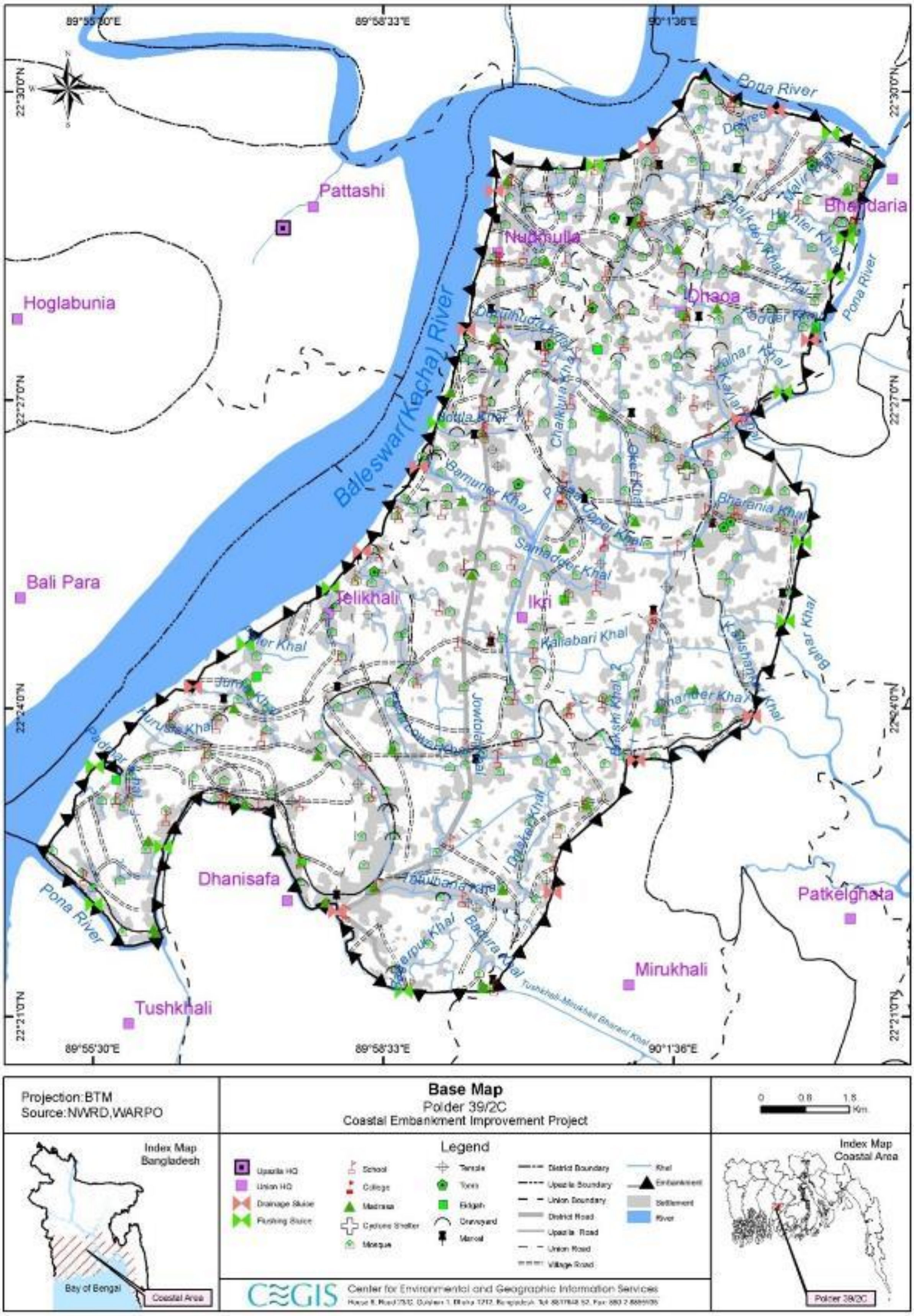
196. The main objective of the Project is to increase the resilience of coastal population from natural disasters and climate change. Specifically, the project aims at (a) reducing the loss of assets, crops and livestock during natural disasters; (b) reducing the time of recovery after natural disasters such as cyclones; (c) improving agricultural production by reducing saline water intrusion which is expected to worsen due to climate change; and (d) improving GoB's capacity to respond promptly and effectively to an eligible crisis or emergency.

4.3 Water Management Problems and Issues in Polder 39/2C

197. In the polder area, the elevation of most of the cultivable land is between 1.40m to 1.60 m. There are some low pockets where land elevation is less than 0.90m. The land elevation gradually decreases from the riverbank towards interior parts of the proposed polder. Most of the paddy fields are submerged during the monsoon, and sometimes even in the dry season, during high tides. Tidal water along with rainfall runoff remains stagnant at a depth of 1m to 1.5m over the land during the monsoon and delays the cultivation of T-Aman. Sometimes seedlings and T-Aman are damaged due to overland deposition of sand coming with tidal water. Besides, it is hardly possible to cultivate Rabi Crop in the dry season due to intrusion of saline water through khals and rivers.Salinity starts at the end of December and continues until April. Every year at the end of November, local people construct earthen cross-dams over the mouth of the internal Khals to protect the agricultural land from saline water intrusion and sand deposition.

198. The embankment segments damaged by cyclone Sidr and re-constructed by BWDB have been damaged again by cyclone Aila. Some reachesof the embankment have fallen under the thrust of wave action and some are engulf by river erosion. The existing metalled road constructed by LGED along Pona River in the South and in the North act as the embankment. Besides, there is embankment along the Baleshwar (Kocha) River in the west side, which has damaged due to Sidr. The internal drainage channels have silted up which needs to be re-excavated to improve local drainage.

199. There is water related problems like tidal flooding and saline water intrusion, drainage congestion, sedimentation in channel and shortage of irrigation water in absence of designated polder. Consequently, the life and livelihood of polder’s community have disrupted. In this situation, existing embankments need rehabilitation and new embankments including all kinds of structures of Polder 39/2C are needed to construct under the CEIP to improve the socio-economic condition as well as quality of life of the people of the polder.In this situation, existing embankments need rehabilitation (west side) and new embankments (in north, east and south side which is actually metallic road and needs to be raised considering climate change) including all kinds of structures of polder 39/2C.It isneedto construct under the CEIP to improve the socio-economic condition as well as quality of life of the people of the polder.



Map4.1: Alignment of the embankment and existing structures of the polder

4.4 Description of the Polder and proposed intervention

200. The proposed embankment to be constructed for new polder under CEIP as per present context, which considered surge height and sea level rise due to climate change scenarios. Two types of embankment havebeen proposed, (1) “Interior-dyke” having side slopes C/S 1:2 and R/S 1:3 with crest level 5.50m from km 33.70 to km 52.20 along the bank of Baleswar (Kocha),and crest level 5.00m from km 52.20 to km 60.030 along the bank of Pona River, and (2) Marginal - dyke with crest level 4.50m and side slopes C/S 1:2 and R/S 1:2 from km 0.00 to km 33.70 along Bahar Khal and Bhuter Khal to the east.

201. However, the proposed intervention will take place in a system that was modified in the past, that is not working properly well and that the social and physical environment is being affected. Therefore, the proposed project will absorbof those liabilities.

202. The proposed interventions in Polder 39/2C under CEIP-1is listed in **Table 4.1.**

Table 4.1: Proposed Interventions in Polder 39/2C

Sl.	Types of rehabilitation	Length
1	Construction of new embankment	34.00 km
2	Re-sectioning of embankment	16.03 km
3	Construction of retired embankment	10.00 km
4	Construction of drainage sluices	13 nos
5	Construction of flushing inlets	22 nos
6	Re-excavation of drainage channels	57.23 km
7	Bank protection works	3.50 km
8	Slope protection of embankment	4.00 km
9	Closure dam	8 nos
10	Flood Wall	1.20 km
11	Afforestation (embankment slope)	39 km

Source: Final Feasibility Report of CEIP, Volume IV: Polder Reports, December 2012; revised in 2015

4.4.1 Works on Embankments

203. The proposed interventions in polder 39/2C, development of new polder, total 15.95 km embankments will be re-sectioned and their height will increased to 5.50 m (Ch. 34.00 km-34.20 km, Ch. 36.00 km-37.00 km, Ch. 38.80 km-39.60 km and Ch. 42.80 km- 51.50 km) and 5.00 m (Ch. 54.50km- 55.00 km and Ch. 55.50km- 60.75 km). Moreover, a total of 7.60 km of embankments will be retired as shown in the **Table4.2** below.

Table 4.2: Detail of Works on Embankments

Sl.	Description	Chainage (Km)	Height m	Length (km)
1	New embankment	0.00 to 34.00	4.50	34.00
2	Re-sectioning (Increasing the height of embankments)	34.00 to 34.20 36.00 to 37.00 38.00 to 39.60 42.30 to 51.50 56.00 to 60.03	5.50 5.50 5.50 5.50 5.00	0.20 1.00 1.60 9.20 4.03
3	Retired embankment	34.20 to 36.00	5.50	1.80
4		37.00 to 38.00	5.50	1.00
5		39.60 to 42.30	5.50	2.70
6		51.50 to 54.00	5.50	2.50
7		54.00 to 56.00	5.00	2.00

Source: Final Feasibility Report of CEIP, Volume IV: Polder Reports, December 2012; revised in 2015

Description of construction activities

204. During pre-construction phase, labor sheds will construct with proper sanitation and other required facilities before the commencement of construction activities for embankment works. Suitable site tobe select and prepared by cleaning bushes, weed trees, etc. Alignment of embankments has to fixe with adequate base width. Base stripping and removal of trees, weed,etc., will do as per instruction of the DCS Consultant. The tools required for construction of embankments will procured during this period. After validating the final design, excavation of soil will be followed and deposited in a selected areaof, borrow pit and dredged spoil from riverbed (Table 4.10). Soil will be dumped inlayers. At the same time, each layer (of 1.5 feet) of dumped soil will be compacted by compactor machine. The sloping and shaping of embankment will bedeveloped after proper compaction of the layers. Then required turfing with grass will beprovided on embankment. Watering and fertilizing will also be provided.

4.4.2 Construction of Drainage Sluices

205. Total 13 number of new drainage sluice will constructed under the proposed interventions of the rehabilitation works of the Polder 39/2C. The detailed description of these sluices has given in **Table 4.3.**

Table 4.3: Detail of Sluice Gates to be constructed

Sl.	Name of drainage sluices	Vent size	Chainage (at km)	Khal Name
01	DS-1	(1 vent-1.5m x 1.8m)	2.250	Dhawa Podder
02	DS-2	(4 vent-1.5m x 1.8m)	6.500	Pona Upper Khal
03	DS-3	(2 vent-1.5m x 1.8m)	12.750	Chandmiar Khal
04	DS-4	(1 vent-1.5m x 1.8m)	15.500	Bakshi Khal
05	DS-5	(2 vent-1.5m x 1.8m)	18.250	Tetulbaria Khal
06	DS-6	(4 vent-1.5m x 1.8m)	24.500	Pona lower river
07	Ds-7	(2 vent-1.5m x 1.8m)	39.500	Juniar Khal
08	DS-8	(2 vent-1.5m x 1.8m)	43.500	Tetulkhali Khal
09	DS-9	(3 vent-1.5m x 1.8m)	45.400	Bamuner Khal
10	DS-10	(2 vent-1.5m x 1.8m)	48.250	Darulhuda Khal
11	DS-11	(2 vent-1.5m x 1.8m)	50.800	Hetalia Khal
12	DS-12	(4 vent-1.5m x 1.8m)	54.250	Nadmolla Khal
13	DS-13	(3 vent-1.5m x 1.8m)	57.75	Degree Khal

Source: Final Feasibility Report of CEIP, Volume IV: Polder Reports, December 2012; revised in 2015

Description of construction activities

206. During pre-construction activities for construction of drainage sluices, i.e. construction of labor sheds, development of sanitation and other facilities,etc., will becompleted. During this period, required construction materials like sand, cement, wood, shuttering materials etc. will beprocured by the contractor as per tender schedule. For construction of sluices at selected locations and shown in Map 4.2. Before starting the construction activities of drainage sluices, Ring bund and diversion channel will have to be constructed. After that the required foundation treatment will do. The Cement Concrete (CC) and Reinforced Cement Concrete (RCC) works along with cutting, bending and binding of rods will then performed as per specification. CC blocks will be prepared and placed as and where required as per design. After construction of approach roads, fitting and fixing of gates and hoisting device will carryout. Gates will properly painted. The

intake and outfall of the gate will construct as per design. The CC blocks will be madefor river training works and pitching works will be conducted.

207. It is mentionable thatdrainage modelling of the coastal polder has been carried out by IWM to find out the design parameters for drainage cannel systems, drainage regulator, river bank and slope protection works. Climate resilient coastal embankment crest level has been design considering the combined effects of cyclone storm surge effects and cyclone induced wind wave. The model has been developed and simulated considering climate change condition considering with and without interventions (IWM, 2016). The interventions have further been detailed in the following sections:

4.4.3 Construction of Flushing Inlets

208. Total 22 numbers of new flushing inlets will constructed.Details sluice gates is given in **Table4.4**.

Table 4.4: Details of Sluice Gates to be constructed

Sl No.	Name of Drainage Sluices	Vent size	Chainage (at km)	Khal Name
01	FS-1	(1 vent-0.9m x 1.2m)	1.250	Mia Bari Khal
02	FS-2	(1 vent-0.9m x 1.2m)	2.250	Hynter Khal
03	FS-2/1	(1 vent-0.9m x 1.2m)	3.750	Mollar Khal
04	FS-3	(1 vent-0.9m x 1.2m)	5.250	Jalnar Khal
05	FS-4	(1 vent-0.9m x 1.2m)	9.250	Banai Bharani Khal
06	FS-5	(1 vent-0.9m x 1.2m)	10.650	Hajir Khal
07	FS-6	(1 vent-0.9m x 1.2m)	25.500	???
08	FS-6/1	(1 vent-0.9m x 1.2m)	26.800	Arial Khal
09	FS-6/2	(1 vent-0.9m x 1.2m)	27.750	???
10	FS-7	(1 vent-0.9m x 1.2m)	29.500	Padmar Khal - 2
11	FS-8	(1 vent-0.9m x 1.2m)	33.000	Horinpala Khal
12	FS-9	(1 vent-0.9m x 1.2m)	35.750	Masterer Khal
13	FS-10	(1 vent-0.9m x 1.2m)	37.000	Padmar Khal
14	FS-11	(1 vent-0.9m x 1.2m)	38.500	Kurnsia Khal
15	FS-12	(1 vent-0.9m x 1.2m)	42.250	Bhojer Khal
16	FS-13	(1 vent-0.9m x 1.2m)	44.500	Chandramoni Khal
17	FS-14	(1 vent-0.9m x 1.2m)	46.000	Botla Khal
18	FS-14/1	(1 vent-0.9m x 1.2m)	47.750	Chowhoria Khal
19	FS-15	(1 vent-0.9m x 1.2m)	55.250	Chinguria Khal
20	FS-16	(1 vent-0.9m x 1.2m)	59.050	Malir Khal
21	FS-17	(1 vent-0.9m x 1.2m)	59.400	Chowkider Khal
22	FS-17/1	(1 vent-0.9m x 1.2m)	0.000	Thanar Khal

Source: Final Feasibility Report of CEIP, Volume IV: Polder Reports, December 2012; revised in 2015

209. Labor sheds will be constructed with proper sanitation and other facilities before starting the construction activities of flushing inlets. The required construction materials (sand, cement, wood, shuttering materials, etc.) will beprocuredsimultaneously. A suitable site of the structure will be selected and prepared accordingly. Alternative diversion channels will be constructed before the starting of construction works. After that, the foundation treatment required for flushing inlets will carried y out. The RCC works, pipe and machine pipe along with construction of allied

fittings with the collar joints will made as and where required. After few days of construction the gates, both in the upstream and downstream of each flushing inlets will becompleted. After completion of all construction activities, the approach embankments will be constructed and turfed with grass. Finally, a channel is to be excavated through lead cut and tail cut to divert the flow to the channel through the flushing gate.

4.4.4 Re-excavation of Drainage Channels

210. Eleven (11) drainage channels with a total of 57.23 km will be re-excavated to ease water flow and reduce drainage congestion. An estimated volume of 0.0296 million cubic meters of soil/silt will be excavated. The excavated soil will be used for strengthening the *khal* banks. Local people may be encouraged to take earth from the spoils, as well. The spoil may be used for raising the plinth level of their earthen kutcha houses as well as individual house yards. If the excavated materials are suitable, the Contractor can use the materials for construction of embankments upon prior approval by the DCSC. The water channels to re-excavate under the project are listed in **Table 4.5. Figure 4.1**shows the conceptual layouts of proposed dumping technique. Compartmental dumping spots will be created along the sides of the excavated khals, allowing any runoff from de-watering of the spoils and from precipitationtodrain into the excavated khals.

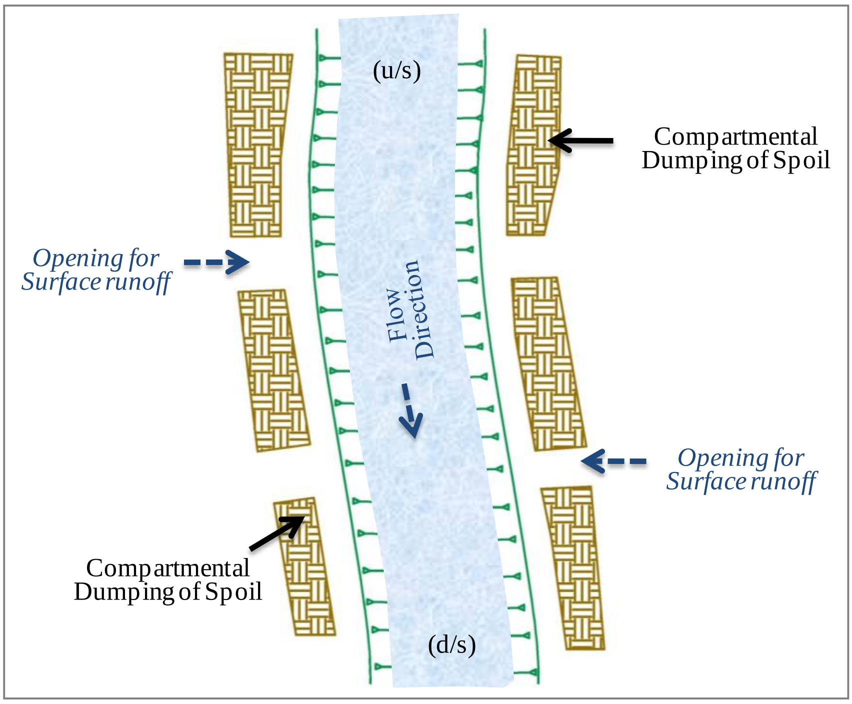


Figure 4.1: Plan form of a typical khal to be re-excavated

211. At first, the required tools will have to be procured for re-excavation of the drainage channels. A schematic diagram showing centerline and layout plan of the excavation will be prepared showing the design depth and width of excavation and disposal sites. The entire channel will be divided into a number of reaches. The excavation will start from the upstream of the channel. Cross dams to be provided at the starting and end locations of the excavation. The plan for the excavation will have to be approve by the DCSC before excavation starts. The excavated soil/sludge will be disposed into the approved disposal sites. After completing excavation of one reach, the next reach downstream would be excavating using the same procedures.

Table 4.5: Channels to be Re-excavated

4.5	Name of Khal (Channel)	Chainage from (km)	Length (km)
1	Chokedev	3.80	5.50
2	Pona Upper	6.30	20.00
3	Baksih	15.25	3.00
4	Dasher	19.0	3.75
5	Junia	39.10	3.00
6	Telikhali	43.25	4.50
7	Chakluia	48.10	5.50
8	Hetalia	50.75	3.50
9	Nodmullar	54.45	4.00
10	Degrer	57.60	2.00
11	Bamuner	44.35	2.48
		Total	57.23

Source: CEIP Office, 2015

4.5.1 Bank Protection and Slope Protection Works

212. 4 km of slope protection works and 3.5 km of bank protection works along the Baleswar (Kocha) river tobe carried out between chainage24.00 km to 51.00 km and 4.2 km to 43.6 km and 51.50 km to 54.00 km, respectively (Refer **Map4.2**).

213. The construction of labor sheds, creation of sanitation facilities and procurement of construction materials (sand, cement, wood, shuttering materials, etc.) tobe carried out before the start of construction activities. At first, the slope of the riverbank will developed by earth as per design. At the same time, the required CC blocks will be casted or manufactured and floodwalls will constructed. After completion of the preparation of CC blocks, Geo-textile bags will beplaced along the slope and CC blocks will be placed on it. A launching apron will be prepared with CC blocks along with dumping of CC blocks in assorted form and will be completed up to toe of the riverbanks. Finally, turfing will be made on the slope or crest of the embankments. Proper drainage provision will be includedto avoid formation of rain cuts for surface run off.

4.5.2 Afforestation

214. Afforestation is another intervention for development of the proposed new Polder 39/2C to abate tree felling for construction of new embankment. In total 143,364 nos of trees will need to fell from the RoW (Source RAP Report, 2016). Afforestation will be donealong the 39.0 km embankment slope around the polder. Of the total area, 11.27 ha will kept for planting timber and fruit yielding tree species.

215. The afforestation regulations (policy) enunciated by the BWDB on June 01, 1998 may be followed. In accordance to that policy, the lower one third of the slope may be planted with deep-rooted tree species, the mid one-third may be planted with shallow rooted medium size tree species and the upper one third may be planted with species that have very small root system.

216. Keeping this in view, the lower row along the slope will be planted with *Tamarindus indica* (Tatul) &*Acacia nilotica* (Babla) at a spacing of 2 meters (6 ft) apart. The upper row will be at a distance of 6 to 8 feet, i.e. 2 to 3 meters from the lower row. The upper row will be planted with *Borassus flabellifer* (Tal), *Cocos nuciferal* (Narikel) and *Phoenix sylvestris* (Khajur) at a spacing of 2 meters (6 feet) interval, but staggered with the lower row plants. The *Tamarindus indica* (Tatul) and *Acacia nilotica* (Babla) seedlings will be raised in 10” x 6” poly bags.

217. Before plantation, a temporary nursery will be established in the polder area to ensure the availability of seedlings. Nursery costing has shown separately in the Feasibility Report. The *Borasus flabellifer* (Tal), *Cocos nucifera* (Narikel) and *Phoenix sylvestris* (Khajur) seedlings will purchased from nurseries. Planting of 2,500 seedlings will make one Hectare under plantation. As per the estimation, total 28,175 nos of saplings will be planted along the embankment slope

218. Since BWDB acquired only the base area necessary for the construction of this polder, there is no foreshore land available for additional afforestation.Detailed information of afforestation with chainage is shown in Table 4.6.

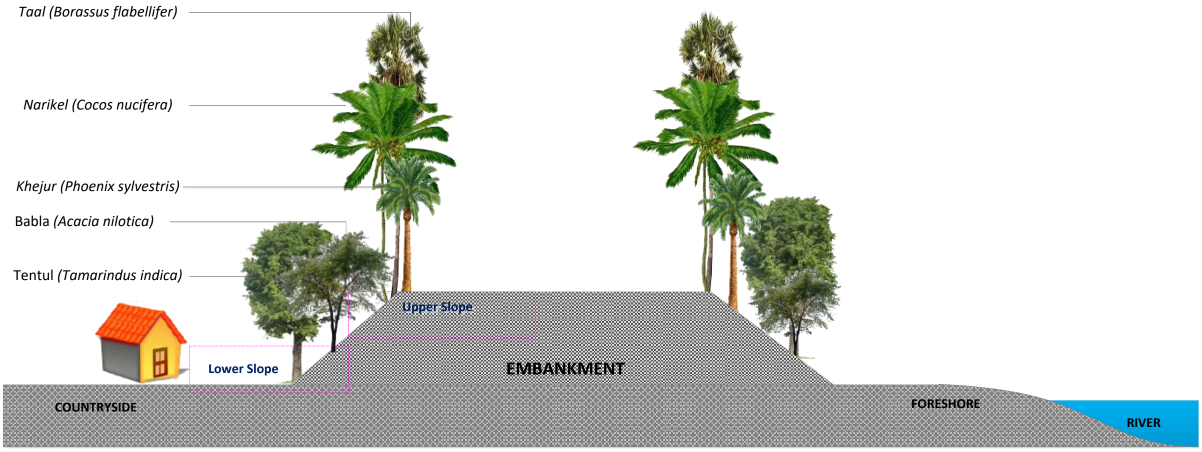


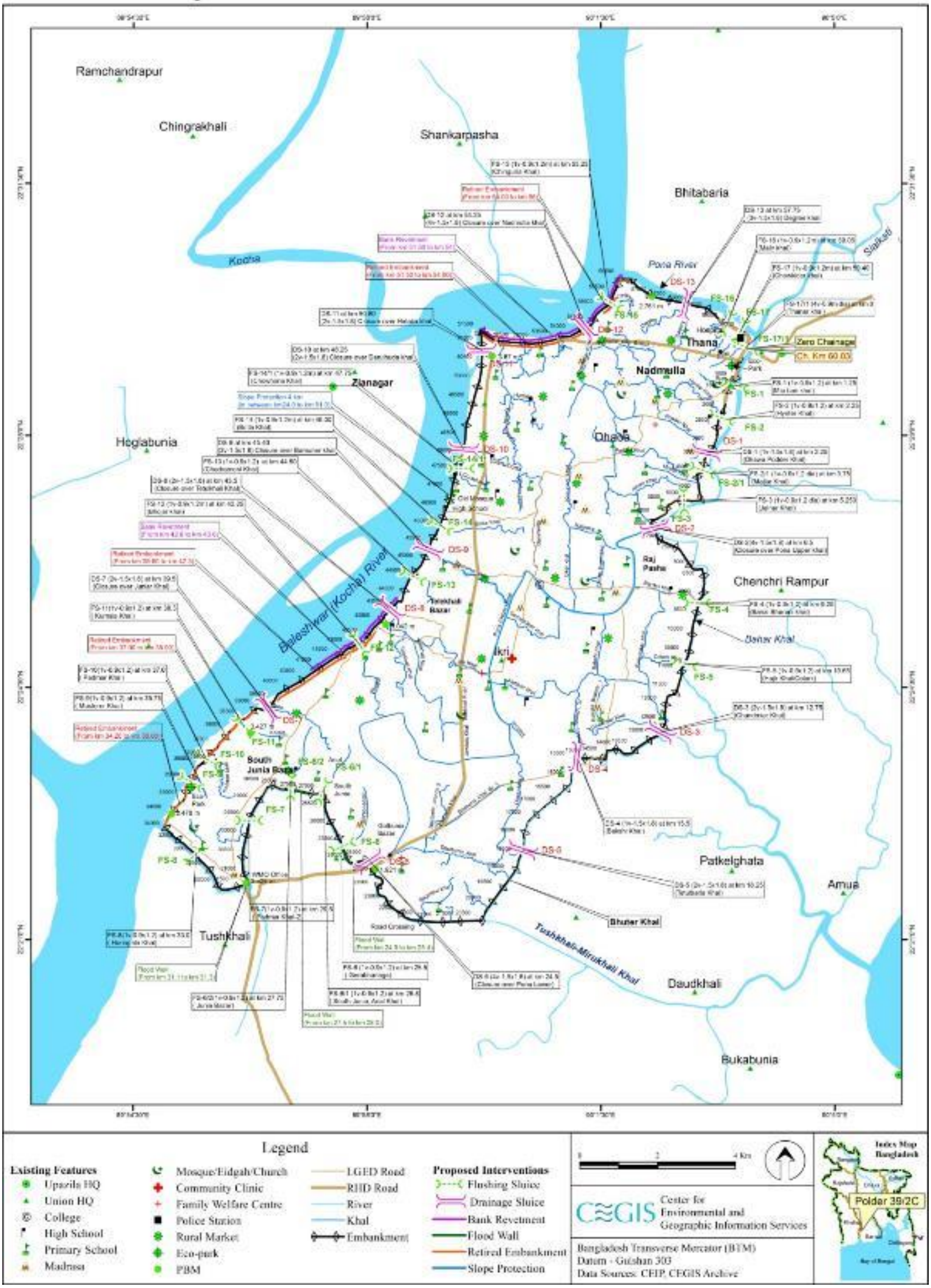
Figure 4.2: Typical Cross Section of embankment slope afforestation works

Table 4.6: Detail of afforestation activities

Sl.	Description	Chainage km	Length km	Total Afforested area (ha)
1	Slope Afforestation	0.00 to 34.00	34.00	11.27
2		56.00 to 61.00	5.00	
	Total		39.00	

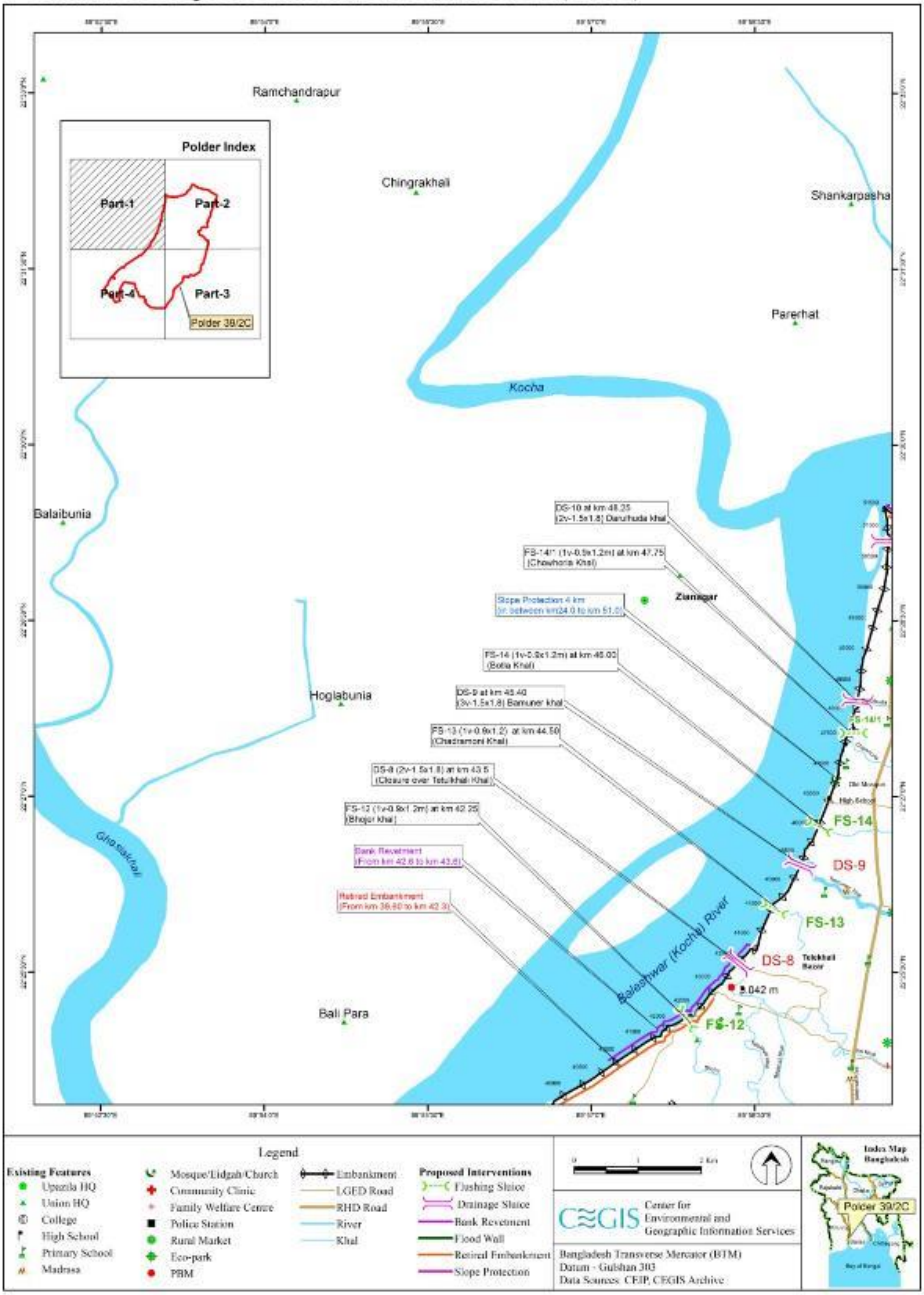
Source: Feasibility Report of CEIP,Volume III: Afforestation Report, September 2013

Location of Proposed Interventions: Polder 39/2C



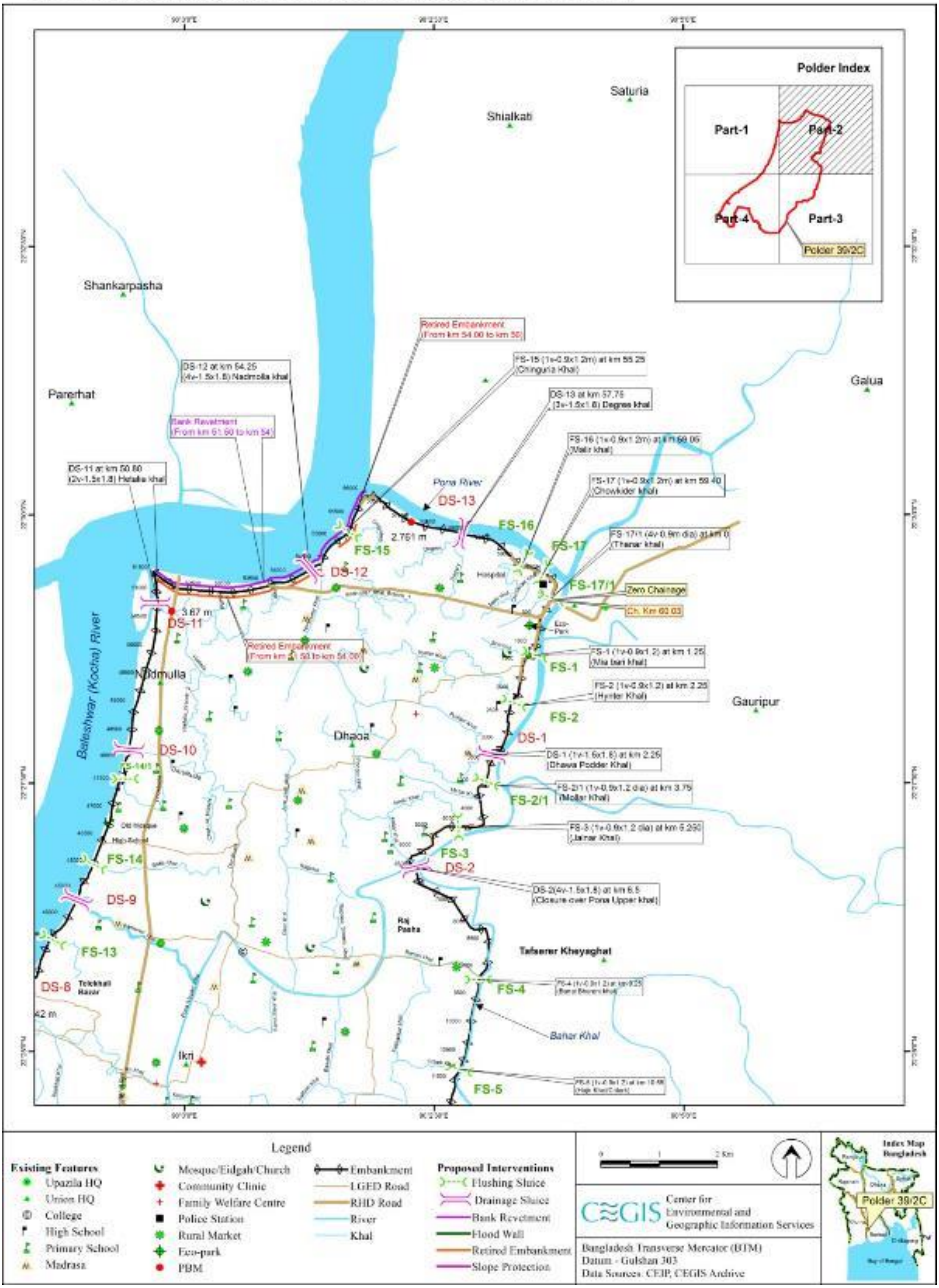
Map4.2: Location of Proposed Interventions in Polder 39/2C

Location of Proposed Interventions: Polder 39/2C (Part-1)

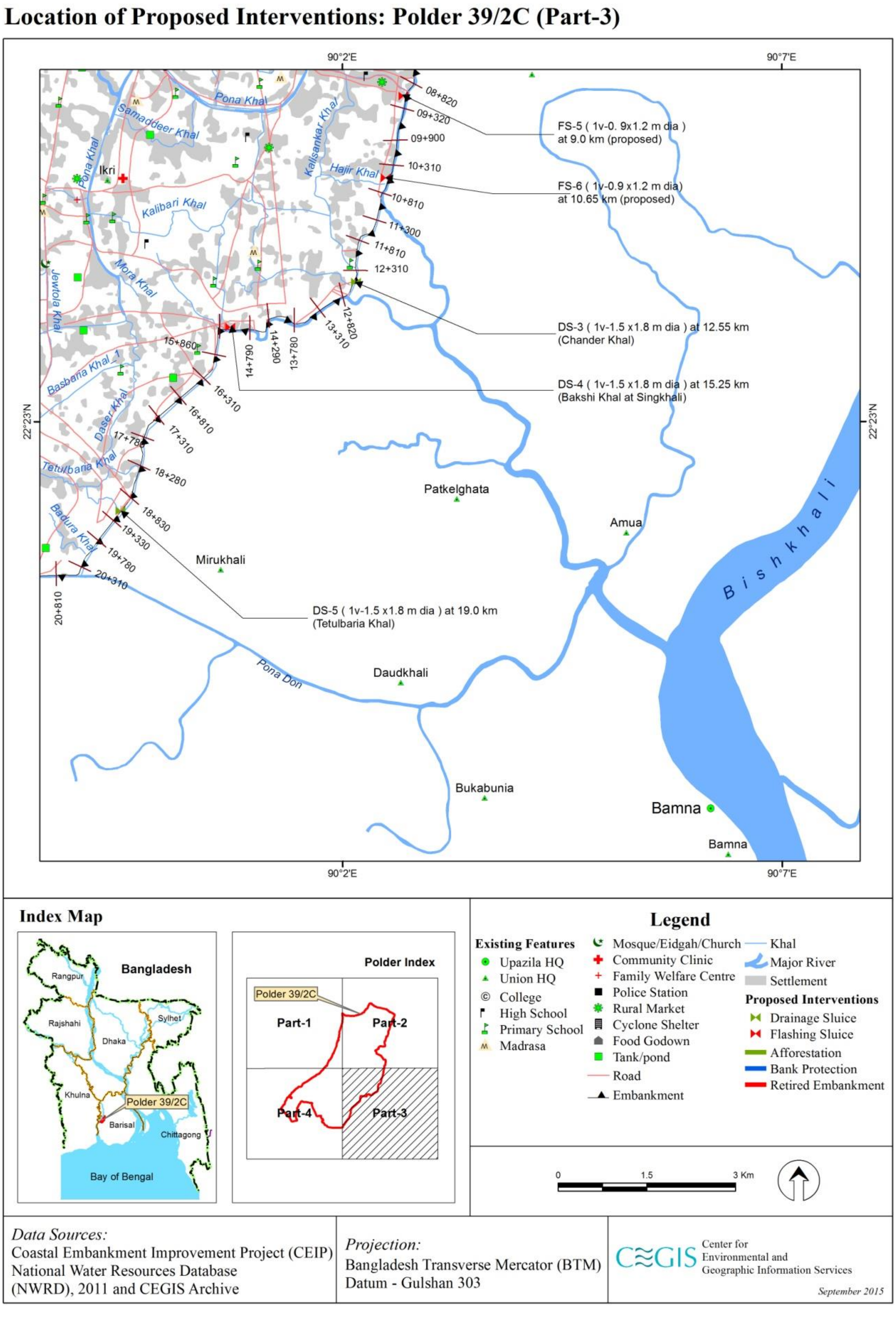


Map 4.2 (a): Location of Proposed Interventions in Polder 39/2C (Part 1)

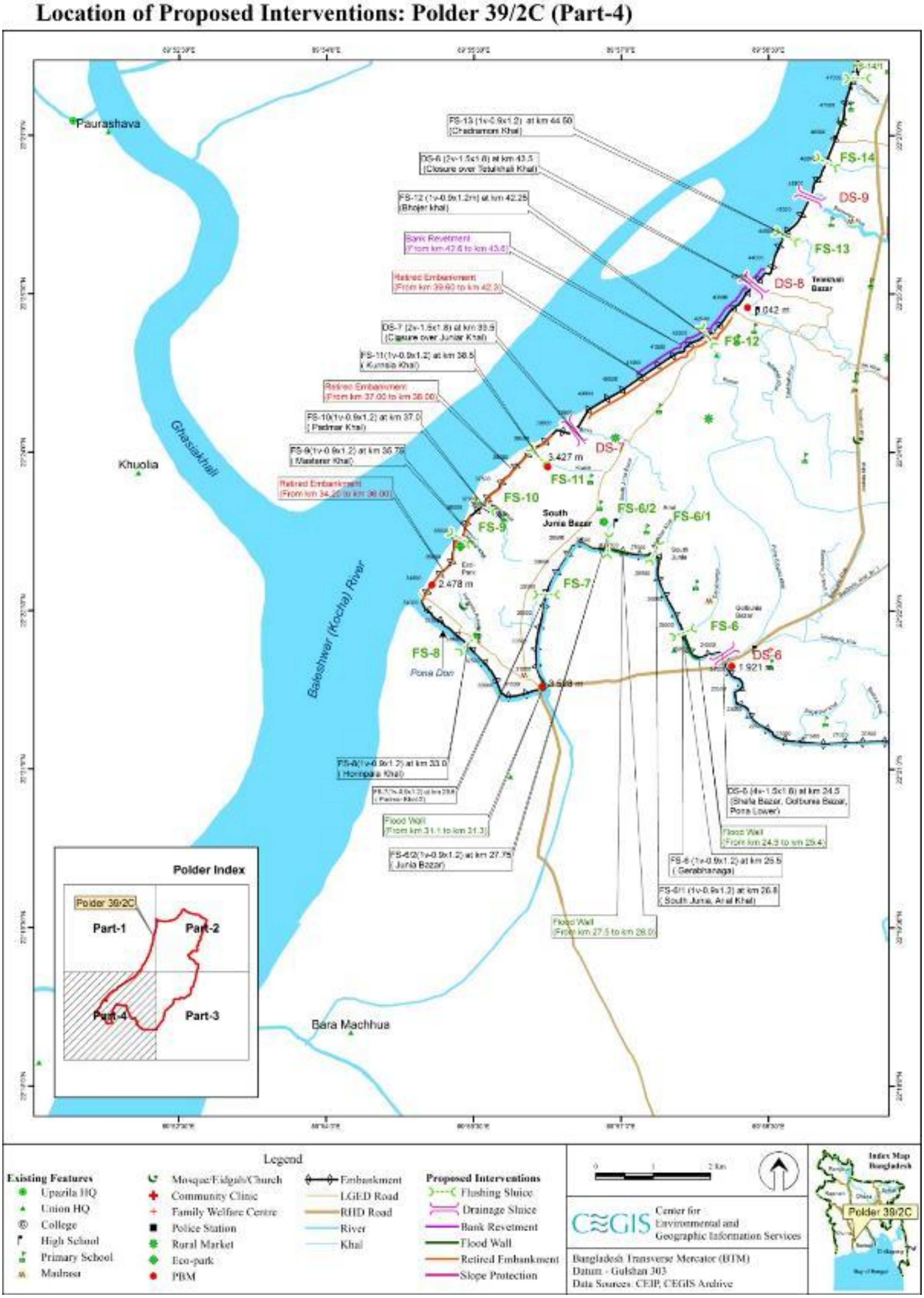
Location of Proposed Interventions: Polder 39/2C (Part-2)



Map 4.2 (b): Location of Proposed Interventions in Polder 39/2C (Part2)



Map 4.2 (c): Location of Proposed Interventions in Polder 39/2C (Part 3)



Map4.2 (d): Location of Proposed Interventions in Polder 39/2C (Part4)

4.6 Construction Details

4.6.1 Construction Schedule

219. The construction works of proposed new Polder 39/2C under the CEIP-1are expected to complete in four years. The construction schedule is presented in **Appendix-1.**

4.6.2 Construction Manpower Requirement

220. Skilled labor is a major concern for construction and infrastructure development of any project. Technical and non-technical labor will be required for the Project construction works. These will include engineers, technicians, supervisors, surveyors, mechanics, supervisors, machinery operators, drivers, and skill and un-skilled labours. Around 60 percent of labor will be engaged from the local area and remaining will be from outside. The estimated labor requirement is presented in **Table 4.7**.

Table 4.7: Required manpower for construction

Sl No.	Required Manpower	Number
1	Engineer	5
2	Machinery Operators	77
3	Mechanics	4
4	Surveyor	6
5	Skill labour (person-day)	4,893
6	Un-skill labour (person-day)	1,28,401

Source: FS Report, 2012

4.6.3 Construction Material

221. The construction materials required for new embankment, re-sectioning and retired embankment, drainage sluices and flushing inlets, and slope and bank protection work include soil, cement, steel, and sand. The estimated quantities of these materials are presented in **Table 4.8**.

Table 4.8: Construction Materials

Sl No.	Description	Quantity	Sources
Re-sectioning, new and retired embankment			
1	Earth work	1,995,202 m^3	Borrow pits, dredging spoils from re-excavation of drainage channels
Construction of sluices and flushing inlets			
2	Cement	216,795 bags	To be procured from local market
3	Sand	12,548 m^3	To be procured from Khulna
4	Stone	28,233 m^3	To be procured from Khulna
5	Steel	553 Ton	To be procured from Khulna
Bank protection			
6	CC Blocks	249,375 nos	To be made at construction site during construction
7	Stones	792,000 m^3	To be collected from Khulna

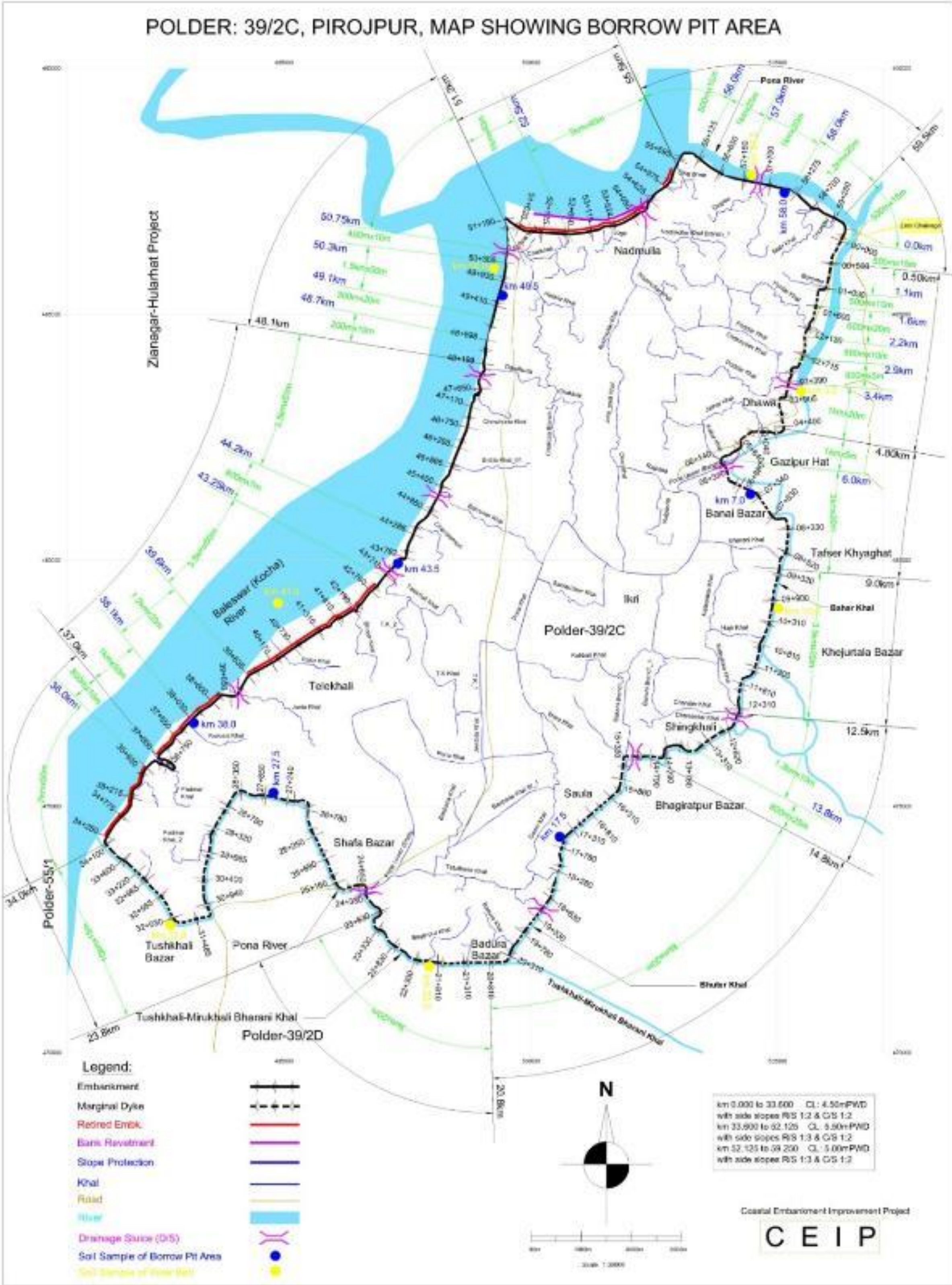
222. The carried earth for embankment rehabilitation will collect from the offshore area of the polder 39/2C. The spatial location of the borrow pit areas are delineated in the Map4.3. The details of borrow pit area are attributed in the following **Table 4.9**:

Table 4.9: Availability of earth in borrow pit areas

Sl. No.	**Quantity of Earth available from Borrow pit area**			**Quantity of Earth available from River bed**		**Details**
	Location (chainage)	**Size (Length x width x depth)**	**Quantity**	**Name of River**	**Location (Chainage)**	
1	i) 1.10 km to 1.60 km	500 m X10m X 1m	5,000 m3	Pona	0.50 km to 6.00 km	Earth is available at borrow pit area and soil of the borrow pit area is silty–clay with traces of sand
	ii) 1.60 km to 2.20 km	600 m X 20m X1.5 m	18,000 m3			
	iii) 2.20km to 2.90 km	500 m X10m X 1.5 m	7,500 m3			
	iv) 2.90 km to 3.40 km	500 m X5m X 1.5 m	3,750 m3			
	v) 3.80 km to 4.80 km	1km X20 m X1.5 m	30,000 m3			
			64,250 m3			
2	i) 4.80 km to 6.00 km	1 km X 5 m X 1.5m	7,500	Bahar Khal	6.00 km to 9.00 km	Earth is available at borrow pit area and soil of the borrow pit area is silty–clay with traces of sand
	ii)6.00 km to 9.00 km	3 km X 20m X 1.5m	90,000			
			97,500 m3			
3	i) 9.00 km to 12.50 km	3.50 km X 20m X 1.5m	105,000 m3	Bahar Khal	9.00 km to 12.50 Km	Earth is available at borrow pit area and the soil of the river bed is silty–sand with clay
4	i)12.50 km to 13.80 km	1.30 km X 10 m X 1.5 m	19,500 m3	Bhuter Khal	12.50 km to 14.80 km	Earth is available at borrow pit area and the soil of the borrow pit area is silty-clay with traces of sand
	ii)13.80 km to 14.8 km	800 m X 25 m X 1.5 m	30,000 m3			
			49,500 m3			
5	i) 14.80 km to 20.80 km	6 km X 20 m X 1.5 m	180,000 m3	Bhuter Khal	14.80 km to 20.80 km	Earth is available at borrow pit area and the soil of the borrow pit area is silty-clay with traces of sand
6	i) 20.8 km to 23.80 km	3km X 20 m X 1.5 m	90,000 m3	Mirukh ali	20.80 km to	Earth is available at borrow pit area

Sl. No.	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed		Details
	Location (chainage)	**Size (Length x width x depth)**	**Quantity**	**Name of River**	**Location (Chainage)**	
				Bharani Khal	23.80 km	
7	i) 23.80 km to 34.00 km	10 km X 15m X 1.5 m	225,000 m3	Pona	23.80 km to 34 km	80 % of Earth is available at borrow pit area and the soil of the river bed is silty-clay with traces of sand
8	i) 34 km to 36 km	i) 2 km x50mx1.5m	150,000 m3	Kocha	1) 34 km to 37 km	Earth is available at borrow pit area.
	ii) 36 km to 37 km	ii) 800mx10mx1.5m	12,000 m3			
			162,000 m3			
9	i) 37 km to 38.10km	1k m X 50m X 1.5m	75,000 m3	Kocha river	37 Km to 48.10 Km	Earth is available at borrow pit area.
	ii) 38.10 km to 39.60 km	1.2 km X 20m X 1.5m	36,000 m3			
	iii) 39.60 km to 43.25 km	3.5 km X 50m X 1.5m	262,500 m3			
	iv) 43.25 km to 44.20 km	800 m X 7m X 1.5m	8,400 m3			
	v) 44.20 km to 48.10 km	3.5k m X 50m X 1.5m	262,500 m3			
			644,400 m3			
10	i) 48.1 km to 48.7 km	200m X 10m X 1.5m	3,000 m3	Kocha	48.10 Km to 51.20 km	80% earth is available at borrow pit area and the soil of river bed is silty-clay with trace of sand
	ii) 48.70 km to 49.10km	0.3 km X 20m X 1.5m	9,000 m3			
	iii) 49.10 km to 50.30 km	1.5 km X 50m X 1.5m	112,500 m3			
	iv) 50.30 km to 50.75 km	0.4 km X 10m X 1.5m	6,000 m3			
			130,500 m3			
11	i) 51.20 km to 52.50 km	1 Km X 40m X 1.5m	60,000 m3	Kocha	51.20 km to 55.50 km	Earth is available at borrow pit area
	ii) 52.50 km to 55.50km	3 Km X 40m X 1.5m	180,000 m3			
			240,000 m3			
12	i) 55.50 km to 56 km	0.50 km X 10m X 1.2m	6,000 m3	Pona	55.50km to	60% earth is available at borrow pit area
	ii) 56 km to 57.00km	1 km X 25m X 1.2m	30,000 m3			

Sl. No.	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed		Details
	Location (chainage)	**Size (Length x width x depth)**	**Quantity**	**Name of River**	**Location (Chainage)**	
	iii) 57.00 km to 58 Km	1 km X 20 m X 1.2m	24,000 m3		59.50 km	and the rest quantity is to be collected from river bed
	iv) 58.00 km to 59.50 km	1.2 km X 20m X 1.2m	28,800 m3			
			88,800 m3			
13	i) 59.50 km to 0.60 km	500 m X 15m X 1.2m	9,000 m3	Pona	59.50 to 0.50 km	75% earth is available at borrow pit area and the rest quantity is to be collected from river bed
	ii) 60.00 km to 0.5 km	500 m X 15m X 1.2m	9,000 m3			
			18,000 m3			



Map4.3: Potential Area for Borrow Material

4.6.4 Construction Machinery

223. Different types of construction machinery and equipment will be required for the construction activities. A tentative list of these machinery and equipment is presented below in Table 4.10.

Table 4.10: List of Construction Equipment and Machinery

Sl.	Description	Quantity (number)
1	Bulldozers	4
2	Dump- truck	7
3	Pay Loader	4
4	Excavator	4
5	Barges	2
6	Engine Boat	4
7	Vibrator	40
8	Compactor	6
9	Mixture Machine	40
10	Mixing-Plant	1
11	Truck	4
12	Tractor	3
13	Generator	15
14	Levelling Instrument	3
15	Total Station	1
16	De-watering System	13
17	Low lift pump	13

Source: CEIP Office, 2015

4.6.5 Labour Camps

224. Camps for labour will construct at all construction sites. total 33 camps for labor is foreseen to be established during construction period. Out of these, 12 camps are for embankment works, 17 camps for sluice and flushing inlets works, one camp for slope protection works, two camps for bank protection works, and one camp for closure dam works. The Contractor will select the location of the camps through consultation with the local Union Parishad Chairman and the local community, and after obtaining permission from the DSC. The planned location of construction camps are shown in Map 4.4.

Map4.4 Location of proposed labour Shed/camps for Polder 39/2C

Drinking Water and Sanitation System in Labour Camps

225. At each labour camp/construction site a tube well will be installed for obtaining drinking water for camps and for construction activities. Latrines with septic tanks along with safe disposal of sewage will be constructed for sanitation at each labour camp/construction site as well.

4.6.6 Traffic during Construction

226. Major quantities of earth will be transported locally to the construction sitesfrom borrow pits using mechanical equipment, like excavators, pay loaders, dump trucks, trolleys, with some minor quantities foreseen transported manually.

227. The Baleswar (Kocha) River (west and north) and Pona River (east and south are navigable throughout the year. To the extent possible, river transportation will useto reduce road traffic.

228. During construction, trucks or other vehicles will use thedistrict road coming from Pirojpur crossing the Charkhali on ferry. Heavy equipment and construction materials including hard rock dumping materials and sluice gate equipment will transport from Khulna on water vessels through the Passur River and Baleswar River.

229. The construction materials would be collected from the stock yard at Telekhali Khas land and then transported to the individual work sites using engine boats or trucks using Charkhali ferry. The materials found usable from the polder may be carried through smaller carts, non-motorized vans and other smaller vehicles inside the polder area.

4.6.7 Jetty Construction

230. A temporary jetty near the location of stock yardsat Telekhali Khas landwill be constructed for unloading of construction materials during construction period.

4.7 Project Implementation Arrangements

Overall Project Management

231. The Government of Bangladesh has the overall responsibility for project management and coordination through its Ministry of Water Resources. A Project Steering Committee (PSC) would provide the forum for overall guidance, policy advice and coordination of the project activities and addressing inter-agency issues. BWDB will act as the Project Implementing Agency and will implement the project through a Project Management Unit (PMU).

Project Steering Committee (PSC)

232. The PSC would be chaired by the Secretary of Water Resources and will include the Secretaries of Finance, Agriculture, Environment, Public Health Engineering, Forestry and Wildlife, the Chief Executive officer of selected NGO, and representatives of the local/district administration as its members. The PSC will oversee the project; provide policy-level guidance and inter-agency coordination for the project. The Project Director of the PMU will act as the secretary of the PSC.

Project Management Unit (PMU)

233. BWDB will set up a PMU to oversee the development and management of the project. The PMU will be led by a project director (PD) appointed by BWDB. The PD will have the rank of Chief Engineer, and will report directly to the Director General (DG). The PMU will have a central project office located at the headquarters of BWDB in Dhaka. The PMU will have 3 subordinate units: (i) Engineering Unit; (ii) Procurement and Finance Unit; and (iii) Social, Environment and

Communication Unit. In addition to the central unit in Dhaka, three *Field Level Offices* will be set up, each headed by an Executive Engineer, recruited by the project. The Field Offices will be located in each of the three main project districts, namely Khulna, Patuakhali/Barguna, and Bagerhat.

Procurement and Finance Unit

234. This unit will be responsible for the entire procurement and financial management process of the project. It will also be responsible for monitoring project progress, to liaise with the Bank, and to prepare annual programs, implementation reporting, updating all procurement reporting documents and financial management reporting. Procurement staff would consist of a Senior Procurement Specialist and one procurement specialist. The Finance staff would consist of one Deputy Director Finance, two accountants and three support staff.

Engineering Unit:

235. The Engineering Unit will oversee the work of the consultants on design and construction supervision matters. A Deputy Project Director will head the *Engineering Unit* and will spend about half of his/her time at the site to provide coordination between the PMU, the supervising consultant and the three Field Offices. In addition to the Deputy Project Director, the engineering unit will also include two Executive Engineers, two Assistant Engineers.

Social, Environment and Communication Unit:

236. The Social, Environment and Communication unit will supervise compliance with the Environmental Management Plan and Social Action Program and together with the engineering unit implement the communication strategy. The unit will include a Sr. Environmental Specialist, a Sr. Social Specialist, a Sr. Forestry Specialist, a Revenue Staff and a Communication Specialist.

Field Offices:

237. Each Field Office willhave staff -one Project Manager/Executive Engineer (XEN), two Sub-Divisional Engineers (SDEs) and two Assistant Engineers (AEs). In addition, an environmental specialist, two social specialists and a revenue staff will work across all three-field offices.

238. The PMU will be supported by the following consultancy

- An *experienced NGO* will be mobilized by the PMU to implement the social afforestation, the EMP; the Social Action Plan including the mobilization of Water Management Organization; the RAP and the EMP.
- DDCS&PMSCs that will assist the PMU in preparing the detail design of the remaining polders and supervise all the construction. For civil works contracts, the Project Director will serve as the *Employer*, and the DDCS&PMSCs will serve as the *Engineer* for construction supervision. At the site, a *Resident Engineer*, appointed by the consultant, with a team of specialists and inspectors will supervise the Contractor.
- *Monitoring and Evaluation* Consultants will provide support in monitoring project impacts and supervise the implementation of the EMP/RAP and will report to the PMU.
- *Procurement Panel.* A Procurement Panel will be appointed by BWDB to oversee the procurement process of large value contracts subject to prior review under the project. The panel consists of two international/expatriate specialists and one national specialist.
- *An Independent Panel of Expert (IPOE).* BWDB will also appoint an IPOE to act as an independent “peer reviewer” and undertake quality control functions of various

technical outputs. The Panel will consist of five renowned experts in the field of: morphology/river engineering; tidal river management/sediment specialist; geotechnical specialist, social specialist and environment/polderization specialist.

- This institutional arrangement is effective and are being followed in Package -1 of CEIP-1.

4.8 Water Management and Operation Plan

4.8.1 Introduction

239. The coastal polders surrounded by embankments in the coastal region protects the lives and properties of people and agricultural lands with crops from tidal inundation; saline water intrusion; storms and cyclonic surges, thereby releasing a large extent of land for permanent agriculture as well as congenial living condition.

240. The polders have been playing a vital role in safeguarding the coastal area; ensuring and increasing agricultural production; improving livelihoods of the people; and mitigating environmental damages. However, these are vulnerable to storm surges; high tides; annual floods; land erosion and drainage congestion. In many cases, the structures as built have not beenfound adequate to cope with the diverse needs of the local people. Changes in the land use pattern have created water management conflicts and newer dimension needs asking the structures to allow water to flow both directions. So, maintenance of the polder system with embankments and structural elements has become of permanent importance. The GoB either with assistances from international donors and lending agencies or out of its own resources has been spending money almost in a regular basis to keep the polders in good working condition eventually to save the coastal people. The Coastal Embankment Improvement Program (CEIP) is one of the latest such interventions to address a systematic restoration and upgrading of the polder systems in the coastal region. Under this long term phased program of polders improvement, Operation and Maintenance issues with special reference to Local Government Institutions (LGIs) as well as local stakeholder’s participation and need based budgeting will continue to remain at the apex.

4.8.2 Approach and Methodology

(a) Approach

241. There is no denying the fact that the Operation and Maintenance (O&M) of large-scale water resources projects in Bangladesh are chronically under-financed. BWDB field offices have a common complaint that they are always provided with poor funds, which are not only inadequate to cover the exact requirement of major preventive maintenance works; but in most cases it is so meager compared to the total needs that even no minor maintenance work is possible to be undertaken. Thus for the years together vital works of preventive maintenance are deferred and eventually pushed down to expensive rehabilitation measures. Several studies for O&M of BWDP sub-projects and polders have addressed this issue quite in depth and many suggestions have been put forward. The most relevant to the current assignment, i.e. *"Guidelines for O&M Planning and Budgeting, August 2001; CERP-II"* has been consulted very carefully. Moreover, the consultants discussed all the pros and cons of polders' O&M issues with BWDB's field staffs and local stakeholders to suggest this approach for polder O&M planning. This is summarized below:

Community Participation in Operation and Preventive Maintenance

242. Polders need to be taken care of its every day wear and tear quite effectively. Experiences show that preventive maintenance of polders (embankments, structures, canals, etc.) through community participation aresuccessful if necessary supervision and guidance are ensured from BWDB's end. To make participation worthy and meaningful, stakeholders should allowed ventilating their opinion right from the planning process to actual implementation stages. However, the success depends on the active participation of the local stakeholders. Above all, institutionalization is most importantly considered in this kind of local participation. There should besome cohesive forces to unite the people together,which can be ensured through building of institutions. When there is a common platform to think on any particular issue leading to some common interests and are tied with some goals to achieve in the long run, the united people can work effectively and yield the desired results.

243. For effective and meaningfulcommunity participation, the following remarks are important.

- ***Firstly,***a formal institutionalization process should be undertaken to organize the local stakeholders in a common platform,like Water Management Organizations (WMOs).
- ***Secondly***, all the potential beneficiaries who intend to take part or are motivated to take part in O&M activities should make their ways to do so only through WMOs. Without formal institutionalization of WMOs, no direct monetary benefits or usufractuary rights will be allowed to any of the functional groups.
- ***Thirdly***, the advantages allowed to any of the groups under WMOs should not be treated as the permanent arrangement but a simple performance based contract. Direct monetary assistances on a regular basis make people crazy and idle; they start behaving oppositely when such benefits are restrained. The members of the functional groups under WMOs will be clearly informedat thebeginning that thecontractsarenotperpetualratherperformancebasedandwill be renewedaftercertainperiod.

Annual Evaluation of the O&M activities done by WMOs

244. There should besome accountability on the part of the Water Management Organizations (WMOs) involved in the O&M activities. Therefore, assessment needs to done ***twice in a year***. Once at the beginning when the polders will be jointly supervised to record the prevailing conditions of the infrastructures, i.e., more specifically the requirement of probable preventive works will be listed. Finally, at the end of the year another joint verification will be made to ascertain the real accomplishment of the maintenance jobs by functional groups (EMGs, CMGs, LCSs & SMGs) working under WMGs.

245. It is wiser to remove themwho will be found worthless and ineffective in accomplishing their duties. Continuous guidance and monitoring the performance of WMGs vis-a-vis the functional groups by BWDB field staffs will make them more accountable and eventually some improvements will become apparent in the preventive maintenance program. The Local Government Institutions (LGIs),i.e. Union Parishad leaders / representatives (i.e. the Ward Members) will be involved for active support and cooperation during the process of this joint verification assessment.

Prioritization of Maintenance Works

246. In case of any shortfall in funding, the large and expensive repair works on embankments; structures and protective works (major periodic maintenance and rehabilitation) will be considered of less priority. Implementation of this type of major periodic

maintenance/rehabilitation works should be separately addressed through other sources of fund instead of the preventive O&M fund. This will release pressure on cost effective and minor periodic maintenance. If the preventive and minor periodic maintenance works are given adequate priority with regular and timely accomplishment, the need for rehabilitation measures will decline over time.

Interaction with Local Government Institutions and Stakeholders

247. Field staffs of BWDB should work more closely with the leaders of Union Parishads and Community Groups in the field. Local stakeholders' participation becomes meaningful and effective. If the Local Government Institutions (LGIs) are involved in the Operation and Maintenance through Water Management Groups vis-a-vis the functional groups or community based organizations. Meetings with local stakeholders will have to be organized at the field level as and when required; comments and opinions of the local stakeholders (including members of the WMGs,i.e. functional groups in particular) received in these meetings should be taken into account with due importance.

248. In addition to the annual joint supervisions for field assessment of the polder infrastructures, Field Supervisory Staffs of BWDB will carry out regular periodic "Field Checks" of the embankment and structures. In all such events, the local Union Parishad leaders preferably the concerned Ward Member will invite to take part. Furthermore, in cases of annual evaluation of the performances of functional groups (EMGs, CMGs, LCSs and SMGs) it is advisable to take up the issues with the Union Parishad Chairman as a fixed agenda.

Engaging NGOs in operation and Preventive Maintenance

249. The employment of the NGOs to a limited scale would have better impacts in actual Operation and Maintenance of polders. The role of NGOs should be limited to the identification and selection of local beneficiaries; formation of Functional Groups from the beneficiaries identified; institutionalizing them as the polder community; and training. BWDB's Sub-Divisions will directly supervise the activities of the NGOs or in other words the NGOs will be directly responsible to the concerned Sub- Division for their performances even though the employment and contract negotiations would have to be completed by the Divisional Office.

4.8.3 Methodology

Meetings with Local Stakeholders at site

250. Itis requiredthatconsultative meetingsonidentifiedinterventionsshould organizewith stakeholders for theirpubliccommitment. Discussionsinthese meetings maylead to bringing somechangesand modificationscompatiblewiththelocalneeds.TheCEIPConsultantswillalsohavesimilaropportunities tohelpand assistthe concernedDivisionOffices. Sothatmeetingswithlocalstakeholdersareheldat projectsitesseekingtheiropinion on the functional aspectsofinterventionsaswell as support / cooperation intheimplementation.

4.8.4 Priority of Maintenance Works and preparation of Work Authorization

251. The most important step of O&M planning is the prioritization of the proposed works especially when there is anticipated shortfall in funding. The list of maintenance works normally considered necessary to undertaken in a polder for a particular period may be large; but depending on the available fund for O&M, many items of the list have to be curtailed. The list thus becomes short and shorter based on priority. The criterion for prioritization or "Budget Cuts"

should apply quite judiciously,i.e., coming down from the items of major periodic maintenance to the items of minor periodic maintenance. Preventive maintenance works should be left untouched (**Figure 4.3**) because adequate preventive and minor periodic maintenance push down the need ofrehabilitation; infrastructure remains in good condition.

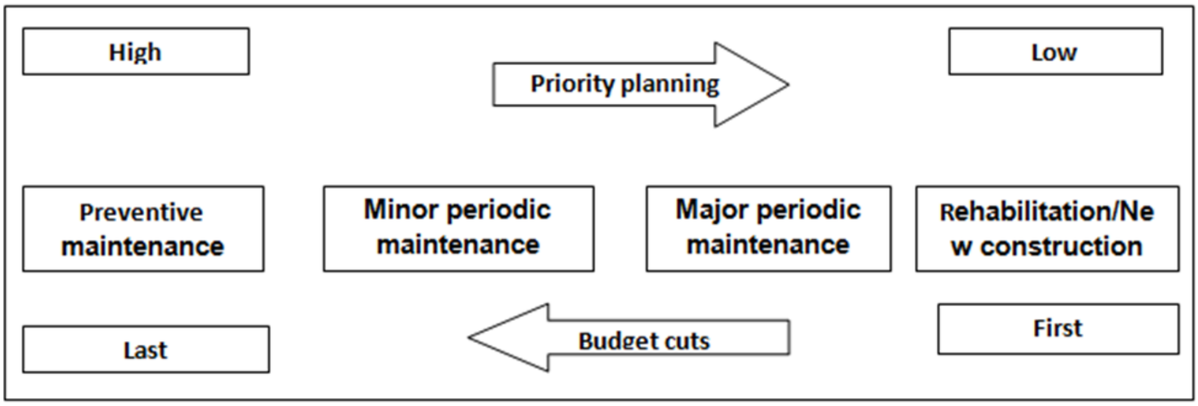


Figure 4.3: Priority Budgetingfor O&M

252. It is very hard to prescribe any standard criterion for prioritization of works because the socio-economic dimensions for each polder vary quite markedly. So the actual selection of work items for prioritization should be done very carefully and for each polder separately.

4.8.5 Water Management and Operational Plan

253. Operational plan involves setting out the schedule of activities related to operation of gates of structures by the users' organization to control water levels best suited to water management and agricultural needs. In the coastal polders, operation of gates mainly focuses on protectingagainst saline water intrusion during high tides and allowing drainage of excess water from inside the polder during low tides to minimize the depth of flooding but storing enough water on the paddy fields. The trend however changes in the dry season where the operational plan aims at storing as much water in the canal networks as possible by closing the gates. The water thus stored should have the basis of a balancing mechanism among all categories of user viz. paddy growers; salt producers (if there is any); shrimp producers (also including other fish culture practices); and domestic user. Operation of structures should therefore be an organizational, low cost activity requiring quick communication with the beneficiaries and with project staffs at the lowest level.

(i) Operational Activities

254. The operational plan provides the framework upon which canal water levels (also referred to as operation target) and day-to-day structure operation will bebased. More specifically, the operational plan for the CEIP polders can be thought of as a hub for the following operational activities:

- *Operation of drainage regulators;*
- *Operation of flushing sluices/irrigation inlets; and*
- *Operation of privately owned Low Lift Pumps (LLPs)*

255. Besides, some other activities may also conceive in the context of varying polder conditions. The following activities are within the purview of operational plan:

(a) Regulation of gates

256. In the past BWDB employed the Gate Operators from its own; but due to budget cuts this position has been discontinued. Currently the responsibilities of gate operation are given to the beneficiaries in the polders. Standard procedures have been developed under different projects but hardly followed as common practices.

257. The picture in other polders where only FCD activities exist is different; institutional set up for the users' organizations is yet to be built and introduced. This particular issue will bediscussed in details in the following sectionto address Beneficiaries Participation in coastal polders.

258. The gates of each drainage sluice / regulator must be operated following certain fixed rules regarding timing. BWDB O&M section in consultation with the beneficiaries' organizations, DWM staffs and DAE field staffs will ensure operation of the gates in conformity with operational timing based on actual water management and agricultural needs.

259. Flap Gates of regulators should remain in place at all times except during maintenance and flushing. During the pre-monsoon period, the vertical lift gates of each regulator should remain closed for retention of water for irrigating Aus crops by LLPs. During monsoon (*July to September)*, the vertical lift gates should normally remain closed; but may be opened to regulate the water levels inside the polder and it should not be allowed to exceed the stated maximum permissible level for safety reasons. In order to achieve this, discharges into the river should commence (river levels permitting) as soon as this level is attained. This type of water management decisions should be taken after due consideration of daily rainfall, river stages, water levels inside the polder, gate opening schedules. However, the frequency and type of this decision making process will vary with the seasonal conditions.

260. During the post monsoon season (*October to November*), the vertical lift gates will be operated to retain water in the drainage canals without overtopping the canal banks and increasing the soil moisture level for cultivation. In all these cases there should have enough consultation with the beneficiaries' organizations because agricultural practices, crop varieties; and cropping pattern changes over time.

261. Operation of Flushing Sluices and Pipe Inlets should also have similar practices with maximum involvement of beneficiaries' organizations. The O&M section and DWM staffs of BWDB will assist them in the water management of command areas inside the polders. A gate operation plan in Bengali is provided in **Appendix 11.**

(b) Frequent Watching of Embankments

262. This is a typical monitoring activity to carryout by the BWDB O&M Staff. It is intended mainly to detect weak sections, gullies, slips, sign of squatter settlements, and cultivation of perennial cash crops, cuts in the embankments to accommodate homesteads, embankment subsidence and erosion and / or settlement of protection works.

263. Recommendations for the frequency of field inspections and reporting of the physical condition of canals and embankments with its associated structures and protective works by BWDB's O&M field staffs have been made quite in details in the relevant SRP reports and findings.

(c) Regular Checking of Structures

264. This is also a typical monitoring activity to carryout by BWDB's O&M field staffs to detect slips at abutments, damage of protective works and wing walls, and periodic damage to flap gates and fall boards, etc. The functional groups under WMGs in the polders will assist the O&M Section Office of BWDB to identify and report the damages for rectification.

(d) Condition survey (of embankment & structures) and Engineering survey

265. The survey data obtained by the O&M field staffs of BWDB are use for estimating the required maintenance works. Physical condition of embankments and structures to be investigated through field surveys once in a year. This is specially required to prepare the details for carrying out periodic maintenance works.

(e) Supervision of preventive maintenance works

266. Preventive maintenance works are done by community-based functional groups (e.g. EMGs, SMGs, and CMGs) as and when required round the year. The works are the most simple, cheap and cost effective maintenance works are carried out more or less continuously. The field staffs of O&M section of BWDB supervise all preventive maintenance works.

(ii) Planning of Operation

267. The objective of structures operation is to maintain control over water levels in the polder channels to ensure integrated water management. This means that the operation of water management structures should be directly linked to agricultural requirements and on-farm water management conditions keeping the eyes open on the requirements of other users also like fisher folk community, navigators/boatmen, salt growers (if applicable) and general water users for domestic purpose. Therefore, in the planning of operation, the demands of all categories of beneficiaries should take into account for achieving a perfect integrated water management. Participation of beneficiaries at all levels of planning is essential.

268. The decision making process involved in structure operation is shown in **Figure 4.4**. This illustrates schematically the procedural steps necessary to translate water management needs into actual structure operation. The water management plan drawn over a season provides the framework upon which water levels in the drainage channels,i.e.,based on operation targets and day-to-day structure operation needs. However, actual field water levels may diverge from the water management targets due to some unpredictable factors like rainfall or other causes. During the cropping season, monthly, weekly or daily operational adjustments will be required. Routine monitoring of water management and hydrological conditions will supply data that together with the water management plan, will dictate the need of adjusting the operational measures.

269. Participation of beneficiaries vis-a-vis the farming community is essential in establishing the seasonal or long-term water management plan. This however, reduces to a somewhat lesser extent in setting up the weekly operation targets. Although the daily structure operation is largely an activity of the responsible O&M authority like BWDB's Section Office, it can be shifted to the WMG if they are provided with adequate training and management capabilities.

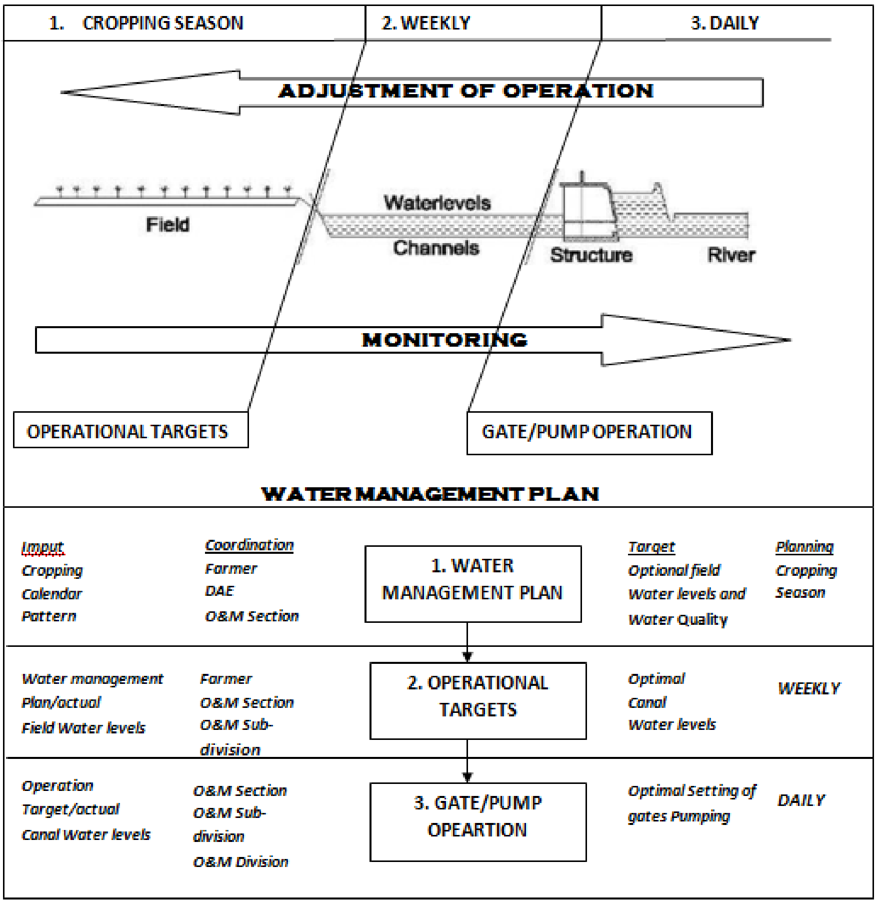


Figure 4.4: Decision making in operation

(a) Seasonal Water Management Plan (WP Plan):

270. In the coastal polders both the drainage and water conservation requirements are equally important; in the wet season drainage will get priority while in the dry season, conservation of sweet water inside the polder becomes the predominant factor. The seasonal water management plan must emerge covering the polder as a whole and based on the requirements of all water users. The plan will have to be prepared jointly by the BWDB's O&M offices, the leaders of WMGs / WMAs, and DWM of BWDB. Draft water management plans will be drawn up at the user level i.e. at WMGs (**Figure 4.5, Planning Procedure**); these will becombined into water management plans at WMA (Sub-Division level). In large polders the plans will be compiled by the Executive Engineer (in support and cooperation of the WMF- if it exists) and DWM to produce the final WM plan. This needs to be prepared well ahead of the cropping season, so that critical farm operation (e.g.seedbed preparation, shrimp or salt production requirements) can be carried out in line with the plan.

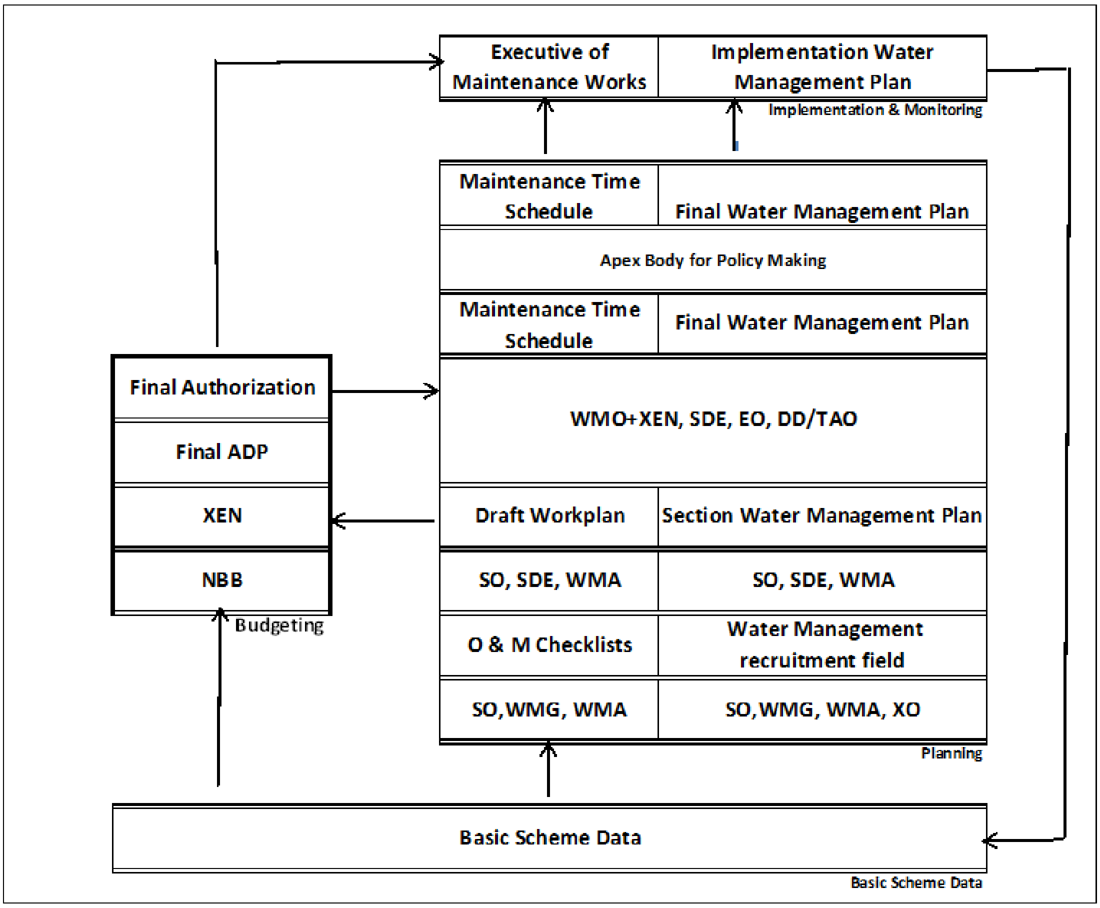


Figure 4.5: Standard Planning Procedure

<u>Note</u>
DD Deputy Director
TAO Thana Agriculture Officer
BS Block Supervisor
For other Abbreviations see FIG: Relationship between WMGs and LGIs

271. Inputs required for the WM plan includes information on cropping calendars and cropping pattern formulated by the farmers in consultation with agricultural extension services, DWM and BWDB's O&M staffs. Together with information on the system (Basic polder data, O&M guidelines, Design details, etc.) and status of the system (monitoring data, O&M checklists, maintenance work plans, and maintenance time schedules) will enable drawing up of a detailed water management plan. In large polders, water management computer model may beused as an important tool in the planning process. The models can used to compute several water management scenarios and the effects of certain measures (e.g. extra regulators, early drainage or flushing etc.) can be simulated. The model can also used to develop weekly operation targets and may become a very useful tool in the day-to-day management of large polders. Specially trained staff will be required for such advanced calculation.

272. In fact, the WM Plan is a formal agreement between the BWDB's O&M offices and the water users' platforms (WMG or WMA) ensuring the operational services to be provided. Once the WM Plan is finalized, information can be passed on to other agencies through the apex body of the beneficiaries so that necessary adjustments can be made to accommodate other national programs, work plans, etc.

(b) Weekly Operation Targets

273. In the coastal polders water levels in the drainage channels can be manipulated easily because the mode of operation is in line with the FCD system; and the water levels inside a *beel* is much more dependent on rainfalls. The parameters in the seasonal WM plan, viz. water levels in the channels and discharges will be compared with the actual field conditions, operation targets, etc., on a weekly basis to eventually arrive at the weekly operation target setting. The system users in close contact with O&M staffs of BWDB can set the weekly operation targets to maintain the desired field conditions.

(c) Day-to-Day operation

274. Daily structure operation requirements involve manipulation of gates or pumps to maintain water levels in the channels as lay down in the operation target. Actual structure operation also implemented and adjusted on a daily basis by the O&M staffs of BWDB. For each polder, the operational practices so developed will have to be documented and kept in proper records for use by the WMGs / WMAs.

4.8.6 Maintenance Works

275. Maintenance of embankments and structures is the most important item of activities in the coastal polders. It is necessary and cannot be avoidedbecause it helps preserving the infrastructure in good and functional condition; protects investments; and prevents high rehabilitation costs. Since this is included in the day-today tasks schedule and needs continuous efforts, maintenance of coastal polders put emphasis on simple and cost effective community-based interventions.

276. In the coastal polders, theworks, which only directly serve the water management, should be regularly maintained. These activities are divided into:

(i) Preventive or Routine Maintenance;
(ii) Periodic Maintenance;
   - Minor Periodic Maintenance
   - Major Periodic Maintenance
(iii) Emergency Maintenance;

277. The objective of preventive maintenance is to keep the overall polder *system* including all its *elements* in good functional order thereby reducing the need of periodic maintenance eventually avoiding high rehabilitation costs. The works are simple, cheap and cost effective and can be implemented through community-based functional groups such as EMGs, CMGs, and SMGs. Preventive maintenance is carried out throughoutthe year, almost continuously or as and when required. The works are noted below:

- All activities related to vegetative covers on embankment, i.e., new (or re-) planting; enrichment planting; and maintenance of vegetation by EMGs and/or EPGs;
- Small earthworks on the embankment by EMGs;
- Cleaning, greasing, and painting of structures by SMGs;
- Cleaning Khals and Outfall Drains from aquatic weeds and floating debris, and removing of silt in wet condition by CMGs.

278. The preventive maintenance interventions have been spelled out precisely in ***Table 4.12***below:

(i) Periodic Maintenance

279. Periodic Maintenance intends to bring the components of the hydraulic infrastructure back to its design standard. The works are more expensive than preventive maintenance and implemented by LCBs, LCSs, and PICs (food for works). Periodic maintenance has the character of repair works and identified during the field assessment at (more or less) regular intervals.

280. The most important distinguishing characteristic of minor periodic maintenance works is that it is more community based and often implemented by LCSs while major periodic maintenance works are generally carriedout through competitive bidding (LCBs). However, in case of earth works at least 25% of the works should allotted to LCSs. Both these types of periodic maintenance are summarized as under:

(a) Minor Periodic Maintenance Works:

- Minor earth works on the embankments byLCSs i.e. shaping and minor fillings including repair of access ramps;
- Minor repair of protective works by LCSs i.e. re-positioning of the displaced blocks;
- Minor repair of structures by LCSs i.e. small patching of brick works, replacing rubber seals etc.; and
- Re-excavation of Khals and removal of earthen cross dams by LCSs and / or PICs;

(b) Major Periodic Maintenance Works:

- Major earth works by LCBs / LCSs,i.e. re-sectioning of embankments including turfing;
- Major repair of structures by LCBs i.e. repair or replacement of metal works/hinges, lifting mechanisms, gates, block works, head / wing walls etc.;
- Re-excavation of Khals by LCSs / PICs.

281. The periodic maintenance interventions have spelled out precisely in **Table 4.12**below**.**

(ii) Emergency Maintenance

282. Emergency works cover unforeseen interventions that require immediate actions to protect the polder as a whole or a part thereof from the adverse effects of flooding or uncontrolled saline intrusion etc. associated with damage of lives and properties. This type of work requiring immediate attention includes the closure of an embankment breach, the repair and replacement of flap gates, or the construction of cross dams over canals if structure fails. As the title implies planning of these kinds of works is not possible. **Table 4.12** indicates each type of emergency maintenance works.

Table 4.12: Types and Classification of Maintenance Works

Sl. No	DescriptionofMaintenance Works	ImplementationMode									
		Classifi-cation by Type of Mainte-nance			Community Based Functional Groups under WMOs						LCB
		I	II	III	EMG	ES	CMG	SMG	LCS	PIC	
1.	Embankment Incidental earthworks: Minor fillings of rills; ghogs;	√			√	√					
2.	New or additional planting of trees and/or shrubs on embankment or toe	√			√	√					
3.	Maintenance of embankment vegetation: Patrolling and protecting young plants against browsing, protecting turfs/ grass/ shrubs against overgrazing and indiscriminate trampling by cattle, upkeep of paths to facilitate inspection of trees, clearing around trees, application of fertilizer, harvesting of producefrom trees, replanting and replacement of diseased/ moribund/dead trees.	√			√	√					
4.	Minor earth works: Shaping or minor fillings of crest and slope but not re-sectioning to bring it back in a shape that allows ESsto settle and trees to be planted.										
5.	Major earthworks: Re-sectioningor filling of crest and/ or slope including turfsso as to bring it back to its design level.		√						√	√	
6.	Repair of damaged access ramp, construction of small partition dyke		√			√			√		
7.	Emergency closingof breached section			√					√		√
8.	Structure Cleaning and greasing of moving and/or sliding parts and seal	√						√	√		
9.	Removing silt and debris (waterhyacinth, aquatic weeds and others) near intake	√							√		

Sl. No	DescriptionofMaintenance Works	ImplementationMode									
		Classifi-cation by Type of Mainte-nance			Community Based Functional Groups under WMOs						LCB
		I	II	III	EMG	ES	CMG	SMG	LCS	PIC	
10.	Checking and tightening nuts and bolts	√						√	√		
11.	Brushing chipped or loose paint ruston metal parts; and painting	√						√	√		
12.	Patching minor damages or minor brick		√								√
13.	Replacing rubber seal of gate, positioning		√					√			√
14.	Repairing or replacing damaged metal works /hinges, lifting devices for flap or Vertical sliding gates.		√					√			√
15.	Repair defective block works (aprons)										
16.	Replacings top logs, flap gate or vertical		√	√							√
17.	Repair headwalls, wingwalls, aprons		√								√
18.	Protective Works Re-positioning/replacing of incidentally displaced blocks/ boulders / concrete frames, small repair to sand/gravel filter		√								√
19.	ChannelsCleaning khal and outfall drains and de-silting outfall drains.	√					√				
20.	Re-excavationofkhal		√						√		
21.	Removing crossdams (usedas access roads, flushing bunds or water retention)		√			√					

Notes:*Maintenance Class; I- Preventive or routine maintenance; II-periodic Maintenance; III- Emergency Maintenance.*

(iii) Planning of Maintenance

283. As already stated, maintenance activities in BWDB polders conceive in three distinct categories, i.e., Preventive Maintenance; Periodic Maintenance; and Emergency Maintenance. Preventive maintenance requires minimumannual planning because Embankment Maintenance Groups and Canal Maintenance Groups go ahead in a continuous process. Emergency maintenance cannot be plann as this is dependent on unexpected conditions and can hardly foreseen. So, the maintenance planning centers on periodic maintenance. The selection of items

to be maintained and repaired, and the ranking of the works, is the recurrent activities in maintenance planning. *Theselection depends on the project inventory; the O&M checklists filled in by the farmers under the guidance of the Section Officer; and monitoring data produced by BWDB. A clear dichotomy is apparent here; monitoring focuses on the elements of the infrastructure while the O&M checklists help identify the water management bottlenecks and support the system approach.* Another important issue in the maintenance planning is the timing of maintenance,i.e., when certain works need to be carried out without hampering water management, and if it hampers in any area, all theseshouldbereflectedintheseasonalwatermanagementplan.Thisconcernsmainly theperiodicmaintenanceworks.Athirdplanning activity isapartoftheimplementation phaseandconcernsthedrawingupofphysicalworkplanspriortothestartoftheworks; thisisinfactanactivitybetweenthecontractor andtheO&M Offices.TheO&M fieldstaff should monitor that maintenance scheduleis followed for executing these physicalworkplans.

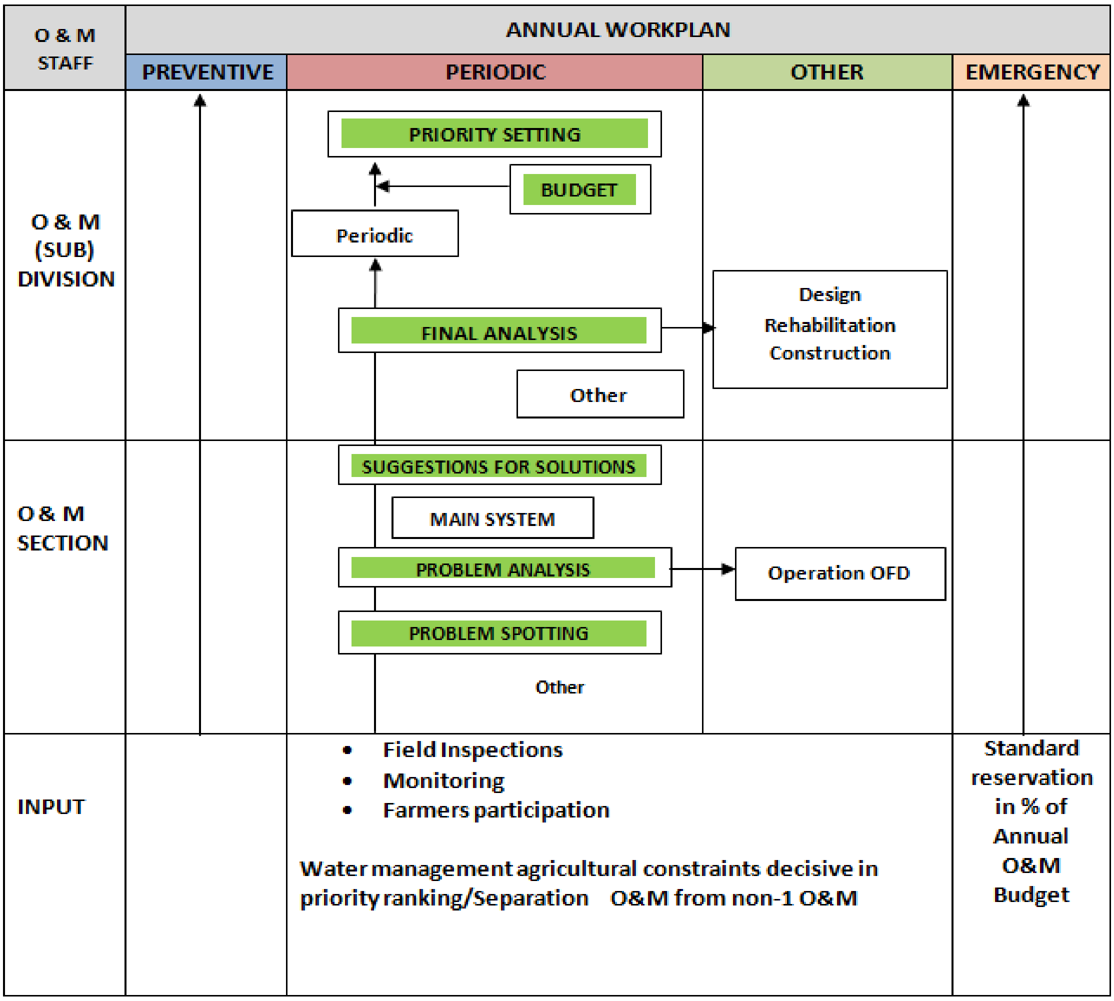


Figure 4.6: Decision Making in Maintenance

284. Before any planning of maintenance, there should be a separation between O&M and non-O&M works. Only that part of the infrastructure,which is related to water management should included in the O&M works. All preventive maintenance works are the part of O&M works; but under periodic maintenance, there may bethe choice of prioritizing between O&M and non-O&M works. A considerable part of the annual planning process will center on selection of works to be included under periodic maintenance.

Rehabilitation works

285. Rehabilitation works are termed as a large repair or replacement types of maintenance works when normal repair and maintenance works are not considered sufficient to bring the polder infrastructure back to its original functioning state. From a different but commonly accepted view point the *Rehabilitation* is defined as the " *restoration of deteriorated facilities and infrastructure within the completed systems to their original functional condition*." Deterioration of structures and other polder elements usually occur due to normal wear and tear over time if regular maintenance works are not done adequately and timely. The tendency to defer normally required maintenance needs often give rise to a need for rehabilitation. Rehabilitation works include the following:

- Construction of new or retired embankment, closing of breach (not emergent);
- All new protective works (CC blocks/boulders), large scale repairs, remodelling at large scale, replacement of blocks/boulders/concrete frames, substantial fillings of sand /gravel bed and major renovation to geo-textile;
- Large scalerepair or replacing of lifting mechanisms for flap gates / vertical slide gates;
- Large scale repair of block works (aprons);
- Replacing stop logs, flap gates or vertical sliding gates for large structures;
- Repair of head walls, wing walls and aprons of large structures etc.; and
- Excavation of new *Khals*.

286. Table 4.13 below depicts the Type of Rehabilitation works.

Table 4.13: Type of Rehabilitation Works

Sl. No.	DescriptionofMaintenanceWorks	ImplementationMode						
		CommunityBased FunctionalGroups underWMOs						LCB
		EMG	ES	CMG	SMG	LCS	PIC	
1	**Embankment** Constructionof newor retiredembankment,closingof breach(notemergent);					√		√
2	**Structures** Bigrepairorreplacingofliftingmechanismsforflapgates orverticalslidegates;							√
3	New protectiveworks(CCblocks/boulders),bigrepairof block works(aprons);							√
4	Repairofheadwalls/wingwalls/aprons							√
5	ProtectiveworksBigrepair,remodelingatlargescale,replacement of blocks/boulders/concrete.frames,substantialfillingsof sand/gravelbedandmajorrenovationtogeo-textile;							√
6	**Channels** Ex-cavationof new*Khals*					√	√	√

4.8.7 Local Participation in O & M and Water Management

287. Local stakeholders' participation in the development and maintenance of water resources sub-projects / polders is a much discussedissue. This is looked upon more seriously in FCD and / or FCDI interventions of BWDB because chronically most of these sub-projects vis-a-vis coastal

polders have been showing poor performances in terms of water management and agricultural crop production mainly due to inadequate Operation and Maintenance (O&M). The potentials in many cases remain underutilized; neither the beneficiaries nor the local government institutions find effective ways and means to get themselves involved in O&M and water management issues. In the past standard procedures were prescribed in some of the study reports under different projects but instances are few where these are commonly followed to achieve substantial results. Until now the provisions of local level participation in the National Water Policy and in the Guidelines for Participatory Water Management that stressed the need for organizing the local stakeholders by themselves with LGIs (i.e., Union Parishad at the grass-root level) playing the roles of coordinating agencies could not succeed in drainage sub-projects for the benefit is not tangible. The challenge of shifting the responsibilities of O&M to beneficiaries' organizations in drainage sub-projects especially in coastal polders yet remains a big question.

a. Institutions for Participation

288. Efforts made in the past to unite the local stakeholders for system operation and maintenance vis-a-vis water management activities in large water resource projects was hardly successful although it was felt that the organizations of beneficiaries/local stakeholders are the driving force.

289. To suggest any pattern of organization for ensuring beneficiaries' participation in water management and O&M responsibilities,i.e., more specifically organizing the beneficiaries for participation in water management and O& M in the coastal polders, past experiences may be considered as the starting point. Looking at the evolution of beneficiaries' participation mechanism in BWDB's subprojects *The Guidelines for Participatory Water Management (MoWR 2001)* usually known as GPWM is regarded as the effective tool for building Water Management Organizations (WMOs). The guidelines provided the basis for all institutional arrangements relating to participatory arrangement. Until 1995, BWDB had been organizing its WMOs on a two-tier basis. This approach was changed to three tiers with the introduction of the previous Guidelines for Beneficiaries Participation and this hierarchy persists with the GPWM. The GPWM has outlined a three-tier organizational structure comprising Water Management Groups (WMG) at the lowest level, Water Management Associations (WMA) at the mid-tier and Water Management Federation (WMF) at the apex. The combination of groups, associations and federations in a particular sub-project is together termed as the Water Management Organization (WMO).

i. Current status of Participation in CEIP Polders

290. At present no beneficiaries' organizations exist in any of the 17 polders selected for improvement under CEIP. Soon after completion of the civil construction works in late sixties or early seventies, the polders were handed over to the local beneficiaries through formation of *Sluice Committees* and *Polder Committees* following the norms prevailing at the time. The polders had to face a series of devastating catastrophies since their commissioning and after each of those occurrences maintenance issues vis-a-vis major rehabilitation works got the priority attention leaving aside the system operational needs and local stakeholders' perception to it. In fact, since early nineties beneficiaries' participation in large water resource projects including coastal polders had been considered with importance.

291. However, the approach to beneficiaries' involvement in operation and maintenance and /or water management in coastal polders has narrowly focused on either combating natural disasters like floods and cyclones or attaining self-sufficiency in food production under any massive program of agricultural development. The National Water Policy (NWPo) released in

1999 emphasized the need for integrated water resources management in an equitable manner among all users.

292. Although there are experiences of forming WMOs in some of the irrigation sub-projects of BWDB no was taken to form the WMOs following GPWM provisions. The scopes were very limited in the CERP/PWP polders to build up institutions for Water Management /O&M as no manpower neither in BWDB or in the TA team were provided to support the task of building beneficiaries' under this program. They simply suggested establishing WMOs (Water Management Organizations) with the help of NGOs. In some of the PWP polders, maintenance of embankments and biological protective measures through CBOs were put on trial by NGOs.

293. The main difficulties that persist in the formation of WMOs in the coastal polders are with the registration of primary level organizations,i.e. Water Management Groups (WMGs) at the lowest tier. The polders are FCD type of sub-projects dealing with salinity prevention and drainage as the major activities; benefits accrued to the local stakeholders are not tangible enough. For the WMOs of FCDI sub-projects, registration at the levels of WMGs and WMAs are allow under the Cooperative Legal Framework and for the WMOs of FCD sub-projects/polders, this has been left open to the choice of beneficiaries (Huda, Shamsul ATM 2006). They either can opt for registration as the Cooperative Societies like those in the FCDI sub-projects or could beregistered with the BWDB. In case of BWDB's registration, it is required to frame rules under BWDB Act 2000. The issue of introducing GPWM provisions in the formation of WMOs as well as registration in the coastal poldersremains. Afterwards, the polders faced at least two severe cyclonic storms "Sidr" and 'Aila'.

ii. Institutional framework for Participation

294. The whole set of activities of beneficiaries' participation in O&M and water management in coastal polders has been conceived to have a definitive framework for institution building discussed here under:

295. As per GPWM provisions, local stakeholders belonging to the polder community may be brought under three tiers of organization or as applicable, namely - *Water Management Groups (WMGs) at* the lowest tier; *Water Management Associations (WMAs)* at the mid-tier; and *Water Management Federations (WMFs)* at the apex level.

Box-1 below depicts the setting out pattern, size and hierarchy of WMOs.

For sub-projects /polders up `to 1000 ha; There may be one or two levels of WMOs as indicated below: WMG at the lowest level for each smallest hydrological unit or social unit (Para/village); and WMA at the apex level
For sub-projects /polders from 1000 ha to5000 ha; WMOs for such polders may consist of two or three levels as indicated below: ➢ WMG at the lowest level for each smallest hydrological unit or social unit (Para / village); ➢ WMA either at the mid-level for each sub-system* of the polder or at the apex level; and ➢ If necessary, WMF at the apex level of the polder in case WMA is formed at the mid-level
For sub-projects /polders above 5000 ha; There will be the following three tiers of WMOs: ➢ WMG at the lowest level for each smallest hydrological unit or social unit (Para/ village); ➢ WMA at the mid-level for each sub-system of the polder; and ➢ WMF at the apex level of the polder

Source: Adopted from GPWM, 2001

Water Management Groups(WMGs):

296. This organization, at the grass-root level will provide the platform for all those who live inside or adjacent (close vicinity) to the polder and will treat as the primary society. The entire command area of the sub-project/polder will be sub-divided into few Units preferably based on hydrological consideration and each of these Units will have one WMG. The size of the units may vary depending on the land topography, actual alignment of the existing roads, canals or embankment, and location of structure, turnouts or even the field channels. Preferably, the size of such hydrological Units should vary within the range of 500 ha to 1500 ha. The areas of the Units so demarcated usually comprise 2 or 3 villages and part thereof. One WMG may therefore include several hundreds to a few thousand as its primary members.

297. A complete household list prepared will scrutinize to find out the actual numbers of beneficiary. By virtue of their staying in the Units or having, land holdings inside the sub-project /polder areas each of the household chiefs will be qualifiedas a Primary Member.

298. The enlisted members will have the right to vote for electing the members of Executive Committee including office bearers. The general body of the WMG comprising of all enrolled Primary Members will be assembled together to elect the 12-member Executive Committee (EC) through a standard franchise procedure. The elected EC will be treated as the legal management body of the WMG concerned.

299. The WMG should allow to function as a primary cooperative society. The individuals enrolled as the primary member will join and cling to the society if they find it beneficial for themselves. WMGs are the building blocks in a polder (large water resource scheme/sub-project) need to establish on a firm foothold. These will led to success for the eventual sustained growth and effective local participation in water management and O&M.

Water Management Association (WMA):

300. The numbers of WMGs functioning in a Polder/Sub-project will form a Water Management Association as a coordinating body at the mid- level of the polder/ sub-project. The WMGs are the grass-root people who would be directly involved in water management while the WMAs will provide necessary coordination at the mid-level. The WMAs chose the point of formal interface between BWDB and WMGs. This is the level where formal agreements relating to respective duties and obligations of the water sector agency (BWDB) and primary societies,i.e., WMGs are reached and signed. For this reason, this level needs to have a legal status and hence the question of registration arises.

301. A coastal polder may have one or more WMA depending on the numbers of WMGs organized. For the polders falling within the category of 5000 ha to 10,000 ha, the numbers of WMAs should not be more than two - each comprising at least 2 WMGs. The EC members of the constituent WMGs will exercise their franchise to elect the 6-member Management Committee (MC) of the WMA from them. Each of the organizations has specific responsibilities to perform; these are summarized in a table below:

Water Management Federation (WMF):

302. This is conceived as the supervisory type of organization functioning at the apex level of the hierarchy and is needed to establish linkages with other higher level organizations for support and mobilization of resources. The WMFs may exist on the basis of actual functioning strength of WMGs and WMAs. Usually in a district or in a bigger hydrological basin comprising of several districts may have one or more federating bodies functioning at the top level of the hierarchy. The office bearers of the WMF, the 5-member federating body will be selected from among the MC members of WMAs. Important personalities in the area like Member of Parliament or local leader

may be nominated as the chairperson of the WMF and other members (not exceeding 04 nos.) may come from the WMAs by virtue of their importance in controlling the numbers of WMGs.

Table 4.14: Duties and Responsibilities of WMOs at different tiers

WaterManagementGroup (WMG)	WaterManagement Association (WMA)	WaterManagement Federation (WMF)
Initiation ofStakeholders activities through preliminary discussions, meetings andmotivational exercises	Preparation of budgets and participation in all activities	Liaison with the implementing agency
Drafting the working procedures and process of interaction	Liaison with implementing agencies, NGOs, CBOs and LGIs Resolution of conflicts (both inter and intra) of WMGs	Oversight of the WMAs Mobilization of efforts to enforce the rules and procedures of water management
Preparation and preservation of documents/reports.	Signingofmanagement transfer agreementsonbehalf oftheWMGswith implementingagencies orLGIsasappropriate	Coordinationofstakeholders 'activitiesin watermanagement
Participationthroughoutthe project cycle	Formal representation of the beneficiaries and project affected people on all issues related to water management	Formal representation of the beneficiaries and project affected people on all issues related to water management
Preparation of annual crop production as well as O&M plans	Preparation of annual crop production/ O&M plans and/or collate the plans emanating from the WMGs	Preparation of annual crop production/ O&M plans and/or collate the plans emanating from the WMAs
Mobilization of local resources and collection of members' contribution towards and recurring costs	Collection of beneficiary contribution towards investment and operation costs and collection of consolidated contributions from WMGs as appropriate	Collection, where applicable, of beneficiary contribution towards polder level operation and maintenance
Maintenance of accounts	Supervision and guidance to WMGs on maintaining the accounts	Financial oversight
Work with implementing agencies, NGOs, CBOs and LGIs	Participation in supervision of sub- project implementation to ensure that the works are as per design and agreement	Observation of sub- project's /polder's construction to ensure compliance with design and agreement
Progressive sharing of water management responsibilities	Operation and maintenance of works in accordance with any leasing agreement	On its completion, leasing out the polder/sub-project level infrastructure from the implementing agency and oversee the operation / maintenance as per terms of the lease.
Resolution of conflicts, election of office bearers, exploration of additional water based economic activities/ IGAs for the WMGs or its members	Assistances in organizing training courses for WMG members and general capacity building initiatives with Government or NGOs for different types of stakeholders	Coordination of WMA's activities in organizing training courses for WMG members and general capacity building initiatives with Government or NGOs for different types of stakeholders

b. Participation of Community Based Organizations

303. Community Based Organizations often termed as CBOs can also play a vital role in maintenance activities. The experiences of CERP described hereunder would form an example that can subsequently use in the actual application of local stakeholders' participation strategies. While engaging any of the functional groups of these CBOs in CEIP polders, care should taken to twist and turn the methodologies slightly in some of the aspects as per local situation and project provisions so that it really fits in. In CEIP, the CBOs are conceived to be included in the Water Management Groups (WMGs) as Functional Groups (FGs). The FGs have the scope of working in the polder O&M under the purview of WMG. So, in this report herein after the terminology of CBO has replaced with FG. Following CBOs have recommended for the polders under CEIP.

ES-Embankment Settler

304. ESs is families selected from squatters and project affected persons who do not have any land or lost it forland acquisition. They can be organized in functional groups for taking part in preventive maintenance of the embankments in specified reach (appx. 0.5 ha) where they are allowed to settle at the toe of the embankment. The maintenance activities include small earthworks, new plantation, re-plantation or enrichment in planting and maintenance of vegetation cover. ESs may be engaged in embankment maintenance activities through a contract agreement period. Unlike CERP, they will simply enjoy the settlement facility and usufractuary rights of the plantation on embankment slopes and toes.

EMG - Embankment Maintenance Group

305. EMGs are the groups formed from the destitute women (maximum 10 members per group) selected from landless families, who are responsible for preventive earthwork maintenance of a specified reach of embankment including grass turfs lying. They are the paid labourers on a daily basis payment. Responsibilities and mode of payment are same as those already in practice in BWDB polders /sub-projects.

LCS – Landless Contracting Society

306. LCSs are the groups selected from landless people consisting of nearly 60 members or more per group (as the case may be). They are responsible for earthworks only up to a limit of Tk. 3.00 lacs in a single contract; they may beawarded a second contract based on their performances. These groups are entitled to have the facility of executing25% of the total earthworks needed in a Division per year. LCSs are enlisted as D-class contractors. They are awarded the works as per scheduled rates of BWDB and need not to compete with contractors in an open bidding. LCSs are needed to sign a contract document before start-up of the assigned job. This has become a popular means of executing earthworks especially in case of emergency needs because they can start works immediately.

CMG – Canal Maintenance Group

307. CMGs are the groups consisting of 10 members selected from landless people; they will be responsible for preventive maintenance of canals inside the polder and outfall drains. Activities include the removal of floating debris, aquatic weeds and water hyacinths; and to some extent disposal of silt deposits in wet condition. CMGs are paid on a daily basis and not on the basis of volumes of actual works done.

c. Roles of NGOs in participation

308. Over the last few decades there has been a tremendous growth of non-government organizations popularly termed as NGOs taking part in various development activities at the grass-root level. For re-structuring or in some cases re-orienting the water management organizations in the coastal polders, the services of experienced NGOs would prove worth enough. Besides, they can also work with the CBOs in accomplishing maintenance activities of the embankments. These are discussed in the following sub-sections:

Organizing the WMOs

309. It is presumed that the Sluice Committees and Polder Committees formed in the past are almost defunct. To organize the local stakeholders to form the WMOs, NGOs may be engaged who are experienced enough to identify and organize the target beneficiaries under a fixed ToR. Not only formation of various groups, their capacity development and integration of local resources towards sustained growth may be looked by the NGOs.

Ensuring CBOs involvement in Preventive Maintenance

310. The NGOs with proven track records of experiences to work among the coastal people may provide their services in organizing the appropriate groups of functionaries so that preventive maintenance of embankments and critical toe protection works with biological means,like vegetative cover, plantation on foreshore lands measures can be successfully undertaken. Especially the EMGs, CMGs, SMGs, LCSs under the guidance and supervision of NGOs can effectively prove worthy in the preventive maintenance of embankments, structures, and canals in the polder system.

Capacity Development of WMOs

311. WMOs, in its current forms in the coastal polders will be quite new at many places. It would not be sufficient to just organize the local stakeholders to form WMGs, WMAs or WMFs. It is at the same time more important that these organizations would work effectively and rise on firm footholds to become sustainable. So, the capacity development initiatives for the individuals as well as for these organizations are inevitable. Addressing the issues of capital building, integration of sufficient resources across the community, implementation of IGA activities and skills development programs should be best looked into by the experienced NGOs.

New Plantation and Re-enforcement ofthe Vegetative Covers

312. Embankment protection with vegetative covers and successful plantation on the berms and foreshore lands are quite technical and usually not within the capabilities of the functional groups; this needs some technical backstopping and guidance. The experiences of CERP and CDSP indicate that services of qualified NGOs are a pre-requisite in planned gardening; especially in species selection, raise of seedlings, ideal plantation, fencing and overall nursing for a certain periods can best be handled by the NGOs. Employing experienced NGOs would be effective in organizing the classified WMOs noted above and providing necessary assistance in successful plantation.

d. Relationship with LGIs and Local Administration

313. At the lowest tier of administration, the Local Government Institutions (LGIs) in Bangladesh have a very good record of existence and performance among the local community. It also becomes the inevitable part of development activities. It would not be appropriate to introduce WMOs to function in coastal polders in an isolated way. LGIs should be already involved in water management, operation, and maintenance activities of the polders. Following

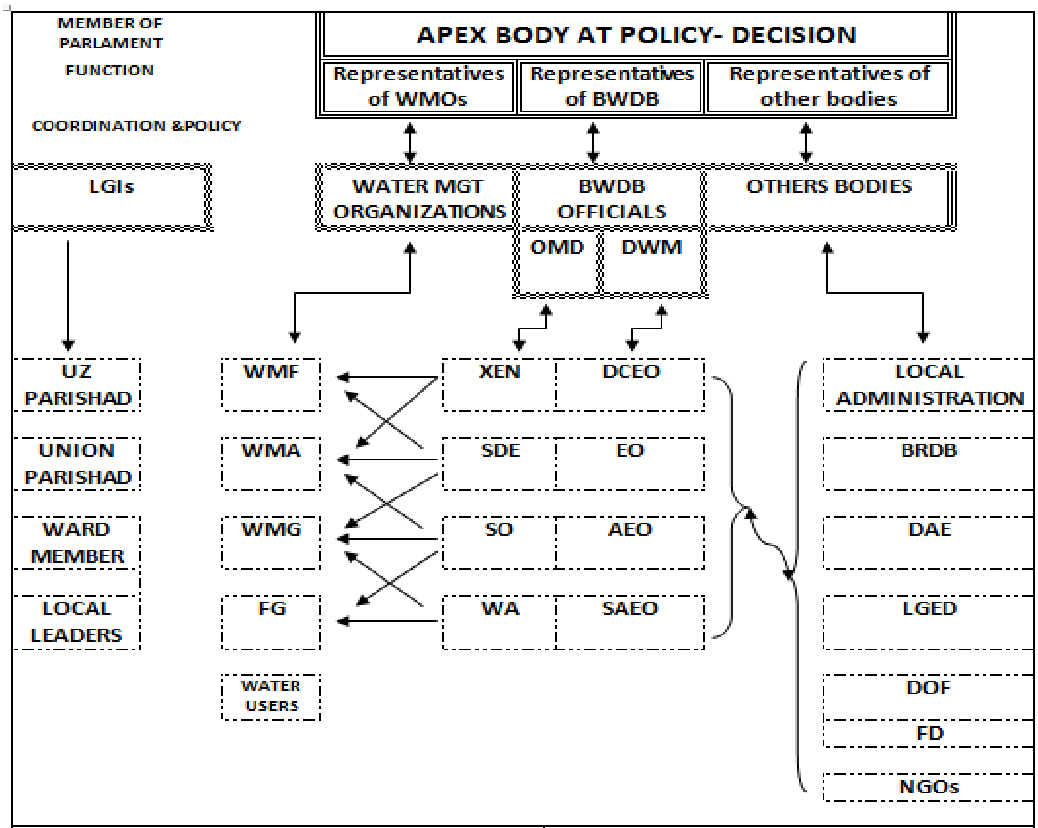
sections will depict the fields of cooperation and coexistence of WMOs with the LGIs and local administration system.

Cooperation of LGIs

314. Coastal polders having the characteristics of FCD type of sub-project yield benefits not so tangible to the local stakeholders. They rather consider the prevention of flood control/ salinity intrusion and drainage facilities as the public good done by the government. Therefore, to get the polder community taking part in operation and maintenance of the polder infrastructure and water management activities is not straight forward like that in the irrigation or FCDI types of subprojects.

315. Apart from the farm families living inside the polder, the embankment settlers; landless section; aboriginals; and people of other trades like fishermen, boatmen, etc., behave differently and their perceptions towards the polder infrastructure are diverse in nature. Nevertheless, the local leaders like UP Chairmen, Ward Members and village leaders have decent acceptability among the local community. It is therefore, required that the LGIs should have specific roles in WMOs; especially the Ward Members will be given the responsibilities to coordinate the formation of WMGs and different functional groups like EMGs, CMGs, SMGs, and also LCSs. Besides, they will also take part in the process of participatory planning and implementation of maintenance activities. Especially at the stage of implementing preventive and minor periodic maintenance works, there should have the provision of LGIs' intervention in conflict resolution and ensuring peaceful co-existence of all groups / sub-groups within the WMGs /WMAs.

316. The LGIs will act as the interface between the WMOs and BWDB's O&M Section; a lateral relationship will prevail among them. It is required that in the process of consolidation of WMOs institutional setting towards sustained growth, LGIs (i.e. Union Parishads) will patronize and extend necessary cooperation. The UP Chairman / Ward Members can play a vital role in some of the important aspects of WMOs' sustainability especially to form Own Capital; manage Community Development Fund; undertake Capacity Building initiatives; launch Members' Welfare / Charity program, Skills Development training, etc. In all these affairs, the LGIs roles should be in the form of oversight and advisory capacity; but the issues of Conflict Resolution in both the 'intra' and 'inter' organizations shall be dealt with by the LGIs as mandatory provisions. The whole affairs of WMOs' relationship with LGIs are depicted in the figure below:



AEO	Assit. Extension Officer	SDE	Sub-Division Engineer
BRDB	Bangladesh Rural Development Board	SO	Sectional Officer
DEA	Department of Agricultural Extension	WA	Work Assistant
DCEO	Deputy Chief Extension Officer	WMA	Water Mgt. Association
DWM	Directorate of Water Management	WMG	Water Mgt. Group
DOF	Department of Fisheries	FG	Functional Group
EO	Extension Officer	UZ	Upazila
SAEO	Sub- Assit. Extension Officer	NGOs	Non-Government Organizations
FD	Forestry Department	OMD	Operation and Maintenance Division
WMF	Water Mgt. Federation	LGIs	Local Government Institutions
LGED	Local Government Engineering Department		

Figure 4.7: Inter-relationshipbetween WMOsandthe LGIs

Support from Local Administration

317. From the viewpoint of geographical location, the coastal polders are situated at distant places and in the islands away from the administrative headquarters of the district and/or upazila and often quite difficult to reach. The people living there have to meet many adversities, which normally the people in other areas do not have to come across at all. In that consideration, they always deserve special and usually a preferential treatment from the administrative authorities. However, in the real life situation things happen more or less contrary to the expectations of the inhabitants of remote polders. The Water Management Organizations (WMOs) and BWDB's O&M section in particular should trigger some of the key points in the whole affairs of local participation to get the local administration more attentive and involved. These are as under:

318. Participation in the Union Parishad and Upazila Parishad Review Meetings

319. Government of Bangladesh has of late reorganized the local government pattern to put more emphasis on undertaking various development initiatives for the rural people. The Upazila Parishad and Union Parishad received more attention in this process. In fact, these are the two important forums to discuss and review periodically the progress of activities, problems and

bottlenecks in development works going on under different departments/agencies. Executive Committee members of WMOs and BWDB's field officers at respective level will simply liaise with the coordinating offices of LGIs,i.e., Union Parishad and Upazila Parishad and ensure the inclusion of their problems and prospects in the agenda of discussion. Through active participation in such meetings at regular intervals WMOs can keep the administration abreast of their concerns; the approach would be simply-"*get yourself focused for your sake*".

320. Creating opportunities for the Administration People to get involved in WMOs' affairs:

321. This is also an important technique to make things attractive for the common people. The WMOs should try to draw in elected representatives / local leaders and administrative stalwarts on special occasions in their programs / ceremonies. In this process, they feel honoured and take the privilege to go into details of the facts. Having more insight of the affairs and issues they put themselves in the position of advocacy among the local beneficiaries and related concerns. Inviting the Administration People in different occasions and showing due respect to them by WMOs would prove worth to earn cordial support and help of the local administration in getting things moved across the hurdles.

4.9 Need of Resettlement Action Plan (RAP)

322. Any development project that requires land acquisition may entail some impacts on people or commercial units and may bring about the changes in the patterns of use of land or other natural resources. For this reason, resettlement program addresses loss of affected people or commercial units for statutory compensation payment to the affected units. In this respect, Resettlement Plan must be prepared to ensure that the affected people or commercial units receive fair and adequate compensation and rehabilitation if needed. It is noted that Resettlement Action Plan (RAP) study is conducted by another sub-consultant of CEIP-1for the Polder 39/2C project.

4.10 No Objection Certificate

323. The proposed Polder 39/2C is situated in the southern hydrological zone in Bhandaria and Mathbaria under Pirojpur District and Kathalia upazila under Jhalakati District. The names of the unions in the polder are: a) Nadmulla, Telikhali, Daowa and Ikri under Bhandaria upazila b) Mirukhali under Mathbaria and c) Chenchri union under Kathalia upazila. There is no archaeological site or any cultural heritage in the polder area that might affect by polder development/rehabilitation. No Objection Certificates (NOC) from the union Chairman are collected and are attached in **Appendix 2.**

5 Environmental Baseline and Existing Conditions

5.1 Physical Environment

324. Physical environment refers to the physical and chemical features of an area. It includes the climate, rainfall, wind, soil, obtainable nutrients and all other natural resources within the area. The following sections provide analyses on different physical environmental features of the Polder 39/2C.

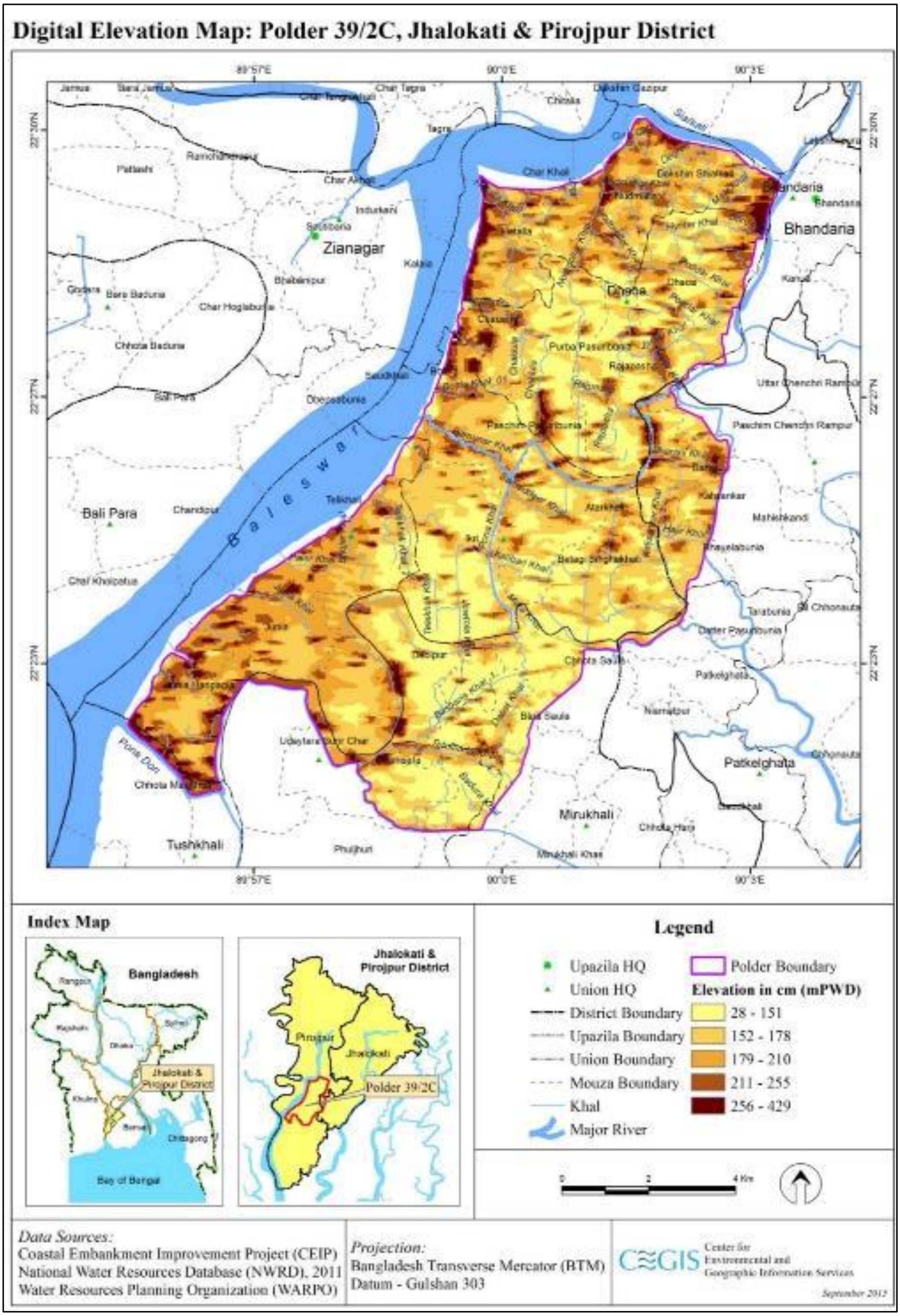
5.1.1 Geology

325. Polder 39/2C situated in a low-lying coastal region and is composed of Tidal Deltaic sediments, whichis deposited sub aqueously in a permanent body of water where tidal waves and currents aid in the transportation and deposition. Typically, a low-lying deltaic environment comprises soft sediments, and these regions are quite dynamic and changes in coastal geomorphology are quite rapid.

5.1.2 Topography

326. The study area is located in the southern hydrological zone of the country, with very low average elevations. Analysis using the available Digital Elevation Model (DEM) infers that the Reduced Levels[11] (RLs) inside the polder vary from 1.02 to 2.43 mPWD, with average RL of around 1.7 mPWD. During high tide, the highest water level at Baleswar (Kocha) River reaches 2.12 mPWD which inundatesaround 95% of the polder while duringthe lowest water level (1.19 mPWD), around 20% of the polder's area remain under water. From the DEM it is also found that around 8% of the land area in the western part of the polder along the river Baleswar (Kocha) has an elevation between 1.93 to 2.43 mPWD, whereas 70% (mostly inside the polder) area has an elevation between 1.45 to 1.93 mPWD. The remaining 22% of the land area in the eastern side of the polder has an elevation below 1.45 mPWD. **Map 5.1** shows the topography of the study area, identifying the rivers and water bodies as well as categorizing land elevations.

[11] Reduced Level in surveying refers to equating elevations of survey points with reference to a common assumed datum. It is a vertical distance between survey point and adopted datum plane.



Map 5.1: Digital Elevation Model (DEM) of Polder 39/2C

5.1.3 Seismicity

327. Bangladesh is one of the seismically active regions of the world, experiencing numerous earthquakes in the past 200 years. As per the updated seismic design provisions of Bangladesh National Building Code, 1993, Polder 39/2C falls under Zone-I, which is considered as a seismically quiet zone, with *Seismic Zone Coefficient*[12]of 0.075, comprising the southwest portion of Bangladesh.**Map 5.2** below shows the seismic location of Polder 39/2C.

328. Polder 39/2C is located inside the sub-zone Barisal-Chandpur Gravity High of Bengal Foredeep[13], situated between Faridpur Trough and Hatiya Trough, and this zone not been sufficiently investigated by seismic surveys. **Map 5.3** below represents the tectonic units available in Bangladesh and the location of Polder 39/2C (within the Barisal-Chandpur Gravity High).

329. It can be inferred that in consideration of seismicity and stratigraphy, Polder 39/2C falls on a relatively safer side.

[12] SeismicZone coefficient is a dimensionless number, which represents the (maximum) earthquake acceleration as a fraction of the acceleration due to gravity.

[13] Bengal Foredeep is one of the world's largest exogeosynclines.

Map 5.2: Earthquake Zones of Bangladesh and location of Polder 39/2C

Map 5.3: Tectonic Units of Bangladesh and with the location of Polder 39/2C

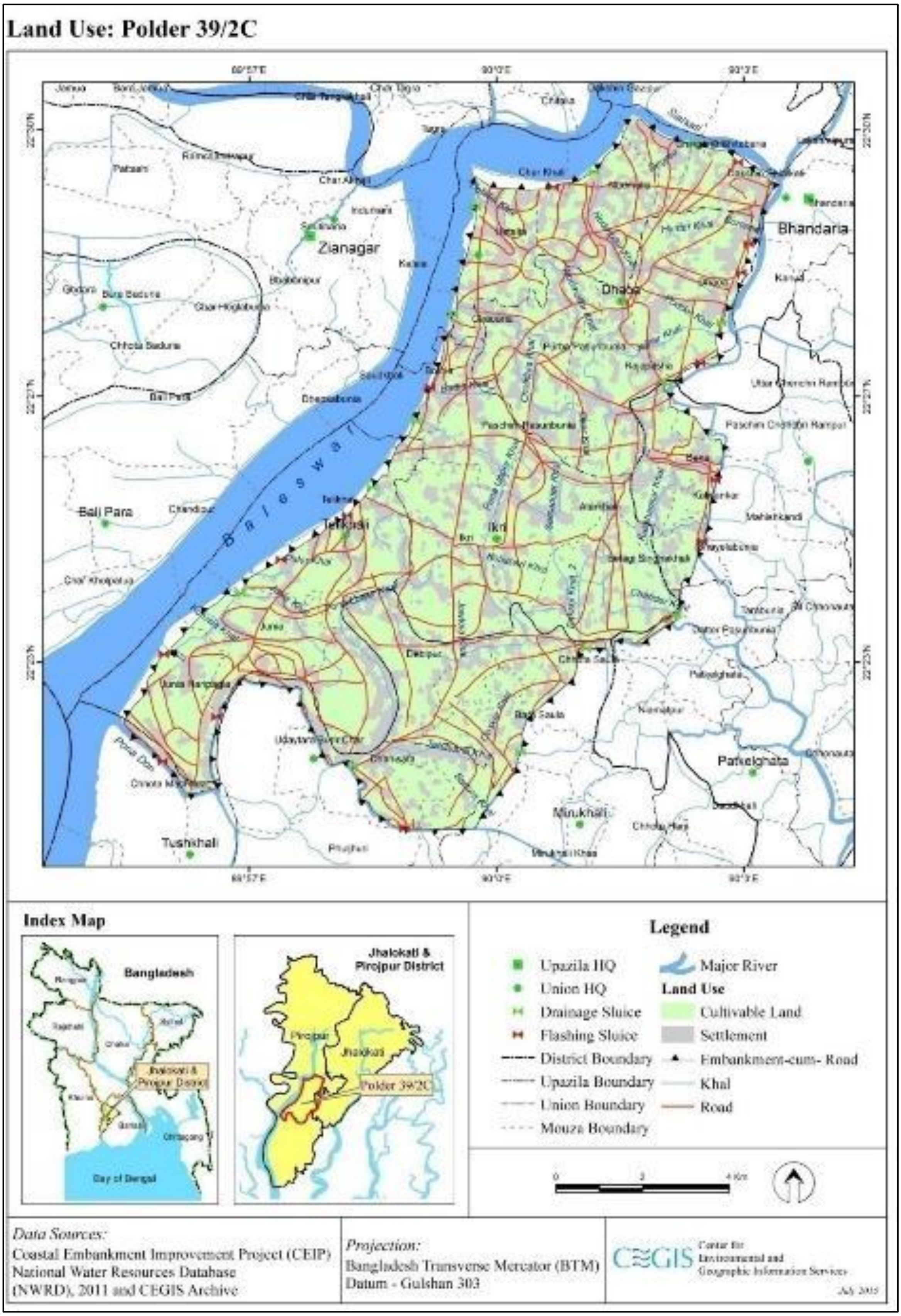
5.1.4 Land Use

330. The total area of the proposed integrated water management project of Polder 39/2C is 10,748 ha of which 8,500 ha is Net Cultivable Area (NCA). The net cultivable area is 79% of the gross area. Settlements and water bodies, respectively cover the remaining16 % and 5% areas. The single, double and triple cropped areas are about 56%, 39% and 5% respectively. Detailed land use is presented in **Table 5.1** and **Map5.4**.

Table 5.1: Present Land Use of the Polder Area

Land use	Area (ha)	%
Net Cultivable Area(NCA)	8,500	79
Single crop	4,786	56.3
Double crop	3,333	39.2
Triple crop	382	4.5
Settlements	1,708	16
Water bodies	540	5
Gross area	10,748	100

Source: Feasibility report (Agriculture), CEIP and CEGIS Assessment, 2012



Map 5.4: Land Use of the Polder Area

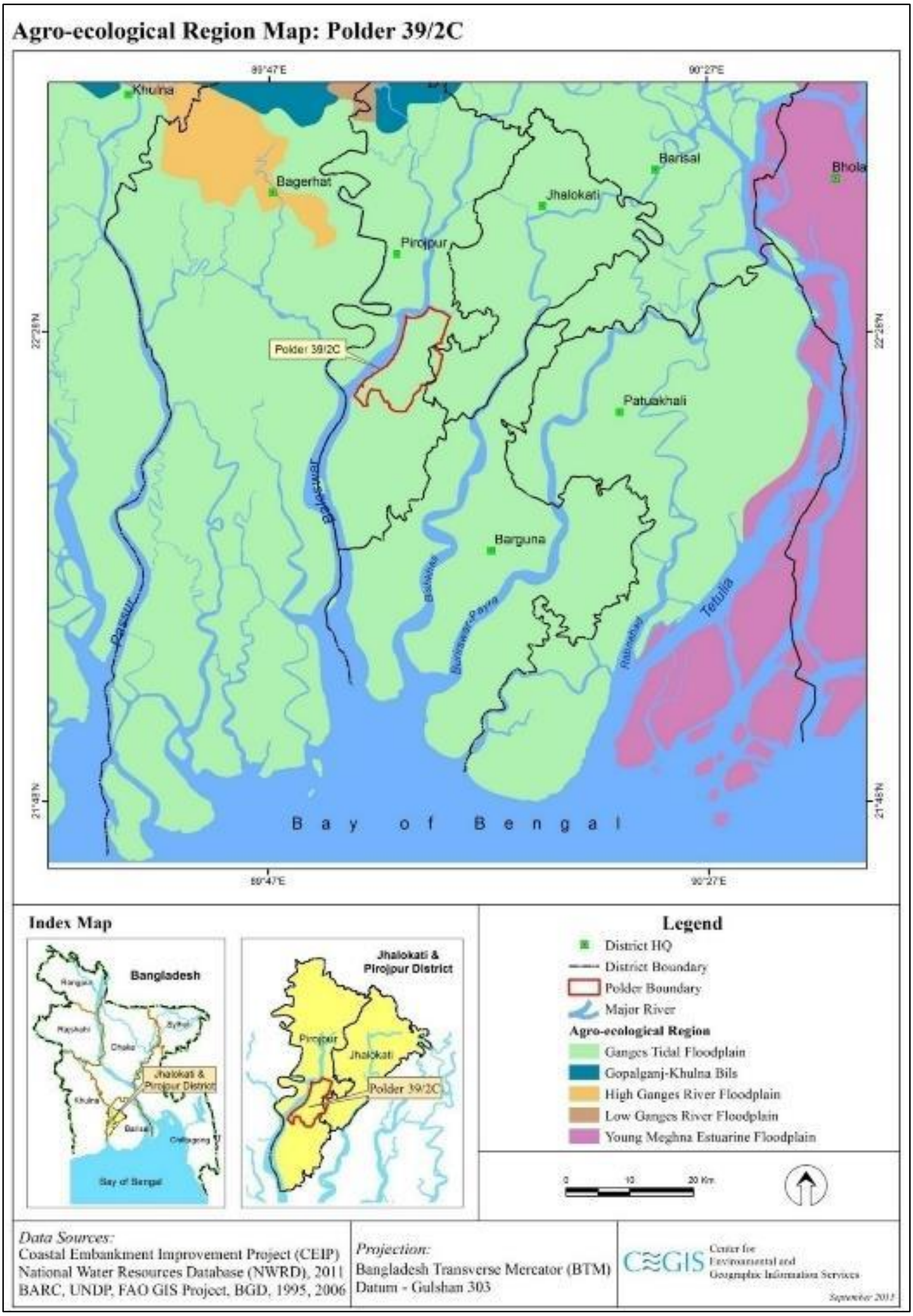
5.1.5 Soil Properties

(a) Agro-Ecological Zone (AEZ)

331. The Land Resources Appraisal of Bangladesh for agricultural development divides Bangladesh into 30 agro-ecological zones and 88 sub zones. The zonation relates to physiographic characteristics (landforms and parent materials). Soil properties, soil salinity, depth and duration of seasonal flooding, agro-climatology(length of kharif and Rabi growing seasons, length of pre-kharif transition period are observed. Number of days below certain winter critical temperatures (<15^0C) and number of days with extremely high summer temperature (>40^0C), which are relevant for land use and for the assessment of present and future agricultural potential (FAO/UNDP,1988, BARC,2012). Polder 39/2C situated in the Ganges Tidal Floodplain zone, see**Map 5.5**.

Ganges Tidal Floodplain (AEZ-13)

332. This region occupies an extensive area of tidal floodplain land in the south-west of the country. The dominant soil type is non-calcareous Grey Floodplain soil. In general, most of the top soils are acidic and sub-soils are neutral to slightly alkaline. Generally, thefertility level is high with low to medium organic matter content.



Map 5.5: Agro-Ecological Zone of the Polder 39/2C

(a) Land Type

333. Land types are classified based on the depth of inundation during the monsoon season. The land type is very important for utilization of lands for crop production.

334. According to IWM modelling report,around 25%, 68% and 7% of the NCA of the polder area (Polder 39/2C) fall under high land, medium high land and medium low land, respectively. Details of the land classification and distribution of land types in polder 39/2C is presented in **Table 5.2.**

Table 5.2: Area under Different Land Types

Land Type	Description	Flooding depth (meter)	Flooding characteristics	Area (Ha)	% of NCA
FF	High Land	(<0)	Non-flooded to intermittent	0	0
F_0	High Land	(0.0 - 0.3 m)	Non-flooded to intermittent	2,144	25
F_1	Medium High Land	(0.3 - 0.90 m)	Seasonal	5,756	68
F_2	Medium Low land	(0.90 -1.80 m)	Seasonal	600	7
F_3	Low land	(1.80 - 3.60 m)	Seasonal, but remains wet in early dry season	0	0
F_4	Very Low land	(>3.60 m)	Seasonal, but remains wet in most of the dry season.	0	0
			Total	**8,500**	**100**

Source: IWM, 2015

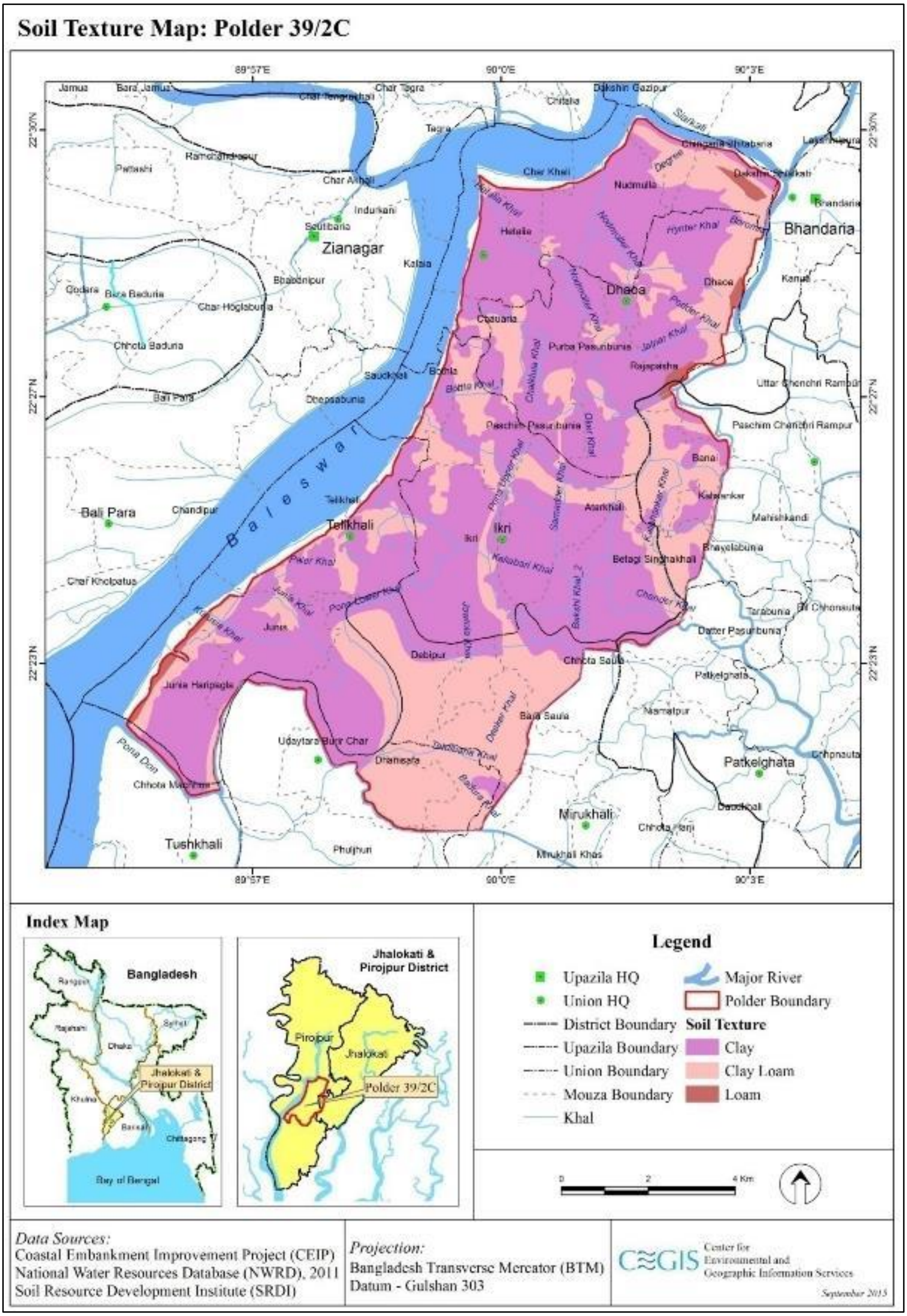
(b) Soil Texture

335. Soil texture relates to the relative proportions of sand, silt and clay. Soil texture is an important soil characteristic that guides crop selection, crop production and field management. The soil texture in the project area varies from clay, clay loam to loam; see **Table 5.3** and **Map 5.6**.

Table 5.3: Soil Texture of the Polder Area

Soil texture with depth (cm)	% of NCA			Total
	Clay	Loam	Clay Loam	
Topsoil (0-15cm)	64	1	35	100

Sources: CEGIS Assessment from SOLARIS–SRDI, 2006



Map 5.6: Soil Texture of the Polder Area

5.1.6 Climate

Rainfall

336. The average monthly rainfall variation at Mongla meteorological station (from 2000 to 2014) shown in **Figure 5.1**. The highest and lowest rainfall is usually observed during the months of July (403 mm) and December (3 mm), respectively. The mean annual rainfall is 1935 mm and varies from 1673 mm to 2786 mm.

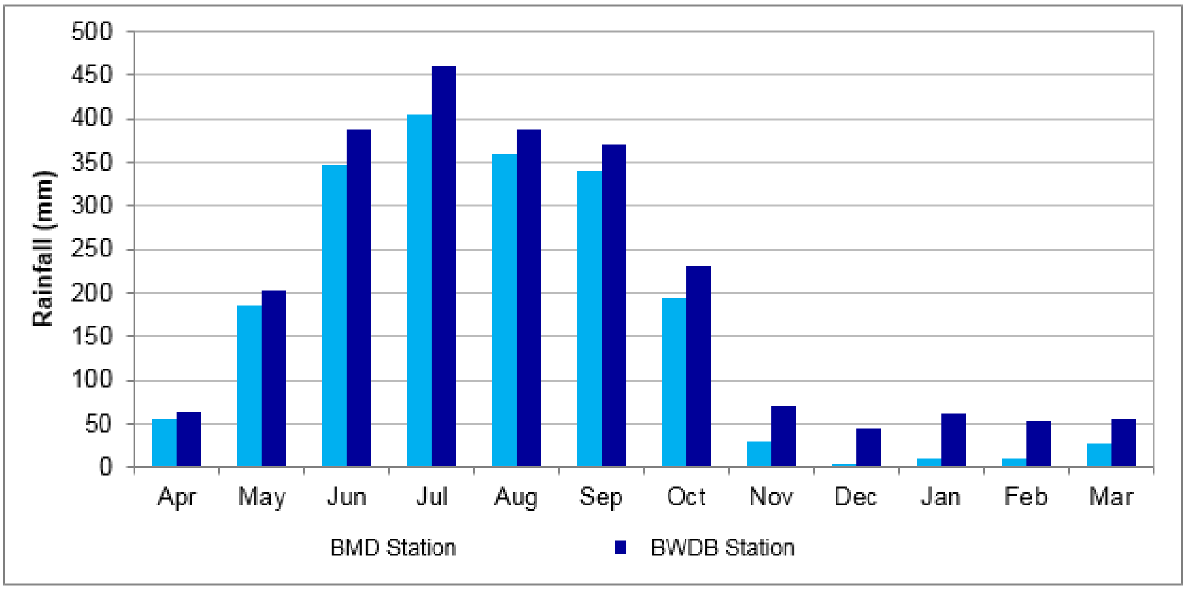


Figure 5.1: Monthly Variation of Average Rainfall at Mongla (2000-2014)

Temperature

337. The mean annual temperature recorded at the Mongla meteorological station is around 26.9^{0}C with a variation in mean monthly minimum and maximum temperature from 10.1^{0}C to 38.9^{0}C with the highest temperature experienced in the month of July and the lowest temperature in the month of January. The monthly mean maximum and minimum temperature are shown in **Figure 5.2.**

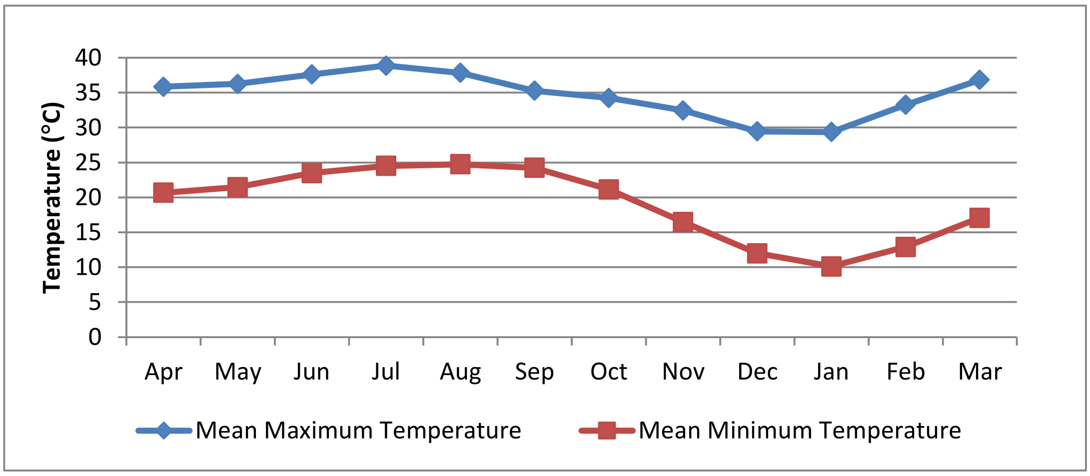


Figure 5.2: Average of Maximum and Minimum Temperatures at Mongla (2000-2013)

Relative Humidity

338. **Figure 5.3** below shows the variation of monthly relative humidity, as recorded at the Mongla station (2000~2013). The relative humidity varies from around 73% inFebruary to above 85% during the monsoon (June to October).

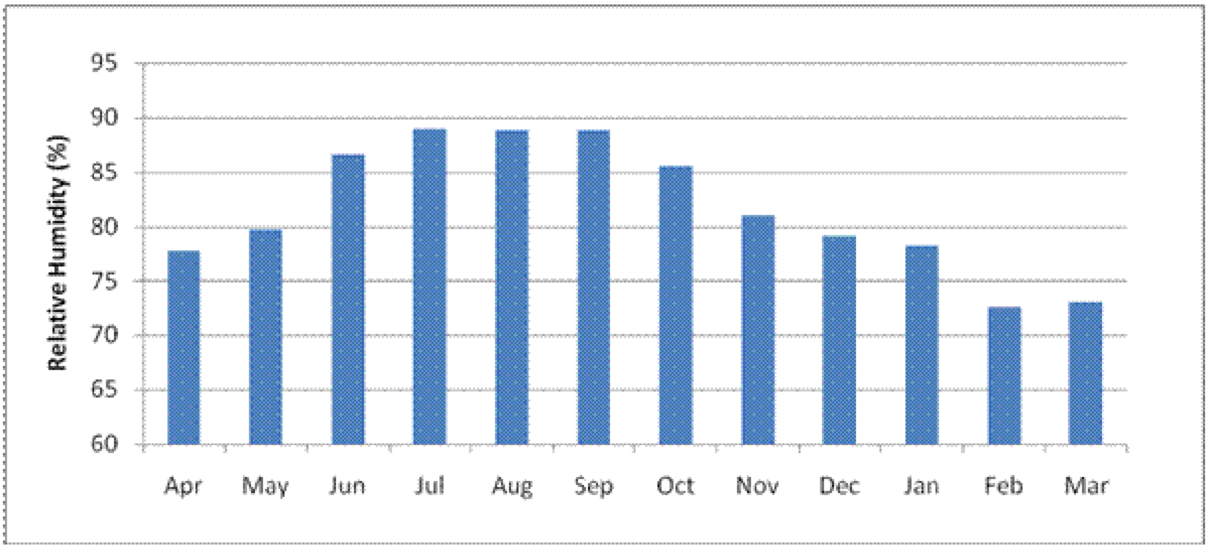


Figure 5.3: Monthly Variation of Average Relative Humidity at Mongla (2000-2013)

Wind Speed

339. **Figure 5.4** shows the distribution of average monthly wind speeds, at the Mongla station (from 2000 to 2013). The wind speed is the highest in April (around 142 kph) and the lowest in November (around 30 kph). During the cyclones Sidr (2007) and Aila (2009), 1 minute sustained wind speeds were recorded at 260 kph and 120 kph, respectively. Sidrcreated devastating impacts due to the high wind speed, whereas the impacts by Ailawere more related to the storm surge. As per Bangladesh National Building Code (BNBC), the *basic wind speed*[14]for Pirojpur is 260 kph.

[14]Basic wind speeds of BNBC refer to the speeds above 10m from ground surface, with terrain exposure B (open terrain with scattered obstructions having heights generally less than 10m and extending 800m or more from the site in any full quadrant)

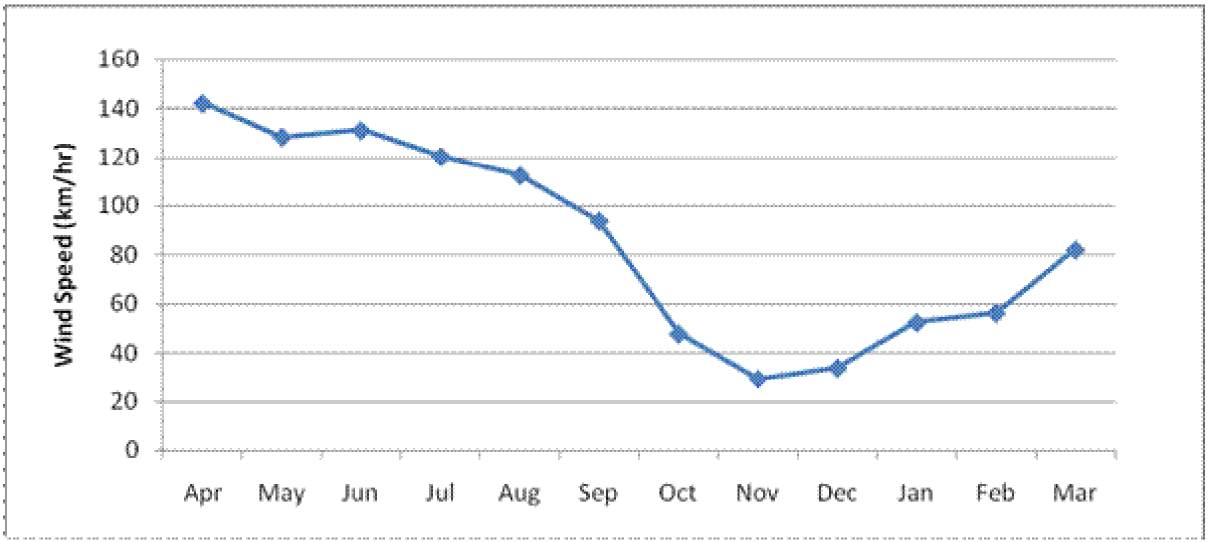


Figure 5.4: Monthly Variation of Average Wind Speed at Mongla (2000-2013)

Sunshine Hours

340. The average sunshine hour data from the Mongla station (2000-2013) are shown in **Figure 5.5.**From October to May the daily average sunshine hours are higher than 6 hours, but due to increased cloud cover in monsoon (June to September) the sunshine hours drop below 5 hours.

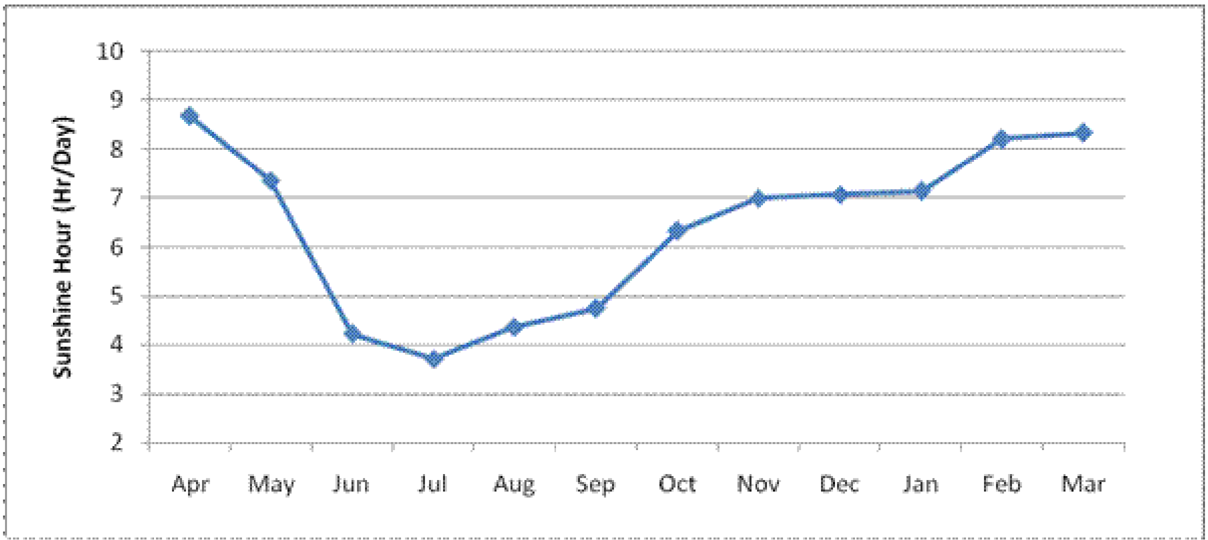


Figure 5.5: Monthly Variation of Average Sunshine Hours at Mongla (2000-2013)

5.1.7 Water Resource System

341. The water resource system is the source of water supply, and plays an indispensable role in assimilating and diluting waste, attenuating and regulating flood, drainage, recharging into the aquifer, and maintaining the environment for aquatic habitats.

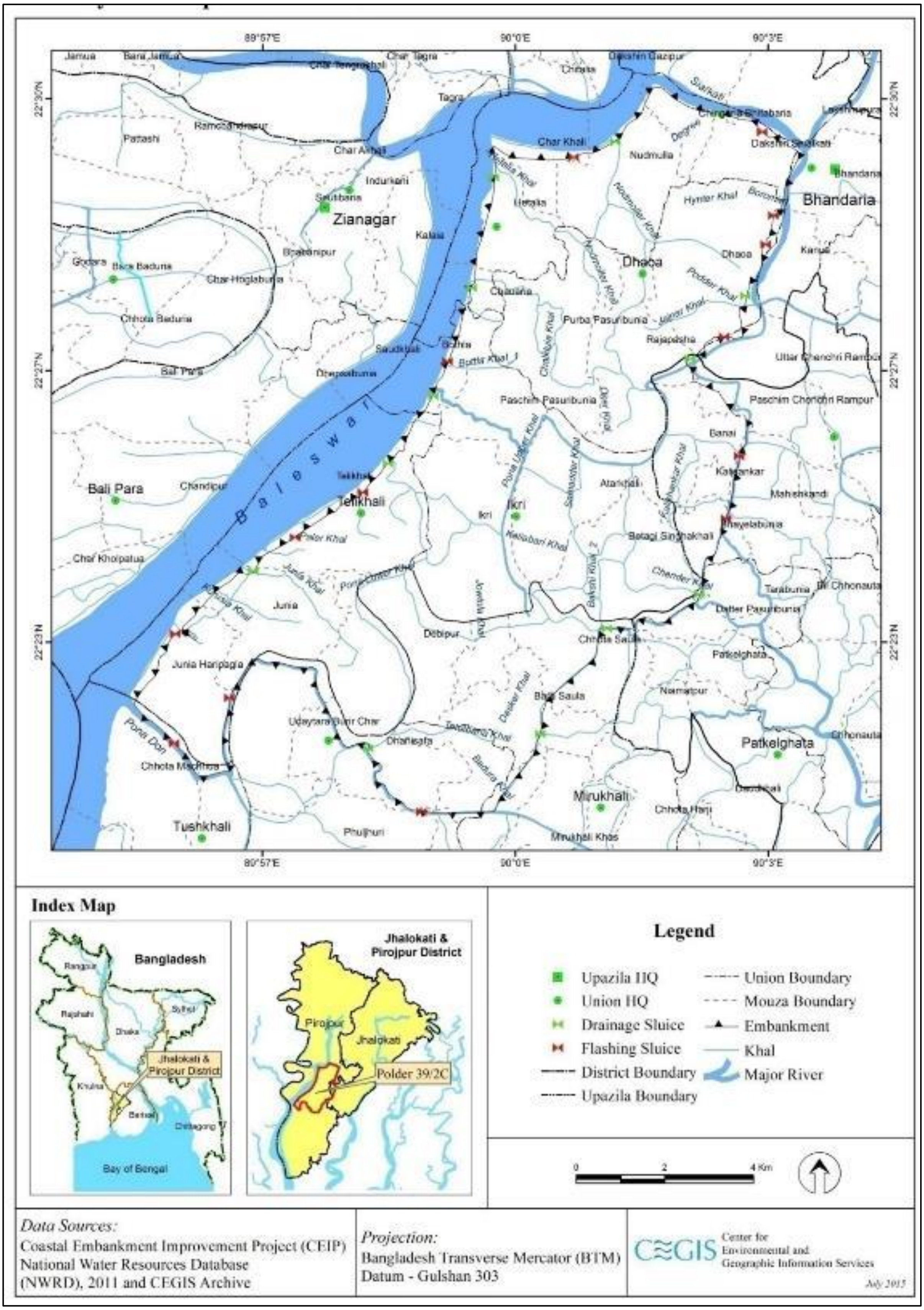
Major Rivers and Khals

342. Polder 39/2C surrounded by Baleswar River *(Kocha)* to the west, Bahar Khal to the east, Pona River to the north and Tushkhali - Mirukhali Bharani khal to the south. Picture 5.1 and 5.2 shows the salient features of the wide Baleswar River and the smaller Pona River. The River system is shown in **Map 5.7**.

Picture 5.1: Baleswar River (Kocha) at Telikhai

Picture 5.2: Bahar Khal inside the proposed Polder area

343. There are numerous khals in the polder, including *Bhuter khal, Bamuner khal, Hetalia khal, Nadmulla khal, Singkhali khal, Podder khal* and others. The surrounding rivers and internal khals are the main drainage features. Besides, the khals are also provides a source of water for irrigation.



Map 5.7: River and Canal System of Polder 39/2C

Hydrological Settings

Surface Water Levels

344. The water levels measured at Bhandaria in the Baleswar River, from 2000 to 2013 has analyzed (**Figures 5.6**). Water levels during high tide range from 1.19 to 2.12-mPWD and from-0.21m PWDto 0.77mPWD.

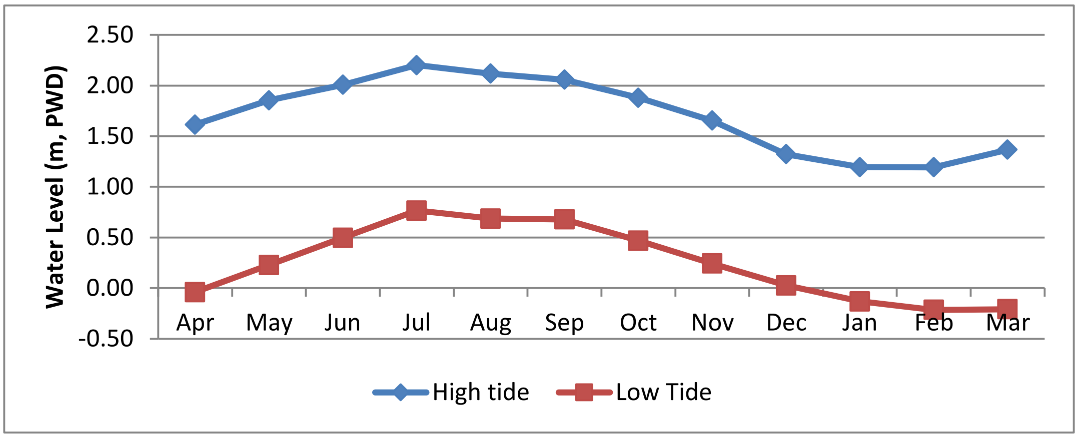


Figure 5.6: Surface Water Level at Baleswar River

Groundwater Table

345. The mean monthly groundwater tablerecordings over the period from 2000 to 2013 are shown in **Figure 5.7** for the groundwater observation well named as PIR002 (at Bhandaria). The groundwater tablevaries from below 2m at the end of the dry season (March) to less than 1.4m during the monsoon.

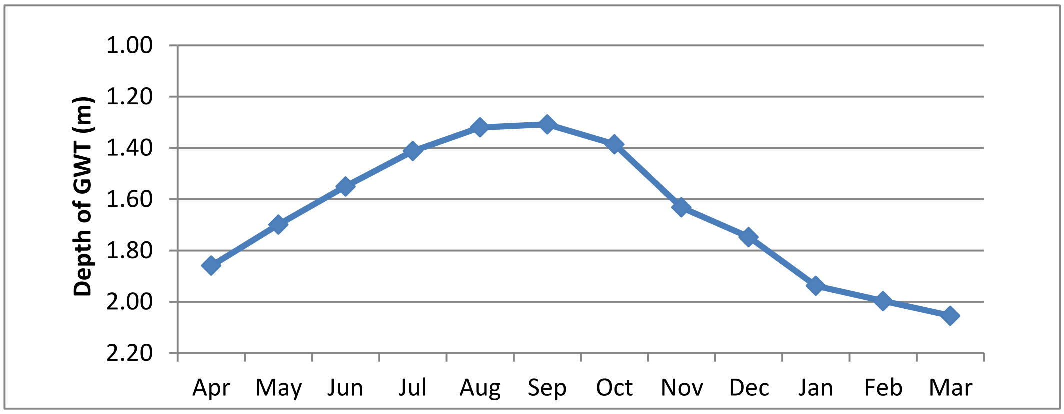


Figure 5.7: Monthly Variations of Average Grond Water Table

5.1.8 Water Resources Issues and functions

Tropical cyclones and Tidal Storm Surge Flooding

346. Cyclones have been hitting the coasts of Bangladesh very frequently in the recent decades. From 1901-1957 only 11 cyclones had hit the coastal areas of Bangladesh, while from 1957 to 2009 a total number of 55 cyclones have hit the area. Therefore, in last 52 years, the number of cyclones hitting coastal areas of Bangladesh has increased 5 times compared to the previous 57 years (BMD).

347. The recent devastating cyclones that hit polder 39/2C wereSidr in 2007 and Aila in 2009. The cyclone Sidr was much more disastrous than the Aila based on the wind speedsrecorded

(ref. Section 5.1.6). The surge entered the polder by overtopping and breachingthe protection embankment of Baleswar River *(Kocha)*. People reported that during cyclone Sidr *Telikhali*, *Nadmulla*, *Daowa* and *Ikri* unions were the worst affected, and more than 100 people lost their lives.

348. In the absence of sluice gates and embankment onthe eastern side along the Pona River, tidal water naturally enters the polder areas and damages crops. The embankment along the Baleswar River is in a vulnerable condition and an estimated 40% of the polder area is under the risk of high tide inundation andcyclonic surges.

Drainage

349. Most of the khals in polder 39/2C run from north to the south(ref. map 5.7). These khals are interconnected by lateral channels running from east to west and draining into the main rivers. The khals are open, i.e. no structures exist in the khals to control tidal inflow, which causes inundation of the low-lying areas of the polder during high tides. In addition to daily inundation by high tides, according to local people, around 12-15% area of the polder are facing drainage problems during the monsoon.

350. However, prolonged water logging is rare inside polder 39/2C with no incidents recorded in the last 10 yrs.

Navigation

351. TheBaleswar (Kocha) Riverto the west and north of Polder 39/2C remains navigable throughout the year. The Pona River to the east and south as well as the internal khals is generally shallow and narrow only suitable for transportation with smaller boats.

Water Use

352. The standard average daily demand of water for domestic and drinking purposes in rural areas isconsidered as 50 liters per capita (lpc) (Ahmed and Rahman, 2010). However, the access to suitable drinking water is poor. During the field survey in the proposed Polder 39/2C, it was found that the average daily domestic use of water is around 30 lpc. This equates to a daily consumption of 3,033 m^3 of water by 1,01,100 people living in the polder. Local people opined that they use tube wellsfor drinking water, while pond water is used for other domestic purposes.

Irrigation Use

353. The farmers in Polder 39/2C cultivate T Aus and some vegetables in the Kharif-I (March-June) season; T Aman in the Kharif-II season (July-October); and Boro, pulses, spices, oils seeds, potato and some winter vegetables in the Rabi (November-February) season. Boro is the main irrigated crop, which is cultivated on about 123 ha and irrigated with surface water using LLPs. Besides, farmers practise supplementaryirrigation of potato and winter vegetables cropsin high and medium-high land areas. Only LLPs are usefor supplementary irrigation. Farmers do not practise supplementary irrigation of T. Aus, T. Aman, pulses, oilseeds and spice crops. The farmers reported they are using about 140 to 180 cm irrigation water in their Boro crop fields and 20-30 cm in winter vegetables, such as Chili and potato crop fields. Using these water requirements, anestimated2.98 Mm^3 ofsurface water is use for irrigation, annually.

5.1.9 Environmental Quality and Pollution

(a) Air Quality

354. The national standards for air quality are given in **Table 5.4.**

Table 5.4: Standards of ambient air quality

Organization	Unit	Concentration of micrograms per meter cube				
		PM_{10}	$PM_{2.5}$	BC in $PM_{2.5}$	SO_2	NO_2
BNAAQS	24h average (µg/m³)	150	65	-	365	-
	Annual (µg/m³)	50	15	-	-	100
WHO	24h average (µg/m³)	50	25	-	-	200 (1h average)
	Annual (µg/m³)	20	10	-	-	40

Source: Bangladesh National Ambient Air Quality Standard

355. **Table 5.5** shows the air quality data measured inside the polder at Bhandaria, under Pirojpur district. The values suggest that except for PM2.5, the concentrations of the measured air quality parameters (PM_{10}, BC in $PM_{2.5}$, SO_2, NO_2) lie within the range of standard values for Bangladesh (refer Table 5.5). The observed $PM_{2.5}$ level is marginally higher than the Bangladesh National Ambient Air Quality Standard. There are numerous diesel vehicles used for internal communication, and fixed chimney brick kilns are in operation as well. Besides, many boats and ferries driven by diesel engines ply on the surrounding rivers, considered to contribute to the 31% of black carbon (BC) of Particulate Matter ($PM_{2.5}$) measured.

Table 5.5: Values of ambient air quality parameters in the project area

Area	Concentration of micrograms per meter cube (24h average)				(µg/m³) (1h average)
	PM_{10}	$PM_{2.5}$	BC in $PM_{2.5}$	SO_2	NO_2
Bhandaria (Polder 39/2C)	82	67.2	20.9	67.4	0.069

Source: Air quality measured by Bangladesh Atomic Energy Commission, November 2015

(b) Water Quality

356. Important water quality parameters (pH, TDS, DO and salinity) were measur during the field investigation in June 2015, from different locations of the polder (**Table 5.6**). The pH values in the inspected surface water samples were higher than neutral scale (pH=7), which means the water in these locations was slightly alkaline, typical for the monsoon season. Values of TDS were found to be low (270ppm) in the Baleshwar (Kocha) river, but higher (364 – 402ppm) in the khals inside the polders. Values of DO were mostly found close to the standards set by DoE for both irrigation (5 to 6 mg/l) and fishing (5 mg/l).

Table 5.6: Surface Water Quality (Wet season)

Location	GPS Reading (Lat-Long)	pH	TDS (ppm)	DO (mg/l)	Salinity (ppt)	Remarks
Podder Khal	22º27'48.3''N 90º02'55.2''E	7.7	400	5.2	0	Inside Proposed polder
Nadmullah khal	22º29'19''N 90º01'11''E	7.2	364	5.6	0	Inside Proposed polder
Baleswar River	22º29'18.8''N 89º59'32.95''E	8	270	6	0	Outside polder
Hetalia Khal	22°29'17"N 89°59'33"E	7.7	402	5.8	0	Inside proposed polder
Bamuner Khal	22°26'6.16"N 89°59'24.13"E	7.5	377	4.9	0	Inside proposed polder
DoE Standard Value (Bangladesh)	**Irrigation**	**7.0-8.5**	**2100**	**5.0**	-	-
	Fishing	**6.7-9.5**		**4.0-6.0**	-	-

Source: Field test by CEGIS, 2015

Table 5.7: Surface Water Quality in Dry Season, 2016

Source of surface water	Location	GPS Reading (Lat-Long)	Water quality parameter				
			pH	TDS (ppm)	DO (mg/L)	Salinity (ppt)	Remarks
Pona River	Nodmullah Kheya ghat	22°29'7.41"N 90° 3'28.22"E	8.2	176	9.9	0	Outside proposed polder
Podder Khal	Purba Dhawa	22°27'47.30"N 90° 2'54.51"E	7.9	206	9.0	0	Inside proposed polder
Nadmullah Khal	Nadmulla	22°29'20.44"N 90° 1'12.14"E	7.7	172	9.4	0	Inside proposed polder
Baleswar River	Charkhali fery ghat	22°29'32.90"N 89°59'30.84"E	7.8	178	9.2	0	Outside proposed polder
Hetalia khal	Hetalia	22°29'8.33"N 89°59'41.57"E	7.6	198	10.5	0	Inside proposed polder
Bamuner khal	Madrasi Bazaar	22°26'3.44"N 89°59'28.65"E	7.7	232	8.5	0	Inside proposed polder
DoE Standard Value (Bangladesh)	**Irrigation**		**7.0-8.5**	**2100**	**5.0**	-	
	Fishing		**6.7-9.5**		**4.0-6.0**	-	

*Source: CEGIS field survey, February 2016; *Salinity in Ground water has found 2 ppt*

357. In addition, surface water quality has measured in dry season (February 2016). **Table 5.7** shows the water quality in dry season of the same parameters of surface water. The pH value is higher than neutral scale (pH=7), which means the water in these locations was alkaline yet. Values of TDS in dry season were found very low in the Baleshwar (Kocha) and Pona Rivers and internal khals which varies from 172 to 232 ppm. Values of DO were Values of DO were mostly found slighty above to the standards set by DoE for both irrigation (5 to 6 mg/l) and fishing (5 mg/l). Salinity of the surface water was not found in this period yet, since rainwater was still present indside the polder and tidal flow of seawater from the Bay of Bengal was yet to intrude. However, local people opined that in dry season, specifically during the month from April to May, concentration of salinity in both ground and surface water found to be moderate to high level.

Water hyacinths were observed on the surface water in the month of February, which is an indicator of freshwater presence.

358. In addition, groundwater quality in the polder area was tested through collection of tube-well water samples. It was observed that most of the water quality parameters are within threshold limit (**Table 5.8**). But higher chloride content, i.e. salinity was found in tube-wellwater samples.

Table 5.8: Ground Water Quality in Polder Area

Sample Location	Date	Ground Water Quality Parameters					
		Temp	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	As (mg/l)
Tube well water of Danishafa UP office, Mothbaria, Pirojpur	01/05/12	25.4	7.56	355	0.78	5	0
Drinking water quality standard as per ECR'97	**-**	**-**	**6.5 – 8.5**	**150 –600**	**0.3 – 1.0**	**10**	**0.05**

Source: EMF Report of CEIP, 2013

(c) Noise Quality

359. A number of suitable sites were selected within the Polder area for noise level measurements, considering some criterion in connection with sound generation (project interventions and other secondary activities) and places which are to be affected by the anomalies in noise level (settlements, schools). The Environmental Conservation Rules 1997, of Department of Environment (DoE), Bangladesh has defined standard noise levels as **50 dB** during daytime for residential area.The Polder area has fallen under the category of residential area and the values of noise levels found within the standard limit. The noise level measured during daytime. The values of noise level (location wise) are shown below:

Sl. No	Location	GPS Reading	Values (dB)	Area Category by ECR ’97
1	Nodmullah Kheya ghat	22°29'7.41"N 90° 3'28.22"E	44.6	Residential area
2	Purba Dhawa	22°27'47.30"N 90° 2'54.51"E	38.8	Residential area
3	Nadmulla	22°29'20.44"N 90° 1'12.14"E	42.3	Residential area
4	Charkhali fery ghat	22°29'32.90"N 89°59'30.84"E	46.8	Residential area
5	Hetalia	22°29'8.33"N 89°59'41.57"E	41.2	Residential area
6	Madrasi Bazaar	22°26'3.44"N 89°59'28.65"E	44.7	Residential area
7	Nodmullah Kheya ghat	22°29'7.41"N 90° 3'28.22"E	43.6	Residential area

Source: CEGIS field survey, February 2016

(d) Soil Quality

360. Soil samples were collected from inside the polder area at East Dhawa (22°27’'51.0"N, 90°03'0.0"E), Paschim Pashurbunia (22°26’26.0’’N, 89°59'27.0"E) and Ikri (22°25’'8.25"N, 89°28'46.1"E) on 21st and 22nd June 2015 for analysing chemical properties. The existing cropping pattern is Fallow-Lt.Aman-Fallow at the soil sampling locations. The samples were collected from top soil (depth: 0-15 cm from surface) and analyzed for Electrical Conductivity

(EC), Soil Reaction (PH), Organic Matter (OM), Nitrogen (N), Potassium (K), Phosphorus (P), Sulphur(S) and Zinc (Zn) by the SRDI, Dhaka and pesticides residues (Carbofurane) by the Entomology Division, BARI, Gazipur.

361. The resultsshowedthat organic matter content is very low to low. Soils are deficient in N and P but the status of S is high to very high and the status of K and Zn are reasonable. The soil was found to be slightly saline. However, according to SRDI information (SRDI, 2010), about 58% of the NCA is non-saline to very slightly saline and 42% of the NCA is generally strongly saline, however with some moderately saline areas. The p^H range variedfrom 7.4-7.8 among the soil sampling sites. Soil quality test result, methods and location is present in Table 5.9. The standard of the physico-chemical properties of the soil are provided in Appendix-3.

Table 5.9: Chemical Properties of Soil on Agriculture Land

Parameters	Unit	East Dhawa	Paschim Pashurbunia	Ikri	Method
EC	ds/m	2.30	5.58	1.11	Glass Electrode
PH	-	7.8	7.8	7.3	Glass Electrode
OM	%	0.48	1.36	1.0	Wet Oxidation
N	%	0.03	0.08	0.06	Kjeldahl distillation
K	meq/100g m	0.14	0.21	0.19	Olsen/ Bray and Kurtz
P	µg/g	5.12	6.68	6.15	NH4OAc
S	µg/g	30.56	134.00	37.95	CaH2PO4 Extracting
Zn	µg/g	1.13	1.01	0.20	DTPA Extraction
Carbofurane	ppm				Thermo Electron & Pekin Elmer

Source: CEGIS (Test from SRDI and BARI laboratory), August 2015

5.2 Biological Environment

The study area supports different type of habitat with different species of flora and fauna. Ecosystems of the study area can be divided into major categories: terrestrial ecosystem, mangrove ecosystem and aquatic ecosystem. The study was carried out under line transect walk literature review, and peoples' interviews to survey both on flora and fauna. A detail on methodology is presented in the section 2.2.4.

5.2.1 Bio-ecological Zone

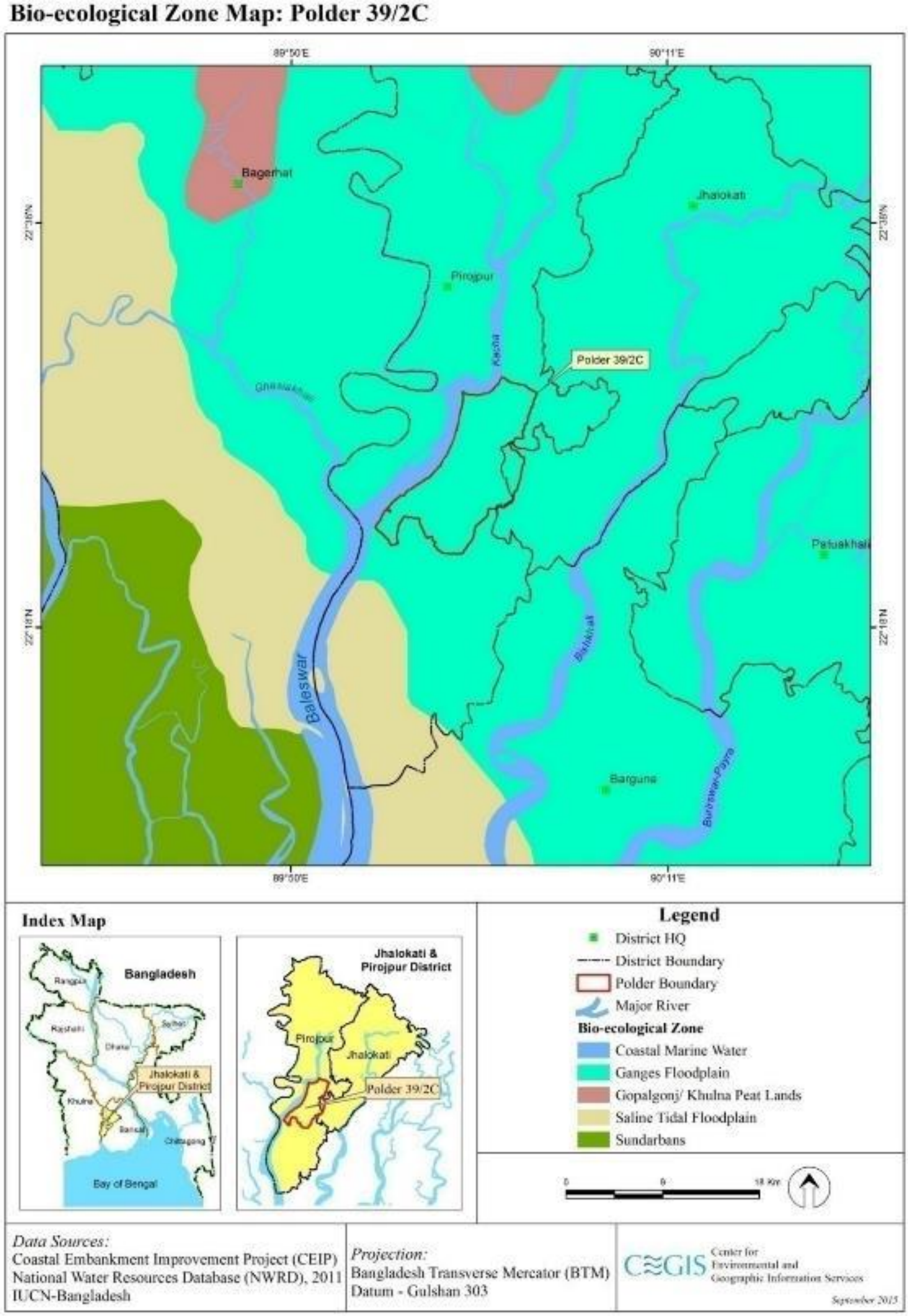
362. According to the physiography, ecosystem features and species diversity, IUCN Bangladesh have identified Polder 39/2C to belong to the bio-ecological zone of the Ganges Flood Plain (**Map 5.8**).

5.2.2 Ecosystems

363. The Polder area (both directly and indirectly impacted area) occupies terrestrial as well as aquatic ecosystems. The project area supported different type of habitat with many species of flora and fauna including other wildlife species. The Polder area is near the Katcha River (**Map 5.8**) where globally and locallyendangered shore birds wereobserved. The project area supports two types of ecosystem with flora and fauna. They are-

- Terrestrial Ecosystem
- Aquatic Ecosystem

364. The biological brief of these ecosystem locations are present in **Map 5.8**.



Map 5.8: Location of bio-ecological features of the Polder 39/2C

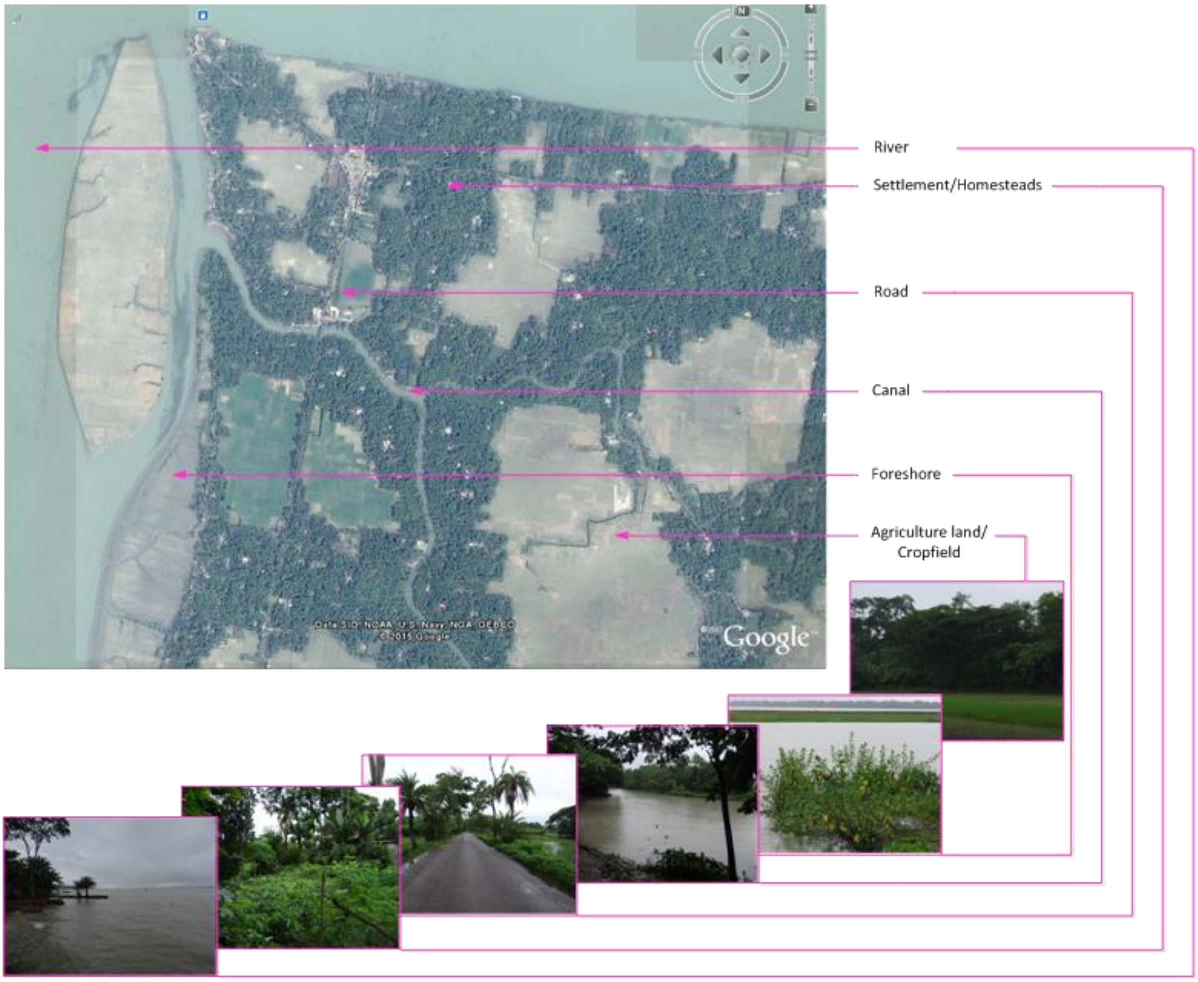


Figure 5.8: Ecosystem Diversity of the Polder

Terrestrial ecosystems

365. The major divisions found within the terrestrial ecosystems of the polder area are i) Agricultural land, ii) Settlement/ homestead vegetation, iii) Embankment and roadside vegetation, and iv) woodlands. The terrestrial ecosystem can divide into two categories: 1) Natural vegetation and 2) Human influenced vegetation. Natural vegetation includes wooded areas (commercial timber plantation), grassland and other natural habitats. Human influenced vegetation includes homestead gardens, plantation, cropland and cultivated habitat. Homestead is the major type of terrestrial ecosystem in terms of biological productivity and wildlife habitats. List of available tree species in the polder are given in the following table 5.10.

Table 5.10: Available trees species (Settlement, agriculture land, embankment) within the polder area

Tree species name	Family name	Local Status	Habit	Utilization	Ecological Value
Supari (Areca catechu)	Palmae	VC	Monocot	Fruit and Thatching	3
Narikel (Cocos nucifera)	Palmae	VC	Tall monocot	Fruit and Thatching	1,2
Khejur (Phoneix sylvestirs)	Palmae	VC	Monocot	Fruit	1,2
Tal (Boassus flabelifer)	Palmae	VC	Tall monocot	Fruit and thatching	1,2
Bash (Bamboosa sp.)	Gramineae	C	CL	Thatching	1,2,3
Babla (Acacia nilotica)	Fabaceae	VC	T	Timber, fuel wood and fruit	1,2,3
Neem (Azadirachta indica)	Meliaceae	VC	T	Timber and fuel wood	2
Sirish(Albizia lebbeck)	Leguminosae	VC	T	Timber and fuel wood	2
Mahogany (Swietenia mahagoni)	Meliaceae	VC	T	Timber and medicine	2
Raintree (Albizia saman)	Leguminosae	VC	T	Timber and fuel wood	2
Akashmoni (Acacia auriculiformis)	Mimosaceae	VC	T	Timber and fuel wood	3
Bot(Ficus benghalensis)	Moraceae	C	T	Timber	1,2,3
Safeda(Manilkara zapota)	Zapotaceae	VC	T	Fruit	1
Khoiya Babla (Pithocelobium dulci)	Fabaceae	C	T	Fruit and Fuel wood	1,2
Tetul (Temarindus indica)	Leguminosae	VC	T	Timber and Fruit	2
Payra(Psitium guajava)	Myrtaceae	VC	T	Fruit	2
Aam(Mangifera indica)	Anacardiaceae	C	T	Fruit and timber	1,2
Jam (Syzygium sp)	Myrtaceae	C	T	Fruit and timber	1,2
Kola (Musa sp)	Musaceae	C	H	Fruit	1,2,3
Kanthal (Artocarpus heterophyllus)	Moraceae	O	T	Timber and fruit	1,2
Jiga (Lennea coromandelica)	Anacardiaceae	VC	S	Fencing	2,3

Source: CEGIS Field Survey,
Note: Local Stratus: C= Common, VC = Very Common, O = Occasionally, R= Rare
Habit: T= tree, H= Herb, S= Shrub, V=Vine; VC= Very Common, C= Common,
UC= Uncommon, CL=Clump
Ecological Value: 1 = For Wildlife, 2 = For Avifauna, 3 = For micro-Ecosystems
Source: CEGIS field survey,(Note: Abundance Code, H= High, M= Medium, L= Low)

Aquatic Ecosystems

366. Aquatic habitats area includes external rivers, internal channels and homestead ponds. Wetlands provide necessary nutrients to the entire ecosystem. Seasonal wetlands are mainly floodplains, which are inundated in the monsoon. Moreover, nearby seasonal aquatic ecosystems are abounded not only with numerous aquatic flora but also with many aquatic wildlife species including birds, fish amphibians and reptiles. Aquatic ecosystems of this polder may be classified into following major categories:

- The surrounding rivers
- Internal canals
- Homestead's ponds and ditches
- River foreshore.

367. The surrounding riversare the mainstreams of aquatic life form that carry regular tidal flow and distribute its influence inside the polder through internal canals and tributaries. Homestead ponds are normally usefor domestic purposes. Ditches exist between settlement and crop fields, which bear comparatively high diversity of plant population. Internal canals possess luxurious growth of dense marginal vegetation. All major canals are connected with surrounding tidal rivers. River foreshore is confinedand difficult to distinct from the homesteads and the rivers.

368. The commo*n aquati*c floral species obs*erved frequently wit*hin the polder area.Available species are given in the following table 5.11*.*

Table 5.11 List of available species in the wetlands of the polder area

Local/English Name	Scientific Name	Abundance
Kochu	*Colocasia esculenta*	M
Kochuripana	*Eichhornia crassipes*	H
Kutipana	*Azolla pinnata*	H
Dhol Kolmi	*Ipomoea aquatica*	H
Helencha	*Enhyra flactuans*	M
Khudipana	*Lemna perpusilla*	H
Topapana	*Pistia stratiotes*	H
Chaila gash	*Hemarthria protensa*	H
Golpata	*Nypa fruticans*	H
Fern	*Lindsaea ensifolia*	M
Hogla	*Typha elephantalis*	H
Shapla	*Nymphaea stellata*	M
Poddo	*Nymphaea nouchali*	M
Kuripana	*Salvina cucullata*	H

Sources: CEGIS Field Survey, June 20. Note: Abundance Code, H= High, M= Medium, L= Low

5.2.3 Importance of polderization for the existing ecosystems and occurrence of indicator species

369. Peripheral embankments of the polder protects against tital flooding, saline water intrusion and the sluices act as drainage controller. The land of the polder supports different types of ecosystems. Homesteads and cropfields are dominated by fresh water loving plant species whereas khal banks and river foreshores are dominated by saline water loving mangrove plant species. Hargoza (Acanthus illicifolius), Kewra (Sonneratiaappetala), and Ora (Sonneratiacaseolaris) indicate the saline water conditions and soil salinity of khal banks and foreshore areas of the polder. Existence of these plants inside the polder area is an indication of soil and water salinity. On the other hand, fresh water shells (bivalves) indicate a fresh water

environment and are found in most of the homestead ponds and stagnant parts of the khals inside the polder. Bivalve species are sensitive to water salinity. So, any significant change of these plant and animal population indicates a change of water salinity due to malfunctioning of water control structures like sluices.

5.2.4 Wildlife

370. Zoo-geographically Bangladesh lies in the Oriental region sharing biodiversity of both the Indo-China and Malayan sub-regions. The coastal zone contains several ecosystems that have potential conservation values. These ecosystems are not only biodiversity hotspots, but they also provide the ecological foundations for common property resources. The wildlife species within the project area generally classified as amphibians, reptiles, birds and mammals. Available species of mammals, birds, reptiles and amphibian in the polder are given in the following table 5.12

Table 5.12: List of terrestrial fauna of the polder area

Types of Species	Name (generic name)	Habitat
Mammals	House Rat (*Rattus rattus*), Field Mouse (*Mus booduga*), Asian House Shrew (*Suncus murinus*), Indian Flying Fox (*Pteropus gangeticus*) House Mouse (Mus musculus), Mongoose (Herpestes edwardsii), Indian Flying Fox (Pteropus giganteus), Jackal (Canis aureus) and Large Indian Civet (Viverra zibetha). **Gangetic River Dolphins** (Platanista gangetica), **Common Otter** (Lutra lutra)	Mostly in bamboo thickets, cropped fields or barren land, bushy areas.
Birds	Indian Pond Heron, Little Egret Cinnamon Bittern, Cotton Pigmy Goose, Little cormorant, White-breasted Water Hen, Common Kingfisher, Lesser Whistling Duck, and Bronzed-winged Jacana, Brahminy Kite, and Pied Kingfisher, etc. Common terrestrial bird species found within the area are Common Myna, Pied Starling; Redvented Bulbul, Asian Magpie Robin, Green Bee-eater, Jungle Crow, House Crow, Common Tailor Bird, and House Sparrow etc.	Terrestrial birds habitat can be divided into two major groups: birds observed in floodplains and wetland, and birds observed in dry habitat such as homestead, open woodland, scrub and grass land.
Reptiles	The reptile species areHouse Gecko (Hamidactylus flaviviridis), Common Garden Lizard (Calotes versicolor), Little Skink (Mabuya macularia), Bengal Monitor (Varanus bengalensis), Checkered Keelback (Xenochropis piscator), Striped Keelback (Amphiesma stolata) were found frequently during the survey. Terrestrial snakes' are found within the Polder area is Indian Rat Snake, Monocled Cobra, Banded Krait, etc. Indian roofed turtle (Pangshura tecta)is common but threatened by illegal tradeandMedian Roofed Turtle (Pangshura tentoria) and Brown Roofed Turtle (Pangshura smithii) are rare.	Habitats belongs to these species are homestead, cropland and garden vicinity.
Amphibians	Bullfrog (*Hoplobatrachus trigerinus*), Indian Pond Frog (*Euphlyctis hexadactylus*) Skipper Frog Common Toad *(Duttaphrynusmelanostictus)*. Asian Brown Tree Frog *(Polypedates leucomystax)*	Wetland areas and the dried areas

Source: Field visit & Local people interview, June, 2015

Table 12-a: List of Major Faunal species in Polder area and their status

Class	Common Name	Local Status	IUCN-Bangladesh Status (2015)	CITES (2016) Appendix
Amphibia	Common Toad	VC	-	-
	Bullfrog	C	-	-
	Cricket Frog	C	LC	-
	Green Frog	O		II
Reptilia	House Lizard	C	-	-
	Common Garden Lizard	C	-	-
	Brahminy Skink	UC	LC	-
	Brahminy Turtle	VR	EN	-
	Monocellate Cobra	R	VU	-
	Binocellate Cobra	R	EN	
	Common Smooth Water-snake	UC	LC	-
	Brahminy River Turtle	Rare	EN	-
	Common Roof Turtle	R	EN	
	Bengal Monitor	O	VU	I
	Rat Snake	C	-	II
Aves	Black Drongo	VC	-	-
	Common Myna	C	-	-
	Red-vented Bulbul	C	-	-
	Asian Pied Starling	C	-	-
	Common Tailorbird	C	-	-
	Oriental Magpie Robin	VC	-	-
	House Sparrow	C	-	-
Mammalia	House Mouse	C	-	-
	Common Mongoose	UC	LC	III
	Jackal	C	LC	III
	Jungle Cat	UC	NT	-
	Indian Flying Fox	C	LC	-

Note: Local Status: VC-very common, C-common, UC-Uncommon; VR-Very Rare,

IUCN-Bangladesh Status: LC-Least Concer, NT- Near threatened, EN-Endangered, VU-Vulnerable

5.2.5 Fish Habitats

371. The fish habitats are primarily classified under two broad categories, capture fishery and culture fishery. Internal khals as well as floodplains are considered as capture fish habitats. The culture fish habitats are of two types: Homestead fishponds and commercial fishponds. Internal Khal fish habitats occupyabout51% of the total fish habitat of the polder area. Floodplains occupy 35%, while commercial fishponds and homestead fishponds occupy 2% and 12% respectively (**Figure 5.9**).

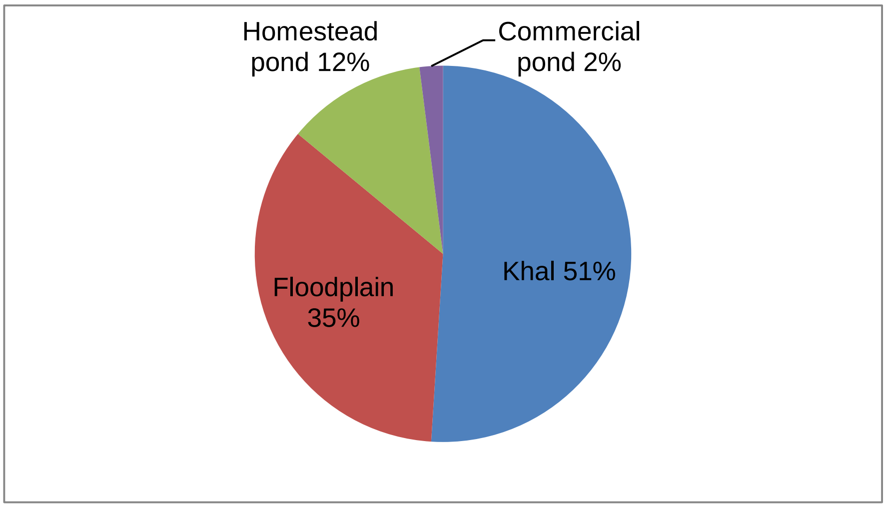


Figure 5.9: Fish habitats in the Polder area

372. The estimated open water fish habitat of the polder area is 716 ha which includes the khals and floodplains as shown in the following **Table 5.10**.

Table 5.10: Fish Habitat Status of the Study Area

Sl.	Fisheries Category	Habitat Types	Area (Ha)	% of Habitat
1	Capture	Khal	426	41
2		Floodplain	290	48
		Sub-total	***716***	***89***
3	Culture	Homestead pond	91	9
4		Commercial pond	15	2
		Sub-total	***114***	***11***
		Grand Total	**830**	**100**

Source: Data extracted from draft final of fishery report, Volume-II, CEIP, 2012 and Image analysis, 2015

373. The polder area consists of a number of seasonal and perennial internal canals/khals, among which *Nadmulla khal, Bamoner khal, Hetalia khal,* etc. are important. During field visits, it was observ that the average depth of the internal khals is 1.5-2.5 m, which is sufficient for fish habitation. The depth of the seasonal canals of the polder area is insufficient for sheltering fish juveniles. Local people reported that the siltation rate in the internal fish habitats of the polder is 2-3 cm per year. Khal beds are silt up due to deposition of loose soil coming from agriculture field and sediments brought in by tidal action.

374. The culture fish habitats in the polder are the ponds, which classified as homestead and commercial ponds. The estimated area covered by culture ponds is 114 ha (Table 5.10). About half of these ponds are non-commercial and traditional in nature. Examples of nature of ponds shown in Picture 5.4. Aquaculture practice is expanding slowly– constrained by overtopping of fishponds and resultant intrusion of saline water. Nevertheless, various types of fish culture systems are practiced by the local people including mono-, poly-, and mix-culture. Poly-culture practice is exclusively adopted by the local people.


Picture 5.4: Culture fish habitats inside the polder area

Water Quality of Fish Habitats

375. The parameters of surface water quality of the Periphery Rivers and khals have been measured and compared with the fish habitat suitability standards and are presented in **Table 5.11**. From the measured data, it is observe that all water quality parameters are within the permissible limit for fisheries resources. The salinity in water bodies (both internal and river) was found nil.

Table 5.11: Water Quality Parameters of Different Water Bodies in the Polder Area

Water bodies	Parameters				
	Temp(ºC)	pH	DO(mg/l)	TDS(ppm)	Salinity(ppt)
Baleswar (Kocha) River	28	8	6.0	270	Nil
Internal khal (Nudmulla khal)	29	7.2	5.6	364	Nil
Standard values for fish	(28-34)**	(6.5-8.5)*	4.0-6.0*	1000*	(0-4) for prawn and (5 -35) for shrimp**

*Source - *M A Mazid 2002 ** Jack M. et al, 2002 (Water quality measured in last June, 2015)*

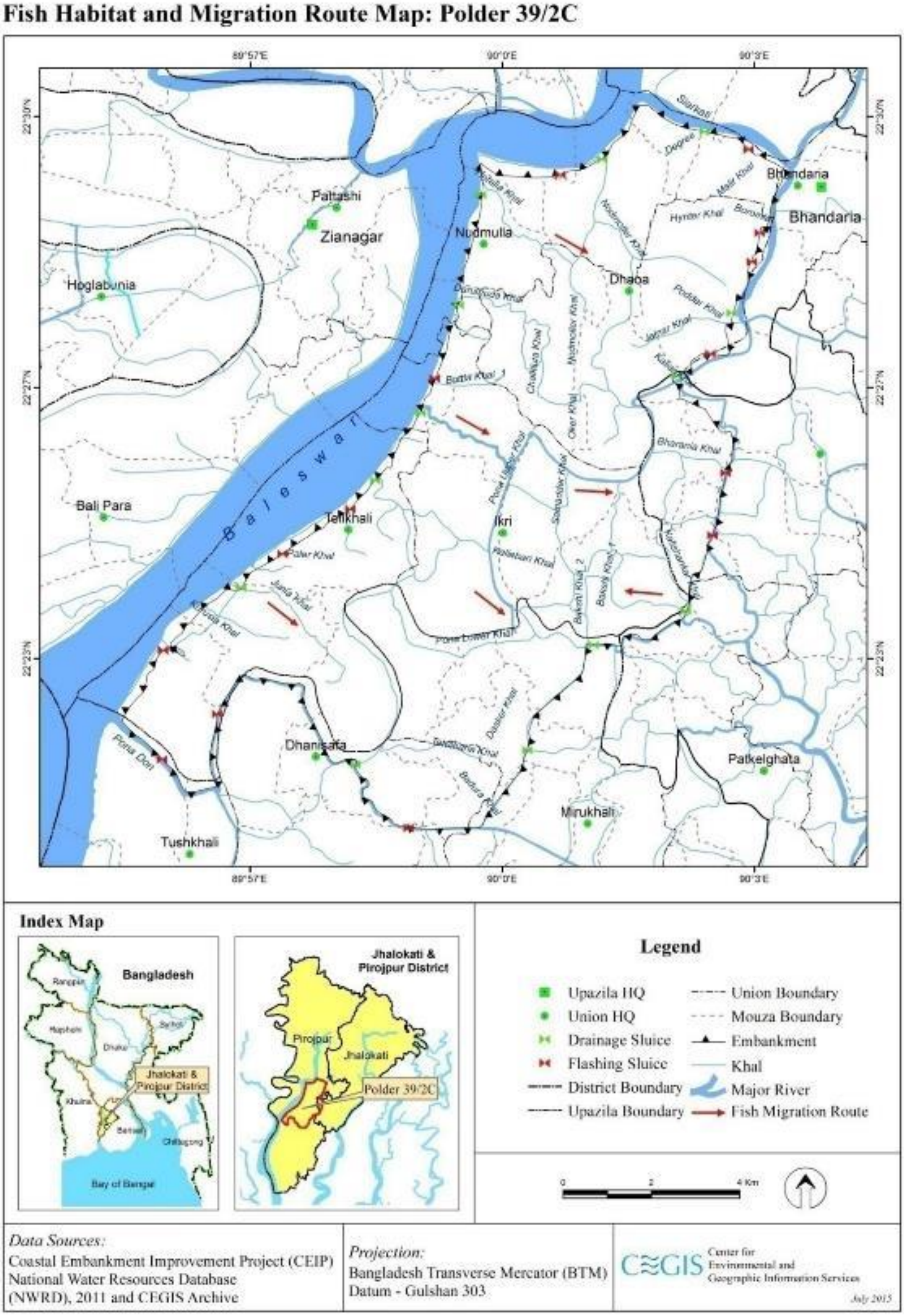
Aquatic Vegetation

376. Aquatic plants or vegetation plays an important role in function of the aquatic ecosystem. They provide important habitats for small animals like aquatic insects, snails and freshwater shrimps, which in turn supply food for fish and waterfowl. Moreover, different types of hydrophytes like emergent, submerged and floating with leaves are used as spawning ground of fish, insects and crustaceans. In the wetlands, some fishes lay eggs in the body of plants. Besides, some fish live on the rotten part of the aquatic plants (Khondker, 2004). During field visit, it is observedethat water bodies in the polder area contain plenty of aquatic floras, such as free floating, submerged, sedges and meadows. Free-floating plants especially duckweed are common in the khals and

floodplains within the polder area. The presence of duckweed has created a congenial environment for habitation of snakehead (*Taki, Shol, Cheng, and Shing*) and benthic fishes (mud eels).

5.2.6 Fish Migration and Movement

377. The main route of migration of natural fish and shrimp is the Kocha River is connected with different khals. It is reported that feeding and spawning migration of riverine and polder area resident fish species occur through open khals to some extent during the period of late June to August. Perennial khals such as Nadmulla khal, Hetalia khal, and Bamoner khal along with other seasonal internal khals are used as feeding, breeding,spawning and nursing ground of most of the open water fishes (Map 5.9). Fish species like Parsa, Bhetki, Horina Chingri, Khorsula, and ChatkaChingri, Boal, Ayre, Tengra migrate horizontally to these water bodies as part of their life cycle.



Map 5.9: Fish Migration Route in the Polder Area

5.2.7 Fish Biodiversity

378. The fish biodiversity in the polder area is moderate although the biodiversity has the declining trend over the years. The causes of gradual decline in fish abundance and biodiversity are morphological changes of internal khals, siltation of fish habitats, squeezing of spawning and feeding grounds,and overfishing. The Polder area comprises an assemblage of both fresh and brackish water fish species (**Picture 5.5**). The available fish species are *Bagda* and *Golda Chingri, Horina Chingri, Baila, Tengra, Paisa, Vetki, Tit Punti Tengra, Shol, Taki, Shing, Baim*, etc. (**Table 5.12**).


Picture 5.5: Major Fishes Occupying the Catch Composition of Polder Area

Table 5.12: Avaulable Fish Species Diversity of Different Fish Habitats in the Polder Area

Scientific Name	Local Name	Habitat Type			
		River	Khal	Floodplain	Fish pond
Brackish water fish species					
Penaeaus monodon	Bagda	M	M	NA	NA
Metapenaeaus monocerus	Harina Chingri	M	M	NA	NA
Leander styliferus	Gura chingri	M	M	NA	NA
Acentrogobius cyanomos	Nuna Baila	H	L	NA	NA
Pama pama	Poa	H	M	NA	NA
Mugil corsula	Kholla/Bata	H	L	NA	NA
Lates calcarifer	Vetki	M	NA	NA	NA
Liza persia	Pairsa	H	L	NA	NA
Polynemus paradiseus	Taposhi	M	NA	NA	NA
Hilsa hilsa	Hilsa	M	NA	NA	NA
Fresh water fish species					
Sperata aor	Ayre	M	L	NA	NA
Mystus vitatus	Tengra	H	H	L	L
Mystus cavasius	Gulsa	P	P		A
Macrobrachium rosenbergii	Golda	M	L	NA	L
Glossogobius giuris	Baila	H	H	L	NA
Aila puntata	Baspata	M	NA	NA	NA
Channa straitus	Shol	NA	M	H	NA
Channa punctatus	Taki	NA	M	H	NA
Puntius ticto	Tit punti	L	M	H	NA
Anabas testudinius	Koi	NA	L	H	NA
Heterpnestis fossilis	Shing	NA	L	H	NA
Mastacembelus spp.	Boro baim	NA	L	H	NA

Scientific Name	Local Name	Habitat Type			
		River	Khal	Floodplain	Fish pond
Mastacembelus pancalus	Chirka baim	NA	L	H	NA
Culture fish species					
Sarotheradon nilotica	Nilotica	NA	NA	NA	H
Telapia mossambica	Telapia	NA	NA	NA	H
Ctenopharyngodon idella	Grass carp	NA	NA	NA	M
Puntius sarana	China punti	NA	NA	NA	H
Labeo rohita	Rui	L	NA	L	M
Catla catla	Catla	L	NA	L	M
Cirrhinus mrigala	Mrigal	L	NA	NA	L
Hypophthalmichthys molitrix	Silver carp	NA	NA	NA	H

Note: Abundance Code: H= High; M= Medium; L= Low; NA= Not available
Source: Feasibility report of CEIP and field survey, 2012 and Field Survey, 2015

Indicative Species

379. **Indicative fish species–**Brackish water fish species like Bhetki, Pairsa Bagda, Horinachingri, Nuna baila, etc are reported as an indicator fish species which prefer brackish to moderate saline water. On the other hand Taki, Shol, Cheng, Koi, Shing, Puti, etc., are common fresh water fishes which is very sensitive to saline water.

5.2.8 Threatened Fish Species

380. Threatened fish species, which are locally rare and unavailable for the last 10 years as reported by the local fishermen and concerned elderly people, are given in **Table 5.13**. The reason of threatened fish species in the polder area are agrochemicals and pesticides coming from paddy fields, decline of water depth, obstruction of fish migration route, destruction of fish breeding and spawning grounds, etc.

Table 5.13: List of Threatened Fish Species

Scientific Name	Local Name	Local Status		
		Rare	Unavailable	Locally Extinct
Notopterus chitala	Chital	√		
Nandus nandus	Veda/Mani	√		
Clarius batrachus	Magur	√		
Acanthopagrus latus	Datina		√	
Channa marulius	Gojar		√	
Puntius sarana	Sarputi			√

Source: Field Survey, 2015

5.3 Human and Economic Development

5.3.1 Fish Production

381. Total fish production of the polder area is about272 tons of which about 51% comes from capture fisheries while 49% from culture fisheries (Table 5.14) The production from different capture fisheries habitats is comparatively low, see **Table 5.14**. Currently, the fish production trend from capture fisheries is declining in the polder area due to silting up of internal khals and indiscriminate fishing activities.

Table 5.14: Fish Production from Different Habitats of the Polder Area

	Fisheries Category	Habitat Types	Total production (MT)
1	Capture	Khal	63
		Floodplain	77
		Sub-total	***140***
2	Culture	Homestead pond	90
3		Commercial pond	42
		Sub-total	*132*
		Grand Total	**272**

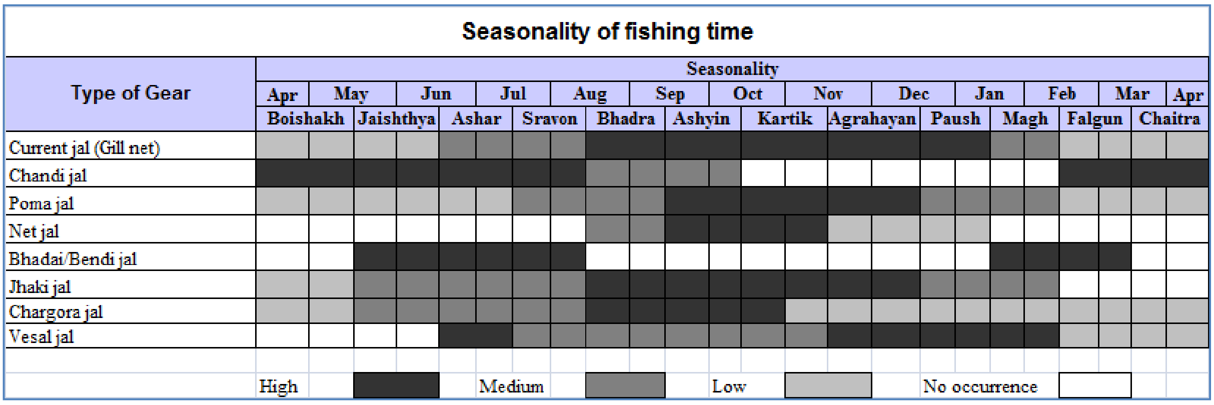
Source: Feasibility report (Draft final of fishery report, Volume-II,) CEIP, 2012 and Field Survey, 2015

5.3.2 Fishing Effort

382. During field investigation and consultations with the local people, it is reported that about 10% of the fisher's households are engaged in commercial fishing while about 35% of fisher's households are involved in part time fishing, 45% of fisher's households are in subsistence level fishing in and around the habitats of the polder area. Fishers mostly come from the Muslim (98%) and rest (2%) from Hindu caste. They usually catch fish in the nearby tidal floodplains, rivers and khals. The main fisheries occupations of the polder area are fishers, fish traders and fish farmers.

383. Fishing in seasonal canals as well as in peripheral rivers starts in May and continues up to March. The rest of the time fishermen are mainly engaged in other fishing. Mono-filament Gill net (Current jal) fishing is the major fishery in the study area. Next to seine Chandi jal, Poma jal, Net jal, Jhaki jal, Chargora jal, Vesal jal fishing is prominent in the polder areafish habitats. The seasonality of major fishery is furnished in the **Table 5.15**.

Table 5.15: Fishing Seasonality of the Polder Area



Source: Field Survey, 2015

384. The commercial fishermen of the polder area catch fish in the khals and in the peripheral rivers by using Engine boat, Jala Nauka, Kousha and Dingi fishing boats.

Picture 5.6: Common Fishing Boat (Kousah nouka) in the Polder Area

385. Eight different types of nets/gears are use for fishing in the polder area. (a) Mono filament net, locally known as Current jal is used to catch *Poa, Ghagla, Chingri, Tengra*, and*Gulsha*, along with other estuarine fish as well; (b) Lift net, locally known as Vesal jal is used to catch *Punti, Tengra, Gulsha, Bailla, Guchi, Bata, Chingri*, etc. (c) Cast net, locally known as Jhaki jal is used to catch *Rui, Katla, Puti, Pua, Bagda, Golda, Phasa*, etc. (d) Drag net locally known as Net jal is used to catch post larvae of shrimp and prawn; (e) Badha jal, is used to catch *Baila, Chingri, Punti, Tengra, Gulsha* as well as other all types of small fishes; (g) Chandi jal is used to catch *Ilish*; (h) Poma jal is used to catch *Poa*; (i) Chargora jal is used to catch *Tengra, Gulsha, Bailla, Punti* along with all small fishes. Around 20% of fishermen have fishing boats and around 70% fishers have fishing gears/nets. Traditional fishing gears of the polder area are cast net (Jhaki jal), drag net (net jal), lining (Borshi), fishing traps (Aton), etc. (**Picture 5.7)**.

Picture 5.7: Different Types of Fishing Gears of the Polder Area

5.3.3 Fish Marketing and Post-Harvest Facilities

386. The fish marketing system in the polder area is not much developed. Local fishers sell the bulk of their catch either directly to the local fish market (*Chinguria Bazaar, Darulhuda Bazaar, Nadmulla Bazaar, Bothla Bazaar, Banai Bazaar, Telikhali Bazaar, Ikri Bazaar, Shafa Bazaar*, etc.) or to fish traders or buyers (*Bapari*) coming from *Patuakhali, Bagerhat*, etc.

387. No structured fish landing centers found in the area. Ice from ice plants is use for icing the harvested fish. No fish storage facility is available. For temporary fish storage, about 20 depots are reported inside the polder area. Transportation facilities at root level are moderately developed. There is no private/ Govt. hatchery inside the polder area. Availability of fish feeds for culture ponds are insufficient. Fish seeds for culture fishery are collected from the fish hatcheries and nurseries, which are situated inBagerhat and Khulna districts. Fish feeds are collect from the fish feed mills at *Patuakhali, Bagerhat*and other places. Qualities of fish feeds are of immense threat for the fish farmers as the growth of fishes are retarddue to this phenomenon.

388. Tidal floods as well as riverine floods sometimes washes away the aquaculture ponds, damages the pond dykes, aggrades the pond beds and causes loss to the pond owner as fishes escape from the ponds. This occurs in every three to four years. The magnitude of fish loss from the aquaculture ponds ranges from 75% to 80%. Tidal floods also cause sand carpeting on the khals and thus make themless suitable for fish habitation. In addition, the lack of fish landing centers also causes wastage of fish.

5.3.4 Fisheries Management

389. There is no community-based fishermen’s association in the polder area. But there is a government registered *Matshya Somiti* that is located at Charkhali Ghat. The roles of Somiti are to organize the fishermen, collect fund for the fishers’ welfare, to remove their internal collusion and to protect them from robbers. Fishing rights on the existing fish habitats are ofsignificance, particularly related to common resources. Department of Fisheries (DoF) has limited initiatives (observe fishing ban and training on aquaculture, etc.) for fisheries resource conservation and management in this region. Some NGOs are working, but their activities are largely limited to aquaculture training. Enforcement of fisheries regulations is also weak.

5.3.5 Agriculture Practices

390. Agricultural farming practices within most of the Polder area have adjusted to the agro-climatic conditions prevailing in the Kharif (March-October) and the Rabi (November-February) seasons. The crop year starts from the Kharif-I season characterized by high temperature, high evaporation, low humidity and low rainfall. S. Vegetables, T. Aus (Local) and T. Aus (HYV) are grown in this season. High rainfalls, lower temperatures, high humidity, low solar radiation and high floods that recede towards the end of the season, characterize the Kharif-II season. T-Aman (Local) and T. Aman (HYV) crops are grown in this season. The Rabi season is characterized by low temperatures, high solar radiation, low evaporation, insignificant rainfalls and low humidity. A wide range of crop varieties such as W. Vegetables, Spices, Potato, Chilli, Wheat, Pulses, Oil seeds and Boro (HYV) crops area grown in these seasons. Sugarcane and Orchard are perennial crops in this polder area. Some occasional overlapping occurs in the polder area. Such as Kharif-I crops (S. Vegetables, T. Aus) are harvested in Kharif-II season, Kharif-II crops (T. Aman) are harvest in the Rabi season and Rabi crops (W. Vegetables, Spices, Potato, Chilli, Wheat, Pulses, Oil seeds and Boro) are harvested in Kharif-I season.

391. The farming practices in Polder 39/2C is complicated due to physical, biological, climatological and socioeconomic factors. The siltation in rivers and channels cause drainage congestion/ water logging during monsoon. Natural calamities like cyclone and surge cause devastating crop damages. Scarcity of fresh water for irrigation during the dry season is also responsible for the non-expansion of the agriculture farming practices. On the other hand, saline surface water creates very favourable environment for brackish water fish culture. The environment of polder 39/2C is also suitable for fish cum paddy cultivation.

5.3.6 Present Cropping Pattern and Intensity

392. The present cropping pattern of the Polder area is Fallow-T Aman (Local)-Fallow, which is practice in 33% of the NCA. T. Aus (HYV)-T. Aman (Local)-Fallow covers 19% of the NCA while Fallow- T. Aman (HYV)-Fallow covering about 15% of the NCA. The cropping intensity of the Polder area is about 149%. Detailed cropping patterns by land type are presented in **Table 5.16**. Picture 5.5 and 5.6 are thetypical examples of paddy fields and orchards in polder 39/2C.

Table 5.16: Present Cropping Pattern by Land Type in Polder 39/2C

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	Area (ha)	% of NCA
Highland	Sugarcane	Sugarcane	Sugarcane	10	0.1
	Orchard	Orchard	Orchard	65	0.8
	S. Vegetables	T. Aman (HYV)	Chili	135	1.6
	T. Aus (Local)	T. Aman (Local)	Potato	47	0.6
	T. Aus (Local)	Fallow	W. Vegetables	228	2.7
	T. Aus (HYV)	T. Aman (Local)	Oilseeds	100	1.2
	T. Aus (HYV)	T. Aman (Local)	Fallow	1,060	12.0
	T. Aus (HYV)	T. Aman (HYV)	Fallow	450	5.0
	T. Aus (Local)	Fallow	Potato	49	0.6
			Sub-total	**2,145**	**24.6**
Medium Highland	T. Aus (HYV)	T. Aman (Local)	Fallow	1,616	19
	T. Aus (HYV)	T. Aman (HYV)	Spices	93	1.09
	Fallow	T. Aman (HYV)	Fallow	1,267	15
	Fallow	T. Aman (Local)	Fallow	2,780	33
			Sub-total	**5,756**	**68**
Medium lowland	Fallow	Fallow	Boro (HYV)	123	1.4
	Fallow	Fallow	Oilseeds	150	2
	Fallow	Fallow	Pulses	327	4
			Sub-total	**600**	**7.4**
			Total	**8,500**	**100**
			Cropping Intensity (%)	**149%**	

Source: Feasibility report (Agriculture), CEIP, 2012 and Field visit, June, 2015

Picture 5.8: View of HYV Aus field in the Polder Area

Picture 5.9: View of Orchard in the Polder Area

5.3.7 Cropped Area and Production

393. The detailed cropped areas, yield rates and crop production is presented in Table 5.17. The total cropped area is 12,650 ha of which rice occupies 11,310 ha and non-rice crops cover the rest 1,340 ha. The rice and non-rice cropped area are 89% and 11% of the total cropped area respectively. Among the rice crops, T. Aus (Local), T. Aus (HYV), T. Aman (Local), T. Aman (HYV) and Boro (HYV/Hybrid) are grown about 3%, 29%, 50%, 17% and 1% respectively of total rice area within the Polder.

394. Total crop production is 31,650 metric tons of which rice production is 23,000 metric tons (Table 5.9) and non-rice production is 8,650 metric tons. Among the rice crops the contributions of T. Aus (Local), T. Aus (HYV), T. Aman (Local), T. Aman (HYV) and Boro (HYV) are about 2%, 39%, 37%, 21% and 1% respectively.

Table 5.17: Present Cropped Area, Yield and Production of the Polder Area

Present crop grown	Present crop area, yield & production			% of contribution
	Cropped area (ha)	Yield/ha (mt)	Production (mt)	
T. Aus (Local)	324	1.57	509	2
T. Aus (HYV)	3,319	2.7	8,961	39
T. Aman (Local)	5,603	1.5	8,405	37
T. Aman (HYV)	1,945	2.5	4,863	21
Boro (HYV/Hybrid)	123	2.25	277	1
Total rice	**11,314**	**0**	**23,014**	**100**
S. Vegetables	135	12	1,620	19
Chili	135	1.25	169	2
Pulses	327	1.5	491	6
Potatoes	96	14	1,344	16
W. Vegetables	228	15	3,420	40
Spices	93	3.25	302	3
Oil Seeds	250	1.3	325	4
Sugarcane (Local)	10	30	300	3
Orchard	65	10.5	683	8
Total non-rice	**1,339**	**0**	**8,653**	**100**
Total Cropped Area	**12,653**	**0**	**31,667**	**0**

*Sources: Feasibility report (Agriculture), CEIP, 2012 and field information; 2015*Indicates cleaned rice*

5.3.8 Crop Damage

395. The scenarios of crop damage during 2007-2011 and 2013 are presented in **Table 5.18**, which shows that crops were damaged by SIDR in 2007, by AILA in 2009, 2012 and in 2013. In 2007, 90% of the vegetable cropsweredamaged due to Sidr. Farmers reported that 15-20% T. Aman and Vegetables crops were damage by water logging in the year 2010. About 10-15% of the vegetable crop, T. Aman and fruits crops were damage by pest and disease infestation in 2011. In the 2013, 60% of the T.Aman (Local) was damage by flooding due to heavy rainfall (Field visit; June 2015).

Table 5.18: Crop area Damaged by Different Means and % Losses during 2007-2013

Sl. No.	Crops	Damage (%)	Year	Reason of damage
1	T. Aman (LV)	85	2007	Sidr
	T. Aman (HYV)	80	2007	Sidr
	Vegetables	90	2007	Sidr
	Oilseeds	90	2007	Sidr
	Spices	85	2007	Sidr
	Fruits	20-30	2007	Sidr
2	T. Aman	15-20	2008	Heavy rainfall (water logging)
	Vegetables/Fruits	10-15	2008	Pests
3	T. Aus	60-70	2009	Aila
	Vegetables	70-80	2009	Aila
4	T. Aman	15-20	2010	Water logging
	Vegetables/Fruits	10-15-8	2010	Pests
5	T. Aman	15-20	2011	Water logging
	Vegetables	15	2011	Pests
	Fruits	10-12-7	2011	Pests
6	T. Aman (Local)	40%	2012	Tidal affect
7	T. Aman (Local)	60%	2013	Flooding due to heavy rainfall

Sources: Feasibility report (Agriculture), CEIP, 2012 and field information, June 2015

5.3.9 Agriculture Input Use

396. The rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability (**Table 5.19**). The major fertilizers used in this area are Urea, Triple Superphosphate (TSP) and Muriate of Potash (MP). The quantities of fertilizer used are generally lower than the recommended doses and the proportions of Urea, TSP and MP by the majority of farmer. The use of nitrogenous fertilizer (Urea) is higher than the use of other chemical fertilizers. Annually about 3,610 metric tons of chemical fertilizers are used in the Polder area of which 53% is urea, 21% is TSP, 16% is MP and 10% is Gypsum. Generally, farmers do not use manure or compost in their fields. An unbalanced use of chemical fertilizers would affect the soil health, which ultimately be reflected in crop yields.

Table 5.19: Fertilizer and Pesticides use in the Polder Area

Crop Name	Fertilizer (Kg/ha)					Pesticides (Tk/ha)
	Urea	TSP	MP	Gypsum	Zinc	
T. Aus (Local)	-	-	-	-	-	500
T. Aus (HYV)	270	130	120	70	10	560
T. Aman (Local)	100	-	-	-	-	580
T. Aman (HYV)	150	133	70	60	-	1500
Boro (HYV)	270	132	120	70	10	800
S. Vegetables	120	80	60	-	-	1000
Chilli	80	45	35	-	-	800
Pulses	70	-	-	-	-	500
Potatoes	100	50	38	-	-	1400
W. Vegetables	50	-	-	-	-	700
Spices	150	170	40	-	-	300
Oil seeds	130	80	80	-	-	-

Source: Feasibility report (Agriculture), CEIP, 2012 and field information, June 2015

397. The use of pesticides depends on the degree of pest infestation. The majority of the farmers apply pesticides in T. Aus (Local/HYV), T. Aman (Local/HYV), and Boro, Chilies, Potatoes, Vegetables and Spices crops. Granular, Liquid and powder pesticides are used for crop protection from the infestation.Annually about 60 metric tons of pesticides are used as liquid or in granular form in the Polder area for pest control. The major insects as reported by the farmers are Yellow Stem borer, rice hispa, Ear cutting caterpillar, Brinjal fruit and shoot borer, and Fruit weevil. Local farmers reported that they are using different types of pesticides such as Darsban, Melathion, Furadan (granular), Cup, Virtako, Aktara Furadan, Fighter, Fanfan, etc., to prevent pest infestation in rice, vegetables and other croplands. Farmers of the polder area applied pesticides once or twice in a season (Field visit; June 2015).

398. Seed plays a crucial role in crop production. Quality seed is important to get optimum yield from any crop. More than 85% germination rate, free from disease infestation and high yield potential need to considerfor seed selection.

399. Most of the farmers in the polder area use their own seeds in case of local variety, such as T. Aus and T. Aman. Medium and small farmers meet their requirement from neighbouring farmers or local markets. BADC and private seed dealers provide various improved crop seeds (HYV/Hybrid). The market price of the private dealer seeds is higher than BADC seeds. The salt tolerant cultivars are not available in the market and the farmers are not aware of them. The seed rate for different crops is presented in **Table 5.20**.

Table 5.20: Cultivation cost in the polder area

Crop Name	Seed (Kg/ha)	Irrigation cost (Tk)	Equipments used for cultivation		Power tiller cost (Tk)
			Power tiller (%)	Bullock	
T. Aus (Local)	35	-	85-90	15-10	3,500-4,500
T. Aus (HYV)	25	-	85-90	15-10	4,000
T. Aman (Local)	30		85-90	15-10	3,500
T. Aman (HYV)	25	2,000	90	10	4,000
Boro (HYV)	25	5,500	100	-	5,000
S. Vegetables	2-3	200	85-90	15-10	3,500
Chilli	2-3	300	85-95	15-10	3,500
Pulses	30	-	-	-	-
Potatoes	2,000 (Tuber)	2,000	85-90	15-10	4,000
W. Vegetables	2-3	300	80	20	3,500
Spices	1-3	-	80	20	3,000
Oil seeds	10	-	90	10	4,000
Orchard	50,000(Sucker)	2,500	90	10	4,000

Sources: Feasibility report (Agriculture), CEIP, 2012 and Fieldinformation, June, 2015

400. Irrigation is providing mainly in HYV Boro crops in the project area. Irrigation coverage of the polder area is only about 1% (123 ha) of the total NCA during the dry season. As of now, surface water is the only source of irrigation. Peripheral rivers (Baleswar river, Kocha river, Bishkhali river), internal river Pona river/Pona don and Khals (Kathaltali khal, Chander khal, Bamuner khal, Bothla khal,Telikhali, Podderer khal, Bhuter khal, Moller khal, Jamner khal, Bahar khal, Banai khal, Nadmulla khal, Haintar khal, Hetalia khal, Fultola khal, Darulhuda khal, Saula khal, Bhitabunia khal) are the sources of irrigation water. Most of the farmers provide irrigation

with surface water for raising seedlings, land preparation and transplantation up to mid-March. During Boro season, they can use this storage water for irrigation purpose by Low Lift Pumps (LLPs). Aus (HYV), Aus (Local), T. Aman (HYV) and T. Aman (Local) crops in the polder area grown under fully rain-fed condition. In some cases, HYV Aman, Orchard (Banana) and W. Vegetables are grown with supplementary irrigation (Field visit; June 2015).Supplementary irrigation to high land and medium high lands crops is practiced and potato and different winter & summer vegetable receive once or twiceor in exceptional cases three irrigation during crop season. Supplementary irrigation cost is Tk. 300-2000 depends on crops and numbers of application. Farmers did not practice supplementary irrigation in T. Aus and T. Aman crops fields. Rabi Season (November-February) crops cultivated in the polder area are primarily pulses, bean, potato, winter vegetables spices (onion and chilli), oilseeds, groundnut, etc. Generally, HYV vegetables are cultivated in winter and summer.

401. In the polder area, mostly manual labor is use for cultivation. Thereby, agricultural labors are considered one of the essential inputs for crop production. The labor requirement is not uniform throughout the year. The number of labor requirement varies from crop to crop. Annual total 1.98 million man-days labour is use for crop cultivation. The average labor used in the study area is presented in **Table 5.21**.

Table 5.21: Agricultural Labor used by crop in the Polder Area

Crop name	Labor (No/ha)	Crop name	Labor(No/ha)
T. Aus (Local)	150	Chili	170
T. Aus (HYV)	150	Pulses	120
T. Aman (Local)	160	Potatoes	200
T. Aman (HYV)	160	S. Vegetables	180
Boro (HYV)	170	W. Vegetables	180
Sugarcane	180	Spices	140
Orchard	140	Oilseeds	120

Source: CEGIS Assessment; 2015

5.3.10 Homesteads

402. Most of the homestead has a part of commercial timber wood plantation. Local inhabitants usually tend to plant Mahogany *(Swietenia mahagoni)* for their high wood value and growth. **Table 5.22** represents the staple floral products and their economic values.

Table 5.22: Economic Output from Homestead Vegetation of the Polder

403. Earning from major fruit yielding plants

Species Name	No. of fruit yield/year/plant	Value (Tk.)/fruit	Total earning (Tk.) from each plant
Narikel *(Cocos nucifera)*	200	25.0	5,000
Supari *(Areca catechu)*	600	2.5	1,500

404. Earning from woodland

Species Name	No. of plant/Acre	Unit Value	Total log Value (Tk.)/Acre after 10 years
Mahagoni *(Swietenia mahagoni)*	484	2,000	968,000

Source: Estimation through public discussion at Dhawa Boro Mianbari and Purba Dhawa during Field Visit, June 2015

Picture 5.10: Commercial Woodland along the Proposed Alignment of the Embankment at Dhawa Boro Mian Bari

5.3.11 Livestock and Poultry

405. Livestock and poultry, being an essential element of integrated farming system, play an important role in the economy of the polder 39/2C area. Livestock, as in other polders of southwestern region provide significant draft power for cultivation, threshing and crushing of oil seeds; cow dung as a source of manure and fuel; a ready source of funds; and meat, milk and eggs for human consumption.

406. Most of the households in the polder area raise poultry and livestock, a practice that significantly reduces poverty through generating income and employment. Detailed status of livestock population is presented in **Table 5.23**.

Table 5.23Status of Livestock and Poultry of the Polder Area

Livestock / Poultry	% HH having Livestock and Poultry	Number of Livestock / Poultry
Cow / bullock	37	35,380
Buffalo	3	1,290
Goat	6	4,290
Sheep	1	1,090
Duck	26	37,500
Chicken	94	110,870
Total		**190,420**

Source: Feasibility report (Livestock), CEIP, 2012 and field survey, June; 2015

Picture 5.11: View of Duck and Cattle in the Polder Area

Source: Field visit; June, 2015

Picture 5.12: View of Goose and Cattle in the Polder area

5.3.12 Feeds and Fodder

407. There is a general scarcity of fodder for livestock during March to December due to shortage of grazing lands. In the Kharif-I seasons, the lands are generally, covered with HYV Aus and Lt. Aus in the polder area. During Kharif-II season, the fields are covered with HYV Aman and Lt. Aman. Rice straw is the main fodder for cattle. Bran of wheat and rice, oil cakes, powder of cereal crops etc. are the other common fodders, but the availability of these feeds in the project area is rare.

408. Shortage of grazing land due to agricultural extension and increasing the cropping intensity, which aggravates the feed problem for the animal population. The poultry population at family level survives by scavenging and generally, no feed supplements are provided. However, at times kitchen wastes become feed for the poultry.

5.3.13 Livestock and Poultry Diseases

409. Production of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreaks of disease are causing a considerable economic loss to livestock farming. Every yeardifferent diseases like Feet and Mouth disease (FMD), Anthrax (Torka), Diarrhea, Pest Des Petits Ruminants (PPR), affect the livestock population etc. A cyst in the head is common disease for goats. Major poultry diseases are Duck Plague, Paralysis, New Castle (h), Fowl pox, Dysentery, etc. The most vulnerable period is between July to October (rainy season) for spreading diseases to livestock and poultry. The duck plague generally occurs in summer. However, some diseases are common throughout the year.

410. During the monsoon season, the wet condition of the animal shelter promotes various kinds of diseases to the bullocks and cows. The unhygienic condition of the courtyards during this season may also spread the diseases to the poultry birds.

5.4 Socio-Cultural Environment

411. Polder 39/2C covers part of Kanthalia upazila of Jhalokati district as well as part of Bhandaria and Mathbaria upazilas of Pirojpur district. The Polder area falls in seven unions namely Chencuri Rampur, Dhaoa, Ikri, Nudmulla, Teikhali, Dhanisafa and Mirukhali. The percentages of unions falling within the boundaries of the polderis shown in Table 5.24.

Table 5.24: Unions and upazilas in polder 39/2C

Name of district	Name of upazila	Name of unions	Percentage of union within polder
Jhalokati	Kanthalia	Chenchri Rampur	18
Pirojpur	Bhandaria	Dhaoa	97
		Ikri	93
		Nudmulla	65
		Telikhali	66
	Mathbaria	Dhanisafa	19
		Mirukhali	38

Source: Spatial GIS Analysis, CEGIS, 2015

5.4.1 Demography

412. The 23,621 households living in the polder area have a total population of 1, 01,101 of which 49,395 are male and 51,705 are female (Housing and Population Census, BBS, 2011, CEGIS estimation, 2015[15]). The female population is higher than the male population. The average male-female sex ratio[16]is 96 of which there are 96 males per 100 females, which is lower than the national figure of 100.3 [BBS, (HIES) 2010[17]]. The average density of the population is 835 persons per sq. km, of which,about 91% of the total populations are Muslim and 9% are Hindu. The demographic data is present in **Table 5.25**. The highest percentage (24%) of household is comprises 4 persons each (**Figure 5.10**).

Table 5.25: Demographic Data of Polder

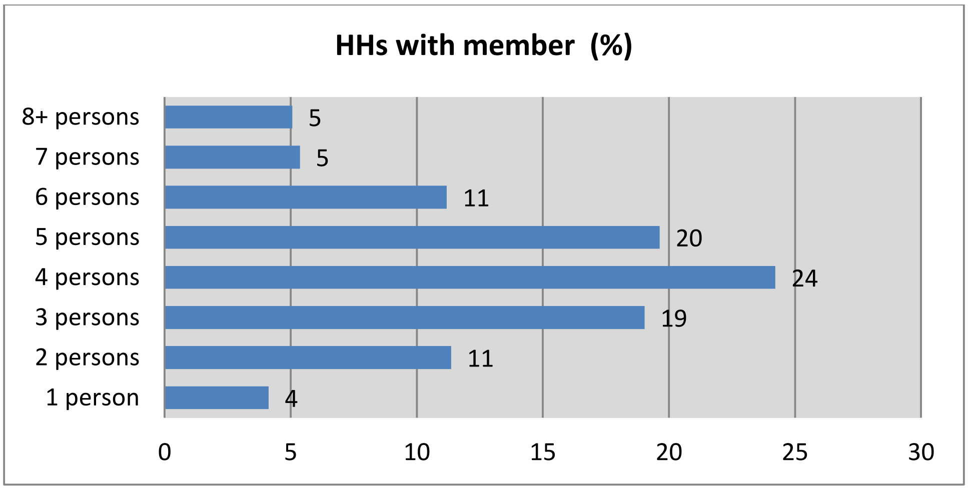
Unions	Households	Population			Sex ratio	Population density [sq. km]
		Both	Male	Female		
Chenchri Rampur	1263	5213	2538	2675	95	733
Dhaoa	4913	21852	10583	11269	94	821
Ikri	5574	22660	10964	11696	94	730
Nudmulla	4024	16804	8219	8585	96	1104
Telikhali	4078	18090	9002	9088	99	924
Dhanisafa	1342	6197	3138	3060	103	857
Mirukhali	2427	10284	4951	5333	93	676
Total/Average	**23,621**	**1,01,101**	**49,395**	**51,705**	**96**	**835**

Source: Population Census 2011, BBS

[15] This estimation is based on BBS, 2011 Census data and 1.37 linear national growth rate

[16]Number of males per 100 females in a population, using the formula: Sex Ratio SR = M x 100 / F

17 HIES 2010 refers to Household Income and Expenditure Survey conducted by the Bangladesh Bureau of Statistics (BBS) in 2010.



Source: Housing and Population Census, BBS, 2011

Figure 5.10: Distribution of Households Comprising HH Members

5.4.2 Age Structure

413. When looking at the age distribution, the highest number of the population (24%) in the polder area is from 30 to 49 years. Only 4% of thepopulationsare in the 60 to 64 years category see Figure 5.12. When looking at the work related categories, the age group of 0-14 years is defined as children, 15-24 years as early working age, 25-54 years as prime working age, 55-64 years as mature working age and 65 years and over as elderly people (source: World Fact Book, CIA[18]), see Figure 5.13. This ILO classification is important, as the size of young population (under age 15) would need more investment in schools, while size of older populations (ages 65 and over) would call for more investment in health sector.

414. The (potentially) active working population from 15 to 64 years constitutes 58% of the total population. A small percentage (6%) is above 65 years. The populations below 14 years and above 65 years are considered as dependent. Thus, the total dependency ratio[19] is 73 in which child dependency ratio[20] is 61 and aged dependency ratio[21] is 11. It illustrates that total73 persons of which 61 are children and 11 are elderly people are dependent on a working force of 100 persons.

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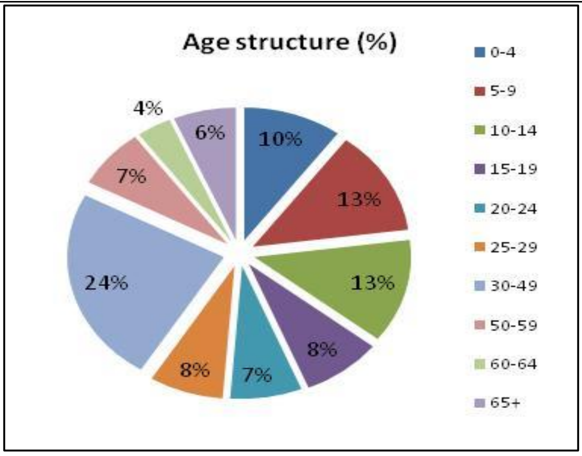
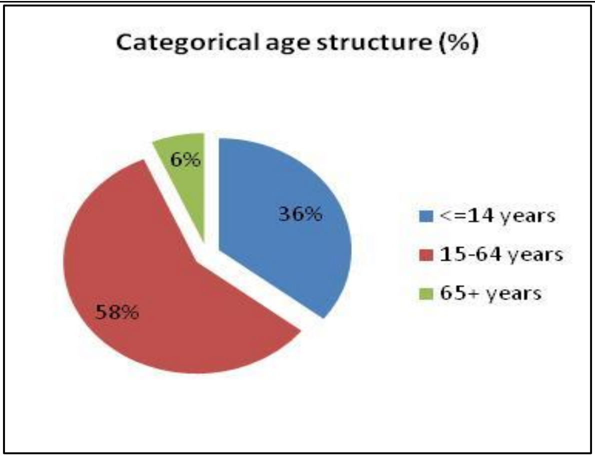
[18]Retrieved on 30/06/2015 from https://www.cia.gov/library/publications/the-world-factbook/docs/notesanddefs.html

[19] Total dependency ratio= $\frac{number\ of\ people\ aged\ 0-14\ \&\ those\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$

[20] Child dependency ratio= $\frac{number\ of\ people\ aged\ 0-14}{number\ of\ people\ aged\ 15-64} \times 100$

[21] Aged dependency ratio= $\frac{number\ of\ people\ aged\ 65\ and\ above}{number\ of\ people\ aged\ 15-64} \times 100$





Source: Housing and Population Census, BBS, 2011

Figure 5.11: Age Structure of the Studied Population

Figure 5.12: Categorical Distribution of Studied Population

5.4.3 Education

415. The literacy rate, is based on the definition "ability to write a letter in any language" is 63.7%, whereas for male the rate is 63.8% and for female 63.6%. The rate of literacy reported above is for the population of 7 years and above. (**Figure 5.13**).

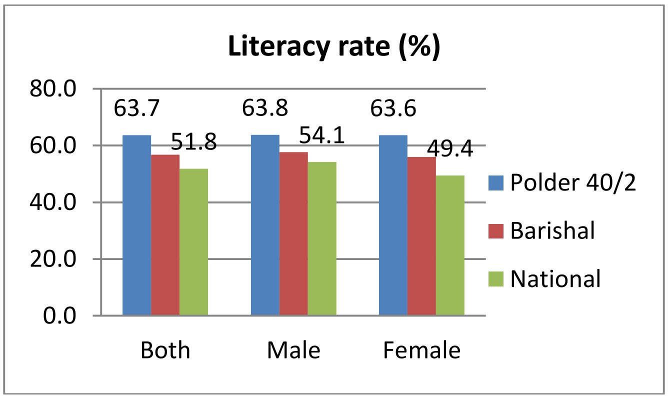


Figure 5.13: Literacy Rate Among the Studied Population

416. Field findings show, there are 3 colleges, 103 primary schools,26 high schools and 63 Ebtedaye/ Dakhil Madrashas in the polder area. Access to these institutions is hampered by poor communication facilities, high poverty rates, inadequate health care and nutrition services, etc. Table 5.26 shows the distribution of educational institutions in the various unions.

Table 5.26: Educational Institutions

Unions	No. of Primary School	No. of Madrasha	No. of High School	No. of College
Nodmullah UP	13	13	08	-
Dhaoa UP	32	36	07	01
Ikri UP	28	04	05	02
Telikhali UP	19	06	02	-
Dhanisafa UP	08	04	03	-
Mirukhali UP	03	03	01	-
Total	**103**	**63**	**26**	**3**

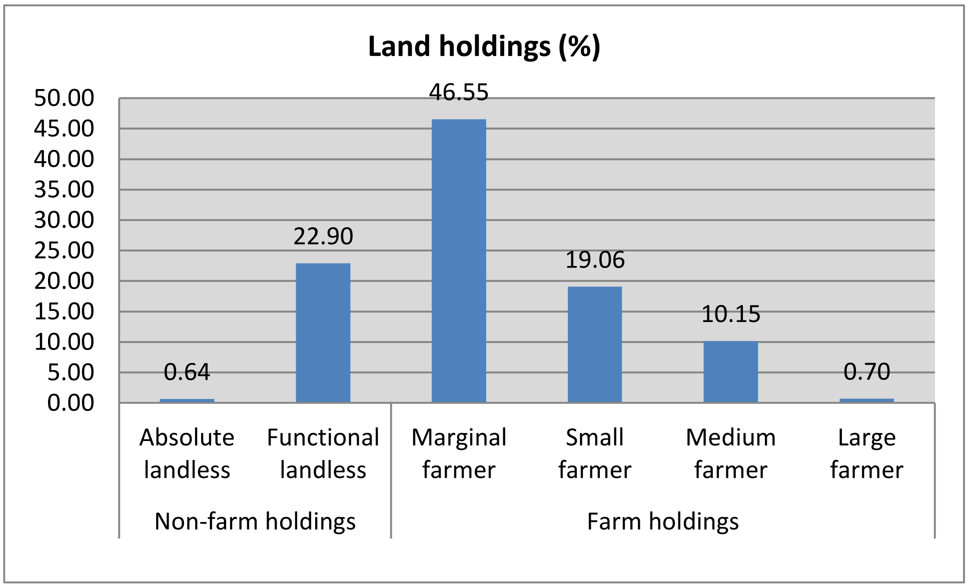
Source: CEGIS field work, 2015

Picture5.13: Local Educational Institution at Polder Area

5.4.4 Ownership and Utilization of Land

417. The Census of Agriculture, 2008 by BBS classified land holdings into two broad categories- one is farm-holdings and the other is non-farm holdings. A farm holding is defined as being an agricultural production unit having cultivated land equal to or more than 0.05 acre. Conversely, non-farm holding includes landless households and households having lands up to 0.04 acre. According to this definition, 76.46% is farm and the rest 23.54% is non-farm holders in polder 39/2C.

418. 0.64% of the households islandless i.e. they have no lands, either homesteads or cultivated. 22.90% households belong to functional landless category that comprise households that only have homestead lands (14.07%) and those, which have homestead with 0.01 to 0.04 acresof cultivated lands (8.86%). Here, cultivated lands include mainly kitchen gardening produced predominantly by housewives mainly for household consumption. The distribution of land holdingsare shown in Figure 5.14.



Source: The Census of Agriculture, 2008, BBS

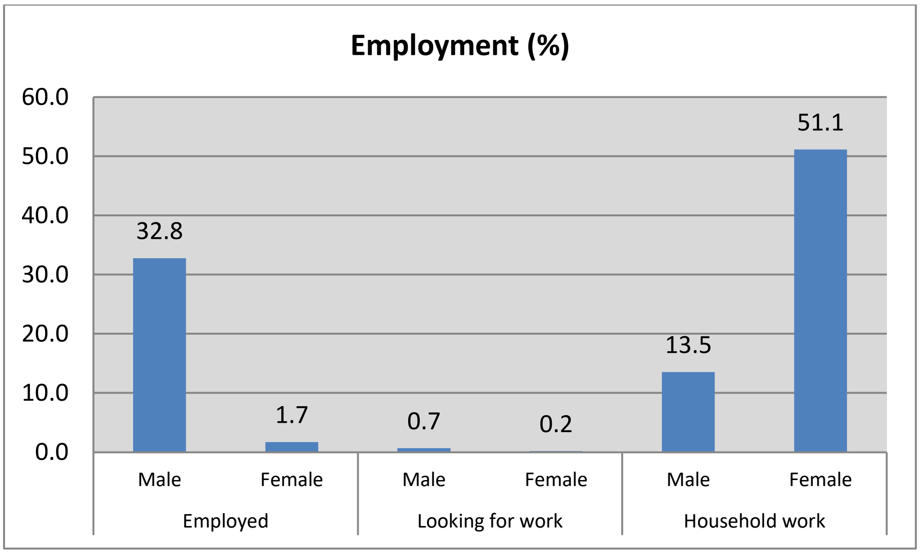
Figure 5.14: Households by Land Holdings

419. The farm holding distribution shows that 46.55% of the households belong to marginal farmer (0.05 to 0.99 acre), 19.06% belong to small farmer (1.00 to 2.49 acre), 10.15% belong to medium farmer (2.5 to 7.49 acre) and 70% belong to large farmer (7.5+ acre) categories. It is evidential that land fragmentation decreases the holding size therefore; large and medium farmers are gradually converted to marginal farmers.

420. Field data confirmed that this large numbers of landless populations usually adopt alternative livelihood options, for instances; farm and non-farm labouring, driving, earth work, working for shrimp farm and other manual works.

5.4.5 Occupation and Livelihood

421. About 58% of the total populations are working calss that mentioned earlier, where as about 35.4% employed, about 1.0% is looking for work, and about 63% are engaged in household work. Here, working class people means economically active population that includes those who are aged 7 and over and not attending school at reference period of Housing and Population Census, 2011. The occupational status of the area is given in **Figure 5.15.**



Source: Housing and Population Census, BBS, 2011

Figure 5.15: Employment status of the polder

422. Women's participation in direct income generating activities (employed category) is trivial as education status confirms that whereas not attending males are engaged in employment, females are getting married and in turn, contribute to the highest participation in household work (51%). The employed category also includes child labour as it was accounted from 7 years old population.

423. Of the employedpopulation, 77.44% are engaged in agricultural activities, 7.4% in industry and 15.1% in services. Agricultural activities include broadly crop farming, fishery and livestock and poultry farming. Field findings suggest that rural women's participation is relatively higher in various post-harvest activities and livestock management activities than other agricultural activities. Few of them participate in some non-agricultural activities like handicrafts making and tailoring, etc.


Picture 5.14: Different modes of livelihood activities in polder 39/2C

5.4.6 Labor Market

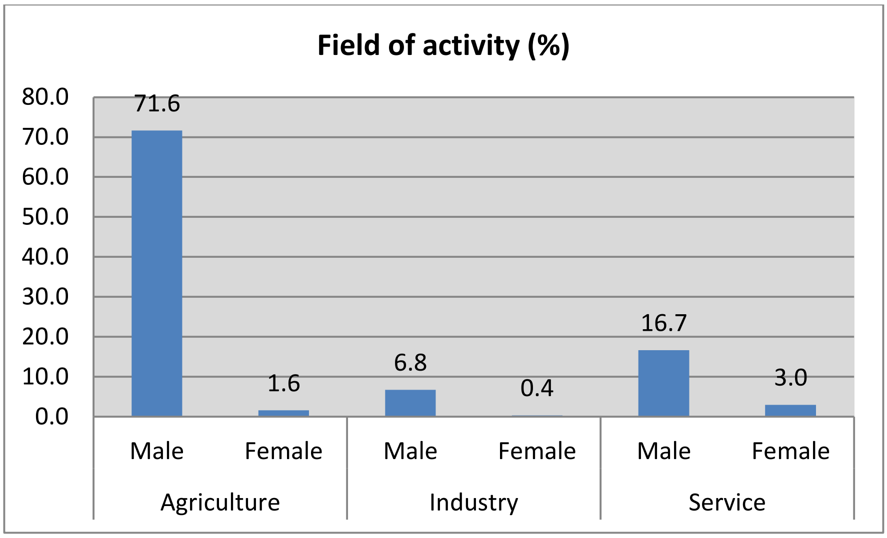
424. The employment[22] rate[23] in the study area is 35 whereas the unemployment rate[24]is 65. Most of the unemployment populations are females who are solely involved in household work and only 2.1% populations are looking for work.

425. Data shows that agriculture, industry and service are the sole sectors to generate employment for the local people. Field findings documented that people who are not permanently employed tend to engage themselves in other sectors such as agricultural labourers, fishers, brick field worker, earth workers, and cleaners. In the agricultural sector, most of the labourers are suppliedfrom the local villages.

[22]The ILO defines employed persons of those who, (1) do any work at all as paid employees, work in their own business or profession or on their own farm, or work 15 hours or more as unpaid workers in a family-operated enterprise; and (2) all those who do not work but had jobs or businesses from which they were temporarily absent due to illness, bad weather, vacation, childcare problems, labor dispute, maternity or paternity leave, or other family or personal obligations — whether or not they were paid by their employers for the time off and whether or not they were seeking other jobs.

[23]Employment Rate = $\frac{Employed\ Population}{Total\ labour\ force} X\ 100$

[24] Unemployment Rate= 100-Employment Rate



Source: Housing and Population Census, BBS, 2011

Figure 5.16: Distribution of Population by Field of Activity

426. The above figures imply that female participation in theservice sector is higher compared to industry and agriculture Field findings documented that during the harvesting period, femaleswork along with men in the same agricultural fields. Some women also collect fry fish from river, do earthwork, etc. The wage rate varies between Tk. 350/=to Tk. 300/= perday for male workers whereas the woman wage rate is fromTk. 160/= to Tk. 200/= day.

427. During field visit, people stated that out migration of labourers is about 3% in the study area whereas in-migration is almost absent. These out-migrants are mainly agricultural labourer that usually go to other Barisal and Khulna) districts during May to September for better livelihood and lack of employment opportunities inthe polder area. Additionally, there are international out migrants (1%) who tend to go to Middle East for searching better livelihood options.

5.4.7 Quality of Life

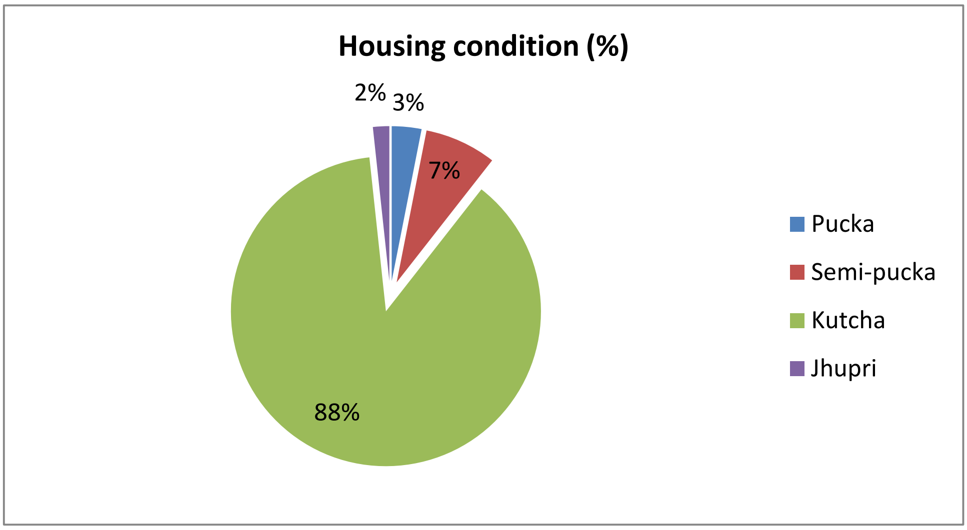
428. Quality of life indicates the level of wealth, comfort, material goods and necessities available to the studied population. This section defines it narrowly and necessarily includes people' access to electricity, sanitation facilities, safe drinking water availability, housing condition and fuel consumption.

429. The facilities for supply of electricity are poor (39%) across the polder area. The supply of grid electricity is un-evenly distributed where Nudmulla Union has the highest coverage (51%) whereas Ikri union has the lowest (33%).Besides,about 35% of total households are now using solar electricity in the polder area (CEGIS fieldwork, 2015).

430. The overall housing condition[25] is not satisfactory and reflects the low-income generation by the majority of the population in polder 39/2C. The study area shows the predominance of

[25]BBS distinguishes housing structures into four classes such as- i) **Jhupri**: House which consist mud walls of 1.5 to 3.0 ft thickness, which carry the roof load. Earthen floor, thatch or CI sheets are used as roofing materials. . There is no monolithic joint between the wall and the roof. ii) **Kutcha**: Walls: Organic materials like jute stick, catkin grass, straw, and bamboo mats. Split are bamboo framing. In some areas wall are made by earth. Foundation: Earthen plinth with bamboo or timber posts. Roof: Thatch-rice or wheat or maize straw, and catkin grass, with split bamboo framing; iii) **Semi-pucka**: Walls: Bamboo mats, CI sheet, Timber or bamboo framing. In some

Kutcha houses (88%) *Semi-Pucka* houses(7%), *Pucka*(3%) and *Jhupri* houses (2%) (**Figure 5.17**). Nudmulla Union has the highest pucka house coverage (4.4%) whereas Ikri Union has the highest kutcha house coverage (92%).



Source: Housing and Population Census, BBS, 2011

Figure 5.17: Housing Condition in the Study Area

Picture 5.15: Housing Structure at Polder Area

431. Sanitation[26] facilities in the study area show that about 24% households use non-sanitary latrines and 56% use non water-sealed sanitary latrines. Field findings confirm that non-sanitary latrines are predominant among the *Kutcha* houses whereaswater-sealed sanitary latrines (19%)

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areas wall are made by earth, sometimes part or full brick. Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete also use. Roof: CI sheet with timber or bamboo framing; and iv) **Pucka**: House which is made by fully concrete, cement, and iron

[26]BBS defined four types sanitation in Bangladesh such as (i) Sanitary (water-sealed): A water sealed latrine is simply a pit latrine that has a water barrier to prevent odors. These latrines are simply pits dug in the ground in which human waste is deposited. (ii) Sanitary (not water-sealed/ring slab), latrine with a slab or other secure cover over the drop hole, or a polyethylene flap preventing in-sects from flying into or coming out of the pit; and (iii) Non-sanitary (Kucha): latrine is a frame or platform extending over earth or water; an "open pit latrine" does not have a squat platform or slab on the pit and (iv) No facilities: Defecation in bushes or fields or other outdoor locations.

are predominat among Semi-Pucka and Pucka housheoldsin the locale respectively. However, there are 1% house with no sanitation facilities that tend to share sanitation facilities with other households and in some cases, they use open defecation.

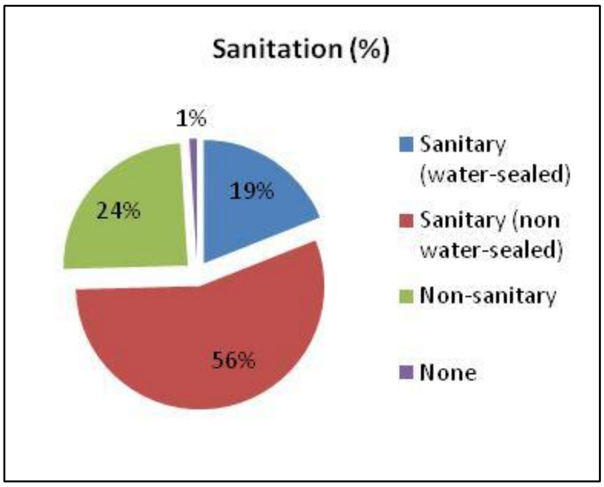


Figure 5.18: Distribution of Households by Sanitation Facilities

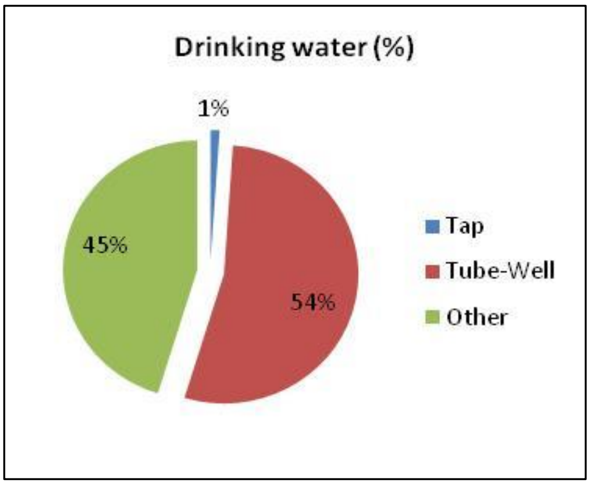


Figure 5.19: Distribution of Households by Sources of Drinking Water Facilities

Source: Housing and Population Census, BBS, 2011

432. Collecting drinking water from Tube wells is predominant (54%) while other sources (45%) include water bodies, ponds, rainwater, etc.,typically used by poor households having no access to tube-wells. Supply of “tap water” (1%) is mainly availablein Paurashava areaon monthly payment. This supply system depends on abstraction of ground water.

5.4.8 Poverty

433. Poverty in the study area has been measured following the Multidimensional Poverty Index (MPI) method. The process intended to indentify multiple deprivations at the household level in three broad dimensions such as education, health and standard of living. The index uses the same three dimensions as theHuman Development Index: health, education, and standard of living. These are measured using ten indicators. Of them, several indicators were selected for analyzing for this study based on data availability and accordingly adapted to the prescribed methodology. The indicators and the threshold for defining poverty are presented in the following **Table 5-27**.

- Poor health;
- Lack of education;
- Inadequate living standard;
- Lack of income;
- Disempowerment;
- Poor quality of work; and
- Threat from violence.

434. Table 5.27 provides the MPI for the poorest fraction of the population in polder 39/2C.

Table 5.27: Weighted Score and Status of MPI Poor Class

Poor Category of People	Landless persons work in share cropping and agricultural labour (L)	Day labourers work in Brick Field (DL)	Marginal Grocer sell things in the rural Bazaar (MG)
Weighted Score (deprivation score)	38.89%	33.33%	27.78%
Status: MPI poor (33.33%)	Greater than MPI poor	Equal to MPI poor	Less than MPI poor

435. Three dimensions, i.e. education, health, and standard of living have been used use at polder level for measuring the MPI. The dimensions are equally weighted. The dimensions are measured using ten indicators. The indicators are valued only ‘0’% and 100% based on field experiences. In this case 0% indicates no deprivation in that indicator, while '100%' indicates total deprivation in that indicator. A person considered poor, if he/she isdeprived in at least 33.33% of the weighted indicators. The households are multi-dimensionally poor, if the deprivation score >= 50%. In the **Table 5.28**, the ‘L’ and ‘DL’ categories scored beyond the threshold level. Thus, they are poor people. The MG Category people are measured as non-poor category people.

Table 5.28: Results of MPI

Factor H for the Polder	**0.667**
Factor A for the polder	0.361
MPI	0.241

436. According to **Table 5.28**,the headcount ratio (H) shows about 66% of the people live in poor households. In the context of intensity of poverty (A), the average poor person deprive in 36% of the weighted indicators. Thus the MPI of the polder is 0.241 (in 2015) compared to Bangladesh 0.292 (in 2007)[27]. **Show Methodology Multidimensional Poverty Index in Annex-C).**

5.4.9 Social Capital

5.4.10 Extension Services

437. The major social safety nets and poverty reduction programs initiated in the area include the Vulnerable Group Development (VGD), Food/Taka for Work (F/TFW), Food for Education/Cash for Education, Rural Maintenance Program (RMP), Old Age Allowance, Freedom Fighter Allowance and the Integrated Poverty Reduction Program. These programs have created food security as well as social safety nets among the targeted poor households and vulnerable communities (**Table 5.29**).

Table 5.29: Households Served by Different Social Safety Nets Programs

Social Safety Net Programs	Households/Communities Served (%)
Vulnerable Group Development (VGD)	6
Food/Taka For Work (F/TFW)	4
Food for Education/Cash for Education	10
Rural Maintenance Programme (RMP)	6
Old Age Allowance	5
Freedom Fighter Allowance	3
Integrated Poverty Reduction Program of BRDB	6

Source: CEGIS fieldwork, 2015

438. A number of local, national and international NGOs are working in the Project area. The main activities of these NGOs are operating micro credit programs among the rural poor and landless women/men. The major NGOs working in the area include BRAC (Bangladesh Rural Advancement Centre), ASA (Association for Social Advancement), JJS (Jagrata Juba Shangha), World Vision, Muslim Aid, CSS (Christian Service Society), Proshika, Focus, Uddipan, and Dak Deye Jai (**Table 5.30**).

439. These NGOs are serving with micro credit while BRAC, ASA, World Vision and JJSare working for non-formal education, Health, human rights, water and sanitation, gender and children development programs. About 45 percent of the households found to benefit from the NGOs interventions. After disasters (Sidr and Aila) the JJS appeared as the most important NGO for the local people.

Table 5.30: NGOs and Their Programs in Project Area

NGOs	Type of Programs						
	Credit	Education	Water and Sanitation	Health	Disaster	Gender	Food security
BRAC	✓	✓	✓	✓	-	✓	✓
ASA	✓	✓	-	-	-	-	-
Muslim Aid	-	✓	-	-	-	-	✓
Uddipan	-	-	-	-	✓	-	✓
World Vision	-	✓	✓	-	-	-	-
Proshika	✓	✓	-	-	-	-	-
Dak Deye Jai	✓	✓	-	-	-	-	-
JJS	✓	-	-	-	-	-	-
CSS	✓	-	-	-	-	-	-

Source: CEGIS fieldwork, 2015

Roads

440. The communication facilities of roadways are moderate to good in the study area. Overall 516 km of road networks exist in seven unions where 106 km roads are paved, 97 km roads are brick soling and 313km roads are earthen (**Table 5.31**).

Table 5.31: Road Network in Polder

Unions	Type of Road	Length (Km)
Nodmulla	Paved	20
	Herringbone/Brick soling	10
	Earthen road	55
Dhawa	Paved	10
	Herringbone/Brick soling	25
	Earthen road	26
Ikri	Paved	10
	Herringbone/Brick soling	12
	Earthen road	60
Telikhali	Paved	40
	Herringbone/Brick soling	20
	Earthen road	130
Mirukhali	Paved	12
	Herringbone/Brick soling	15
	Earthen road	17
Dhanisafa	Paved	14
	Herringbone/Brick soling	15
	Earthen road	25
	Total	***516***

Source: CEGIS fieldwork, 2015


Picture 5.16: Muddy and Soling Roads in the Polder Area

Waterways

441. Waterway is an important mode of communication in polder 39/2C. There are two main internal waterways used by the local people, see **Table 5.32**.

442. As a mode of transportation, people use trawlers, rockets or small boats to carry goods and commodities. River depth varies based on seasonal variation. During the dry season, the depth of Boleswar/Kocha River remains within 45-50ft while in wet season it increases to about

60-75ft. Similarly, in Pona River the depths are 15-20ft and 20-25ft in dry and wet season, respectively. Table 5.32 shows the major navigation routes and types of vehicles in the study area.

Table 5.32: Major Navigation Routes in the Area

Navigation Route/River	Navigation Path	Type of Vehicle
Boleswar /Kocha	• Bhandaria-Barisal(Doarika+Sikarpur-Dhaka(Launch) • Khulna-Mongla(Pasur)-Bhandaria-Dhaka(Rocket/Ship)	Rocket/Ship, Launch, Trawler, Cargo, Fishing Boat(to Sea)
Pona	• Bhandaria-Khejurtala-Tarabunia-Bhagirathpur-Patkelghata	Cargo, Trawler, Fishing Boat

Source: CEGIS fieldwork, 2015

Market/growth centre

443. There are19 markets/bazaars in the study area, among them in Nomullah, Dhaoa and Ikri union carried highest proportion of bazaars wherethe rest of the bazaars i.e. 5 (five) are situated in Telikhali, Dhanisafa and Mirukhali unions (**Table 5.33**).

Table 5.33: Markets in Project Area

Unions	Name of market	No of Market
NodmullahUP	NodmullahBazaar	04
Dhaoa UP	Dhaoa Bazaar	05
Ikri UP	Ikri Bazaar	05
Telikhali UP	Telikhali Bazaar	02
Dhanisafa UP	Dhanisafa Bazaar	02
Mirukhali UP	Mirukhali Bazaar	01
Total		19

Source: CEGIS database, 2015

5.4.11 Gender and Women

444. Field observation suggests that Polder 39/2C is male dominated area. Roles of women in both decisions making at household level and economic contribution to household income are inconsequential. Traditional belief is very strong here whichgenerallyinfers that males make all major household decisions and at the same time, they contribute to household income more than females. Few women work as day labourers and wage discrimination is very common where male labours get Tk. 300 to 350 and women labours get Tk. 200 to 250 per day.

445. Government's Policy towards women'seducation has changed considerably over time and influenced the gender situation in the polder area. Women's education rate has increased; and women dropping out of school due to early marriage have been reduced. NGOs have changed the rural society to a significant extent in terms of awareness rising. Different NGOs and community health clinics work for women health has reduced women's maternal mortality rate significantly.About 15 percent of the women are living with good health condition and the rest are suffering from various diseases such as low blood pressure and premature delivery. About 20 % women are getting proper nutrition and about 10% have access to the health centers, which are around 15 km away on average from their residence. (CEGIS field work, 2015).

446. Women mobility in the area mostly localized except for the purpose of medical treatment, fetching water, farming activities, and visiting relatives.

5.4.12 Vulnerable Communities

447. Fishers & farmers are the most vulnerable communities in the polder area. The polder on the other bank of Kocha River and PonaRiverwere completed long ago, while polder 39/2C remained generally unprotected. Tidal floodwater enters the polder, as there is no functional gate of any drainage and flushing sluices. This incoming tidal water often coincideswith heavy rain, in turn flooding farmland, aquaculture installations, internal road networks, homesteads, commercial areas and educational institutions. Besides, cyclonic stormsare common, referSection 5.1.8, causes severe human and human asset losses.

5.4.13 Community Facilites

448. The common property resources and/or community facilities in the area include social amenities, e.g. mosques, graveyards, temples, cremation grounds, playgrounds, open water bodies and *Eidgahs* (place for offering Eid prayers). These are use by the local people for the purposes of religious, social and cultural gatherings.Besides, embankmentsare also commonly used for different livelihood purposes, i.e. living or taking shelter by the local inhabitants.

449. There are 407 mosques, 52 temples and 9 crematoriums in the polder area. However, there is no known historical and archaeological site declared by government in the Polder area (**Table 5.34)**.

Table 5.34: Common Property Resources in Polder 39/2C

Unions	No of Mosque	No of Temple	No of Crematorium
Nodmullah	115	12	2
Dhaoa	66	12	3
Ikri	76	20	4
Talekhali	107	3	-
Dhanisafa	18	3	-
Mirukhali	25	2	-
Total	**407**	**52**	**9**

Source: Union web site and CEGIS field work, 2015

5.4.14 Water Related Human Health Problems

450. RRA findings show that Gastric-related disease is the most prevalent disease in the study area. On the other hand, Influenza/Common fever, waterborne diseases, coldness, respiratory and skin diseases are also dominant throughout the polder**(Table 5.35)**.

Table: 5.35: Disease Profile in the Polder 39/2C

Diseases	Ranking by Incidence
Gastric	1
Influenza/Common fever	2
Diabetes	3
Skin diseases	4
Cough/cold	5
Dysentery	6
Asthma	7
Hypertension	8
Typhoid	9
Chicken pox	10

Source: CEGIS Field Work, 2015

451. Field data shows that there is one upazila health complex, three Union Family Planning and Health Complexes and eight community clinics in the polder area. (**Table: 5.36**). Additionally, there are peripheral health services institutions outside the polder area. The status of the health facilities of mentioned health centers are very poor due to lack of physicians, medicine availability and infrastructures.

Table 5.36: Health Service Facilities in the Study Area

Union Name	No of Hospital	No of Community Clinic	Health facilities (outside of Polder)
Nodmullah	1 (Bhandaria, Upazila Health Complex)	3	Pirojpur & Jhalakati
Dhaoa	1 (Union Family Planning Health Complex)	3	Pirojpur & Jhalakati
Ikri	1 (Union Family Planning Health Complex)	-	Mothbaria UPZ, Pirojpur
Talekhali	1 (Union Family Planning Health Complex)	-	Mothbaria UPZ, Pirojpur
Dhanisafa	-	1	Mothbaria UPZ, Pirojpur
Mirukhali	-	1	Mothbaria UPZ, Pirojpur

Source: CEGIS field work, 2015

452. Survey also confirmed that nearly 40 percent people receive health services from quacks and 35 percent from trainedparamedic/ diploma physicians and only 15 percent from a trained doctor. It is noteworthy that about 10 percent cannot afford treatment due to poverty. People reported that the pasttendency to go to the local healer for treatment is reducing due to increase in income and more cost-effectiveness of proper treatment.

453. The Population Census 2011 identified almost six types of disabilities and their proportionate distribution in the respective area. It is found that the study area comprises 3.2% of all types of disabilities and 1.7% people reported that they are physically challenged,0.5% mentioned speech and mental disorder.

5.4.15 Cultural Sites

454. No notable cultural sitesare found inside the polder area.

6 Environmental Impacts and Mitigation Measures

6.1 Preamble

455. This Chapter identifies the environmental and social impacts, which may potentially occur invarious projectsphases, and also proposes appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts. Potential interventions, which may cause perceivedenvironmental impacts during pre-construction, construction, and O/M phase,have identified in **Chapter 4**. The project influence area has been identified in Article 2.2.1 of Chapter 2. The following detailed investigations are carried out to assess the magnitude of these prioritized impacts:

- Census survey to assess the extent of land acquisition and resettlement, loss of vegetation, occupation, income and poverty levels of the affected households, etc.
- Polder drainage model developed using the existing calibrated and validated Southwest Regional Model as base model has used to understand the impact of project intervention to improve the existing drainage system and impact of climate change with the existing drainage system and with modified drainage system.
- Environmental quality baseline monitoring of air, noise, surface water, groundwater and soil,
- Ecological surveys comprising vegetation, wildlife and fisheries covering both mainland and Charland,
- Expert consultations focus group discussions, and public consultations.

456. It is mentioned here that some of the studies are in progress; the results of the selected investigations completed to date are discussed in this chapter. Most of the project activities are yet to be finalized (for example locations for afforestation component, locations of construction yards, operational arrangement of the sluices during the operation period). Similarly, the detailed bills of quantities and equipment usage are yet ascertained. Therefore, this report has to be further improved as per suggestions and future need.

6.2 Impact Screening

457. As a part of the environmental impact assessment process, a screening matrix was use tailored specifically to the proposed Project, focusing on the potential environmental impacts during design, construction and operation phases. Key potential impact sites are shown in Map 6.1. The matrix examined the interaction of project activities with various components of the environment. The impacts were broadly classified as physical, biological and social and each of these broad categories were further divided into different aspects. The potential impacts thus predicted were characterized as follows:

- High negative (adverse) impact;
- Low negative impact;
- Insignificant impact;
- High positive (beneficial) impact;
- Low positive impact; and
- No impact.

458. The matrix of Polder 39/2C is provid in **Table 6.1**. The negative impacts predicted in this manner are the ‘unmitigated’ impacts. Appropriate mitigation measures recommended as part of this EIA study, thus reducing the occurrence possibility and severity of the potentially adverse

impacts. The potentially negative impacts identified through this process anddiscussed in the subsequent sections.

6.3 Impact during Pre-Construction Phase

459. Site development involves the following activities:

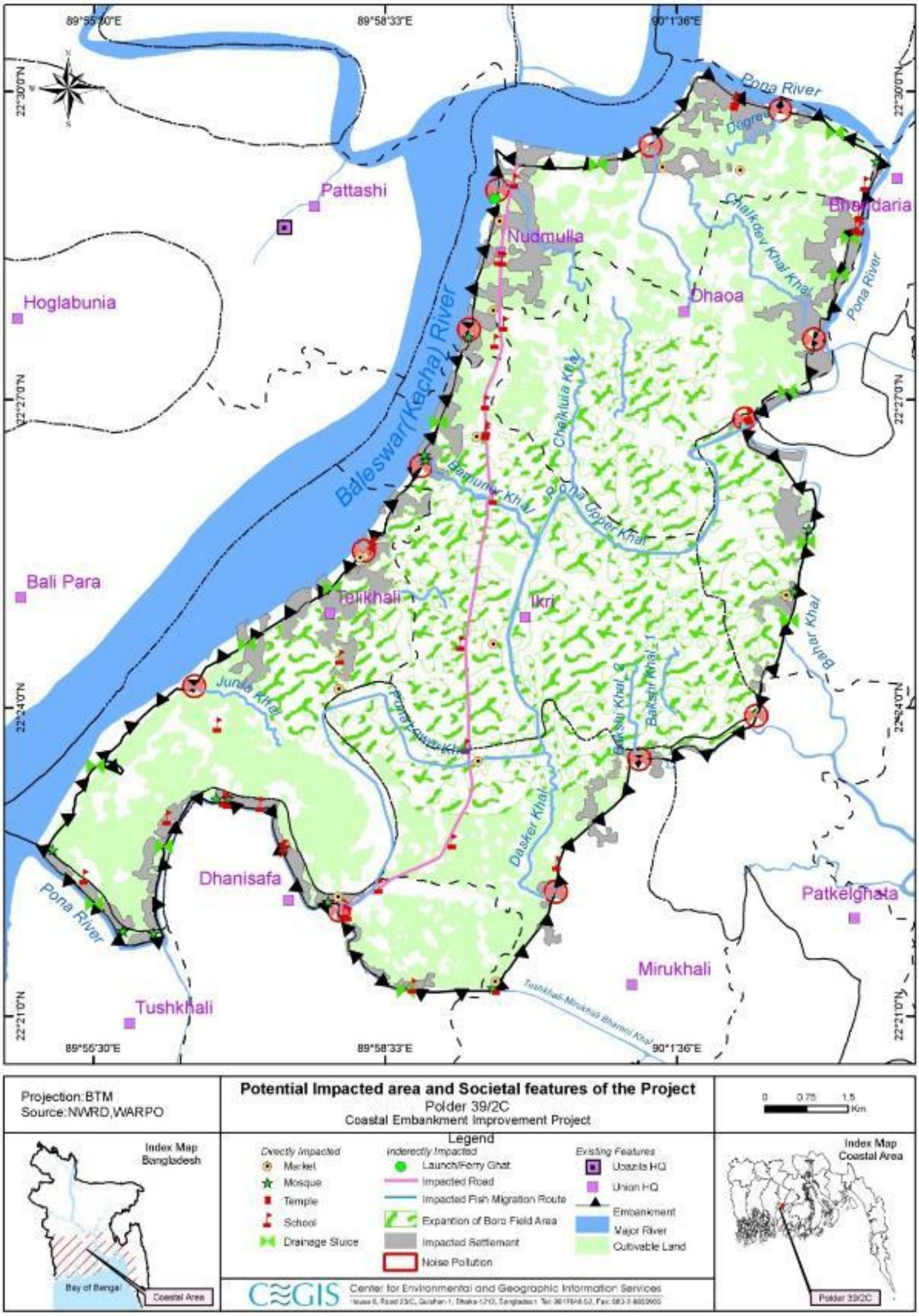
- Mobilization of equipment, construction material/vehicles
- Clearing of sites
- Collection of earth materials from burrow pits and Pona and Baleswar (Kocha) river bed and Baher and Bhuter khal
- Construction of civil amenities and development and
- Establishment of temporary construction yards

460. The activities will cause the following environmental impacts

6.3.1 Damages of properties due to Project Intervention and Land Acquisition

Impact

461. Land will have to be acquired to construct new embankment, retirement embankments (Ch. Km 14.2 to km 17.5) and water control structures. It is estimated that about 111.54 ha of land would be acquired resulting in displacement of about 1,747 households (Pucca-72, Semi pucca-97 nos, Tin shed – 742 nos, Katcha-468 nos and Thatched –368 nos). The details of acquired land are 25.71 ha for household, 11.38 ha of Vita/Highland, 18.78 ha crop land, 48.15 ha of orchard, 2.78 ha of pond, 2.78 ha of wetland/ditch and 3.09 ha commercially used land.CEIP, Planning and Design consultant has prepared Land Acquisition and Resettlement Action Plan as per guidelines of acquisition and requisition of immovable property ordinance, 1982 (Ordinance II of 1982). In this case, the details of the land acquisition plan, process and cost including the list of the PAPs are incorporat in the RAP report prepared by Planning and Design Consultants. During distribution of compensation, conflict may arise due to absence of proper legal document in connection with the ownership of land. The details of the acquired lands and other affected structures in Polder 39/2C are presented in **Tables 6.2** to **6.6.**



Map 6.1: Key Potential Impacts in Polder 39/2C

Table 6.1: Environmental and Social Screening Matrix (Unmitigated)

	Physical						***Biological***				***Social and Socio-economic***												
Project Phases and Activities	Soil Erosion/Contamination	Salinity Intrusion	Air Quality Air Quality	Surface Water Quality	Groundwater Quality	Water Availability and Consumption	Natural Vegetation	Wildlife/Aquatic Fauna	Fish habitat & Migration	Fish biodiversity & Production	Resettlement	Blocked Access Routes	Noise and Vibration	Impacts on Agriculture and grazing	Impacts on Fisheries	Flooding	Vehicular Traffic	Safety Hazard	Damage to Infrastructure	Public Health	Aesthetic Value	Gender and Cultural Issues	Employment Opportunities
Design Phase and Pre-Construction Phase																							
Land Acquisition	0		0	0	0	0	0	0	0	0	HN	0	0	0	0	0	0	0	0	0	0	0	0
Contractor Mobilization	MN	0	MN	MN	0	0	MN	MN	0	0	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Construction Camp Establishment	MN	0	MN	MN	0	0	MN	MN	0	0	MN	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	MP
Construction Phase																							
Equipment / Material Transportation	MN	0	MN	MN	0	0	0	0	0	0	0	MN	MN	MN	MN	0	MN	HN	MN	MN	0	MN	MP
Operation of Construction Camp	HN	0	MN	HN	MN	MN	0	MN	0	0	0	MN	MN	0	MN	0	MN	HN	MN	HN	0	MN	MP
Site Clearance	MN	0	MN	MN	0	0	MN	MN	0	0	0	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	HP
Borrow and disposal area management	HN	0	MN	HN	0	0	MN	MN	0	0	0	MN	MN	HN	MN	MN	MN	HN	MN	HN	MN	MN	HP
Re-excavations of water channels	MN	0	MN	HN	0	0	MN	HN	HN	MN	0	MN	MN	0	HN	MN	MN	HN	MN	MN	MN	MN	HP
Re-sectioning of Embankments	HN	0	MN	MN	0	0	MN	0	0	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Retirement of Embankments	HN	0	MN	MN	0	0	MN	0	0	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Installation/replacement/repair of Regulators	HN	0	MN	MN	0	0	0	MN	0	0	0	HN	MN	0	MN	HN	MN	HN	MN	MN	MN	MN	HP
Construction of flood wall	0	0	0	MN	0	0	MN	MN	0	0	0	0		0	0	0	MN	MN	0	0	0	MN	MN
Demobilization	MN	0	MN	MN	0	0	MN	MN	0	0	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Operation Phase																							
Operation of Regulators	MN	HN	0	HN	0	MN	0	MN	0	MN	0	0	0	HN	HN	HN	0	0	0	0	0	0	MP
Repair and Maintenance	MN	HN	0	MN	0	0	0	MN	0	MN	0	MN	MN	HN	HN	HN	MN	MN	0	0	0	0	MP
Monitoring	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	MN	0	0	0	0	0	MP

Key:-HN: High negative impact; MN: moderate negative impact; 0: insignificant/negligible impact; HP: high positive impact; MP: moderate positive impact.

Table 6.2: Land to be Acquired in Polder 39/2C

Type of land use	Quantity (ha)
Homestead	25.71
Vita/ Highland	11.38
Crop land	18.78
Orchard/ Forest land	48.15
Pond	2.78
Wetland/ Ditch	1.44
Fallow	0.20
Commercially used	3.09
Total	111.54

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012 and revised, 2016

Table 6.3: Primary Structures to be Affected in Polder 39/2C

Description	Quantity	Covered Area (square feet)
Pucca (made of bricks and mortar)	72	36,653.55
Semi pucca	87	33,555.95
Tin	742	235,742.76
Katcha	468	76,492
Thatched	368	36,864.79
Total	**1,747**	**409,252.48**

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012 and revised, 2016

Table 6.4: Secondary Structures to be Affected in Polder 39/2C

Description	Quantity
Pucca floor (sft)	4,879
Pucca latrine (numbers)	33
Gate (sft)	361
Meherab (sft)	36
Bathroom (sft)	212
Boundary wall (sft)	1,313.5
Bench (rft)	56
Urinal place (rft)	18
Stairs of house (rft)	160
Pucca latrine (numbers)	30
Slab latrine (numbers)	305
Katcha latrine (numbers)	2
Tube well (numbers)	69
Pillar (numbers)	8
Ablution bench (numbers)	45
Motor (number)	4
Septic tank (cft)	388.5
Water tank (cft)	1,320
Machine foundation (cft)	80

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012 and revised, 2016

Table 6.5: Trees to be Affected in Polder 39/2C

Types	Big	Medium	Small	Plant	Total
Fruit trees	38,789	7,560	14,403	14,830	75,582
Timbers trees	4,963	10,013	19,449	9,653	44,078
Medicinal	20	37	253	33	343
Banana	8,768	2,263	3,143	2,106	16,280
Bamboo	4,745	593	1,432	311	7,081
Total	57,285	20,466	38,680	26,933	143,364

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012 and revised, 2016

Table 6.6: Common Properties to be Affected in Polder 39/2C

Description	Quantity
Mosque	14
Eid Ga	2
Club House	1
School/Pathshala	5
Grameen Bank Center	1
Madrasa (religious school)	6
Hospital	2
Eco park	1
Atimkhana	1
Total	33

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012 and revised, 2016

462. The significance of this potential unmitigated impact has been assessed as Major, on the basis of impact magnitude and receptor sensitivity.

Mitigation

463. The following mitigation measures are to beundertakento address the above concerns:

464. A Resettlement Action Plan (RAP) is prepared in accordance with the national laws and WB OP 4.12. Salient features of the RAP includes: the affected households to be compensated for their loss of land, structures, trees, ponds and others; squatters and tenants are to be paid compensation for the loss of their structures and livelihood; sanitation facilities to be provided for each displaced household in the Polder area since about 337 latrines and 69 tubewells will be displaced during construction works; and community based drinking water facilities are to be constructed.

- Compensation will be madeprior to construction in accordance with RAP.
- Contractor will maintain liaison with communities.
- Grievance Redress Mechanism (GRM) tobe established.
- Follow ‘Find Chance’ procedures for common property resources.

Residual Impacts

465. The impacts associated with the involuntary resettlement are likely to be addressed with the help of the above mitigation measures, and the significance of residual impact is considered to be **Moderate**.

6.3.2 Deterioration of Environmental Quality for Contractor and Labour force mobilization

Impact

466. Establishment and construction of site facilities in the Polder may potentially cause air and water contamination, noise generation, hindrance to local communities, and other similar impacts. **Figure6.1** shows the key locations in the Project area where this impact is likely to take place as 19 schools are located near the embankment, whereas all the labour force facilities will be implemented near the embankment.

467. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

468. The following mitigation measures are to be undertaken to address the above concerns:

- Contractor will prepare site establishment plan and shall obtain approval from the DDCS&PMSC
- Approval from DDCS&PMSCwill be obtained for the location of temporary facilities.
- Tree felling and vegetation clearing will be minimized to establish site facilities.
- Photographic record willbe maintained to record pre-construction condition of the area.
- Site facilities will be established at safe distances from communities.
- Contractor will prepare and implement pollution control and waste management plans.
- Untreated wastes should be released on ground or in water.
- Exhaust emissions from vehicles and equipment will comply with standards.
- Vehicles, generators, and equipment will be properly tuned.
- Water will be sprinkled as and where needed to suppress dust emissions.
- Speed limits will be enforcedfor vehicles on earthen tracks.
- Vehicles and machinery will have proper mufflers and silencers.
- Liaison will be maintaineed with the communities.

Residual Impacts

469. The impacts associated with the establishment and construction of site facilities are likely to addressed with the help of the above mitigation measures and the significance of residual impact considered to Low.

6.3.3 Increase Traffic during mobilization Vehicular

Impact

470. Mobilization of contractor, 164 equipment and machinery, construction material and manpower will be transported to the Polder resulting in additional traffic on roads and in waterways. This traffic may potentially cause traffic congestion particularly in Charkhali to Mathbaria road. **Map 6.1** shows the roadsin the project area where this impact is likely to take place. Moreover, a total of 19 numbers of schools are located near the embankment approximately within 100 m to 500m (See section (2.2.1) and seven important bazaars are also located near the embankment of which four Bazaars namely Bhaylebunia Bazaar (Ch

10.31 km), Teltulbania Bazaar (Ch 20.3 km) Dhanisafa Bazaar (24.30 km) and Hetalia Bazaar (Ch 49.93 km) will face traffic congestion during *Hat* time.

Mitigation

471. The following measures are to be undertaken to address the above concerns:

- Contractor to prepare and implement a mobilization plan considering water vessels and launch movement in the external rivers and internal khals/canals. Avoid launch movement during navigation traffic hours.
- Contractor to prepare and implements a traffic management plan for vehicular movements.
- Vehicular traffic should take place in the polder area and on embankment during off peak time. There will be no vehicular movement during school hours(10:00 am to 13:00pm) and during market hours at marketing days (Hatbar).
- Ensure minimal hindrance to local communities and commuters, specifically, in the Charkhali ferry Ghat (Figure 9.1).
- Liaise with local communities, concerned bazaar committeeandSpecifically,Union Parishad members of the polder. The details of communication with theUnion Parishad Chairman and members have mentioned in the public consultation chapter.
- Keep provision for training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing Video at different places of the polder especially in the Bhaylebunia Bazaar, TeltulbaniaBazaar, Dhanisafa Bazaarand Hetalia Bazaar. These four places are the common community gathering places in the polder area. This training is need for the safety of the local stakeholders.

Residual Impacts

472. The impacts associated with the increased traffic are likely to adequately address with the help of the above mitigation measures and the significance of residual impact will be Low.

6.3.4 Changes in Land Use

Impact

473. The polder partially embanked by the western dyke, which is located on the left bank of the Baleswar River. The proposed marginal dyke will change the land use pattern of the area. Land would be needed to establish temporary facilities including construction camp (labour shed) and borrow pit areas. It is estimated that 33 labour sheds will be constructed to provide temporary housing facilities for the non-resident rehabilitation workforce. All labour sheds will be constructed in the requisite land. The major lands that are fallow during dry season will be used as borrow pit areas. In the wet season, these borrow pits areas are in scattered use for seedbeds or grazing of livestock by the dwellers of the polder.

474. The significance of this potential unmitigated impact has been assessed as Low based on impact magnitude and receptor sensitivity. All the borrow pits of the foreshore areas will be filled up over time due to tidal inundation.

Mitigation

475. The following mitigation measures will be undertaken to address the above concerns:

- Pay compensation/rent if private property acquired on temporary basis, the instructions of which shouldbe specified in the tender document.

- Construct labour shed/camp at government khas land, where possible.
- Avoid unnecessary tree cutting as much as possible.
- Consult local stakeholders in the polder area in presence of elected executive body of Union Parishad.
- Site-specific camps management plan will be prepared by the Contractor for each camp as part of the Construction Environmental Action Plan to followed upon approval by the DCSC &PMSCand PMU.

Residual Impacts

476. The impacts associated with changes in land use are likely to adequately addressed with the help of theabove-mentionedmitigation measures and the significance of residual impact will be **Low.**

6.4 Impacts during Construction Phase

477. Reconstruction and rehabilitation of embankment and polder area will involve the following tasks during construction phase:

- Mobilization of equipment, construction material/vehicle
- Placement and compaction of earth
- Re-excavation of canals
- Construction of water control structures
- Construction of flood wall
- Demolition of non-repairable hydraulic structures
- Disposal of canal excavated wastes

6.4.1 Increase of Drainage Congestion and Water Logging

Impact

478. The Project activities particularly on regulators and sluices and in water channels may block or clog the drainage channels, potentially causing water logging in the surrounding areas and negatively affecting the agricultural practicesand the associated communities. In particular, areas along Dasher Juniar, Teli Khali, and Chakluia water channels are already facing drainage congestion problems. The Project works on the regulators in the area and any additional drainage congestion caused by the construction activities are likely to exacerbate the water logging problem. In addition, excavation of eleven *khals* in the Polder (Table 4.3) is likely to disturb the drainage, which takes place through these channels.

479. The significance of this potential unmitigated impact has been assessed as major on the basis of impact magnitude and receptor sensitivity.

Mitigation

480. The following mitigation measures are to be undertakento address the above concerns:

- Construct diversion channels before replacement of regulators.
- Proper scheduling of the construction works of regulators and re-excavation of khals should be prepared to to avoid drainage congestion.
- Contractor will ensure that drainage channels not obstructed or blockedby the construction activities adding to any drainage congestion.

Residual Impacts

481. The temporary impacts associated with construction related water logging are likely to adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.2 Loss of Agriculture production

Impact

482. About 27.73 ha of agriculture land is likely to be acquired for construction of retired embankment along Baleswar (Kocha) river. This land includes single cropped areas (Ch 34.2-36.00 km; Ch 37.00 to 38.00 km; Ch.39.6 to 42.3 km; Ch.51.5 to 54.0 km; Ch.54.00 to 55.50km) which are likely to be affected. The loss of production under the acquireed land given in **Table 6.7**. During collection of earth from the borrow pit areas, no agriculture land will be impacted in the Project area as the spoil earth will be collected from areas outside the embankments. Besides, collecting earth material from borrow pits, dredging of suitable material from the rivers of Baleswar (Kocha) and Bahar Khal, Bhuter Khal and Mirukhali and Bharani Khal is an option.

483. In addition, construction activities, movement of construction machinery, project related vehicular traffic, material borrowing, material stockpiling, waste disposal or camp establishment can potentially damage crops or affect the cultivated land.

484. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Table 6.7: Loss of Production under the acquired land

Name of Crops	Area(ha)	Yield(T/ha)	Production loss (m.ton)
T. Aman(Local)	27.73	2.2	61.0
Total			61.0

Source: CEGIS estimation, 2015

Mitigation

485. The following mitigation measures are to be implemented to address the above concerns:

- Compensation will bemade for any land loss and crop damage.
- Avoid standing crop fields for mobilization and vehicular movement during construction.
- Avoid agricultural land for spoil dumping, material borrowing, material stockpiling, and construction of labor camps.If not avoidable, the land will be cleared as soon as possible after completion of the works.
- Contractor will maintain liaison with communities.
- Contactor will prepare site-specific spoil management and disposal plans for each site to follow upon approval by the DSC Consultant and PMU.

Residual Impacts

486. The impacts associated with loss of agriculture are likely to adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.3 Disturbance of irrigation water conveyance

Impact

487. Irrigation is vitally important for the agricultural activities in the Teulbaria, Dhanisafa, Bansbunia, Junia, Telikhali, Pasurbunia and Nudmulla of the Polder. Construction activities particularly for regulators and in water channels can potentially disrupt the crop irrigation thus negatively affecting cultivation. The works on sluices can cut off the incoming water from the river, while the excavation works in water channels can affect water conveyance through them.

488. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

489. The following mitigation measures are to be implemented to address the above concerns:

- Contractor will construct diversion channels before construction of each regulator.
- Sequence of work for the regulators and the water channels will carefully be planned to avoid irrigation disruption.
- Contractor will maintain liaison with communities.

Residual Impacts

490. The impacts associated with disruption of irrigation are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.4 Hindrance of Fish Habitat and their Migration

Impact

491. New structures including 13 drainage sluices, 22 flushing sluices and 8 closures will constructed as part of the Project activities. The drainage sluices will be installed at confluence of all major khals to the surrounding rivers.In8 of the major khals, the present free connection to the surrounding rivers will be closed, however with sluice gates connected to ensure managed in- and out-flow providing protection against surges and floods, and proper drainage. (refer Map 4.2).During construction fish migration from the rivers to the interior of the polder fish species, particularly smaller species such as *Pairsa*, Vetki (juvenile), *Harina Chingri, Gulsa*, etc., now considered to take part in drifting migration with tides would be hampered in their movement.Thepotential impact on the fish local fish population is considered as Major.

492. *Khal* re-excavation would hamper fish movement inside the polder temporarily. The impact assessed as Medium.

493. The significance of the combined impacts on fish migration has been assessed as **Major** on the basis of impact magnitude and sensitivity to receptors.

Mitigation

494. The following mitigation measures are to be implemented to address the above concerns:

- Duration of construction of structures and other interventions should be shortened as much as possible at least should maintain the contract period.
- Dismantle bundhs and other obstructions built to support the construction of structures as soon as work is over.

- For manual re-excavation of Khals, compartments could be built in a cascade manner and bailing out of water to take place from one compartment to another to avoid damage to fish.
- Sequence of construction of regulators and re-excavation of drainage Khals should beplanned based on the fish migration calendar so that implementation of project could complete with minimum hindranceto fish migration.
- Contractor will maintain liaison with communities so that they could realize the issue. It is more important in case of timing of entering water into the polder for shrimp culture along with paddy cultivation and exiting water from the same. Liaison of contractor with community would create scope for setting proper time for the construction work so that no or insignificant impact to the shrimp farming and paddy cultivation is caused.

Residual Impacts

495. The impacts on fish habitat and migration are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Medium**.

6.4.5 Damages of Benthic Fauna

Impact

496. Benthic communities play an important role in food chain not only for lentic (standing water) but also for lotic (flowing) water bodies. Construction activities including re-excavation of the 11 *khals* **(Table 4.5)**, possible dredging of Kocha and other external rivers of the polder for construction material and discharge of solid wastes and waste effluents can potentially impacts the benthic communities of the water bodies.

497. The significance of this potential unmitigated impact has been assessed as lowbased on impact magnitude and receptor sensitivity.

Mitigation

498. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will preparesite-specific plans for pollution control and for standard operation and procedures for handling pollution spills to be implemented upon approval by the DSC Consultant and PMU.
- Contractor will carry out *khal* excavation in segmentwise thus minimizing impacts on benthic fauna.

Residual Impacts

499. The impacts on benthic fauna will be somewhat reduced with the help of the above mitigation measures. After the construction phase, these resources are likely tofully recover gradually. The significance of the residual impacts has been assessed as **Low**.

6.4.6 Damage / Disturbance to Faunal Resources

Impact

500. Implementation of the proposed interventions in this polder would have temporary impacts on fauna. The existing fauna inhabiting the homestead and roadside vegetationmight be relocatedeither permanently or temporarily due to disturbances or habitat destruction in the construction sites especially, the reptile species like Gecko (*Hamidactylus flaviviridis*), Common Garden Lizard (*Calotes versicolor*), Little Skink (*Mabuya macularia*), Bengal Monitor

(*Varanus bengalensis*), Checkered Keelback (*Xenochropis piscator*), and Striped Keelback (*Amphiesma stolata*).

501. During re-sectioning and retired embankment works of embankment along the Baleswar (Kocha) river, and the construction of the embankment along the Pona River to the east and Tuchkhali Khal to the south some wildlife species like Jackal (*Canis aureus),* Mongoose (*Herpestes javanicus),* Bengal Monitor (*Varanus bengalensis), and Fishing Cat (Prionailurus viverrinus)*may be impacted.

502. The significance of this potential unmitigated impact has been assessed as **Moderate**based on impact magnitude and receptor sensitivity.

Mitigation

503. The following mitigation measures will be implemented to address the above concerns:

- Construction works would be carriedout carefully to minimize disturbance of wild life.
- The Contractor will preparesite-specific plans for pollution control and for standard operation and procedures for handling pollution spills to implement upon approval by the DCS Consultant and PMU.
- Labor will not indulge in hunting, trapping, or shooting wild animals.

Residual Impacts

504. The impacts on faunal resources are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low.**

6.4.7 Damages / Disturbance toFloral Resources

Impact

505. It is estimated that 143,364 trees of different species and varying sizes have to be cut for the re-sectioning, retirement and new construction of embankments in Polder 39/2C on 111.54 ha of land to be acquired. In addition, establishment of temporary labor camps and other temporary facilities, material stockpiling, material borrowing, and waste disposal can potentially affect the natural vegetation and trees. The details of species composition is provided in the RAP Report.

506. According to Afforestation Plan of Feasibility Report (Volume III: Afforestation Report, September 2013), there is a scope of only 28,175 nos trees (2500 saplings/ha) of proposed species along 11.27 ha embankment slope. That number is not sufficient considering number of felling trees for new embankment construction.

507. The removal of vegetation from canal and riversides due to pilling of spoils earth during re-excavation of khals and dredging spoils will cause local negative impacts on the floral community. Small plants and shrubs would be impacteddue to pre-construction materials dumping and construction of labour shed.

508. The significance of this potential unmitigated impact has been assessed as **Moderate**,based on impact magnitude and receptor sensitivity.

Mitigation

509. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare a tree cutting plan and re-plantation plan, and will carry out compensatory tree plantation towards the end of the construction phase. A plant nursery should be established for this purpose with selected tree species (egg, *Narikel, Taal, Tentui* and *Babla*) in the beginning of the Project.

- The Contractor will prepare a site-specific spoil management and disposal plan for implementation during construction upon approval by the DSC Consultant and PMU, ensuring collection of earthen materials and dumping of spoils at low or less vegetated areas. Consider minimum vegetation loss as much as possible for the construction of labour camps and allied facilities.
- Implement an additional social afforestation programme at homestead platforms, khal, dykes, graveyards, institution grounds and other available lands to compensate tree felling for embankment construction.
- Ensure proper implementation of afforestation onavailable land, primarily on embankmentswith local floral species after completion of construction works.
- Distribute plant saplings to the local inhabitants free of cost for more vegetation in settlement areas and fallow land

Residual Impacts

510. The impacts on the floral resources are likely to be addressed with the help of above mitigation measures, adequately and the significance of residual impact is consideredto be**low**.

6.4.8 Deterioration of Air Quality

Impact

511. Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), and particulate matter (PM). These emissions can deteriorate the ambient air quality in the immediate vicinity of the Project sites (particularly along the embankment, and around the channel excavation sites and borrow pit areas. Furthermore, construction activities such as excavation, levelling, filling and vehicular movement through unpaved tracks may also cause fugitive dust emissions. These emissions pose health hazards to the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will exposed to air contamination caused by the Project activities (**Map6.1**). Nineteen schools (at Ch 0.5 km, Ch 1.03 km, Ch 6.3 km, Ch 9.0 km, Ch 17.3, Ch 17.7 km, Ch 20.00 km, Ch 22.00 km, Ch 24.55 km, Ch 27.24 km, Ch 27.8 km, Ch 28.27 km, Ch 24.55 km, Ch 33.22km, Ch 42.7 km, Ch 43.25 km, Ch 44.28km, Ch 54.00 km and Ch 56.6 km) are located near the embankment, where the students are under threat for fugitive dust emissions.

512. The significance of this potential unmitigated impact has been assessed as **Moderate**based on impact magnitude and receptor sensitivity.

Mitigation

513. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare a site specific pollution control management plan for air quality control to be implemented upon approval by the DSC Consultant and PMU, where:
- Exhaust emissions from vehicles and equipment will comply with the standards level and monitoring by DoE and independent monitors.
- Proper tuning of vehicles, generators, and equipment will carryout by the contractors, to minimize exhaust emissions.

- Construction material (sand/soil) will keep covered while transporting and stock piled.
- Regular water sprinkling will carryout as and where needed, particularly on the earthen tracks near communities.
- Vehicle speed will be restricted (15 km per hour) on earthen tracks particularly near communities and school.
- Vehicles and other machinery will be turned off when idle
- Camps will be located at a safe distance from communities and schools.
- Liaison with the communities will be maintained and grievance redress mechanism will be established at the site.

Residual Impacts

514. The impacts associated with the air quality degradation are adequatelyaddressed through the aforementioned mitigating measures. The residual impact considered as **Low.**

6.4.9 Soil and Water Contamination

Impact

515. Wastes particularly effluents from the work sites may contaminate the soil and water. Construction material, demolition debris, or fuel/oils may enter in the river Pona, Nalbunia and Siakati or other water bodies causing contamination. The contractor's camps will generate domestic solid wastes and wastewater including sewage. The contractor's workshops will generate oily water, waste oils, oily rags, and other similar wastes. The stores and warehouse will generate solid wastes such as empty cement bags, cardboards, and wooden crates. Improper disposal of these waste streams can potentially contaminate the soils and water resources of the area. Soil and water contamination can potentially have negative impacts on the local community, natural vegetation, agriculture, and biological resources of the area including aquatic flora and fauna.Borrow material from the riverbanks may potentially cause increased turbidity in the rivers. Further, release of effluents, soil, and/or sand in water bodies may increase water turbidity, which would prevent sunlight to enter into the water that is necessary for promoting photosynthesis of aquatic plants. **Figure 2 under Appendix D** shows the key location where these impacts are likely to take place.

516. The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

517. The following mitigation measures are to be implemented to address the above concerns:

- Contractor will prepare and implement site-specificpollution control plan and a Standard operation plan and procedures for handling pollution spills, and management of fuels and hazardous wastes for implementation upon approval by the DDCS&PMSC and PMU. Here:
- Contractor workshops will have oil separators/sumps to avoid release of oily water;
- Contractor will avoid repairing vehicles and machinery in the field.
- Contractor will use plastic sheet or gravel in the workshop and equipment yard to prevent soil and water contamination.
- Contractor will dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources.

- Contractor will ensure that there is no leakage, spillage, or release of fuel, oil or any other affluent/wastes on the ground or in the water from its construction machinery, vehicles, boats, launches, and barges. Contractor will regularly monitor the condition of its fleet.
- Material borrowing from the riverbanks will carryout sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river.
- Contractor will locate camps away from the communities and drinking water sources.
- Contractor will prepare and implement campwaste management plan (septic tanks, proper solid waste disposal).
- Contractor will not release untreated wastes on ground or in water.
- Contractor will re-use spoil and excavated material where possible.
- Contractor will dispose spoil at designated areas with community consent.
- Construction material, demolition debris, and excavated soil/silt will not be allowed to enter into water bodies.

Residual Impacts

518. The impacts associated with soil and water contamination are likely to be addressed with the help of the above mitigating measures appropriately and the significance of residual impact will be **Low**.

6.4.10 Increased Sedimentation

Impact

519. Borrowing material from the riverbanks may potentially cause increased sediments in the rivers. Similarly, excavation of Chokeydev, Pona upper, Bakshi, Dasher, Juniar, Teli Khali, Chakluia, Hetalia, Nodmullar, Degrer and Bamuner water channels (Refer Section 4.5.4) can potentially increase sediment loads. Excavated material from the channels if left along on thebanks may again enter into the water, thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter into the river or other water bodies causing increased sediments in them. Run off from construction sites, camps, and other temporary facilities may enter water bodies increasing their sediment load.

520. The significance of this potential impact has been assessed as **Major**based on impact magnitude and receptor sensitivity.

Mitigation

521. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare a site-specific sediment and erosion control plan for each construction site, as well as a spoil management and disposal plan to be implemented upon approval by the DCS Consultant and PMU. Here the:
- Contractor will protect embankment slopes.
- Contractor will excavate channels after dewatering the same.
- Contractor will not leave excavated earth and silt on channel banks.
- Contractor will implement measures to protect channels from run-off from work areas and camps.
- Contractor will obtain borrow material from riverbanks in a manner not to increase siltation in rivers, and will not leave loose soil after excavation.

Residual Impacts

522. The impacts associated with sedimentation are likely to adequately addressed with the aforementioned mitigating measures and the significance of residual impact will be **Low**.

6.4.11 Generation of Noise and Vibration

Impact

523. The construction activities particularly constructionof water control structures, excavation, compaction, operation of construction machinery, and vehicular traffic will generate noise and vibration which are likely to affect the nearby communities. In addition, camp sites may also generate noise.

524. Increased noise levels may cause disturbance, nuisance and even health hazards to the nearby communities as well as to the construction workers. In particular, the settlements near the working areas will be exposed to noise and vibration generated by the Project activities; in addition, sensitive receptors such as schools (Map 6.1) are likely to be more severely affected by noise. Nineteen schools are located along the proposed embankment of which ten are very close to embankment (refer Map 6.1). The students of these schools may experience serious noise disturbance problems during school time.

525. The significance of this potential unmitigated impact has been assessed as **Moderate**based on impact magnitude and receptor sensitivity.

Mitigation

526. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare site specific pollution control plans for noise control for each construction site as well as a traffic management plan to be implemented upon approval by the DCSC and PMU, for:
- Restricting/limiting construction activities during the daytime.
- Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards.
- Vehicles and machinery will have proper mufflers and silencers.
- Provision of noise barriers are to develop at schools and other sensitive receptors, as needed.
- Provisions of PPE (earmuffs and plugs) to ensure the labor.
- The construction crew will be instructed to proper use the equipment, to minimize noise levels.
- Camps will be located at a safe distance from communities.
- Liaison with the communities will be maintained and grievance redress mechanism will be established at the working site.

Residual Impacts

527. The impacts associated with noise and vibration likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.12 Increase of Inland and Waterway Traffic

Impact

528. Transportation of construction materials is a key concern during execution of the interventions. A couple of options are available for carrying construction materials to the Project stockyards in the polder. The first option would be the involvement ofwaterway transportation along Ghasiakhali-Baleswar River from the Khulna-Mongla port to the Polder. Water vessels would used for carrying materials in this case. The second option would be the involvement of road transportation from Khulna to Charkhali Ferry ghat inside the Polder through truck.

529. Material transportation along the major roads and waterways may not create a significant problem; however, additional traffic at smaller ferry ghat such as the one at Charkhali ferry jetty (*ghat*) may cause traffic congestion and hindrance to other commuters, travellers, and transporters. Increased amount of waterway traffic would also increase the noise level of the area.

530. The significance of these potential impacts has been assessed as **Moderate**based onimpact magnitude and receptor sensitivity.

Mitigation

531. The following mitigation measures are to be implemented to address the above concerns:

- Contractor will prepare a site-specific traffic management plan to implement upon approval by the DCSC and PMU. That may address:
- Use of transportation of material and machinery by waterways to minimize disturbance to land and ferry traffic to the possible extent.
- Contractor to establish new, temporary jetties as and where needed (eg. at Charkhali ferry ghat).
- Liaison to maintain with community and Charkhali ferry ghat authority.

Residual Impacts

532. The impacts associated with additional traffic on roads and along waterways can be addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.13 Safety and Public Health Hazards

Impact

533. The area is prone to cyclones and storm surges. Although the works will becarriedout during the dry season, a certain level of safety hazards still exists for the construction staff.

534. The construction activities will involve operation of heavy construction machinery, vehicular traffic, excavation and filling operations. These activities may pose some safety hazards to the local population as well as for the construction workers. The fuel storage at the campsites may also pose safety hazards for the construction staff as well as to surrounding population.

535. Inappropriate waste disposal at the camps and construction sites, and air quality deterioration caused by the Project’s vehicular traffic and construction activities potentially pose health hazards to the construction staff and nearby population. Unhygienic condition and unavailability of safe drinking water for the construction staff will expose them to health risks. In addition, influx of construction staff can potentially expose the nearby population to communicable diseases.

536. The significance of the potential impacts is assess as **Major**based on impact magnitude and receptor sensitivity.

Mitigation

537. The following mitigation measures are to be implemented to address the above concerns:

- Liaison will be established with the Bangladesh Meteorological Department for early warning of storms and cyclones. Radio and television sets will be kept in all the labor camps for obtaining weather information.
- The contractors will prepare site specific Camp management plans, an Occupational health and safety plan including training programs as well as an Emergency response plan with early warning system and training programmes to beapprovedby the DSC Consultant and PMU. The Plan will also include awareness raising and prevention measures, particularly against communicable diseases such as hepatitis B and C, and HIV/AIDS. Besides:
- All temporary facilities including labor camps will meet minimum safety, hygiene and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection against disease vectors, and protection against weather elements, firefighting, and other similar essential services).
- All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities.
- The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible.
- Health screening of employees would be a Contractor obligation prior to labourers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and include a review of appropriate vaccinations. Workers would be given vaccinations as and when required.
- All site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the working site.
- All employees need to carry out induction health and safety training prior to commencement of work. Training would include the provision of appropriate written or visual materials to reinforce learning. Where illiteracy levels are high, OHS issues need to be covered more frequently than normal in toolbox talks.
- Public awareness training and workshops on safety and health risks will be conducted for local communities prior to and during construction operations.
- Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activities. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible.
- Ensure the acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work;
- Ensure that no workers are charged fees to gain employment on the Project.
- Ensure rigorous standards for occupational health and safety are in place.
- Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.

- The contractor will adopt a Human Resource Policy appropriate to the size and workforce, which indicates the approach for management employees (this could be part requested in the tender process).
- Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits;
- Provide health insurance for employees for the duration of their contracts;
- Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts;
- Employ a community liaison officer (this could be full time or part of another post's responsibilities);
- Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training;
- Report regularly on the labor force profile, including gender, and location source of workers;
- Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase;
- Organize a training program and keep training registers for construction workers;
- Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system, which provide workers with a safe and healthy working environment taking into account the inherent risks for this type of project.
- Availability of safe drinking water will be ensured for the construction staff.
- First aid boxes will be made available at each construction site. Emergency phone numbers (including hospitals, Fire Department, and Police) will be displayed at key locations within the site. Each site will have anambulance facility.
- Firefighting equipment will be made available at the camps and worksites.
- The camp staff will be trained for safety against firefighting.
- All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel.
- Waste management plan to be prepared and implemented in accordance with international best practice.
- Liaison with the community will be maintained.

Residual Impacts

538. The impacts associated with safety and health hazards are likely to be addressed with the help of above mitigation measures and the significance of residual impact will be **Moderate**.

6.4.14 Hindrance for Pedestrian and Vehicle Movement

Impact

539. Seven markets (at Ch. 20.51 km, Ch 24.30 km, Ch 10.30 km, Ch 43.2, Ch 49.9 km, Ch 48.19 km and Ch 39.5 km) **(Map 6.1)** and a few other small markets are located besides the marginal dyke of the polder. These markets play a very important role in the livelihood of the Polder inhabitants as well as meeting the daily needs of the people. Construction activities along the embankments are likely to disrupt the market as these will displaced during construction of the embankment. The construction activities along the embankment will also cause temporary disturbance in the movement of local people. The internal roadways are not sufficient to provide alternate means of transportation. Local people will suffer due to their

limited roadway movements during construction works along the embankment. This will affect their economy and earning options as well.

540. The significance of those unmitigated impacts is assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity.

Mitigation

541. The following mitigation measures are to be implemented to address the above concerns:

- The Contractor will prepare site specific traffic management plans as well as Spoil management and disposal plans to be implemented upon approval by the DDCS&PMSC and PMU, for:
- The works on embankment will carefully schedul to minimize impact on local markets and transportation routes.
- The embankment works will carryout segment wise and soil will placed linearly on half of the embankment, leaving the other half to be used as track. The works of the first half when completed, it will open for local traffic while the works of the other half will be undertaken.
- Work schedule will be finalized in coordination and consultation with local representatives and communities.
- Local routes will not be blocked as far as possible. If unavoidable, alternative routes will beidentified through consultation with local community.
- A GRM will be put in place.

Residual Impacts

542. The impacts on the floral resources are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.4.15 Raise social unrest between Local worker and outside worker

Impact

543. Around 4,890 number of skilled and 128,400 number of unskilled labour will be required for construction activities. Most of the labours will be needed for re-sectioning of embankment and retired embankment. It is envisag that about 60 percent of the construction workers will recruited from the polder area and the remaining will come from other areas. The presence of outside labourers in the area may create friction and conflict between the local labor and outside labor, and between local community and outside labor.

- Demand of the local people related to the labour recruitment processes.
- Conflicting issues between the labours and the contractors related to wage, working hour, working facilities, women worker’s involvement and payment schedule.
- May create labour leadership problem.

544. Presence of a large number of outside labours can potentially cause encroachment in the privacy of local population particularly women and their mobility can be negatively affected.

545. The significance of this potential unmitigated impact has been assessed as **Moderate**based on impact magnitude and receptor sensitivity.

Mitigation

546. The following mitigation measures are to beimplemented to address the above concerns:

- The Contractor will prepare a site specific camps management plan and specific traffic management plans to be implemented upon approval by the DSC Consultant and PMU, including:
- Proper awareness programs will be conducted through public consultation measures such as village scoping sessions, meetings, and placement of billboards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers.
- Liaison with the communities will bemaintain.
- Cultural norms of the local community will be respected and honoured.
- A GRM will be established to address the grievances of local as well as outside labourers.
- Careful use of local natural resources and project resources, fuel-wood and electricity.
- Restrictions related to consumption of alcohol and drugs.
- Safe driving practices.
- Respect for the local community and its cultural norms in which labourers are working.
- Avoid construction activities during prayer time.

Residual Impacts

547. The impacts associated with social unrest are likely to address with the help of above mitigation measures, and the significance of residual impact will be **Low**.

6.4.16 Disturbance of construction activities due to natural hazards

Impact

548. Historically, this area is vulnerable to cyclone, storm and tidal surges. As per construction schedule, the development activities of proposed new polder will conduct from October to May while most of the cyclone and storm surges have occurred in this area. In the event of a cyclone, the works will be in danger.

549. The significance of this potential unmitigated impact has beenassessed as **High**on the basis of impact magnitude and receptor sensitivity.

Mitigation

550. The following mitigation measures are to be implemented to address the above concerns:

- The contractors will prepare site specific Emergency response plan with early warning system and training programmes to be approved by the DSC Consultant and PMU, incorporating:
- Disaster warning and Weather signals will be considered by the contractor during construction works
- STOP construction during cyclonic event and repatriate all the workers in a safe zone
- Radio and television will be kept in all the labour sheds for getting weather information through these media.
- Ensure rigorous standards for occupational health and safety are in place.

Residual Impacts

551. The impacts associated with natural hazards are likely to address with the help of above mitigation measures and the significance of residual impact will be **Moderate**.

6.4.17 Increase employment generation

552. The construction work including construction of new and retired embankment, re-sectioning of embankment, re-excavation of khals, construction and repairs of sluices, afforestation etc. will generate a significant amount of employment over the construction period for local people and outside professionals. About 4,890 skilled and 1,28,400 unskilled labor will need for implementation of the project.

6.5 Impacts during Operation Phase

6.5.1 Increase use of agro-chemicals

Impact

553. Presently around 3,610 metric tons of chemical fertilizers (53% urea, 21% TSP, 16% MP and 10% Gypsum) and 60 metric tons of pesticides (both granular and liquid form) are use for cultivation. The cropped area and cropping intensity will beincreased due to implementation by improving irrigation facilities, removing of drainage congestion and arresting intrusion of saline water. Additional about 2,220 metric ton of chemical fertilizers and 40 metric ton of pesticides would need to be applied for expansion of crop area as well as conversion from local varieties to high yielding varieties. This runoff may also lead to eutrophication of the water bodies. Such phenomenon would increase the diurnal variation in the dissolved oxygen concentrations in thereceiving water creating anoxic conditions during night and thus negatively affecting the aquatic fauna. Besides, high runoffs with pesticides may be toxic to the aquatic fauna.

554. The significance of this potential unmitigated impact has been assessed as **Major**based on impact magnitude and receptor sensitivity.

Mitigation

555. The following mitigation measures are to be implemented to address the above concerns:

- Capacity building and awareness raising of the farmers will be carried out to practice Integrated Pest Management (IPM) and Integrated Crop Management (ICM) – in order to minimize usage of chemical inputs.
- Farmer groups will have close contact with DAE for adoption of various measures of IPM/ICM.
- Farmers will be encouraged to use organic manure to increase soil fertility and avoiding water contamination.
- Farmers will be encouraged to cultivate leguminous crops to enhance the soil quality.

Residual Impacts

556. The impacts associated with usage of increased level of chemical inputs are likely to addressed with the help of above mitigation measures and the significance of residual impact will be **Moderate**.

6.5.2 Increase of sedimentation in water channels and rivers

Impact

557. Sediment may deposit at the intake of regulator, which may create further drainage problem inside the polder if a sediment management plan not adequately implemented in future.

558. The significance of this potential unmitigated impact has been assessed as **Major**based on impact magnitude and receptor sensitivity.

Mitigation

559. The following mitigation measures are to beimplemented to address the above concerns:

- An ongoing program of de-silting of water channels will be considered with full involvement and participation of the community.
- The local government (Union Parishad) will be authorized to monitor the development activities.
- Prepare Bangla manual for sluice gate operation and provide training to WMOs.

Residual Impacts

560. The impacts associated with drainage congestion are likely to be mostly addressed with the help of above mitigation measures and the significance of residual impact will be **Moderate**.

6.5.3 Increased Salinity Intrusion due to Leakage of Regulators

Impact

561. The proposed project has been designed to protect polder 39/2C against salinity intrusion, constituting an important element for expanding agricultural and aquaculture production inside the polder. According toexperiences from other coastal polders, mal-operation and leakage of regulators may occur and will result in salinity intrusion during thedry season causing severe damage to the soil, water resources, and crops. If the regulators are not monitored and operated by the BWDB after project completion, then salinity intrusion due to leakage of regulators constitutes a risk in future.

562. The significance of this potential mitigated impact has been assessed as **High**on the basis of impact magnitude and receptor sensitivity.

Mitigation

563. The following mitigation measures are to beimplemented to address the above concerns:

- Regular monitoring and careful maintenance of the water control structures will be ensured.
- Standard operating procedures will be prepared and implemented for the water control structures. These procedures will translate in Banglaas well.
- Capacity building of WMOs will be carried out.

Residual Impacts

564. The impacts associated with salinity intrusion are likely to be adequately addressed with the help of above mitigation measures and the significance of residual impact will be **Low**.

6.5.4 Reduction in of Fish Habitats

Impact

565. Due to implementation of intervention like construction of closure dam, new water regulator structures, construction of new embankment, fish habitats the internal khals would change from brackish to freshwater habitats during the in dry season. Excavation of internal khal would improve the fish habitat quality to some extent in the polder area. It is expect that khals would go under culture fishery (about 80ha). It is observedfrom the field study that there are some fish farms practising culture of finfish and prawn together. So it is expected that safeguarding of the area from flooding inundation and salinity intrusion would promote prawn culture practices in this polder.

566. The significance of this potential unmitigated impact has been assessed as **Minor**based on impact magnitude and receptor sensitivity.

Mitigation

567. The following mitigation measures are to beimplemented to address the above concerns:

- Use organic manure and IPM method for controlling contamination of water pollution.
- Re-enforcing of fisheries laws and regulations in the field for protecting indiscriminate fishing.

Residual Impact

568. Implementing the above mitigation measures, the impacts associated with fish habitat are likely to alleviat and the significance of residual impact will be **Low**.

6.5.5 Obstruction to Fish Migration

Impact

569. Most of the brackish and freshwater fish species migrate through the khals at some stage of their life cycle for spawning, nursing and feeding purpose (see Chapter 6). The important khals for fish migration are Pona Upper (Ch. 6.30 km), Baksih Pona Lower (Ch. 24 35km), Junia (Ch 39.10 km) Telikhali (Ch 43.25 km), Hetalia (Ch 50.75 km), Nodmullar (Ch 54.45 km), Darulhuda (Ch 48.10) and Bamuner Khal (Ch 44.35 km), which are directly connected with external rivers.

570. New structures including 13 drainage sluices, 22 flushing sluices and 8 closures will constructed as part of the Project activities. The drainage sluices will be installed at the confluence of all major khals to the surrounding rivers (refer Map 4.2). In8 of the major khals, the present free connection to the surrounding rivers will closed, however with sluice gates connected to ensure management of in- and outflow providing protection against surges and floods, and proper drainage. The Sluices will allow management of inflow and outflow from the interior polder area. However, if not proper managed, the sluice gates would directly hamper lateral fish migration of mild to moderate saline tolerant fish species. The fish species include Poa (*Pama pama*), Tulardandi (*Sillago domina*), Chewa (*Taeniodes anguillaries*), Boal (*Wallago attu*) etc. Moreover, most of the brackish fish species, such as Bhetki (*Lates calcarifer*), Harina Chingri (*Metapeneaus monocerus*) and freshwater fish (*Labeo rohita*, *Puntius spp*, *Catla catla*, *Cirrhinius mrigala* etc.) species migrate at some stage of their life cycle particularly for feeding and spawning. Obstruction to fish migration in turn would result in decline of fish production of the study area and ultimately would affect the dependent livelihoods.

571. The significance of this potential unmitigated impact has been assessed as **Major**based on impact magnitude and receptor sensitivity.

Mitigation

572. The following mitigation measures are to beimplemented to address the above concerns:

- WMO groups with representatives of fishermen will be established for management of the sluice gates and trained in proper water management, including fish friendly operation allowing fish migration at critical periods. A gate operation manual will be prepared and provided to the WMOs. The Manual should be translate into Bangla and the WMOs trained for properly management of the structures[28].
- Besides, there are options for:
  - Establishment of fish sanctuaries in internal khals.
  - BWDB with collaboration of DoF provide training and introduce net pen and cage culture.

Residual Impacts

573. Implementing the above mitigation measures, the impacts associated with fish migration are likely to alleviate and the significance of residual impact will be **Low**.

6.5.6 Loss of Fish Biodiversity

Impact

574. Any obstruction to fish migration and the protection against saline intrusion will change the fish species composition in the polder area, lead to a dominance of freshwater species.

575. The significance of this potential unmitigated impact has been assessed as **Medium**based on impact magnitude and receptor sensitivity.

Mitigation

576. The following measures may be implemented to conserve the highest possible fish biodiversity and production:

- Conserve fish species through construction of deep pools in the major khals like Nodmollar khal, Hetalia khal, and Bamoner khal.
- BWDB with collaboration of DoF is expected to provide training on improved culture technology, and introduce net, pen culture in Darulhuda khal, Hainter khal, Poddarer khal, Mollar khals, and:

Residual Impacts

577. The impacts associated with loss of fish biodiversity are likely to alleviateafter implementing the above mitigation measures and the significance of residual impact will be **Low**.

[28]The "Wet land Biodiversity Rehabilation Project" of Department of Fisheries already successfully implemented 5 Sluice gate management and operation committee through WMA. Based on this result a guidelines prepared on how to operate and manage sluice gate in eco-friendly manner was already submitted by Department of Fisheries to the concerned Ministry for approval (source DoF).

6.5.7 Decline of Fish Production

Impact

578. Due to construction of embankment, and water regulatory structure, it is expected that capture habitat fish yield may be reduced significantly. On the other hand, the areas suitable for culture ponds in the polder area will increase with a high safety against regular losses due to storm surges. The people will adopt the modern technology for fish culture which will boost up the fish production.

579. The significance of this potential unmitigated impact has been assessed as **Medium** on the basis of impact magnitude and receptor sensitivity.

Mitigation

580. The following mitigation measures will be implemented to address the above concerns:

- Golda farming will be encouraged through campaigning/awareness building.
- Provide fisheries training on improved culture practices as well as the rice-cum-golda farming.
- BWDB with collaboration of DoF is expect to provide Extension services like transfer of improved culture technology with pure strain and native fish species to increase the fish production from Prawn gher and aquaculture ponds.
- Provide training on improved culture technology like Carp-cum-Golda culture in pond, Floating Cage culture, Rice-cum-Golda culture, Semi-intensive to Intensive fish culture, etc.
- Release fish fries in the khals inside the Polder regularly during monsoon to enhance fish production

Residual Impacts

581. The impacts associated with fish production decline are likely to alleviate implementing the above mitigation measures and the significance of residual impact will be **Low.**

6.6 Positive Impact of the Project

6.6.1 Land type change

582. According to the proposed intervention, construction of new and retired embankment, re-sectioning of embankment, and replacement and repair of structures would protect the polder from tidal and monsoon flooding and will arrest salinity intrusion and would remove drainage congestion in the polder area. Besides, drainage congestion will significantly reduce due to re-excavation of internal khals within the polder area as per the proposed plan. These would increase the area under cultivation, which would increase crop production as well as create opportunity for employment generation.

583. Presently, maximum (68%) study area is under F_1 land type of the NCA which is followed by F_0 (25%) and F_2 (7%) land type **(Table 6.8).** If the project is not implementing in future, the cropped area may reduced further. As per the project design the drainage congestion will significantly reduce, salinity intrusion halted and safety against flooding from storm surges and cyclones be increased. Consequently, the land types are expecte to change significantly, see Table 6.8. F_0 land type would convert to FF land type. F_0 and F_1 land type area reduced 18.67% and 7% respectively. According to Institute of Water Modelling (IWM), around 93.37% would be under FF land type, which is follow by $F_1$and F_2 land type respectively.

584. Overall, the increase land protected against flooding and drainage congestion is consideringa **high** positive impact of the Project.

Table 6.8: Changing land type of the Polder area

Land Type	Baseline		FWIP		Impact (FWIP-FWOP)
	Area(ha)	% of NCA	Area(ha)	% of NCA	
FF(<0)	0	0	7,936	93.37	93.37
F0(0.0-0.3m)	2,144	25	538	6.33	-18.67
F1(0.3-0.90m)	5,756	68	25.5	0.3	-67.7
F2(0.90-1.80m)	600	7	0	0	-7
F3(1.80-3.60)	0	0	0	0	0
F4(>3.60)	0	0	0	0	0
Total	8,500	100	8,500	100	0

Source: Feasibility report-Agriculture, CEIP, 2012 and IWM, 2015

6.6.2 Cropping pattern and intensity

585. At present, the cropping intensity of the polder area is 149%. After implementation of the proposed intervention, the polder would be protected from tidal and monsoon flooding and will arrest salinity intrusion and remove drainage congestion in the polder area. Besides, drainage congestion will significantly reduce due to re-excavation of internal khals of the polder area as per proposed plan. Due to improved situation, farmers of the respective areas would be able to cultivate more crops in their lands. Thus, it is expectedthat cropping intensity would increase to 210% in the polder area **(Table 6.9).**

Table 6.9: Future-cropping pattern of the Polder area

Land type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (November-February)	Area (ha)	% of NCA
FF	Sugarcane	Cont'd	Cont'd	50	0.6
	Orchard	Cont'd	Cont'd	325	3.8
	S. Vegetables	T.Aman(HYV)	W.Vegetables	550	6.5
	Fallow	T.Aman(Local)	Pulses	819	9.6
	T.Aus(HYV)	T.Aman(Local)	Potato	96	1.1
	Fallow	T.Aman(HYV)	Spices	260	3.1
	T.Aus(HYV)	T.Aman(HYV)	Fallow	4,533	53.3
	Chilli	Fallow	Oilseeds	250	2.9
	T.Aus(HYV)	T.Aman(HYV)	Water melon	150	1.8
	T.Aus(Local)	T.Aman(Local)	Pulses	460	5.4
	Fallow	T.Aman(Local)	Boro(HYV)	443	5.2
Sub-total				7,936	93.4
F0	Fallow	T.Aman(Local)	Boro(HYV)	538	6.3
Sub-total				538	6.3
F1	Fallow	T.Aman(Local)	Fallow	26	0.3
Sub-total				26	0.3
Total				8,500	100
Cropping intensity (%)				210	

Source: Feasibility report-Agriculture, CEIP, 2012 and IWM, 2015

586. Overall, the increase in cropping considered providing a **high** positive impact of the Project.

6.6.3 Increased crop production

587. Presently, out of the total cropped area of about 12,653 ha about 11,314 ha are rice-cropped and the non-rice cropped area is about 1,339 ha. Total annual crop production is about 31,667 metric tons of which rice is about 23,014 metric tons and non-rice is about 8,653 metric tons **(Table 6.10).** If the project is not implemented both the cropped area and production are expected to remain at the present level or may well deteriorate further.

Table 6.10: Impact on cropped area and production of the Polder area

Crop name	Baseline/FWOP			FWIP			Impact (FWIP-FWOP)	% of Change
	Cropped area(ha)	Yield (m.ton/ha)	Production (m.ton)	Cropped area(ha)	Yield (m.ton/ha)	Production (m.ton)		
T. Aus (Local)	324	1.57	509	460	1.8	828	319	63
T. Aus (HYV)	3,319	2.7	8,961	4,779	3.5	16,727	7,765	87
T. Aman (LV)	5,603	1.5	8,405	2,382	2.5	5,955	-2,450	-29
T. Aman (HYV)	1,945	2.5	4,863	5,493	3.5	19,226	14,363	295
Boro(HYV/Hybrid)	123	2.25	277	981	4	3,924	3,647	1318
Total rice	11,314	0	23,014	14,095	0	46,659	23,645	103
S. Vegetables	135	12	1,620	550	15	8,250	6,630	409
Chilli	135	1.25	169	250	1.6	400	231	137
Pulses	327	1.5	491	1,279	2	2,558	2,068	422
Potatoes	96	14	1,344	96	20	1,920	576	43
W. Vegetables	228	15	3,420	550	20	11,000	7,580	222
Spices	93	3.25	302	260	4.5	1,170	868	287
Oil Seeds	250	1.3	325	250	2	500	175	54
Sugarcane (LV)	10	30	300	50	300	15,000	14,700	4900
Orchard	65	10.5	683	325	10.5	3,413	2,730	400
Water melon	-	0	-	150	40	6,000	6,000	0
Total non- rice	1,339	0	8,653	3,760	0	50,211	41,558	480
Total cropped area	12,653	0	31,667	17,855	0	96,870	65,203	206

Source: Feasibility report-Agriculture, CEIP, 2012 and CEGIS estimation, 2015

588. In the with Project situation the total cropped area is estimated to become about 17,855 ha of which the rice cropped area would become about 14,095 ha and the non-rice cropped

area would be about 3,760 ha. This will boost the agricultural production considerably. The total annual crop production would be about 96,870 metric tons of which rice and non-rice would be about 46,659 and 50,211metric tons respectively. Rice production would increase due to expansion of T. Aus (HYV), T. Aman (HYV), Boro (HYV), and non-rice especially both summer and winter vegetables, pulses, sugarcane and water melon cropped area. Additional 23,645metric tons of rice and 50,211metric tons of non-rice would be produced annually in the polder area.

589. Overall, the increase in crop production considered to provide a **high** positive impact of the Project.

6.6.4 Increased employment generation

590. Even more important, permanent local employment opportunities will becreated especially in the agricultural sector due to the substantial increase in agricultural production due to the expansion of cropped area. Annually, an estimated 640,000person-daysof additional employment willbe created in the agricultural sector.

591. Overall, the increase in employment generation considered to provide a **high** positive impact of the Project.

6.6.5 Gender Promotion

592. Construction work requires various types of skilled and unskilled labours, of which a portion is female. The female workers are often distressed or, and do not have any other source of income. Therefore, the substantial increased job opportunities for women in the construction works and especially in the agricultural sector during the operation phase is significantly positive.

593. Overall, the project considered to provide a medium to **high** positive impact on the gender situation.

6.6.6 Seasonal out-migration

594. The seasonal out migration of day labourers from this polder area to other areas is expected to decline due to creation of local employment opportunities in the agriculture and other sectors, respectively.

595. Overall the Project is considered to provide a **medium** positive impact by reducing out-migration.

6.6.7 Accessibility of social use of water

596. Main social uses of waterfor taking shower, washing chores etc. During the dry season, most of the open water bodies like Khals and ponds dry up. However, the re-excavation of khals will increase the storage capacity of water from the monsoon season to the dry season and increase access to water for social uses

597. Overall, the Project considered to provide a **medium** positive impact on the access to social use of water.

6.6.8 DisasterRisk Reduction

598. The Project will improve people’s safety by providing protection against storm and cyclone related flooding as well as river related flooding. Considering the high vulnerability of the population, and the high risk of flooding, the Project expected to increase the safety of the population and improve the socio-economic conditions.

599. Overall, the Project considered a **high** positive impact by reducing the risk of disasters.

6.6.9 Increase foreshore vegetation area for afforestation

600. Implementation of the afforestation programme will partly mitigate negative impacts associated with tree cutting necessary for the construction activities. Slope plantation will enhance embankmentsidevegetation coverage of the polder and is expected to reduce erosion of embankmentsides and provide habitats especially for various avifauna (i.e.: Egrets, Herons, Bee-eaters, Sandpipers, Owls/owlets, Kingfishers, Sparrows, Wagtails, Sunbirds, Babblers, Starlings), reptiles (i.e. Garden Lizard, monitors, pit viper), mammals (i.e. Bats, flying fox and pipistrelle, jackal, monkeys) and fishes.

601. Overall, the Project considered a **medium** positive impact on afforestation and providing habitats for fauna.

6.7 Summary of Assessed Impacts

602. A summary of the negative impacts without and with mitigation and their significance discussed in the sections above is presented in **Table 6.11**.

Table 6.11: Significance of Environmental Negative Impacts

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
A. Pre-construction Phase								
Damages of properties due to Project Intervention and Land Acquisition	Long term	Local	Irreversible	Certain	High	Major	RAP to be prepared Compensation to be paid prior to construction in accordance with RAP Maintain liaison with communities. Grievance redresses mechanism (GRM) in place.	Moderate
Deterioration of Environmental Quality for Contractor and Labour force mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium	Major	Contractor will prepare site establishment plan and shall obtain approval from the Construction Supervision Consultants (CSC). Approval from DSC will be obtained for the location of temporary facilities. Tree felling and vegetation clearing will be minimized to establish site facilities. Photographic record will be maintained to record pre-construction condition of the area. Site facilities will be established at a safe distance from communities. Contractor will prepare and implement pollution control and waste management plans.	

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							No untreated wastes will released on ground or in water. Exhaust emissions from vehicles and equipment will comply with standards. Vehicles, generators, and equipment will properly tune. Water will sprinkl as and where needed to suppress dust emissions. Speed limits will enforc for vehicles on earthen tracks. Vehicles and machinery will have proper mufflers and silencers. Liaison will maintain with the communities.	
Increased Vehicular Traffic during mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	Contractor to prepare and implement a mobilization plan considering water vessels and launch movement in the external rivers. Any vehicular movement will be avoided during hours specified in the baseline chapter. There will be not vehicular movement during school time (10:00 Am to 13:00Pm) and day of marketing time (Hatbar). Ensure minimal hindrance to local communities and commuters, specifically in the Charkhali ferry ghat. Liaise with local communities and concerned bazaar committee. Specifically	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							union parishad members of the polder. The details of communication address of union parishad Chairman and members have got in the public consultation chapter. Keep provision of training on vehicular traffic moving pattern and management system for the local stakeholders using multimedia presentation and showing video at different places of the polder especially in the Bhaylebunia Bazaar, Teltulbania Bazaar, and Dhanisafa Bazaar Hetalia Bazaar. These four places are the common population gathering places in the polder area. This training must needed because of safety of the local stakeholders.	
Changes in land use (preparation of construction facilities, borrow areas, others)	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Low	Establish all these facilities within the area owned by BWDB Pay compensation/rent if private property is acquired on temporary basis, the instructions of which should be specified in the tender document. Construct labour shed/camp at government khas land if available. Avoid unnecessary tree cutting as much as possible. Consult local stakeholders in the polder area in presence of elected executive body of Union parishad.	Negligible

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Consult communities Avoid impacts on communities.	
B. Construction Phase							h	
Air quality deterioration (dust, combustion gases)	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	Exhaust emissions from vehicles and equipment to will comply with the standards. Proper tuning of vehicles, generators, and equipment will carry out, to minimize exhaust emissions. Covering construction material (sand/soil) will kept covered while transporting and stock piled. Regular water sprinkling will have to carryout as and where needed. Speed limits for vehicles, particularly on the earthen tracks near communities. Turn Vehicle speed will be low (15 km per hour) on earthen tracks particularly near communities and school. Vehicles and other machinery will be turned off engine when idle Use of good quality fuel will use, minimizing exhaust emissions. Locate camps will be located at a safer distance from communities and schools. Liaison with the communities will be maintained and grievance redress mechanism will beestablishedat the site.	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Generation of Noise and vibration	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	Restricting/limiting timing of construction activities during the daytime. Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards. Vehicles and machinery to have proper mufflers and silencers. Provision of noise barriers are to develope at schools and other sensitive receptors, as needed. Provision of PPE (earmuffs and plugs) to labor are to be ensured. Instruction for the construction crew will instruct to proper use of the equipment, to minimize noise levels. Liaison with community Camps will be located at a safe distance from communities. Liaison with the communities will maintain and grievance redress mechanism will establish at the working sites.	Low
Increased inland and waterway traffic	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	Contractor to prepare and implement traffic management plan. Contractor to establish new, temporary jetties whereas and needed (e.g., at Charkhali ferry ghat).	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Materials may be transported during nighttime as much as possible and appropriate. Liaison to be maintained with community and Charkhali ferry ghat Authority.	
Soil and water contamination	Short term	Local	Reversible (after construction phase)	Certain	High	Major	Contractor will prepare and implement pollution control plan. Contractor workshops will have oil separators/sumps to avoid release of oily water; Contractor will avoid repairing vehicles and machinery in the field. Contractor will use plastic sheet or gravel in the workshop and equipment yard to prevent soil and water contamination. Contractor will dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources. Contractor will ensure that there is no leakage, spillage, or release of fuel, oil or any other affluent/wastes on the ground or in the water from its construction machinery, vehicles, boats, launches, and barges. Contractor will regularly monitor the condition of its fleet. Material borrowing from the riverbanks will carryout sufficiently away from the water	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							line, minimizing the possibility of loose soil to wash away in the river. Contractor will locate camps away from the communities and drinking water sources. Contractor will prepare and implement camp waste management plan (septic tanks, proper solid waste disposal). Contractor will not release untreated wastes on ground or in water. Contractor will re-use spoil and excavated material where possible. Contractor will dispose spoil at designated areas with community consent. Construction material, demolition debris, and excavated soil/silt will not allow entering into water bodies.	
Soil erosion	Short term	Local	Mostly Irreversible	Likely	High	Major	Avoid operating heavy machinery close to the banks of rivers and water channels (khals). Implement appropriate erosion control measures (egg, stone pitching) where needed Re-contour burrow areas where needed Protect untreated embankment slopes Avoid works in rainy season.	Low
Increasing of	Short term	May extend	Mostly Irreversible	Likely	High	Major	Contractor will protect embankment slopes. Contractor will excavate channels after dewatering them.	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Sedimentation		beyond Polder					Contractor will not leave excavated earth and silt not to placed on channel banks. Implement measures to protect channels from run-off from work areas and camps Contractor will obtain borrow material from riverbanks in a manner not to increase siltation in rivers; do, and will not leave loose soil after excavation.	
Increase of drainage congestion and water logging	Short term	Local	Reversible	Occasional	Medium to high	Major	Construct diversion channels before replacement of all regulators. Sequence of works for regulators and in the water channels will carefully plan to avoid drainage congestion. Contractor will ensure that drainage channels are not obstructed or clogged No water ponding near cultivation for the construction activities, which causes drainage congestion situation in crop fields.	Low
Loss of agriculture production	Short term	Local	Reversible	Likely	High	Major	Compensation to be paid for any crop damage Avoiding agricultural land for labor camps Avoiding cultivation fields during construction Vehicular movements inside cultivation fields should be restricted Material should be dumped inside cultivation fields Maintain liaison with communities.	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Disturbance of irrigation water conveyance h	Short term	Local	Reversible	Likely	High	Major	Construct diversion channels before replacement of all regulators. Sequence of works for regulators and sluices in the water channels will be carefully planned to avoid drainage congestion. Ensuring no negative impacts on crop irrigation. Contractor will ensure that drainage channels are not obstructed or clogged for the construction activities, which causes drainage congestion situation in crop fields.	Low
Hindrance of fish habitat and migration	Short term	Local	Reversible	Likely	Medium to high	Major	Duration of construction of structures and other interventions should be shortened as much as possible at least should maintain the contract period. Dismantle bundhs and other obstructions built to support the construction of structures as soon as work is completed. For manual re-excavation of Khals, compartment could built and bailing out of water from one compartment to another to avoid less damage to fish and excavate in cascading manner. Sequence of construction of regulators and re-excavation of drainage Khals should be set scientifically so that implementation of	Moderate

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							project could be completed with minimum hindrance to fish migration. Contractor will maintain liaison with communities so that they could realize the issue. It is more important in case of timing of entering water into the polder for shrimp culture along with paddy cultivation and exiting water from the same. Liaison of contractor with community would create scope for setting proper time for the construction work so that no or insignificant impact to the shrimp farming and paddy cultivation is caused.	
Effects on benthic communities	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	Contractor will not release untreated wastes on soil or in water. Contractor will carry out khal re-excavation in segment wise thus minimizing impacts on benthic fauna.	Low to medium
Damage / disturbance to faunal resources	Short term	Local	Reversible	Likely	Medium	Moderate	Construction works would carry out carefully to minimize disturbance of fauna and wild life. Contractor will not release untreated wastes on soil or in water. Labor will not indulge in hunting, trapping, or shooting wild animals.	Negligible

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Damage to floral resources	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	Carry out compensatory tree plantation for tree felling Avoid dumping of spoil earth in vegetated areas; Enhance flora environment by planting fruit trees and mangrove plants; Use grasses to assist slope and soil stability. No material to be brought from and no waste to be disposed in Sundarban.	Negligible
Hindrance for Pedestrian and Vehicle Movement	Short term	Local	Reversible	Likely	Medium	Moderate	Contractor will prepare a tree cutting plan and re-plantation plan, and will carry out compensatory tree plantation towards the end of construction phase. A plant nursery should be established for this purpose with selected tree species (e.g., Narikel, Taal, Tentuland Babla) in the beginning of the Project. Implement additional social afforestation programme at homestead platforms, khal dykes, graveyards, institution grounds and other available lands to compensate tree felling for embankment construction Collect earthen materials and dumping spoil earth at low or less vegetated areas. Consider minimum vegetation loss as much as possible to construct camps and allied facilities. Ensure proper implementation of	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							afforestation with local floral species after completion of construction works.	
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	Liaison will be established with the Bangladesh Meteorological Department for early warning of storms and cyclones. Radio and television sets will kept in all the labor camps for obtaining weather information. The contractors will prepare site specific Health, Safety and Environment (HSE) Plan and obtain approval from the Construction Supervision Consultants. The Plan will also include awareness raising and prevention measures, particularly against communicable diseases such as hepatitis B and C, and HIV/AIDS. The WBG's EHS Guidelines will be included in the contract documents. All temporary facilities including labor camps will meet minimum safety, hygiene and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection against disease vectors, and protection against weather elements, firefighting, and other similar essential services). Each contractor will prepare an Emergency Response Plan defining procedures to	Moderate

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							follow during any emergency. This plan will submit to Construction Supervision Consultants for review and approval. All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must provided and there would be procedures in place to access appropriate emergency facilities. The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible. Health screening of employees would be a Contractor obligation prior to laborers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and include a review of appropriate vaccinations. Workers would be given vaccinations as and when required. All site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the working site. All employees need to carry out induction health and safety training prior to commencement of work. OHS issues would be part of the employee-training plan. Training would include the provision of	

Potential Impacts	Temporal aspects (See Table 2.1)	Spatial aspects	Reversibility	Likelihood	Sensitivity (Table 2.2)	Significance (Unmitigated) (Table 2.3)	Mitigation Measures	Residual Impact
							appropriate written or visual materials to reinforce learnings. Public awareness training and workshops on safety and health risks will be conducted for local communities prior and during construction operations. Observing statutory requirements relating to minimum age for employment of children and meeting international standards of not employing any persons under the age of 16 for general work and no persons under the age of 18 for work involving hazardous activities. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but would include short training activities for youth to the extent possible. Ensure the acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work; Ensure that no workers are charged fees to gain employment on the Project. Ensure rigorous standards for occupational health and safety are in place. Contractor will establish a labor grievance mechanism and documenting its use for	

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							complaints about unfair treatment or unsafe living or working conditions without reprisal. The contractor will adopt a Human Resource Policy appropriate to the size and workforce, which indicates the approach for management employees (this could be part requested in the tender process). Produce job descriptions and provide written contracts and other information that outline the working conditions and terms of employment, including the full range of benefits; Provide health insurance for employees for the duration of their contracts; Provide insurance for accidents resulting in disabilities or death of employees for the duration of their contracts; Employ a community liaison officer (this could be full time or part of another post's responsibilities); Raise awareness prior to recruitment, clarifying the local hire policy and procedures, including identification of opportunities for women to participate in employment and training; Report regularly on the labor force profile, including gender, and location source of workers;	

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Hold toolbox talks on workers' rights and the labor grievance mechanisms during the construction phase; Organize a training program and keep training registers for construction workers; Establish Occupational Health and Safety (OHS) procedures in the overall environmental management system, which provides workers with a safe and healthy working environment taking into account the inherent risks for this type of project. Availability of safe drinking water will ensured for the construction staff. First aid boxes will made available at each construction site. Emergency phone numbers (including hospitals, Fire Department, and Police) will displayed at key locations within the site. Each site will have ambulance facility. Firefighting equipment will made available at the camps and worksites. The camp staff will train for safety against fire fighting. All safety precautions will be taken to transport, handle and store hazardous substances, such as fuel.	

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Waste management plan to be prepared and implemented in accordance with international best practice. Liaison with the community will maintain.	
Social Unrest	Short term	Local	Reversible	Likely	Medium	Moderate	Proper awareness programs will conducted through public consultation measures such as village scoping sessions, meetings, and placement of billboards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers. Liaison with the communities will be maintained. Cultural norms of the local community will be respected and honored. GRM will be be established to address the grievances of local as well as outside laborers. Careful use of local natural resources and project resources,, fuel-wood and electricity. Restrictions related to consumption of alcohol and drugs. Safe driving practices. Respect for the local community and its cultural norms in which laborers are working. Avoid construction activities during Prayer time.	Low

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Seasonal Impacts (Natural Hazards)	Short term	Local	Reversible	Likely	Medium	Moderate	Weather signals will considered by the contractor during construction works. Radio and television will kept in all the labour sheds for getting weather information through these media. Ensuring rigorous standards for occupational health and safety are in place.	
C. Post Construction Phase								
Soil and water contamination (increased use of chemical inputs) and reduced soil fertility	Long term	Local	Reversible	Likely	High	Major	Capacity building and awareness raising of the farmers will carry out to practice Integrated Pest Management (IPM) and Integrated Crop Management (ICM) – in order to minimize usage of chemical inputs. Farmers group will have close contact with DAE for adoption of various measures of IPM/ICM. Farmers will be encouraged to use organic manure to increase soil fertility ad avoiding water contamination. Farmers will be encouraged to cultivate leguminous crops to enhance the soil quality.	Moderate
Drainage congestion and increased sedimentati	Long term	Local	Reversible	Likely	High	Major	An ongoing program of de-silting of water channels will considered with full involvement and participation of the community.	Moderate

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
on in khals and rivers							The local government (union parishad) will authorized to monitor the development activities. Prepare Bangla manual for sluice gate operation and provide training to WMOs; and Reduce conflicts between farmers and fishermen.	
Increase salinity intrusion due to leakage of regulators	Long term	Local	Reversible	Likely	High	Major	Regular monitoring and careful maintenance of the water control structures will ensur. Standard operating procedures will be prepared and implemented for the water control structures. These procedures will translat in bangle as well. Capacity building of WMOs will carry out.	Low
Reduce of fish habitat	Long term	Local	Reversible	Likely	High	Major	Use of organic manure and IPM method for controlling contamination of water pollution. Re-enforcing of fisheries laws and regulations in the field for protecting indiscriminate fishing.	Moderate
Loss of fish Biodiversity	Long term	Local	Reversible	Likely	High	Major	Conserve fish species through construction of deep pool in the major khal like Nadmollar khal, Hetalia khal, Bamuner khal Introduce net pen culture in Darulhuda khal, Hainter khal, Poddarer khal, Mollar khal. Provide training on improved culture technology.	Moderate

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Promote skill development training to the fish farmer for more fish production from Prawn gher and ponds.	
Decline fish production	Long term	Local	Reversible	Likely	High	Major	Golda farming will be encouraged through campaigning/awareness development Provide fisheries training on improved culture practices as well as the rice-cum-golda farming. Extension services like transfer of improved culture technology will be taken by respective government agencies and different local and national NGOs with pure strain and native fish species to increase the fish production or aquaculture ponds. Provide training on improved culture technology. Promote skill development training to the fish farmer for more fish production from Prawn gher and ponds.	Moderate
Obstruct Fish Migration	Long term	Local	Reversible	Likely	Medium	Major	Construction of fish sanctuaries in the internal khals. Introduce net pen culture. Operation and Maintenance (O & M) of all water regulatory structures will be strengthened. Proper operation of water regulatory structures and timely opening of the gate during fish breeding period.	Moderate

Potential Impacts	Temporal aspects	Spatial aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Gate operation manual will be prepared and provided to WMOs. Manual should be translated into Bengali and the members of the WMOs are to be trained up for properly handling of the structures	

6.8 Risk Assessment

6.8.1 Function and Funding of Water Management Groups and Associations

603. Risk assessment in a development project involves the identification or recognition of weaknesses and gaps in the project and evaluation of their potential threats to the sustainability of the project. The construction works in proposed Polder 39/2C would have the dual purpose of prevention of saline water intrusion into the polder area and agricultural improvement within that area. The expected positive impacts from the project interventions have been summarized below, while the potential adverse impacts have been identified and quantified above as well as their mitigation measures have also been suggested in this report. Yet, challenges or threats do remain in navigation which is addressed in this section.

604. Navigation in the inland waterways is an important aspect of the coastal economy - facilitating the movement of people and commodities. Hence, empoldering areas are likely to obstruct normal navigational operations in the rivers and connecting khals, and this issue could be a matter of concern in Polder 39/2C. Field visits to Polder 39/2C revealed that water bodies and internal khals in the project area are presently used for transportation of goods and persons. Drainage sluices and sluice gates will be constructed under this project, and these water control structures would provide seasonal fish migration in the area for their spawning and breeding. The gates in those structures would also be operated in regular intervals to restrict salinity intrusion. However, such gates or boat passes in the embankment for allowing navigation through the embankment to and from the polder would be unrealistic because these gates would allow large volumes of saline water inside the polder and thus damage the soil, water and land – destroying crops as well as freshwater fishery. In other words, navigation gates or boat passes along the embankment causing salinity intrusion would defeat the basic objective of constructing the polder. Hence, the risk or disbenefit of not facilitating boat operation into the poldered area through water control structures is estimated as extremely marginal and low.The agricultural practices in the polder area will be hampered due to salt water intrusion during boat passing. The impact magnitude of agriculture will be greater than that boat pass because a few number of navigation may be operated a week.

7 Analysis of Project Alternatives

605. This chapter presents an analysis of various alternatives considered during the Project feasibility and design stage including the 'no project' alternative. To the extent possible, environmental and social considerations of these alternatives have considered.

7.1 'No Project' Alternatives

606. The 'No-Project' option analysis provides a clear view of the existing situation of the Polder and helps understand the need of the proposed interventions under CEIP-1. At present the people in polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, as described in **Chapter 8**. Furthermore, the polder is not in a state to provide required services, i.e. protection against tidal inundation, efficient drainage, and minimizing the impact of cyclonic surges. About 40 percent of the Polder area is vulnerable to salinity intrusion and water logging. The silted water channels are resulting into limited navigation in these waterways, declining fisheries, and increasing environmental pollution.

607. The interventions proposed in Polder 39/2C under CEIP-1are plann to eliminate the major problems described above. To highlight the present state of various aspects in the Polder and to help understand the importance of the proposed interventions under the Project, the 'No Project' and 'with project' scenarios are compare in **Table 7.1** below.

608. Section 6.6 provides a detailed assessment of the high positive impacts of the Project that is considere to improve the security and socio-economic conditions for all strata in polder 39/2C.

Table 7.1: Comparison of 'No Project' and 'With Project' Scenarios

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
Construction of new embankments (34.00 km)	Some part of the polderis open. As a result, cyclones, rise in surge heights due to global warming, and tidal actions will inundate the Polder, causing severe damage to the lives and properties of local people.	New embankments will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, reduce the loss of lives and assets caused from natural disasters.
	During monsoon, the transportation system would heavy impacted inside the Polder, and sufferings of local people would further increase.	New embankments will provide enhanced protection to Polder, facilitating transportation within the Polder even during monsoon.
	Reduction of agricultural area, crisis to the farmers from January to April (salinity intrusion) and May to August (flooding).	New embankments will provide enhanced protection to Polder, facilitating enhanced agriculture activities and increase the area for cultivation, thus increasing agriculture output.
	Continued silt deposition inside the Polder due to cyclonic surges and floods would be increased causing	Decrease in silt deposition in the Polder will improve drainage and navigation in internal lakes/khals, and increase usage of surface water

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	water logging, drainage congestion and other associated problems.	for irrigation, and reduce water logging problem.
	Local farmers and labor will remain financially stressed. Livelihood opportunities will remain limited, and local people will migrate outside the Polder for employment.	Enhanced agricultural activity will increase the demand of farm workers. Local people can engage themselves in the construction works inside the Polder. Improve the earnings of local people during construction phase of the project.
Re-sectioning of embankments (15.95 km)	The embankments will further deteriorate at a number of locations, and will drop below design level. Therefore, cyclones, rise in surge heights due to global warming, and tidal actions will inundate the Polder, causing severe damage to the lives and property of local people.	Re-sectioned embankments would be more effective and resilient, and will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Reduce the loss of lives and assets from natural disasters.
	Because of submergence of the embankments during monsoon, transportation system would further deteriorate inside the Polder, and sufferings of local people would further increase.	Re-sectioned embankments will provide enhanced protection to Polder, facilitating transportation within the Polder even during monsoon.
	Reduction of agricultural area, crisis to farmers from January to April (salinity intrusion) and May to August (flooding).	Re-sectioned embankments will provide enhanced protection to the Polder, facilitating enhanced agriculture activities and increased area for cultivation, thus increasing agriculture output.
	Continued silt deposition inside the Polder due to cyclonic surges and floods would be increased causing water logging, drainage congestion and other associated problems.	Decreasein silt deposition in the Polder will result inimproved drainage and navigation in internal lakes/khals, increase usage of surface water for irrigation, and reduce water logging problem.
	Local farmers and labor will remain financially stressed. Livelihood opportunities will remain limited, and local people will migrate outside the Polder for employment.	Enhance agricultural activity will increase the demand of farm workers. Local people can engage themselves in the construction works inside the Polder. Improve earnings of local people during the construction phase of the project.

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
Construction of retired embankment (10.80 km)	Embankments will remain more vulnerable to wave action of river, Polder area will be more prone to inundation, and agricultural loss will increase due to salt water intrusion.	Retirement/relocation of embankments will result into enhanced protection against floods and wave action, decrease salinity intrusion, and increase agricultural productivity.
	Further damage to the non-retired portion of embankments, further deterioration of the transportation system	Retirement/relocation of embankments will facilitate transportation within the Polder throughout the year.
	Continued silt deposition inside the Polder due to cyclonic surges and floods would be increasedcausing water logging, drainage congestion and other associated problems.	Decreased silt deposition in the Polder will result in improved drainage and navigation in internal lakes/khals, increased usage of surface water for irrigation, and reduced waterlogging problems.
Bank revetment (3.5 km)	River bank erosion would further deteriorate the embankments and land resources would be damaged/ lost.	Bank revetment will provide enhanced protection against erosion from wave action, storm surges and currents resulting into preservation of Polder and its land/agriculture resources.
	Further subsidence of the embankments and f damage to transportation routes.	The bank revetment will protect the embankments and facilitate transportation within the Polder.
Slope protection (4.0 km)	Continue the weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be damaged/ lost.	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
Construction of 22 new flushing sluices 7.1.1	Cultivable lands and irrigable lands will further decrease in future.	New flushing sluices will alleviate drainage congestion, facilitate the availability of surface water, better control on irrigation during periods of low rainfall, and will increasedagricultural production.
Afforestation 39 km of embankment slope with 28,175 saplings	Wind and wave action during cyclones would cause severe damage.	Effects of cyclone surge, wave action and wind could mitigated to some extent, reducing loss of lives and assets.
Closure Dam (8 nos)	At present al khal are open to the surrounding rivers allowing tidal water to enter the polder regularly, as well as providing no protection	Will close major khals now open to the surrounding river system. At each closure, a sluice gate will installed to allow for regulation of water in- and

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	against storm and cyclone surges resulting in devastating flooding regularly inside the polder	outflow for flood protection and proper drainage. That protect against storm surge, flooding and salinity intrusion.
Re excavation of Drainage Channels (57.23 km)	Depth of water bodies would further decrease, and drainage congestion and water logging will further increase.	Depth of water bodies will increase, water logging and drainage congestion will decrease and fish habitats will increase.

7.2 Site Selection Alternatives

609. Since CEIP-I is a rehabilitation project, no site alternatives were available to be considered. However, a comprehensive multi-criteria analysis was carried out to prioritize the polder rehabilitation under CEIP-I. The analysis results are present in **Table 7.2.**

Table 7.2: Results of Multi-Criteria Analysis to Prioritize Polder Rehabilitation

Criteria		Mark Obtained
Polder No	39/2C	
Type of Dyke	SD, MD	
Location of the Polder	Matbaria	
Gross Area of the Polder (HA)	10748	
Embankment Length (Km)	55	
Breach of Embankment (Km)	-	0
Erosion (Km)	-	0
Requirement of BPW (Km)	-	0
Location in the Risk Zone	LRZ	5
Drainage Congestion (HA)	0	0
Opinion of Stakeholder (marks, MV=15, MDV=10, LV=5)	MV	15
Rehabilitation Cost (Crore BDT)	122	15
Special Criterion		0
Total Marks		**35**

Notes:

a) Rate of marks = Full marks allotted for the criterion against highest quantity of the criterion except "Rehabilitation Cost".
b) Negative marks has been allotted in case of "Rehabilitation Cost" exceeding $30 Million (210 Crore BDT).
c) HRZ = High Risk Zone, MRZ = Medium Risk Zone, LRZ = Low Risk Zone.
d) MV = Most Vulnerable, MDV = Medium Vulnerable, LV = Less Vulnerable.
e) SD = Sea Dyke; ID = Interior Dyke; MD = Marginal Dyke.
f) BPW = Bank Protective Work.
g) Rehabilitation Cost to consider embankment section with one meter extra height over the existing designed level.
h) Special Criterion indicates territory loss due to erosion of polders located in border area.

7.3 Technical Alternatives

610. The technical possibilities and alternatives for addressing the issues related to the status of the Polder and living conditions for its inhabitants were considered. These have pertained to strengthening the polder embankment, protection of riverbanks, protection of embankment slope, improving the sluices and their performance, and reducing drainage congestion and water logging. These technical alternatives are discussed in **Table 7.3** below.

Table 7.3: Technical Alternatives for Polder 39/2C

Proposed Interventions	Alternative Options	Consequence
Strengthening of the existing embankment	No change in alignment and no re-sectioning/repairing of the existing embankment	The present vulnerable situation of the embankment and thus the entire polder will continue (similar to the 'No Project' scenario discussed in earlier).
	Retirement/relocation of the existing embankment, as and where required	Partial achievements of the Project objectives.
	Backing/minor inward shifting of embankment with slope protection	Same as above.
	Constructing new embankments (selected option for 34km embankment east and south)	New embankments will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, loss of lives and assets caused by the natural disasters.
	Re-sectioning of existing embankment with new design heights (selected option). (Selected option for 10.8km existing embankment).	Higher and wide embankments would be more effective and resilient, and will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, reduce the loss of lives and assets caused by the natural disasters.
River bank protection works	No change in the existing embankment	River bank erosion would further deteriorate the embankments and land resources would be damaged/lost (similar to the 'no project' scenario discussed in earlier).
	Retirement of embankment	Partial achievements of the Project objectives; decrease the Polder area; and erosion of the riverbank will be continued.
	Bank Revetment for 3.5 km (selected option)	Bank revetment will provide enhanced protection against erosion by wave action, storm surges and currents, and will result in preservation of the polder and its land and agriculture resources.
Protection of embankment slope (against wave action)	No change in the existing embankment	The embankments will be more weakened; continuous subsidence of embankments due to traffic load and wave action will be continued; land resources would continue to be damaged/ lost (similar to the 'no project' scenario discussed in earlier).
	Slope protection (selected option for 4.0km)	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
	Foreshore plantation (selected option 39 km embankment)	Effects of cyclone surge, wave action and wind could be mitigated to some extent, and reduce the loss of lives and assets.

Proposed Interventions	Alternative Options	Consequence
Replacement of drainage sluices	No change in the existing structures	Use of the existing drainage sluices will be continued for both flushing and drainage, which would cause further damage to these structures. As a result, water logging and drainage congestion would increase due to malfunctioning of the sluices (similar to the 'no project' scenario discussed in earlier).
	Repairing of structures (possible where there is no need of re-sizing) (selected option for some structures)	For sluices, which are beyond any repair, this option would be similar to the 'no project' scenario described above.
	Replacement of existing Drainage Sluice with Drainage-cum-flushing sluice (selected option for some of the sluices depending upon need)	Drainage-cum-flushing sluices will be more efficient and will make the polder as sweet water can be stored and used later in the dry season for irrigation.
	Regulators with provision for appropriate passages for fish and small boats.	In addition to the above advantage, the structures will facilitate fish migration and navigation through them. The cost of such structure is likely to be high.
Rehabilitation of flushing sluices	No change in the existing structure	No dry season agriculture practice will be possible. There will be Shrimp culture from January to May, as sweet water cannot be used in the period for low rainfall (similar to the 'no project' scenario discussed in earlier).
	Repair of the existing structures	For sluices, which are beyond any repair, this option would be similar to the 'no project' scenario described above.
	Replacement of the existing Flushing Sluices (selected option)	Replacement of flushing sluices will facilitate better agriculture practices, increase dry season rice cropping, and reduce shrimp culture - thus benefiting the poor farmers.
Constructing new water drainage structure	Not constructing any Flushing Sluices	Cultivable lands and irrigable lands will continue to decrease (similar to the 'no project' scenario discussed in earlier).
	Construction of drainage cum flushing (selected option in certain cases)	Drainage-cum-flushing sluices will be more efficient and dry season rice cropping practice will be possible as sweet water can be stored and used later in the dry season for irrigation.
	Construction of new Flushing Sluices (selected option in certain cases)	New flushing sluices will facilitate the availability of surface water, better control on irrigation during periods of low rainfall and increase agricultural production.

Proposed Interventions	Alternative Options	Consequence
	Providing closure dam (selected option in a few locations)	Providing closure dam would restrict the entry of silt and saline water into the internal rivers. In the same time, it will increase the level of water in the channel to facilitate better irrigation.
Reducing water logging and drainage congestion	No action is taken.	Depth of water bodies would further decrease, and drainage congestion and water logging will further increase (similar to the 'no project' scenario discussed in earlier).
	Channel re-excavation (selected option)	Depth of water bodies will increase, water logging and drainage congestion will decrease and fish habitats will increase.

7.3.1 Technical, Financial, Economic, Environmental, and Social Considerations of Selected Options

611. An attempt has been made to evaluate the technical, financial, economic, environmental, and social considerations of the selected options discussed above. This evaluation is presented in **Table7.4** below

Table 7.4: Technical, Economic, Environmental and Social Considerations

Intervention	Considerations			
	Technical	**Financial/Economic**	**Environmental**	**Social**
Re-sectioning, Retirement/ Relocation of existing embankment with new design heights	Better protection against cyclone surges and water level rise	Financial savings for reduction of damages caused by the floods	Improve surface water quality; improve natural vegetation	Reduce loss of lives and assets which would bring poverty reduction; increase employment opportunities for local people.
	Protection to river bank erosion	Financial savings as the embankments will provide good road transportation routes.	Reduced traffic congestion inside the polder because of improved embankments, which will facilitate vehicular movement.	Reduce loss of assets which would bring poverty reduction
	Prevention of salinity intrusion in the polder	Improve earning of local people during construction		Improve cropping particularly for small farmers thus alleviating poverty.
		Improved cropping pattern and boosting the local economy		
Bank revetment, slope protection	Enhance embankment protection against tidal	Financial savings from reduced damages caused by the floods; increased	Improve embankment stability; reduce soil erosion; and	Reduce loss of lives and assets which would bring poverty

Intervention	**Considerations**			
	Technical	**Financial/Economic**	**Environmental**	**Social**
	wave action of rivers and provide protection against erosion	life span for the infrastructure and associated water control structures; improved earnings of local people through employment during bank revetment works and slope protection works.	provide good means of transportation.	reduction; increase employment opportunities for local people.
Coastal afforestation	Enhance embankment erosion	Financial savings for reduction ofdamages caused by the floods and storms; increase the life span of the infrastructure and associated water control structures; improve earnings of local people through employment during bank revetment works and slope protection works.	Improve embankment stability; reduce soil erosion; enhance soil quality; improve air quality; enhanceaesthetic value of the area.	Reduce loss of lives and assets which would bring poverty reduction; increase employment opportunities for local people; Increase income from timber and other plantation products.
Replacement of existing drainage sluice with drainage-cum-flushing sluice and construction of new flushing sluices where needed	Better functional performance in both flushing and drainage; achieve the objectives of Polder and CEIP-I	Financial savings against damages due to water logging, drainage congestion, and salinity intrusion. Agricultural production will be boosted as dry season rice cropping would increase	Removal of inactive sluices will improve the drainage characteristics Water logging, drainage congestion would be reduced.	Better agriculture practice could be achieved which would improve the cropping pattern, enhance local earnings, and reduce poverty.
Channel re-excavation	Reduce water logging and drainage congestion	Enhance agriculture output; the dredged soil can later be used in construction works and will save construction cost	Increase navigability of water ways, fish habitats would be improved, the ecosystem will be enhanced	Increase of cultivable area, increase of availability of irrigation water thus increase of farm income for local community; increase farm

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
				labor opportunities.
Closure Dam	Better control against entry of silt free water. Restrict the entry of saline water as well. Increase the elevation head of water in the channel	Better agricultural prospects (dry season Boro cropping would be possible)	Environmentally compatible. Surface water quality inside the polder would enhance.	Better agriculture practice could be achieved which would improve the cropping pattern, enhance the local earnings, and reduce poverty.

7.4 Alternatives during Construction

612. The key alternatives available during the construction phase include location of material stockpiling, material sourcing, manpower sourcing, and transportation of materials, equipment, and manpower. These are discussingas below.

7.4.1 Material Storage

613. For project works in Polder 39/2C, two options are available for material storage: within the Polder at suitable location(s); and outside the Polder at suitable locations. The first option would entail easy transportation of bulk materials from the sources outside the Polder; however, it would involve regular transportation of materials from the storage site to the work sites.

614. The required materials would be collected and transported from their respective sources to the Polder and then would be stored in the stockyard to be used during construction phase.

7.4.2 Material Sources

615. The sources from which the construction materials will collect have been discussed below.

Soil for Embankments

616. For retirement, re-sectioning, and construction of new embankments, about 19.55 million cubic meters of soil will be required. The following options are available for sourcing this material:

- Soil can be obtained from borrow pits along the riverbank just outside the embankments, provided the soil quality is appropriate for this purpose. This is afeasible options with some benefits since it will minimize soil transportation needs, minimize related to material transportation and having minimum environmental and social impacts related to excavation and transportation. However, as BWDB does not own any land sites for borrow pits, these have to obtain from the owners and compensation provided.

- Part of the required material can obtain from the re-excavation of the water channel within the Polder, provided the quality of this material is technically acceptable. About 0.27 million cubic meters of earth will be obtained from re-excavation of channels during implementation of rehabilitation works inside the Polder. This option minimize the cost of excavation for the borrow material, though the cost of transportation to work site will be slightly more than the first option, in addition to some environmental and social impacts such as traffic congestion and air pollution within the Polder.
- Some quantity of soil can be sourced from borrow pits inside the Polder. For this purpose, consent of the landowners will have to obtain and mutually agreed compensation will have to pay them. This option will entail cost of excavation similar to the first option but more than the second option discussed above. Other considerations including cost of transportation and environmental and social impacts are likely to be similar the ones for the second option, though land degradation may take place in addition to the air quality and traffic congestion.
- If the riverbed material is suitable having the required material, quality, dredged material can use for embankment construction. From an environmental point of view, this is the preferred option, as there will be no terrestrial impact, while the aquatic impact will temporary and localised to the riverbed. Any dredged material will rapidly replac due to the high sediment transport capacity in the rivers in the polder region. Transport of the dredged material can take place directly at the embankment construction site, requiring minimal land transport. However, sites for de-watering the dredged material will be required. Use of dredged material consider the preferred option from an environmental point of view.

617. As per the Project design, the final decision regarding the material source will depend on the material quality, either dredged from rivers, from re-excavations of khals or from borrow pits, as well as the availability of the latter two. The Contractor will carry out tests of the material quality from various sources, provide a plan for obtaining the required amounts of suitable quality and obtain approval from the DCS Consultant before starting obtaining the material.

Sand

618. Sand would need for embankment improvement works, concrete works, and for manufacturing concrete blocks for slope protection. Two broad options are available to source this material:

- Sand could procure from markets. This would entail consistent quality and assured supply; however, it would also entail increased transportation with associated environmental and social impacts including traffic congestion, noise and air pollution.
- The second option is to obtain sand from the riverbeds. This would reduce the transportation needs along with the associated costs and environmental as well as social impacts. However, the quality of the sand readily available may not as required.

619. As per the Project design, the final decision regarding the sand source will depend on the material quality, either acquired on the market or dredged from rivers. The Contractor will carry out tests of the material quality from various sources, provide a plan for obtaining the required amounts of suitable quality and obtain approval from the DSC Consultant before starting obtaining the sand.

7.4.3 Alternatives for Workforce Procurement

620. Two broad options are available for sourcing the manpower for the construction works. These are discussing below.

- Employing the bulk of the manpower from outside the polder. This will entail requirement of larger labor camps, need for labor transportation causing traffic congestion and air pollution, and possible resistance and resentment from the local community.
- Employing manpower from within or nearthe polder and only bringing more skilled and technical manpower from outside. This option will reduce labor camp sizes, decrease transportation needs and reduce environmental and social problems related to outside workers. This option will also offer employment opportunities for the local community thus increasing their economic condition and increasing the local ownership and acceptance of the project. In view of these advantages, this is the preferred option for work force sourcing.

7.4.4 Alternatives for Mode of Transportation

621. All the construction materials are to be transported to the main stockyard by road with Trucks. The materials will becarriedfrom the main stockyard to the worksite mainly by river and by road. The road conditions inside the polder are not suitable for transportation of larger vehicles, i.e. dump trucks, trolleys, excavators, etc. Therefore, land transportation of earth and other construction materials will have to be done by small carts, non-motorized vehicles, manual labor etc. while using roadways; and small boats, trawlers in the waterways.

622. Polder 39/2C is located along the right bank of Baleswar(Kocha) River. The Kocha river (North and West), is a large river considering its depth and width. The river remains navigable throughout the year and can use for transportation purposes during construction. The Pona River surrounds the other parts of the polder (East and South), which is shallower and narrower and unsuitable for larger vessels. Large Cargo vessels, Barges,and trawlerscan move along the Kocha River whereas smaller vessels are recommended for transportation using the Ponadon Riveras the preferred option for transport of materials to the construction sites.

623. For transporting materials to the stockyard from Khulna or other suitable locations, road transport is feasible. The district road named Charkhali-Matbaria road recommended to use for its good quality. This road is diverged from the Bagerhat-Khulna highway to the ferry crossing of the KochaRiver to polder 39/2C near Nudmulla union.

8 Climate Change Impact

8.1 Overview

624. Bangladesh is one of the most climate-vulnerable countries in the world due to its geophysical location and hydro-geological and socio-economical characters. Bangladesh experiences tropical cyclones, storm surges, floods, riverbank erosion, droughts and many other natural disasters. The risk of climate change is accelerating the duration, magnitude and frequency of these natural hazards and making communities more vulnerable. Natural disasters cause a severe effect on different sectors like agriculture, fisheries, livestock, forest and ecosystem, infrastructure etc. It is predict that climate change in future will bring more changes in temperature, characteristics of rainfall and natural hazards, which will have significant implication on the physical, social and economic systems. Studies and assessments on impacts, vulnerabilities and adaptation to climate change and sea level rise for Bangladesh clearly demonstrate that Bangladesh is one of the most climate vulnerable countries in the world. Rainfall is predicted to become higher and more erratic.

625. Sea level rise has various impacts on Bangladesh, a coastal country facing a 710 km long coast to the Bay of Bengal. It already has affected Bangladesh by land erosion, salinity intrusion and loss in biodiversity. Its potential threats are coming even strongly in the future. Sea level rise will cause riverbank erosion, salinity intrusion, flood, damage to infrastructures, crop failure, fisheries destruction, loss of biodiversity, etc. along this coast. Overall impacts of climate change on Bangladesh would be significant. It was found that the population living in the coastal area is more vulnerable than the population in other areas (Alam and Laurel, 2005). Coastal resources upon which the most people are dependent and are likely to be severely affected due to climate variability and change. It is predicted that for 45 cm rise of sea level may inundate (10-15)% of the land by the year 2050 resulting over 35 million climate refugees from the coastal districts.

8.2 Regional Context

626. Asia is very likely to be warm during this century; the warming is likely to be well above the global mean in Asia. Precipitation in winter is very likely to increase in South Asia.There is very likely to be an increase in the frequency of intense precipitation events in parts of South Asiawhere extreme rainfall and winds associated with tropical cyclones are likely to increase as well.

8.3 Local Context

8.3.1 Tidal Flooding

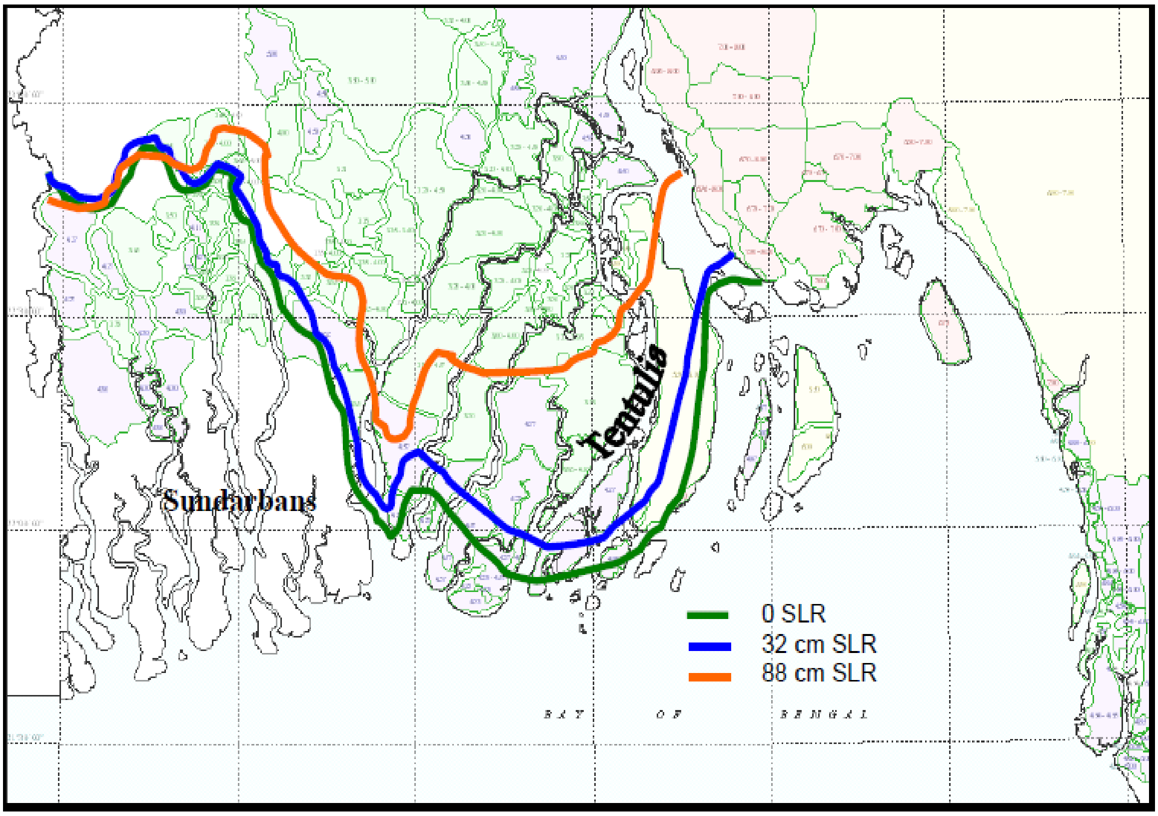
627. Tidal flooding is a common phenomenon in the coastal belt of Bangladesh. Two tide events (high tide and low tide) occur in a day. During high tide, low lying and un-protected areas are inundated causing damage to agriculture and any seas level rise gradually increases the extent.

628. WARPO (2006) predicted that the Sea Level Rise (SLR) may be increased at 14, 32 and 88 cm by 2030, 2050 and 2100, respectively which may inundate about 8, 10 and 16% of total land mass of Bangladesh. According to 5th IPCC (2013), the global sea level rise may be increased 26 and 47 cm during the period 2046-2064 and 2081-2100, respectively, using RCP4.5 scenario.

629. The rate of sea level rise of Bangladesh is higher than that of global sea level rise. SMRC (2000) found that tidal level at Hiron Point, Char Changa and Cox's Bazaar raised 4.0 mm/year,

6.0 mm/year and 7.8 mm/year respectively; observing three tidal gauge record of the period 1977-1998 (22 years) has been collected from BIWTA. Three tidal gauge stations are located in western coast (Hiron Point), Central Coast (Char Changa) and Eastern Coast (Cox's Bazaar) respectively. The rate of the tidal trend is almost double in the eastern coast than that of the western coast. This difference could be due to subsidence and uplifting of land (Sing, 2002).

630. In a recent study, IWM (2006) predicted that flooding of coastal lands might increase by 21% by the year 2100 while it is 10.3% for the year 2050 with respect to ordinary flooding condition when approximately 50% lands go under flood.



Map 8.1: Salinity intrusion during the dry season considering various sea level rise scenarios (IWM and CEGIS, 2007)

8.3.2 Salinity Intrusion

631. Saline water intrusion is highly seasonal in the coastal area of Bangladesh. Salinity and its seasonal variation are dominant factors for the coastal ecosystem, fisheries and agriculture. Therefore, any change in the present spatial and temporal variation of salinity will affect the biophysical system of the coastal area. IWM and CEGIS (2007) found that in the present base condition about 10percent of coastal area, is under 1 part per thousand (ppt) salinity, and 16percent area is under 5 ppt salinity, and this area will be increased to 17.5 percent (1 ppt) from 10 percent and 24percent (5 ppt) from 16 percent by 2050 considering 88 cm sea level rise. Therefore, there will be an increase of about 8 percent in the area under 5 ppt salinity levels due to sea level rise. The areas of influence of 5 ppt salinity line under different sea level rise shown in **Map 8.1**. The intrusion of salinity will increase soil salinity and surface water salinity and might affect agriculture crop production.

Table 8.1: Major Cyclones Hitting the Bangladesh Coast

Major Cyclone year and Dates		Maximum Wind Speed (km/hr)	Storm Surge Height (meter)
30 Oct	1960	211	4.6-6.1
30 May	1961	160	6.1-8.8
28 May	1963	203	4.2-5.2
11 May	1965	160	6.1-7.6
15 Dec	1965	211	4.6-6.1
1 Nov	1966	146	4.6-9.1
23 Oct	1970	163	3.0-4.9
12 Nov	1970	224	6.1-9.1
25 May	1985	154	3.0-4.9
29 Nov	1988	160	3.0-4.0
29 Apr	1991	225	6.0-7.5
2 May	1994	210	2.0-3.0
25 Nov	1995	140	2.0-3.0
19 May	1997	220	3.1-4.2
15 Nov (Sidr)	2007	240	up to 10
25 May (Aila)	2009	120	3.0

Source: MCSP, 1993; Bangladesh Meteorological Department and field survey, 2010

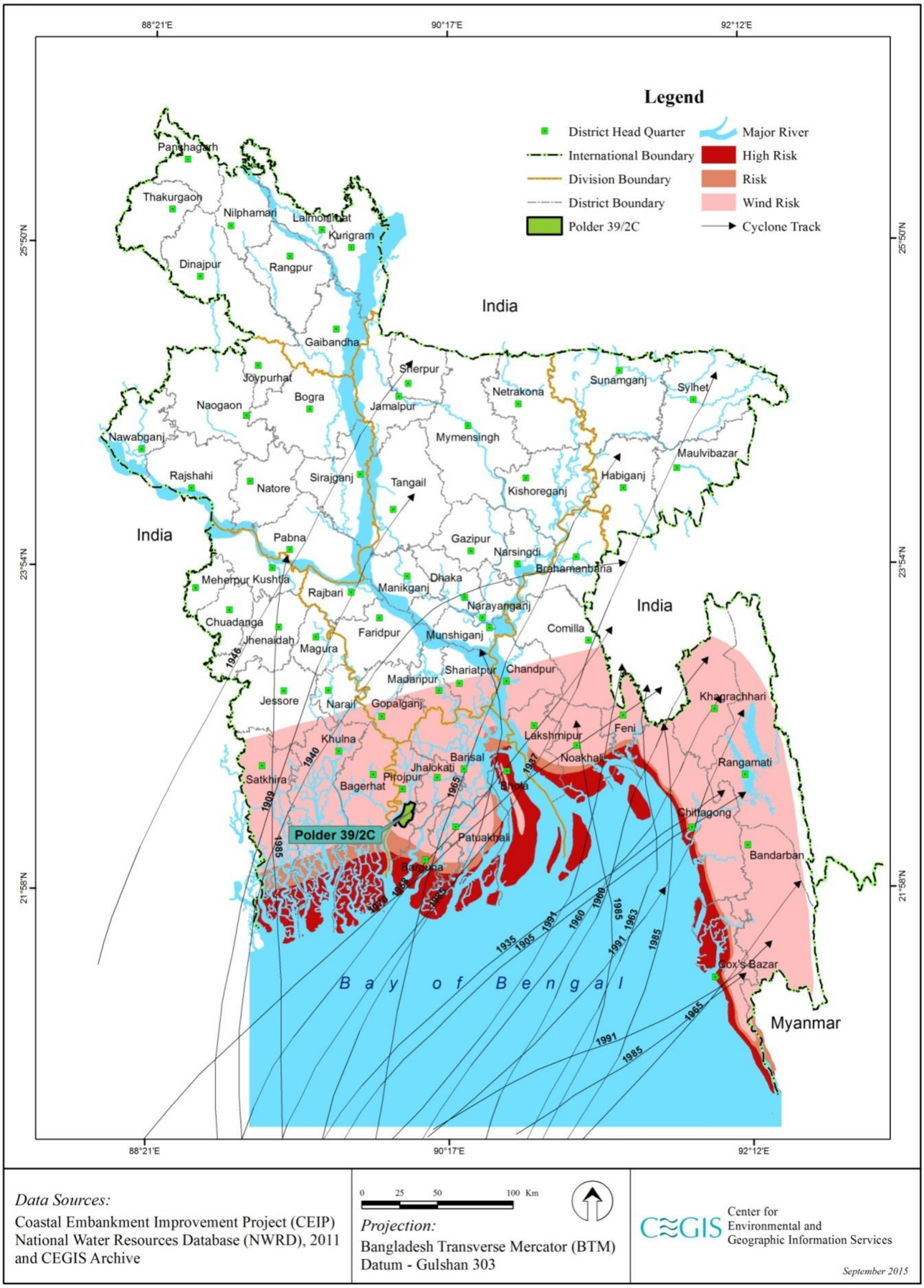
8.3.3 Cyclones and Storm Surges

632. Bangladesh is especially vulnerable to cyclones because of its location at the triangular shaped head of the Bay of Bengal, the sea-level geography of its coastal area, its high population density and the lack of coastal protection systems. During the pre-monsoon (April–May) or post-monsoon (October–November) seasons, cyclones frequently hit the coastal regions of Bangladesh. About 40% of the total global storm surges recorded in Bangladesh (Murty, 1984).

633. There is some evidence that the peak intensity may increase by 5 percent to 10 percent, which would contribute to enhanced storm surges and coastal flooding. Increases in wind velocity and storm surge height result in further inland intrusion.

634. During the last 125 years, more than 42 cyclones had hit the coastal areas (**Figure 7.2**) and 16 cyclones (**Table 8.1**) have occurred in the last 25 years. Table 8.1 shows a high frequency of cyclones in the 60ties, with a lower frequency in the 70ties and then an increase in frequency in the 90ties. The strength and number of major cyclones may be increasing because of higher sea surface temperatures associated with global warming. The last devastating cyclones (Sidr and Aila) hit the polder area in 2007 and 2009, respectively.

635. During Aila, storm surge water entered the polder area. As per the local community perception, the polder experienced the maximum surge height during cyclone Aila with an estimated surge height of 2-3 m.



Map8.2: Cyclonic Storm Tracks

8.3.4 Rainfall and Temperature, Drainage, and Waterlogging

636. The impact of climate change on higher temperature hasbeen projected through using a Regional Climate Downscaling technique. The South Asia Coordinated Regional Climate Downscaling Experiment (CORDEX) domain data (resolution 50 km) is available at Centre for Climate Change Research (CCCR), IITM, India. These data have used to forecast rainfall and temperature at Patuakhaliconsidering representative for the south-west polder area, see Figure 8.1.

637. For Year-2030 the change of rainfall is found to be -8.3%, 12.2%, 1.7%, 14.2% and 3.4% for winter, pre-monsoon, monsoon, post-monsoon and annual, respectively. For Year-2050: The change of rainfall is observed to be -2.0%, 1.0%, -4.6%, -18.5% and -4.8% % for winter, pre-monsoon, monsoon, post-monsoon and annual, respectively in 2050, a high reduction compared to the present and even higher compared to the prediction for 2030 (Figure 8.2).

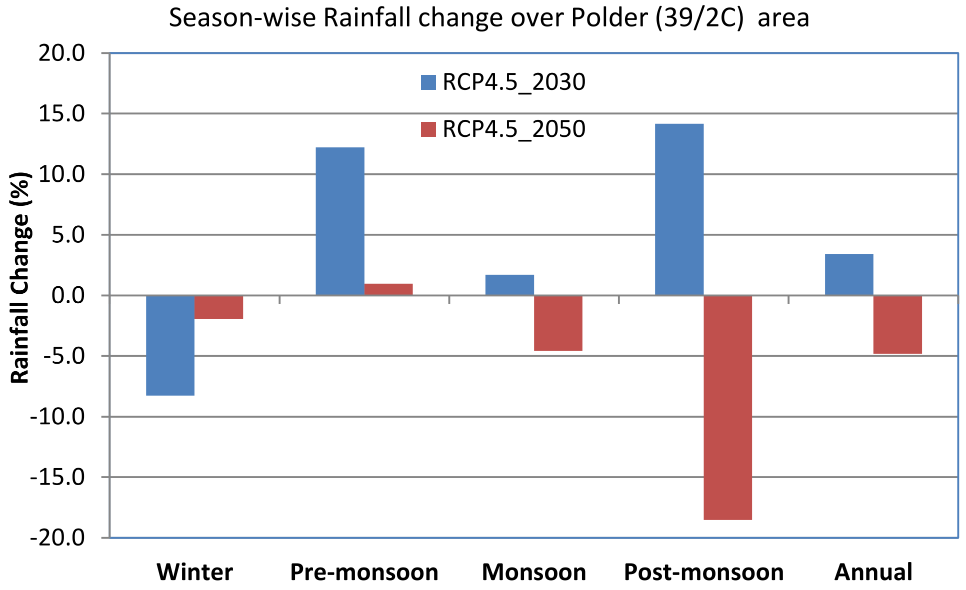


Figure 8.1: Change of seasonal rainfall (%) over Polder (39/2C) for 2030 and 2050, respectively.

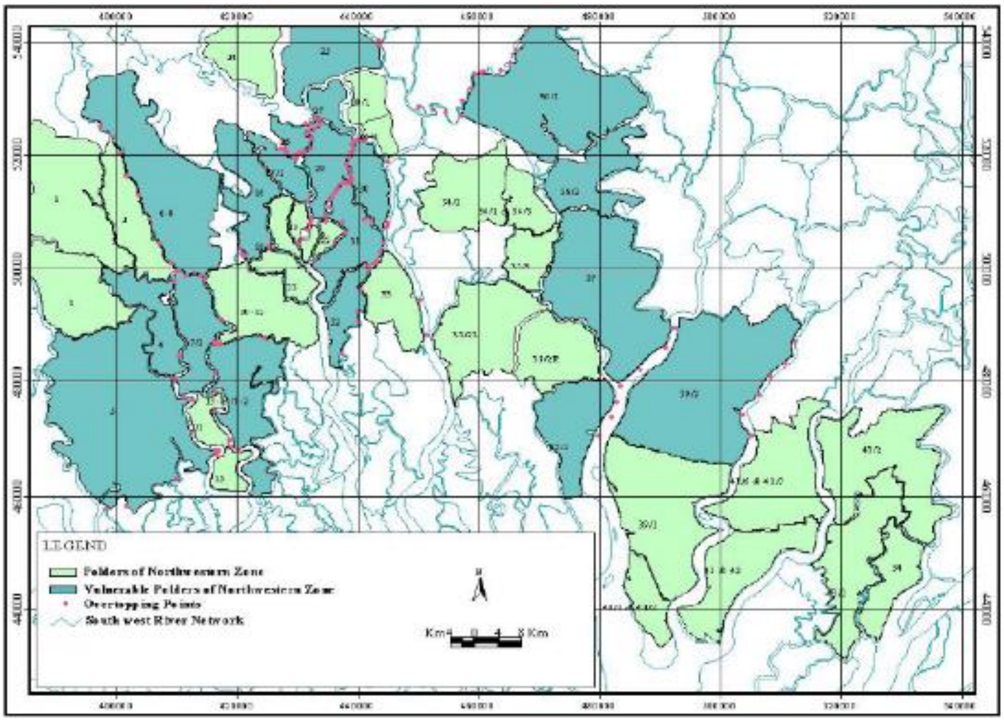
638. For Year-2030the maximum surface air temperature is predicted to increase by 0.2 to 1.3^{o} C with the highest increase during winter. For Year-2050the maximum surface air temperature may increase in 2050 by 0.8^{o} C, see Table 8.2.

Table 8.2: The change of maximum and minimum surface air temperature over Polder area (39/2C) for the year 2030 and 2050 respectively

Scenario	Reference period	Maximum Temperature Change(ºC)												
		Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RCP4.5	1990 (1981-2000)	2030	1.3	1	0.3	0.2	0.2	0.8	0.5	0.7	0.6	0.6	1.3	1.1
		2050	2	1.8	1.8	1.5	0.8	1.4	1.3	1.6	1.2	1	1.5	1.6
Minimum Temperature Change(ºC)														
RCP4.5	1990 (1981-2000)	2030	2	1.1	1.7	0.7	0.7	1	0.7	0.9	0.9	1	1.6	2
		2050	2.7	2.3	2.5	1.9	1.3	1.5	1.4	1.5	1.5	1.3	1.4	1.7

639. The drainage of coastal polders mainly depends on the tidal characteristics of the surrounding rivers and degree of siltation of these rivers. IWM (2008) found that high water level at the surrounding rivers of polders increases in the range of 30-80 cm due to sea level rise. This rise will eventually hamper the smooth drainage of a number of polders. Inundation area in few polders causing drainage congestion due to sea level rise is present in **Map 8.3**.

640. Sea level rise will deteriorate drainage conditions to large extent. 17 polders (light green in **Map 8.3**) out of 35 will be facing acute drainage congestion whereas present performance of these polders is satisfactory.



Map 8.3: Drainage Congestion in Affected Polders due to Sea Level Rise

8.3.5 Adaptation Strategy for Climate Change Impacts in Project Adaption at Local level

641. Local people of the project area are already facing different natural problems due to climate change. Specifically, drainage congestion, tidal flooding, water logging, storm surges and salinity intrusion are the major natural hazards in the project area, some of which can be linked with the climate change phenomenon as described above. People have reported that the occurrences of the natural hazards are more frequent than before in the project area. Locally the following adaptation measures have been practiced in different physical, environmental and social sectors in the coastal belt of Bangladesh for adapting climatic hazards.

- Peoples switching their livelihoods from agriculture to shrimp culture activities.
- High yielding and salinity tolerance varieties of paddy are introduced in the project area.
- Social and homestead forestry is being increased due to protect their life and properties from the strong wind velocity during cyclone.
- People raise the plinth level of their houses due to adapt water logging and flooding.
- Peoples introduce floating vegetable gardening system and case culture in the water logging area.
- Rainwater harvesting system is adopted to mitigate their drinking water problem during dry season.

8.3.6 Adaptation at Rehabilitation and Improvement planning

642. The IPCC projections have been considered in the hydrologic and hydrodynamic modeling of the feasibility study of the CEIP-I. The climate change projections have considered determining the design criteria and finally these outcomes have adopted in the planning and design of rehabilitation and improvement plan. The following criteria and the projected climate change information have been used in the design and planning of the interventions for taking care of climate change scenario in 2050.

- Sea level rise of 50 cm;
- 10 percent increase in maximum wind speed of cyclones; and
- Rainfall increase by 26 percent from March through May; and 13 percent increase from June through August.
- In respect of polder area in Bangladesh, rainfall may increase in pre-monsoon season (March-May) by 12.2% and monsoon season (June-September) rainfall may increase by 1.2% in 2030 using RCP4.5 scenario.

643. These considerations have ultimately led to determine the design crest level of the embankments and used for the design of the drainage system to cope with the impact of climate change.

9 Cumulative and Reciprocal Impacts

644. Chapter 9 presentsthe analysis of cumulative and reciprocal impacts of the proposed Project and other projects in the area.

Cumulative Impacts of all CEIP –1 Polders

645. A number of rivers and lakes / khals (Map 4.1) surrounds polder 39/2C. The Baleshwar River flows along the north-west directions and Pona Don River covers the north and south periphery by intersecting the polder from Rajapasha union.

646. The polder is surrounded by Polder 38 (north) and 37 (west). Polder 35/1 is among the four polders under CEIP-1in Package I, located in the downstream of Baleshwar River, and hydrologically connected with Polder 39/2C. The design crest level of Polder 35/1 is 6-6.5 mPWD whereas the level of Polder 39/2C is 5 – 5.5 m. The implementation of CEIP-1in Polder 35/1 would divert the storm surge further upstream and downstream which might have impact on the surrounding polders. In this context, the crest levels of 39/2C as well as that of adjacent Polder 35/1 under CEIP-1would be raised to mitigable the impacts. Therefore, during cyclonic event, the embankments with a design crest level would provide the desired protection against storm surge and cyclone induced floods.

647. The other 15 polders under CEIP-1are located quite far from Polder 39/2C and would have no hydrologically connectivity. As such there would have no changes in water level around these 15 polders though design the crest levels of these polders would also be raised to withstand the storm surge impacts. As such, the improvement of the polder 39/2C would not generate any cumulative impacts on other CEIP-1polders.

9.1 Other Projects around Polder 39/2C

648. Apart from CEIP, there are some other development projects implemented by GoB and a number of Non-Government Organizations (NGOs) at or near polder 39/2C. **Table 9.1** and **Table 9.2** show lists of various projects undertaken by the GoB and NGOs frequently in the districts of Khulna, Bagerhat, Pirojpur, etc. where Polder 39/2C is situated.

Table 9.1: List of other Projects Implemented by the GoB

Agency	Project Name	Duration	Location
DMB, BWDB, FAO, LGED	Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)	2008-ongoing	Pirojpur, Barguna, Barisal, Bagerhat, Bhola, Khulna etc.
LGED	Flood Rehabilitation Project in the Area of Rural Development Project-18 (Greater Khulna, Jessore and Kushtia District).	2000-2003	Khulna, Satkhira, Bagerhat
	Greater Khulna District Infrastructure Development Project.	2000-2004	Khulna, Satkhira, Bagerhat
DoF	Extension of Culture Technology of Marine Shrimp.	1997-2004	Khulna, Bagerhat, Satkhira & Cox's Bazaar
BEPZA	Mongla EPZ (Phase-1)	1998-2004	Khulna
KCC	Solid Waste Disposal and Environmental Improvement in Khulna City Corporation	1996-2004	Khulna

Table 9.2: List of Projects Implemented by the NGOs

Agency	Project Name	Duration	Location
WRDS	Dissemination and standardization of hydroponics (floating garden) in waterlogged areas as an adaptation to the impact of climate change	2003-2005	Gopalganj, Bagerhat, Jessore
RIC	Sundarbans Biodiversity Conservation Project	2000-2004	Pirojpur
CDP	CDP-CARE RVCC Partnership Project: Collection and Dissemination of Information on Climate Change in South West Bangladesh: Development of Central Information Centre (CIC)	2003-2005	Bagerhat, Khulna, Satkhira, Jessore, Narail and Gopalganj
CCEC	Sundarban Conservation through Crab Fattening	2002-2003	Khulna

9.2 Cumulative Impacts of Other Projects in the Area

649. The potential cumulative impacts in polder 39/2C in relation to other projects in adjacent polders are discussed below:

a) Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)

650. In order to facilitate recovery from damage to livelihoods and infrastructure caused by Cyclone Sidr and to build long-term preparedness through strengthened disaster risk management, the GoB implemented the "Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)" in a total number of 13 districts (Barguna, Bagerhat, Barisal, Khulna, Bhola, Pirojpur, Jhalokati, Noakhali, Feni, Chittagong, Patualkhali, Sathkhira, Laksmipur) of Bangladesh.

651. A major component of the overall activities of this project is rehabilitation of coastal embankments in Five upazillas of Barguna district (Amtali, Bamna, Betagi, Barguna Sadar, Patharghata), two upazillas of Pirojpur district (Bhandaria, Mathbaria), and three upazillas of Patuakhali district (Dashmina, Galachipa, Kalapara). Among the 29 polders considered for rehabilitation under the project, polder 39/1C is located in the downstream of Kocha river, at the opposite side of polder 35/1 (Map 1.1).

652. The design height of embankments in polder 39/1 is 4m (from mean sea level) and the rehabilitation works will rehabilitate the embankments to the design levels. No significant cumulative impacts are expected from the rehabilitation works that will bring polder 39/2C back to its former design conditions.

Other GoB projects

653. Apart from ECRRP and CEIP there are other projects undertaken by the GoB at or near the study area (**Table 9.1**). The foreseeable impacts generated by the implementation of such projects discussed below.

654. The Local Government Engineering Department (LGED) implemented a flood rehabilitation project at local level in Khulna, Satkhira, Bagerhat districts. The project improved the status of local people with a few social impacts in polder 39/2C. Due to agricultural development caused by the flood rehabilitation project, food security has developed for polder

39/2C. The effective implementation of the project ensured growth in development, and hence many people from polder 39/2C preferred such developed places of Khulna, Sathkhira, Bagerhat for employment. LGED also implemented an infrastructure development project during 2000-2004, which eventually improved the communication system, thus affecting the overall socio-economy positively.

655. In the year 1998, Department of Forest (DoF) extended the culture technology of marine shrimp on macro scale in Khulna, Bagerhat, and Sathkhira& Cox's Bazaar. The project continued up to 2004, discovering the consequences of virus attacks (of white spot syndrome virus, taura syndrome virus, and infectious hypodermal and haematopoietic necrosis virus) on shrimps during the later stages of the project implementation. However, the popularity of shrimp culture spread at regional level and in Polder 39/2C shrimp culture has become a common practice during dry season. The culture of shrimp is not labor-intensive practice, thus shrimp culture in Polder 39/2C created more unemployment among the poorest people. However, overall shrimp culture in Polder 39/2C has ensured an overall socio-economic development of the area. Due to frequent shrimp culture practice in the polder area, agricultural practice is being hampered, which eventually is affecting the asset level of poor farmers in Polder 39/2C.

656. The Khulna City Corporation (KCC) implemented the "Solid waste disposal and environmental improvement" project in 1996-2004. This project improved the surrounding environment, as the disposal of waste does not affect Sundarbans the way it used to do before. The quality and navigability of the Ponadon Riverhasbeen improved due to the implementation of the project by KCC.

657. The focus of these projects is not directly linked with the hydrologic system in the polder 39/2C area. So, no significant cumulative impacts are expected from these project activities in this polder area.

NGO projects

658. In recent times, a few projects have been implemented in Khulna, Bagerhat, and Pirojpur by several NGOs. Most of these projects are awareness building projects. The Coastal Development Partnership (CDP) implemented an awareness-building project to disseminate information on climate change in the southwest region of Bangladesh. Apart from that, a number of projects were implementing as a measure of climate change adaptation (crab-fattening, floating garden etc.). These non-structural projects have mostly been able to spread awareness against climate change, biodiversity conservation, etc. Now a day, people in polder 39/2C consider floating garden as a very useful practice in response to climate change effects. Such adaptable measures adopted by the people of Polder 39/2C may help their economic status on crises.

9.3 Reciprocal Impacts of Climate Change and Polder Improvement

659. Reciprocal impacts of Climate Change and Polder improvement refers to the impacts occurred on polder due to climate change and vice versa.IWM used hydrologic (MIKE11-NAM), hydrodynamic (MIKE11, MIKE-21) and cyclone/ storm surge (MIKE-21 Cyclone) models and analyzed the existing meteorological situation of the polder area. They have evaluated the physical changes in the relative polders, which may occur due to climate change. The data used for the model setup and calibration (including topography, soil maps, land use maps, and weather data, river network and cross-section, water level, discharge and salinity) have been obtained from national/international sources, published reports and surveys by IWM. The IWM study utilises the southwest regional model and Bay of Bengal model developed by IWM.

660. In order to evaluate the reciprocal impacts of Climate Change and Polder improvement of Polder 39/2C, both quantitative assessments and qualitative judgments have been carried out. Two separate hydrological and hydrodynamic models have been setup and simulated with data input from climate and hydro-meteorology to assess the impact of climate change on some sensitive issues of the polder namely, water availability, flood security and salinity.

9.3.1 Impact of Drainage Congestion

661. Simulation of rainfall event of 5-days 10 year is carryout for the existing drainage system i.e. without changing the regulators and khals under climate change scenario (RCP 8.5)[29]. The same projection of climate change is applyfor all polders. Simulation result enables to examine the inundation depth and land class. Analysis of model results on inundation suggests that existing drainage is not adequate for draining the design rainfall under climate change scenario and need improvement.

662. From beginning of the 21st century a new problem “water logging” (the long-term inundation of areas because of inadequate drainage) arose in south/south-west coastal region of Bangladesh. It has become an increasing problem in recent years for a various reasons: natural changes in river flow; increased sediment in riverbeds due to reduced sediment deposition on floodplains protected by embankments; and a lack of proper operation and maintenance of sluice gates of the polders i.e. circular embankments. Due to the permanent water congestion, sudden flood occurred during the rainy months. In the other words, the water logging situation causes recurring flood in every monsoon seasons. Among the affected areas, polder 39/2C is the worst hit and experiencing severe and year-round water logging. Although the dimension of water logging problem was little in the initial stage that slowly increased over the years by natural disasters this is likely happening by climate change. The situation expected to worsen more in future. While there is a very little specific research on the water logging problem, it is believed that climate change could further exacerbate this issue through changes in sedimentation and river flow, increased monsoon rainfall and retarded discharge of rivers due to back water effect and sea-level rise.

663. On the contrary, the river water carrying huge amount of sediments will move further downstream and may cause siltation in the water bodies outside the polder. Sedimentation may take place in the surrounding Baleswar River and new morphological changes may be established outside the polder. Moreover, sedimentation in smaller water bodies namely Pona River and Bharani Khal may cause regular drainage congestion problems and several smaller water bodies may permanently silted up. The navigability of rivers may further deteriorate over the years.

9.3.2 Impact onWater Level

664. Table 9.3shows the predicted water levels at Polder 39/2C with Climate Change. The predicted water level due to climate change is lower than the proposed crest levels of the polder 39/2C and will protect the interior polder area and the agricultural land. All of the internal channels have been connected with Baleswar River (western side) and Pona river (northeast), Bahar khal (east) and Bharani Khal (north). Therefore, naturally water level of internal khals will also increase.

[29] Representative Concentration Pathways

Sampling Point	Chainage along the Embankment (Km)	Peripheral river/Canal	Water level (mPWD)
29	51.19	Baleswar (Kocha)	3.33
30	39.00	Baleswar (Kocha)	3.32

Source: IWM, 2015

9.3.3 Climate Change Resilience Developed in Polder 39/2C

665. During field investigations, it was found that the local people are mostly aware of the climate change consequences and events. In recent years they are the victims of climate change induced natural disasters, frequently hitting them and causing massive loss of lives and properties. The initiatives already undertaken through different interventions by programs other than CEIP, the insight of climate resilience has developed within the polder habitants. Through the community mobilization in the CEIP program, local people have become more active towards building a climate resilient society. Now they are driven by the concept of climate smart village. Most of the people who are able to afford are now re-building their houses and infrastructures on a relatively higher level. Local people claimed that they would use the excavated spoil from the internal khals for their household purpose, if available. This will allow them to have their house and other infrastructures on a re-built higher land. The local farmers are now more concerned about climate change issues as well. They regularly follow and take part in the knowledge development and capacity building programs organized by CEIP, which they believe enhanced their understanding and preparedness on flood and disaster management.

10 Environmental Management Plan

666. This Chapter presents the Environmental Management Plan (EMP) for the CEIP-1 activities in the Polder 39/2C. The EMP essentially provides the implementation mechanism for the environmental and social mitigation measures discussed in **Chapter6**.

10.1 Objectives of EMP

667. The basic objective of the EMP is to manage, prevent, and mitigate potentially adverse impacts of Project interventions in the Polder 39/2C. The specific objectives of the EMP are to:

- Facilitate the implementation of the environmental and social mitigation measures identified in the present EIA and discussed in **Chapter 6**.
- Assign responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters to ensure effective implementation of the mitigation measures.
- Assess environmental training requirements for different stakeholders at various levels.
- Describe communication and documentation requirements.

10.2 EMP Components

668. The EMP components are listed below:

- Institutional Arrangement
- Mitigation Measures and Plan
- Monitoring Plan
- Documentation and reporting
- Contractual arrangements for EMP implementation
- EMP implementation cost
- Capacity building
- Grievance redress mechanism

669. These components are discussed in the following sections.

10.3 Institutional Arrangement

670. Clearly defined and functional institutional arrangements are essential for ensuring effective and sustainable implementation of the EMP, particularly the mitigation measures identified in the EIA. An Organogram showing the institutional setup of CEIP-I including organisation for implementation and monitoring of the EMP shown in Figure 10.1.

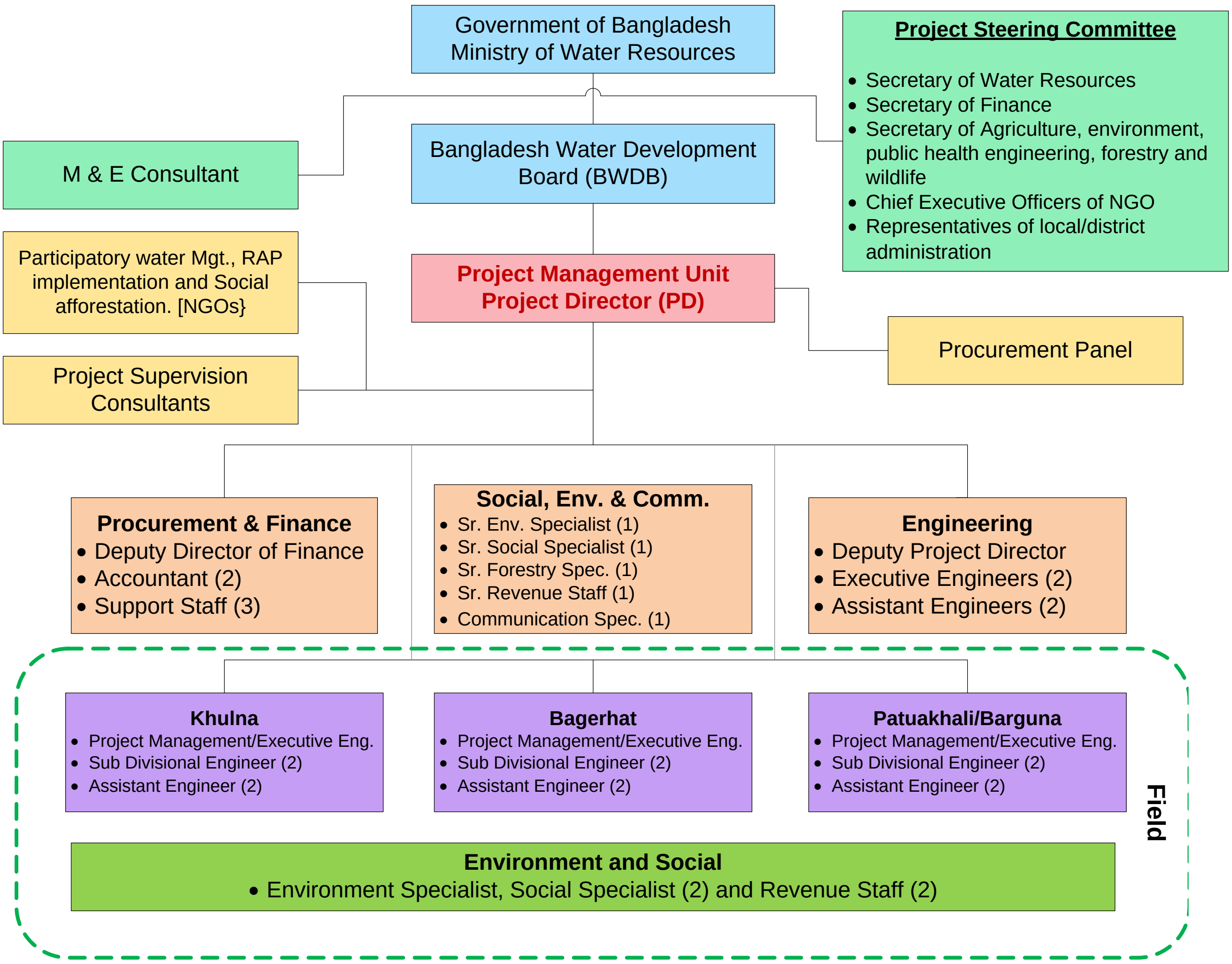


Figure 10.1: Organogram showing the institutional setup for CEIP-I

671. The institutional arrangements proposed to implement the EMP of Polder 39/2C are described in detail below.

10.3.1 Overall Responsibility

672. The overall responsibility of EMP implementation and fulfilling other environmental obligations during the Project lies with the Project Director (PD). For this purpose, PD will supportd by environmental and social staffs of the PMU, DCSCand contractors.

10.3.2 Construction phase

Environment and Social Staff in PMU

673. As described in **Section 4.8**, the BWDB will set up the PMU to manage the Project implementation. The PMU will led by the Project Director (PD). To manage and oversee the environmental and social aspects of the Project, the PMU will have an Environment, Social, and Communication (ESCU). The Unit will supervise compliance with and implementation of the EMP. The Unit will include a Senior Environmental Specialist. One environment specialist posted at the field level to support all three divisions. The ESCU will maintain liaison with WB safeguards team, regulatory agencies, and other stakeholders during the Project implementation. The ESCU will also coordinate with the environmental staff of the DCSC. In order to manage the EA process

and EMP implementation effectively, the ESCU will be established and made operational before awarding the contract to contractor. BWDB will update the EIA report, if necessary. The Mode of EMP implementation is shown in the figure-10.2 as follows:

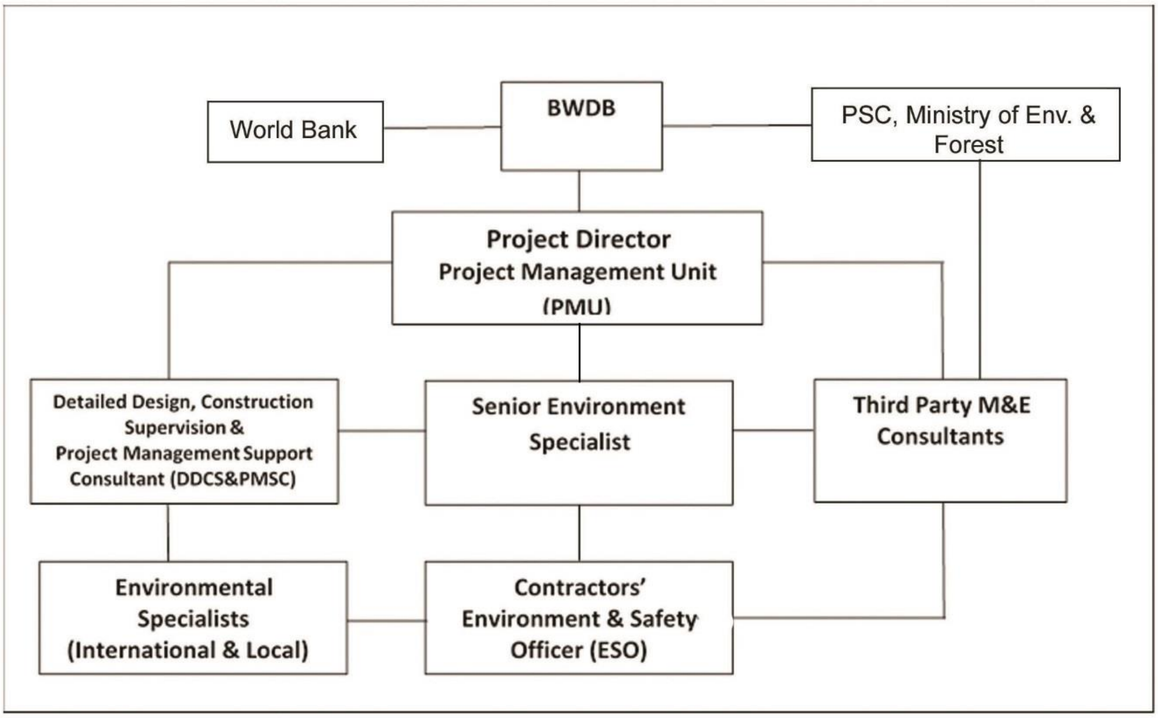


Figure 10.2:Organogram for Mode of EMP Implementation

Environment and Social Staff with DCSC

674. The DCSC will be responsible for the overall supervision of polder rehabilitation related activities. The DCSC will ensure quality control and report to the PD. The DCSC will also assist the ESCU for ensuring environmental compliance and monitoring of progress including EMP and/or ECoP implementation. They will supervise the contractors, ensuring design compliance and quality of works. For supervising the EMP implementation, DCSC will have dedicated and adequately qualified and experienced environmental staff including field-based environmental monitors (EMs). The DCSCwill supervise and monitor contractors to ensure compliance with the EMP. The DCSC environmental staff will maintain coordination with the ESCU for the effective implementation of EMP and other environmental commitments and obligations of the Project.

Contractor's Environment Supervisors

675. The construction contractors will have an adequate number of dedicated, properly qualified and experienced, site-based Environment Supervisors (ESs) at the construction sites. The ESs will be responsible to implement various aspects of the EMP particularly the mitigation measures to ensure that the environmental impacts of the construction works remain within acceptable limits. The ESs will maintain coordination with the DSCconsultant at the site level. The ESs will also be responsible to conduct environmental trainings for the construction crew.

10.3.3 Post-construction Phase

676. The BWDB monitoring unit has postings of 4 Assistant Chiefs and 2 Deputy Chiefs to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP, the ESCU will provide training to the BWDB people responsible for monitoring of environmental

compliance. Thus, a smooth transition to BWDB will happen to ensure environmental compliance during the O&M after the completion of the project. These staff will be responsible to manage the environmental aspects of the operation and maintenance of the polder, its water control structures, and other relevant issues such as protection of key environmental resources of the older and maintain fish migration. Water Management Organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (Nov 2000) and involve the beneficiary communities. WMOs will trained by BWDB to ensure environmental management during project operation. The Environmental Management Unit of BWDB will ensure and oversee the environmental management during project implementation and operation. The Water Management Organization will be trained and involved in EMP implementation during the operation phase.

10.4 Mitigation Measures and Plan

677. Mitigation is an integral part of impact evaluation. Where mitigation is deemed appropriate; theImplementing Agencyshould strive to act upon effects, in the following order of priority, to:

- Eliminate or avoid adverse impacts, where reasonably achievable.
- Reduce adverse impacts to the lowest reasonably achievable level.
- Regulate adverse impacts to an acceptable level, or to an acceptable time.
- Create other beneficial impacts to partially or fully substitute for, or counter-balance, adverse effects.

678. Project specific construction environmentalmanagement plans will be prepared by the Contractor and implemented upon approval by the DCSC and the PMU. These plans will specify precautions and mitigation measures for construction activities. Good Environmental Construction guidelines have been compiled in Appendix 10 of Environmental Management Framework.

679. Impacts identified as significantwill be further analyzed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted levels of impact. Potential mitigation measures will include:

- habitat compensation program
- species specific management program
- engineering design solutions
- alternative approaches and methods to achieving an activity‘s objective
- stakeholders participation in finalizing mitigation measures
- Construction practice, including labor welfare measures.
- operational control procedures, and
- management systems

680. Based on the experience, generic Mitigation Measures for the EMP havebeen compiled in Table 10.1 below for reference. These can used as a reference material for comprehending the scope of the EMP. Table 10.1 will be used in conjunction of the polder specific mitigation measure stated in Chapter 9.

Table 10.1: Generic Mitigation/Compensation Measures/Guideline

(ECoP: Environmental Code of Practice)

Parameter/Activities	Mitigation/Compensation Measure/Guideline
ECoP 1: Soil/ Land Management	
Sources of Material for Earthwork	• During design, the segment wise soil requirement and location of the sources of soil for earthwork for each polder construction/rehabilitation will be identified. • Selection of Borrow pit areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure that borrowed materials used for embankment filling is free of pollutants • Disposal of excess soil will be made at site with no objection from DoE and local authority
Borrowing of Earth	**Borrow Area Selection** Borrowing of spoil from places close to the toe line on any part of the embankment is prohibited. Earth available from dredging as per design, may be used as embankment material (if necessary and applicable), subject to the approval of the Engineer, with respect to acceptability of the material. Borrowing to be avoided from the following areas: • Lands close to toe line and within 0.5 km from toe line. • Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles). • Grazing lands. • Environmentally sensitive areas such as reserve forests, protected forests, sanctuary, and wetlands should save. A distance of minimum 500 m will have maintained from such areas. • Water-bodies (only if permitted by the local authority, and with specific pre-approved redevelopment plans by the PMU and DCSC) • Streams and seepage areas. • Areas supporting rare plant/ animal species. **Documentation of Borrow Pit** The contractor must ensure that following data base is documented for each identified borrowing areas before commencing the borrowing activity that provide the basis of the redevelopment plan. • Chainage along with offset distance; • Area (Sq.m); • Photograph and plan of the borrowing area from all sides; • Type of access/width/kutcha/pucca etc. from the roadway; • Soil type, Slope/drainage characteristics; • Water table of the area identified from the nearest well, etc.; • Existing land use, for example barren / agricultural /grazing land; • Location/name/population of the nearest settlement from borrowing area; • Quantity excavated (likely and actual) and its use; • Copy of agreement with owner/government; and • Community facility in the vicinity of borrow pit. • Rehabilitation certificate from the landowner along with four photograph of the rehabilitated site from different angles.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Excavation operation and Management of Excavated Material	To minimize any adverse impact during excavation of material following measures are need to be undertaken: • Adequate drainage system shall be provided to the excavated area • The Contractor shall construct sediment barriers at the stockpiling locations to prevent the erosion of excavated material due to runoff. The followings precautions shall undertake during quarry operations. • Overburden shall remove. • During excavation, slopes shall be flatter than 20 degrees to prevent any sliding. • The Contractor shall ensure all workers's related safety measures shall be taken. • The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation. • During transportation of the material, measures shall be taken to minimize the generation of dust and to prevent accidents.
Handling Dredged Material from River Dredging	• Deposition of dredged material will be far away from the channel edge to limit damage to streamside habitats. This also allows a degree of flooding to occur on the floodplain, thereby creating opportunities for wet grassland, scrub/wet woodland, wetlands and seasonally grazed rough grass. • Apply biotechnical engineering where possible for example geo textiles, may be used to help in stabilizing the material and aid re-colonization. • Other possibilities include: drying and spreading the spoil over adjacent land, which can improve soil fertility in some cases, but may also smother important flora and habitats; excavating a trench and infilling it with spoil, thus minimizing disturbance to agriculture and the local environment; dumping off-site is possible but expensive, using spoil to create artificial wetlands.
Contamination of soil by fuel and lubricants	The Contractor will prepare and implement a site specific pollution control plan, including: Contractor workshops will have oil separators/sumps to avoid release of oily water; Contractor will avoid repairing vehicles and machinery in the field. Contractor will use plastic sheet or gravel in the workshop and equipment yard to prevent soil and water contamination. Contractor will dispose contaminated soil appropriately ensuring that it does not contaminate water bodies or affect drinking water sources. Contractor will ensure that there is no leakage, spillage, or release of fuel, oil or any other affluent/wastes on the ground or in the water from its construction machinery, vehicles, boats, launches, and barges. Contractor will regularly monitor the condition of its fleet. Material borrowing from the riverbanks will be carried out sufficiently away from the water line, minimizing the possibility of loose soil to wash away in the river. Contractor will locate camps away from the communities and drinking water sources. Contractor will prepare and implement camp waste management plan (septic tanks, proper solid waste disposal).

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	Contractor will not release untreated wastes on ground or in water. Contractor will re-use spoil and excavated material where possible. Contractor will dispose spoil at designated areas with community consent. Construction material, demolition debris, and excavated soil/silt will not allowed to enter into water bodies.
ECoP 2: Water Resource & Hydrology Management	
Hazardous Waste Management	The contractor will minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes).
Ponding of water/water logging	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all storage containers,which are capable of storing water, after use or store them in inverted position • Reinstate relief and landscape • Monitor drainage pattern after high down pouring and recession flood • Connect water pockets to the nearest drainage channels/canals
Soil Erosion and siltation	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as and where required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds) • All working sites (except permanently occupied by the road and supporting facilities) will be reinstated to its initial conditions (relief, topsoil, vegetation cover). • Ensure that roads used by construction vehicles are swept regularly to remove sediment
Dredging	• Disturbance can be minimized if mechanical excavators work from one bank. If the channel is too wide, the digger must work within the channel. Disruption can be minimized by diverting the river down one side of the channel and dredging the other side while it is 'dry'. Smaller plant equipment generally limits the level of impact on bank-side and in-stream habitats.
Construction activities in water bodies	• Protect water bodies from sediment loads by silt screen or bubble curtains or other barrier. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary
ECoP 3: Air Management	
Construction vehicular traffic	The Contractor will • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in an efficient manner • Covered haul vehicles to be used carrying dusty materials (cement, borrow and quarry) moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Materials will be transported to site in off peak hours.
Construction activities	• Water the material stockpiles, access roads and bare soils on an as and where required basis to minimize the potential for environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds). • Stored materials such as excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid them from wind-drift • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas/side of the embankment as soon as practicable by plantation/vegetation/grass-turfing • Establish adequate locations for storage, mixing and loading of construction materials, in such a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems
Odor from Construction labor Camps	• Construction worker‘s camp shall be located at least500 m away from the nearest habitation. • The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odor is generated.
ECoP 3: Agriculture Management	
Loss of Top Soil	• Soil from fallow lands/ non-agricultural lands will be used in all type of earthwork and in embankments • Collect/strip top soil before earth filling and store the same for and reusing it for final surfacing of embankment top and tree plantation/afforestation. • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and similar others. • The stockpiles will be maintained a slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil • Locate topsoil stockpiles in areas outside the drainage lines and protect from erosion • Spread the topsoil to maintain the physio-chemical and biological activity of the soil. • The stored topsoil will be utilized for covering all disturbed area and along the proposed plantation sites • Topsoil stockpiles will be monitored and the adverse conditions are to be identified and the following corrective actions are to be undertaken: • Anaerobic conditions-turning the stockpile or creating ventilation holes through the stockpile; • o Erosion – temporary protective silt fencing will be erected;

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Soil salinity	• Use of duckweed will remove soil salinity • Flushing with pre-monsoon rainwater will reduce soil salinity. • Saline tolerant crops need to be cultivated. • Environmentally and socially responsive shrimp farming e.g. shrimp-rice farming system to be encouraged. • Increasing upland discharge of fresh water will push back ingress of saline water from the sea • Green manure application is to be promoted • Ground water abstraction for shrimp farming will avoided.
ECoP 4: Noise Management	
Construction vehicular traffic	• Maintain all vehicles in order to keep it in good working condition in accordance with manufactures maintenance procedures • Organize the loading and unloading of trucks, and handling operations for purpose of minimizing construction noise at the work site.
Construction machinery	• Appropriately site all noise generating activities to avoid noise pollution to local residents • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures.
Construction activity	• Notify adjacent landholders/Schools prior any typical noise events outside of daylight hours. • Employ best available work practices on-site to minimize occupational noise levels. • Install temporary noise control barriers where appropriate • Plan activities on site and deliveries from site to minimize impact. • Monitor and analyze noise and vibration results and adjust construction practices as required • Avoid working during 09:00pm to 06:00 am within 500m from residences.
ECoP 5: Ecology Management	
Flora	
Vegetation Clearance	• Tree outingwill be performed upon preliminary notification to the relevant authority (District Forest Office, DoE). • Preparation of maps in GIS format, cadastral description of trees to felled, marking, and supervision of Forest Department are necessary elements of the procedure. • Provide adequate knowledge to the workers regarding nature of protection and the need of avoid felling trees during construction • Fruit and timber trees owned by local population will be compensated at their replacement cost according to market prices
Plant Management	• Tree seedlings of local/indigenous species are planted in such a way that minimizes damage to the soil, while facilitating seedling survival. Tree seedling species are to be selected appropriately for maintaining long-term productivity. • Focus on tree species suitable for site condition • Prevent unreasonable species resulting in slow growth, less water and soil conservation and pest or disease outbreaks • Local species as planting materials, since natural selection and succession are most suitable for local climates and natural conditions • Ensure of avoiding single species or clone monoculture

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Choose suitable species for berm, turfing and side
Planting	• Leave set back requirements around streams, restricted areas e.g. native vegetation, protected riparian strips, historic and heritage sites, research areas. • For nursery raising, physical and biological controls are to be practiced to control the pests and diseases in the nurseries. • Do not plant spread-prone species on sites where there is a high risk of uncontrollable wilding spread beyond the boundaries of the plantation. • Consider appropriate species, patterns and layout when planting areas with high visual values and/or with important recreational values
Polypropylene Bags Handling	• Make a borrow Pit at each site for collection/disposal of poly bags • Collect all bags at the pits after plantation • If feasible, inform private sector to collect those bag for recycling
Pest Management to Nursery	• During outbreak of any deadly plant disease, develop a plan to manage pest in coordination with neighbors by identifying existing pests and diseases and the risks for the introduction of new pests and diseases.
Water Management	• Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from nursery • Divert runoff from undisturbed areas around the harvesting site • Stockpile of fertilizer or agrichemical should be far away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, fertilizer waste and transport to an approved waste disposal site.
Fauna	**10.4.1**
Construction works in the surrounding lands	• Pre-entry survey and prevention of damage to fauna prior to start up • Limit the construction works within the designated sites allocated to the contractors • To restrict any destruction of active nests or eggs of resident birds • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.
ECoP 6: Fisheries Management	
Construction works in the canals and on the surrounding lands	• Creation of small lagoons and pools,which may trap the fishes should be avoided. • Creation of artificial waterfalls and other barriers for migration will be avoided. • Natural river channel will be reinstated after completion of construction works
Hydraulic Structure	• Hydraulic structure will be operated considering the time of fish migration and spawning time • Area specific hydraulic structure operation guideline will have to be developed
Dredging	• Ensure that the dredging activity will create minimum sediment load in the water • Avoid dredging during spawning period of fish and other critically endangered aquatic species
ECoP 7: Socio-Economic Management	

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Construction Camp Management	
Location of constructionCamps (MRDI, 2011)	• Locate the construction camps inareas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • BWDB will endorse detailed layout plan for the development of the construction camp submitted by the contractor. The plan will show the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.
Construction Camp Facilities	The following facilities will have to be provided by the Contractor • Adequate housing for all workers • Safe and reliable water supply • Safe hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Provide in-house community/common entertainment facilities, dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Solid Waste Management	• Ensure proper collection and disposal of solid wastes within the construction camps • Store inorganic wastes in safe place and clear organic wastes on daily basis to waste collector. • Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Not to establish site-specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved disposal sites
Fuel supplies for cooking and heating purposes	• Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Conduct awareness campaigns to educate workers to protect the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.
Health and Hygiene	• Provide adequate health care facilities within construction sites • Provide first aid facility round the clock. Maintain stock of medicines in the facility • Provide ambulance facility for the laborers during emergency for transferringto nearest hospitals. • Initial health screening of the laborers coming from outside areas • Train all construction workers on basic sanitation and health care issues and safety matters, and on the specific hazards of their work • Provide HIV awareness programming, including STI (sexually transmitted infections)

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• And HIV information, education and communication for all workers on regular basis • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon. • Carryout short training sessions on best hygiene practices to all workers is mandatory. • Place display boards at strategic locations within the camps containing messages on best hygienic practices
Payment of Wages	• The payment of wages will be as per the Minimum Wages Act, Department of Labor, and Government of Bangladesh for both male and female workers. • Display of the minimum wages board at camps and major construction sites will be made in local languages at the construction and labor campsites. • Wages will be paid to the laborers only in the presence of BWDB staff; • Contractor is required to maintain register for payment of labor wages with entry of every labor working for him. Also, he has to produce it for verification if and when asked by the DSC, PMUand/or the concerned BWDB staff/DSC's representative
Rehabilitation of Labor and Construction Camp	At the completion of construction, all construction camp shall dismantle and removed from the site. The site shall be restoreed to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include: • Oil and fuel contaminated soil shall be removed and transported or buried in waste disposal areas. • Soak pits, septic tanks shall be covered and effectively sealed off. • Debris (rejected material) will be disposed of suitably. • Underground water tank in a barren/non-agricultural land should be covered. However, the tank shall be remove from agricultural land. • If the construction campsite is on an agricultural land, preserve top soil and good earth can spread back for a minimum 30cm for faster rejuvenation of the land. • Proper documentation of rehabilitation site is necessary. • This shall include the following: • Photograph of rehabilitated site; • Land owner consent letter for satisfaction in measures taken for rehabilitation of site; and • Undertaking from contractor; In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per the guideline. The rehabilitation is mandatory and will be included in the agreement with the landowner by the contractor. He would have to obtain a certificate for satisfaction from the landowner.
Damage and Loss of Cultural Properties	
Conservation of Religious Structures and Shrines	• All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important structures as

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	identified during design and all properties / sites / remains notified. No work shall spillover to these properties and premises. The design options for cultural property relocation and enhancement need to be prepared. • All conservation and protection measures will take up as per design. Access to such properties from the road shall be maintained clear and clean.
	• During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from the PD. The Archaeological Department shall be intimate of the chance find and the DCSC shall carry out a join inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work. • All fossils, coins, articles of value of antiquity, andstructures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall dealt with as per provisions of the relevant legislation.
Worker's Accident Risk	
Risk from Operations	• The Contractor is required to comply with all precautions as required for the safety of the workmen as per the International Labor Organization(ILO) convention. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, books, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and outlet.
Risk from Electrical Equipment	• Adequate precautions will be taken to prevent danger from electrical equipment. No materials on any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provideedto protect the public. All machines to be used in the construction will conform to the relevant Bangladesh Standards (BS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per BS provisions and to the satisfaction of the DSC.
Risk from Hazardous Activity	• All workers employed on mixing material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would provided with welder's protective eye-shields. Stonebreakers will provided with protective goggles and clothing and will be seated at sufficiently safe intervals.
Malarial Risk	The Contractor, at his own expense, conform to all anti-malarial instructions given to him by the DSC and the EMU, including filling up any borrow pits, which may have been dug by him.
Disruption to Users	
Loss of Access	• At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. Work that affects the use of existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the DDCS&PMSC

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• The works shall not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, and any other access footpaths to or of properties whether public or private.
Traffic Management	• Special consideration shall be given in preparation of the traffic control plan for the safety of pedestrians and workers at night • The temporary traffic detours in settlement areas shall kept free from dust by frequent application of water.
Traffic Control and Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain barricades, including signs, markings, flags, lights and flagmen as may required by the DCSC for the information and protection of traffic approaching or passing through the cross section.

10.5 Chance-Find Procedures for Physical Cultural Property

681. The Contractor will be responsible for familiarizing themselves with the following “Chance Finds Procedures” in case of culturally valuable materials are uncovered during excavation or any project activities as per Antiquities Act, 1968, including:

- Stop work immediately following the discovery of any materials with possible archaeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artefacts as far as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artefacts;
- Prevent and penalize any unauthorized access to the artefacts; and
- Restart construction works only upon the authorization of the relevant authorities (e.g. Upazila Nirbahi Officer, Deputy Commissioner and Department of Archaeology).

10.6 Monitoring Plan

682. Extensive monitoring of the environmental concerns of the CEIP project will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans will be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive database of the polder specific Environmental Impact and Monitoring information will be created, which will help to evaluate the impacts easily.

683. The Monitoring activities during design/preconstruction period are:

- checking the contractor’s bidding documents, particularly to ensure that all necessary environmental requirements have been included; and
- checking that the contract documents’ (Construction Environmental Action Plan) references to environmental mitigation measures requirements have been incorporated as part of contractor’s assignment and making sure that any advance works are carried out in good time.

684. **Environmental monitoring** during construction phase is a function of supervision, and the essential purpose is to ensure adherence to the EMP. The monitoring is a daily process,

which ensures that departures from the EMP are avoided or quickly rectified, or that any unforeseen impacts are quickly discovered and remedied. This monitoring will carryout by the Design and Supervision Consultants on a regular basis. Additional monitoring will carryout by the Environmental and Social Unit.

685. **Post project monitoring evaluation** will carried to evaluate the impacts of the Project during first three (3) years of operation of the Project. Regular monitoring of the condition of the embankment, drainage structures and slope protection structures and afforestation are important from an environmental management point of view. In addition to this activity, information on the locations, type and consequences of flooding, erosion, flora and fauna mortality, availability of fish, occupational shift, migration is required. Recommended air, noise and water quality monitoring, greening and landscaping and community feedback are also included in the Monitoring Plan. The monitoring plan and details of monitoring locations for environmental condition indicators of the project during the construction and operation stage are present in Table 10.2 and Table 10.3.

Table 10.2: Environmental Monitoring Plan during Construction and Operation of Rehabilitation and Improvement of Polders System

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Construction					
Sources of Material	Work Site	Possession of official approval or valid operating license of suppliers materials (Cement, soil).	Before an agreement, for the supply of material finalized.	Contractor	DCSC and M&E Consultants, BWDB
Operation of borrow site	Borrow pit/site	Visual inspection of borrowing site and ensuring operational health and safety	monthly	Contractor	DCSC and M&E Consultants, BWDB
Top Soil	Storage area	Top soil of 0.15 m depth will be excavated and stored properly	Beginning of earthwork	Contractor	DCSC BWDB
		The stored top soils will be used as cladding material over the filled lands	Immediately after filling and compaction of dredge materials	Contractor	DCSC, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation.	At the end of filling activity	Contractor	DCSC BWDB
Erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	DCSC M&E Consultants andBWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Hydrocarbon and chemical storage	Construction camps	Visual Inspection of storage facilities	Monthly	Contractor	DCSC BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are placed and flagmen for traffic management are engaged	Monthly	Contractor	DCSC, BWDB
Air quality (dust)	Construction site	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Daily	Contractor	DCSC, BWDB
	Material storage sites	Visual inspection to ensure dust suppression work plan is being Implement	Monthly	Contractor	DCSC and BWDB
Air Quality (PM10, PM2.5)	Close to School/ Madrasha, Hospital &Villages	Air quality monitoring	Half Yearly	Contractor through a nationally recognized laboratory	DCSC M&E Consultants and BWDB.
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	DCSCM&E Consultants, BWDB
	Construction sites	Ensure work restriction between 09:00 pm-6:00 am close to School/ Madrasha, Hospital & Villages	Weekly	Contractor	DSC and M&E Consultants andBWDB
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, and CODetc.)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Dry season	Contractor through a nationally recognized laboratory	DCSC,M&E Consultants and BWDB
Drinking Water Quality (TDS, Turbidity, pH, EC, as if groundwater etc.)	Sources of drinking water at construction camp/site	Sampling and analysis of water quality	Yearly	Contractor through a nationally recognized laboratory	DCSC BWDB andM&E Consultants

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	DCSC, BWDB and M&E Consultants
Waste Management	Construction camp and construction site	Visual inspection of collection, transportation and disposal of solid waste and solid waste is deposited at designated site	Weekly	Contractor	DCSC BWDB and M&E Consultants.
Flora and Fauna	Project area	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute	DSC and M&E Consultants, BWDB
Cultural and archeological Sites	At all work sties	Visual observation for chance finding	Daily	Contractor	DCSC BWDB and M&E Consultants
Reinstatement of Work Sites	All Work Sites	Visual Inspection	Aftercompletion of allworks	Contractor	DCSC BWDB and M&E Consultants
Safety of workers Monitoring and reporting accidents	At work sites	Usage of Personal Protective equipment	Monthly	Contractor	DCSC BWDB and M&E Consultants
During Operation and Maintenance					
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc.)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Air Quality (Dust PM10, PM2.5)	At the baseline monitoring site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Flora and Fauna specially fisheries	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Agriculture	In the project area	Compare the production with the baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant

Source: MRDI, 2011, LGED, 2011

Table 10.3: Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Implementation					
Plant Selection	Nursery	Visual inspection. Type and variety of plant species to be planted for turfing on the top of embankment and its slopes.	Before plantation	Contractor	DCSC, BWDB and M&E Consultants
Water Quality	Water bodies near nursery	Odor and chemical testing	Half yearly	Contractor through nationally recognized laboratory	DCSC, BWDB and M&E Consultants
Waste Management	Work site and Nursery	Visual inspection of collection, transportation and disposal of grasses, debris and is deposited at designated site	Weekly	Contractor	DCSC, BWDB and M&E Consultants
	Work site and Nursery	Visual inspection of Water bars & cut-offs .sediment traps to prevent water pollution caused by run-off from harvesting areas	Beginning of work	Contractor	DCSC, BWDB and M&E Consultants.
Nursery Embankment Management	Nursery	Visual inspection of height of embankment, possibility of water logging and connection to the waterbodies	Beginning of each nursery	Contractor	DCSC, BWDB and M&E Consultants.
During Operation and Management					
Multilevel belt of trees	Polder top and along the polder	Visual inspection	Yearly	BWDB through nationally recognized institution	M&E Consultant
Flora and Fauna	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Erosion	Along Alignment	Visual Inspection presence of gullies or erosion	Yearly	BWDB	M&E Consultant

Qualitative Spot Checking Indicators

686. Moreover, a rapid environmental monitoring will carryout according to the following checklist in terms of visual judgment during field visit as an indirect control to implement Environmental Mitigation plan. Table 10.4 can follow during project construction and operation process.

Table 10.4: Spot Checking Indicator

Parameter	Visual Judgment			Comments
	Poor	Moderate	Satisfactory	
Workers Safety				
Camp Site Management				
Plant Site Management				
Borrow Area Management				
Top Soil Prevention				
Waste Management				
Occupational Health and Safety				
Stockpiling of construction materials				
Reporting and Documentation				

<u>Third Party Validation</u>

687. BWDB will engage independent consultants to conduct a third party validation (TPV) of the EMP implementation on a yearly basis during the construction phase. During the TPV, the consultants will review the implementation and effectiveness of various EMP activities including mitigation measures, environmental monitoring, trainings, and documentation. The consultants will also identify gaps and non-compliances in EMP implementation and propose actions for their remediation.

10.7 Documentation, Record keeping and Reporting

10.7.1 Record Keeping

688. Proper arrangements are necessary for recording, disseminating and responding to information, which emerges from the various environmental monitoring and management programs. They are also necessary for rendering the environmental management system "auditable". However, the primary focus must remain on the pragmatic control of pollution, not creation of complex bureaucratic procedures. BWDB will maintain database of the polder specific Environmental Impact and Monitoring information for keeping all type of monitoring record. The ESCU will assist BWDB for keeping these records initially. The trained BWDB staff will take the responsibility of record keeping and monitoring during operation phase.

10.7.2 Monitoring Records

Quantitative Physical Monitoring

689. The objective of quantitative physical monitoring is to ensure that the mitigation measures designed to prevent, reduce and where possible offset any significant adverse impacts on the environment are implement throughout the Project lifecycle. DCSC will regularly monitor and provide information to ESCU for updating the database. DCSC will provide the following information bi-weekly to ESCU, if not urgent.

- Sampling points;
- Dates and times of sample collection;
- Test results;
- Control limits;

- "Action limits" (approximately 80 percent of the control limits) at which steps must be taken to prevent the impending breach of the control limit; and
- Any breaches of the control limits, including explanations if available.

690. The monitoring data would be continually processed as it is received, so avoid a build-up of unprocessed data.

General Site Inspections and Monitoring

691. A Site Inspection Checklist for recording the findings of the general site condition surveys would be developed by the respective contractors, based on the Environmental Mitigation Plan described in Chapter 6 and Section 11.4, during the construction phase. The Site Inspection Checklist would be supported by sketches, as necessary.

Information Sources

692. A complete and up-date file of all relevant sources of information will be maintained by the ESCU of PMU. This file would be readily accessible and include, as a minimum, copies of the following documents:

- Current environmental permits and consents;
- Action to fulfil the requirement of annual site clearance for polder area
- All relevant national regulations, international guidelines and codes of practice;
- Manufacturers' MSDSs for all hazardous substances used on the plant;
- Manufacturers' operating manuals for all the environmental monitoring equipment;
- Current calibration certificates for all the equipment that requires calibration by an external organization; and
- The latest version of Environmental Management and Monitoring Plan.

Non-Compliance Report

693. Any breaches of the acceptable standards specified, would be reported to the PMU using a standard form, i.e. a Non-Compliance Report (NCR).

694. A copy of each completed NCR would hold on file by DCSC, to replac by the reply copy when it is receiv. A record of corrective actions would make and tracked to their completion.

Monthly Internal Reports by DCSC

695. The DCSC will prepare a monthly report for issuance to the ESCU of PMU. These reports will summarize the following:

- Progress in implementing this EMP;
- Findings of the monitoring programs, with emphasis on any breaches of the control standards, action levels or standards of general site management;
- Any emerging issues where information or data collected is substantially different from the baseline data reported in the Environmental Assessment;
- Outstanding NCRs;
- Summary of any complaints by external bodies and actions taken / to be taken; and
- Relevant changes or possible changes in legislation, regulations and international practices.

Half-Early Progress Report by BWDB

696. The ESCU of BWDB will prepare the bi-annual monitoring report whichwill include the environmental monitoring and the plan for next 6 months during the construction phase, and will submit to the World Bank for review. The bi-annual monitoring report will summarize the information presented in Article 11.6.5, Table 10.2 and Table 10.3, respectively.

Environmental Audit Report & Third Party Monitoring Report

697. It is expected that BWDB will havean annual environmental audit carried out by the Third Party Validation team. Besides, an environmental audit will carried out out before the mid-term evaluation and before project closing. All Environmental Audit Reports will be shared with World Bank.Any Third Party Validation and Monitoring report will share with World Bank. TheWorld Bank would also supervise the environmental compliance as part of their regular implementation support missions.

10.8 Contractual arrangements for EMP implementation

698. A fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The contractor needs to submit aConstruction Environmental Action Plan (CEAP) based on the EIA including the EMP in line with the construction schedule and guideline. The CEAP needs to review by the supervision consultant and clearby BWDB and World Bank.

10.8.1 Guideline to Incorporate Environmental Management in Bid Document & Preparation of EAP

- Prepare cost estimates, to be incorporated in the Bid Documents.
- The EMP along with the good environmental construction guidelines to be incorporated in the bid document‘s work requirements.
- Preparation of work requirement (addendum/corrigendum to polder & hydraulic structure construction/afforestation) and
- Corrigendum / Addendum to polder/embankment specification if any andespecial provisions to incorporat in bid document.
- Penalty clauses for not complying with EMP requirements to be incorporated. Indicative penalty clauses proposed in the CEIP are presented below (Addendum to Clause 17.2 Contractor‘s Care of the Works of FIDIC).
    - The contractor has to follow all traffic safety measures as defined in the technical specification. Damage shall levy at the rate Tk. 3000/- per day per location for non – conformity of traffic safety measures as per the decision of the DCSC.
    - The contractor has to follow all environmental mitigation measures as defined in the technical specification read along with the Environmental Management Plan for the specific CEIP activities. Damage shall levy at the rate Tk. 3000/- per day per location for nonconformity of Environmental Management Plan measures as per the decision of the BWDB Engineer.
    - The contractor has to ensure that prior to every monsoon season, during the construction period; all the temporary and permanent cross drainage structures are free from debris as defined in the Technical Specifications read along with the Environmental Management Plan. Damage shall be levied at the rate of Tk.3000/- per day per location for non-conformity as per the decision of the DCSC.

699. The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), will be provide to staff and labor all time as defined in the labor codes read along with the EMP. Damage shall be levied at the rate of Tk. 1000/- per day for non-conformity as per the decision of the DCSC.

10.9 Guideline for Compensation and Contingency Plan during Project Period

700. Compensation becomes necessary when project impacts cannot satisfactorily mitigate. This can be paid in cash or kind and the emphasis will be on ensuring fairness and causing minimum inconvenience to the affected party. The most common cause of compensation payment is displacement of people and loss of productive land due to land acquisition, tree cutting, or property damage. Such impacts can rarely fully compensate. The compensation will give as per provision of the Resettlement Action Framework. Any disputes over the compensation will be handled by the Grievance Redress Committee.

701. In addition to the compensation, water management projects should also have a contingency plan to deal with emergencies and accidents. Such incidences encompass a whole range of situations from personal injury during operation of a machine to breaching of an embankment. Therefore, BWDB would be prepared for the following emergency situations:

Embankment failure during a flood – keep sufficient number of sand bags in reserve.

Bank caving/erosion – keep sufficient number of concrete blocks and sand bags in reserve.

Have an emergency evacuation plan for the people in the line of danger.

Have a place designated as emergency shelter and ensure proper water supply, power supply and sanitation at this site.

Accidental spill of harmful chemicals – train some members on how to confine such a spill and minimize potential danger to humans and other animals.

Fire – keep fire extinguisher or emergency water pump ready at local project office.

Personal injury – keep a first aid box at the project office. Have a plan for quickly transporting a seriously injured person to the nearest hospital.

10.10 EMP Implementation Cost

702. The estimated costs for the environmental management and monitoring activities are set out in **Table10.5** below:

Table-10.5: Cost of EMP

Item No.	Description	BDT	US 1,000 $	Responsible Agency	Time frame
1	Crop compensation to the indirect loser/ land owner/ share croppers of construction sites /damage to dredge spoils	3,000,000	37.50	Contractor	Construction phase
2	Soil quality monitoring including N, P, K, S, Zn, Salinity, Organic Matter, pH etc. during pre- construction, construction and post construction period (16 samples in polder 39/2C) during pre-construction, construction and post construction periods) = total 16 samplesx3 times @ Tk.5,000	240,000	3.00	BWDB in collaboration with DAE	Pre-construction, construction and post construction period

Item No.	Description	BDT	US 1,000 $	Responsible Agency	Time frame
3	Habitat Observation for four (4) times per year (dry & wet season).	50,000	0.63	BWDB in collaboration with Upazila Fisheries Office	Construction and post construction period
4	Construction of fish sanctuary in perennial khals	200,000	2.50	BWDB in collaboration with Upazila Fisheries Office	Post construction period
5	Catch Assessment Survey for two (2) times per year (dry & wet season).	427,500	5.34	BWDB in collaboration with Upazila Fisheries Office	Construction and post construction period
6	Farm Survey for four (4) times of year (dry & wet season).	60,000	0.75	BWDB in collaboration with Upazila Fisheries Office	Construction and post construction period
7	Awareness program on plant and wild life conservation.	430,000	5.38	BWDB in collaboration with Forest Office	Construction and post construction period
8	Consultancy services cost for supervision and monitoring of EMP	200,000	2.50	DCSC	Construction and post construction period
9	Training to the farmers with field demonstration regarding IPM and ICM.	200,000	2.50	BWDB in collaboration with DAE	Post construction period
10	Awareness building up to local community for conservation of threatened fish species.	40,000	0.50	BWDB in collaboration with Upazila Fisheries Office	Construction and post construction period
11	Training to the fisherman/pond owner with field demonstration regarding pond culture.	40,000	0.50	BWDB in collaboration with Upazila Fisheries Office	Post construction period
12	Release fish fry in the khals inside the Polder after completion of construction works.	120,000	1.50	BWDB in collaboration with Upazila Fisheries Office	Post construction period
13	Air and noise quality monitoring and analysis.	200,000	2.50	BWDB in collaboration with DoE	Construction period
14	Solid and liquid waste disposal arrangement.	120,000	1.50	BWDB	Construction period
15	Capacity building and training to the WMOs regarding gate operation, post project monitoring	1,800,000	22.50	BWDB	Construction and post construction
16	Consultancy services cost for river bank erosion monitoring	1,200,000	15.00	BWDB	Post construction period
17	Training to the Contractors regarding environmental management	100,000	1.25	BWDB in collaboration with DoE	Pre construction period
18	Training of Environmental awareness of local population	200,000	2.50	BWDB in collaboration with DoE	Pre construction period
19	Updating EMP as per requirement.	100,000	1.25	BWDB	Post construction

Item No.	Description	BDT	US 1,000 $	Responsible Agency	Time frame
20	Construction of alternative or bypass channels at each construction sites.	1,532,632	19.16	BWDB and Contractor	Pre construction period
21	Materials for net pen culture (at least 25 households in each word/council of a Union).	1,944,000	24.30	BWDB in collaboration with Upazila Fisheries Office	Post construction period
22	Conservation and stocking of threatened fish species (at least 3 spots).	820,000	9.25	BWDB in collaboration with Upazila Fisheries Office	Post construction period
23	Campaigning and providing training on improved culture practices as well as the rice cum golda farming.	200,000	2.50	BWDB in collaboration with Upazila Fisheries Office	Post construction period
24	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	3,600,000	45.00	BWDB	Post construction period
25	Surface and ground Water quality monitoring cost (testing for Turbidity, pH, DO, BOD, Salinity etc. + test of As, Fe etc. for HTWs at workers' camp site), 20 samples in polder 39/2C during pre-construction, construction and post-construction periods (during dry season) + water quality analysis of HTWs of 33 workers' camp= (Tk.4,000x20x3) + (Tk.700X33).	263,100	3.19	BWDB in collaboration with DAE	pre-construction, construction and post-construction
26	Additional Tree Plantation at HH and other grounds to compensate the tree cutting (planting 3 trees for cutting I tree) @ Tk.50 each tree including the cost of sapling, gabion etc. Total nos. = 401917x Tk.50	20,095,850	251.20	BWDB in collaboration with Forest Office	Post construction period
27	Water sprinkling at re-sectioned/newly constructed embankments (@ Tk.3, 000 per km of embankment.	177,750	2.22	BWDB and Contractor	Construction period
28	WMOs monitoring cost	360,000	4.50	BWDB	Post construction period
Total Cost		**37,720,832**	470.42	-	-
	1 US$= BDT 80				

10.11 EMP Updating

703. The study infers that the EMP has developed assessing the impacts of interventions based on baseline and prediction information. However, monitoring has carried out to collect information on the impacts that actuality have occurred due to construction of interventions. Furthermore, actual information due to implementation of the EMP measures need to be collected for updating the EMP to make the development more environmental friendly as because EMP is not an one time plan rather it is a plan which needs continuous updating.

10.12 Grievance Redress Mechanism

704. BWDB will establish a grievance redress mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any

irregularities in application of the guidelines adopted in this EMF for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The procedure will however not pre-empt a person's right to go to the courts of law.

10.12.1 Grievance Redress Focal Points

705. A Grievance Redress Committee (GRC) at local level will be formed for each Union with union level representation to ensure easy accessibility by the project affected persons and communities. This local GRC will be the local focal points of the project GRM. The GRM sets out the information and communications strategy to ensure that PAPs and communities are fully informed about their rights to offer suggestions and make complaints. All grievances received through the GRM process will primarily forward to the GRCs. The Secretariat for each GRC will be at the office of the Executive Engineer. If any grievance is not resolved at GRC, the aggrieved person may request the convener of GRC to forward the case to the Project Director at PMU. The GRC will officially forward the cases with their comments to the Project Director. Hearing of petitions with GRCs will be held at the Convener's office or at Union Parishad/Ward Councillor's office as agreed by the committee members. The membership of the GRCs will ensure proper presentation of complaints and grievances as well as impartial hearings and investigations, and transparent resolutions.

<u>Membership of GRC</u>

Executive Engineer (BWDB Division Office)	:	Convener
2. Representative of the RP Implementing NGO	:	Member-Secretary
3. Local UP Chairman /Ward Councillor	:	Member
4. Teacher from Local Educational Institution (nominated by Upazila Administration)	:	Member
5. Representative from Local Women's Group	:	Member
6. Representative from the PAP Group	:	Member

706. Members of the GRCs will be nominated by the Executive Engineer at division level and approved by the Project Director, PMU, BWDB, Dhaka.

10.12.2 Grievance Resolution Process

707. All complaints will receiv at the GRCs facilitated by the implementing agency. The aggrieved persons may opt to make complaints directly to the Project Director or Secretary of the MoWR or even to the court of law for resolution. The Member Secretary will review and sort the cases in terms of nature of grievance, urgency of resolution, and schedule hearings in consultation with the Convener. All cases will be heard within four weeks from the date of receiving the complaints.

708. If the resolution attempt at the local level fails, the GRC will refer the complaint with the minutes of the hearings to the Project Director at PMU for further review. The Project Director will assign the ESCU at PMU for review the grievance cases and assist Project Director in making decision. The ESCU will review the case records, and pay field visits for cross-examining and consult the GRC members and aggrieved persons, if required. If decision at this level is found unacceptable by the aggrieved person(s), BWDB can refer the case to the MoWR with the

minutes of the hearings at local and headquarters levels. At the ministry level, decisions on unresolved cases, if any, will made in no more than four weeks by an official designated by the Secretary, MoWR. A decision agreed with the aggrieved person(s) at any level of hearing will be binding upon BWDB, as shown in the following Figure 10.3:

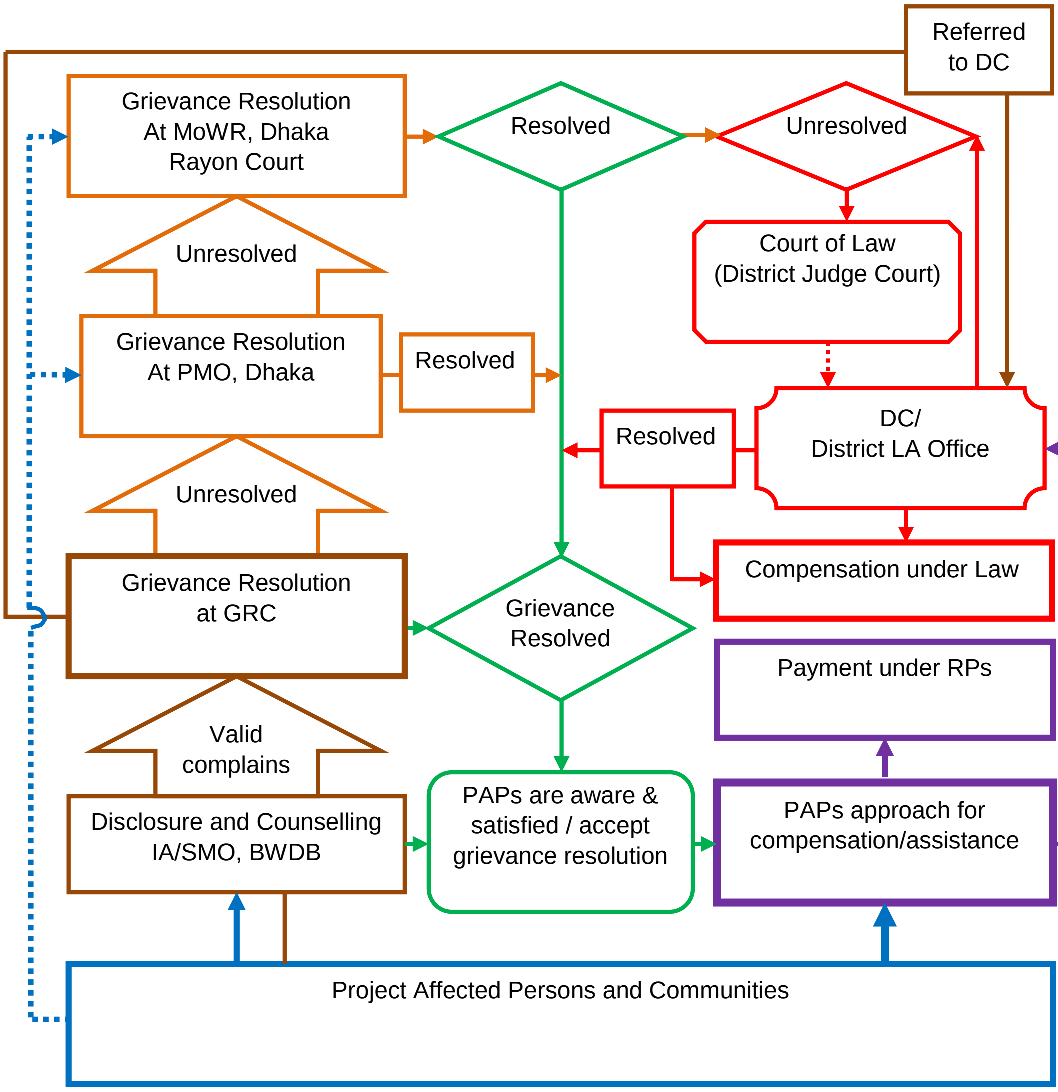


Figure 10.3: GRM Process Flow Chart

709. To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, the Convener will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.
- Remove a recommendation by any person that may separately accompany the grievance redress application.
- Disqualify a GRC member who has made a recommendation on the application separately before the formal hearing:
  - Where a GRC member is remove, appoint another person in consultation with the Project Director.
- The Convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this SMRPF and the mitigation standards, such as compensation rates established through market price surveys.

10.12.3 GRM Disclosure, Documentation and Monitoring

710. The affected persons and their communities will be informed of the project's grievance redress mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the EMF and the GRM in the form of information brochures will be distributed among the project affect persons. The PAPs will also brief on the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

711. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The GRCs will record the details of the complaints and their resolution in a register, including intake details, resolution process and the closing procedures. BWDB will maintain the following three Grievance Registers:

- **Intake Register**: (1) Case number, (2) Date of receipt, (3) Name of complainant, (4) Gender, (5) Father or husband, (6) Complete address, (7) Main grievance regarding social (loss of land/property or entitlements) or environmental, (8) Complainants' story and expectation with evidence, and (8) Previous records of similar grievances.
- **Resolution Register**: (1) Serial no., (2) Case no.,(3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.
- **Closing Register**: (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants' satisfaction, and (8) Management actions to avoid recurrence.

712. Grievance resolution will be a continuous process in RP implementation. The PMU will keep records of all resolved and unresolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by WB and any other interested persons/entities. The PMU will also prepare periodic reports on the grievance resolution process and publish these on the BWDB website.

10.13 Capacity Building

713. Since the effectiveness of the Environmental Assessment & implementation depends considerably on the understanding and preparedness of their Engineers and in particular their Environmental Team (Consisting of Contractor Environmental specialist, Consultant environmental specialist, and ESCU of BWDB). It is important that the project authority makes effort to sensitize the Engineers and Environmental Team on management of environmental issues, provides guidance, and encourages them to build requisite capacities. Table 10.6 provides a summary of various aspects of the environmental and social trainings to conduct at the construction site. PMU may revise the plan during the Project implementation as required.

714. During the O&M phase of the Project, these trainings will continue to be conducted by BWDB staff for all relevant O&M personnel and community.

Table 10.6: Environmental Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness;	Selected BWDB; PMU; DCSC staff	DDCS&PMSC &ESCU	Prior to start of project activities.

Environmental and social sensitivity of the project area; Key findings of the EIA; Mitigation measures; EMP; Social and cultural values of the area.			(To be repeat as needed.)
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Mitigation measures; Community issues; Awareness of transmissible diseases Social and cultural values.	PMU; DCSC; selected contractors' crew	DDCS&PMSC &ESCU	Prior to start of field activities. (To be repeatas needed.)
EMP; Waste disposal; HSE	Construction crew	Contractors	Prior to start of the construction activities. (To be repeat as needed.)
Road/waterway safety; Defensive driving/sailing; Waste disposal; Cultural values and social sensitivity.	Drivers; boat/launch crew	Contractors	Before and during field operations. (To be repeatas needed.)
Camp operation; Waste disposal; HSE Natural resource conservation; Housekeeping.	Camp staff	Contractors	Before and during field operations. (To be repeat as needed.)
Restoration requirements; Waste disposal.	BWDB core unit, Restoration teams	Contractors	Before start of the restoration activities.
Strengthening of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	Member of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	BWDB, ESCU, Contractor	Before and during construction activities

715. Capacity building training programs will be undertaken in the following area:

- Training of the management level officials of BWDB, BWDB environmental compliance personnel on the overall environmental concerns and responsibilities for implementing EMP
- Recruitment of new professionals with background on environment, if required and provide necessary training
- Organizing workshop, seminar, with stakeholders on the environmental concerns of CEIP
- Special training program for the contractors and workers on the EMP and their responsibilities, who will actually be involved in the construction of the project interventions. The Contractors will be provided guideline for preparation of Environmental Action Plan in line with the construction workplan

- Training of the WMOs on successful operation of hydraulic structures
- Training on structured format in reporting for all stages of implementation and those of relevant agencies who are involved in EMP implementation.

716. The training programs will be arranged before implementation of the interventions in the polder area. Detail plan can be made by the proposed ESCU of BWDB.

11 Stakeholder Consultations and Disclosure

717. This Chapter provides details of the consultations held with the stakeholders at the Project site and framework for consultations to carryout during construction phase. Also included in the Chapter are the disclosure requirements for the EIA.

11.1 Overview

718. The GoB as well as international donors (e.g. the World Bank) place great importance on involving primary and secondary stakeholders for determining the environmental and social impacts associated with project implementation. In order to gather local knowledge for baseline conditions, understand perceptions of the community regarding impact significance, and propose meaningful mitigation measures, participation of stakeholders is an integral part of the EIA process. During the present EIA, an attempt has been made to consult with a full range of stakeholders to obtain their views on Project interventions.

719. According to the EIA Guidelines of the DoE, public participation is obligatory for the EIAs of the Red Category projects. Public participation through consultations in the water sector project is mandate according to the Guidelines for the Participatory Water Management (GPWM) of the BWDB. Similarly, the World Bank's OP 4.01 requires that stakeholder consultations are carried out at least twice for the Category A projects, once shortly after environmental screening and before the terms of reference for the EA are finalized, and then once a draft EIA report is prepared.

720. The present EIA has been conducted after consulting with local communities, non-governmental organizations (NGOs) and concerned government departments/ organizations dealing particularly with related fields, thus ensuring that their views and concerns are taken into account in the study.

11.2 Objectives of Stakeholder Consultations

721. The following objectives have served as the moving force for the design, implementation and fact findings during the participation process:

- ✓ To provide key Project information and create awareness among various stakeholders about project intervention;
- ✓ To have interaction for primary and secondary data collection with project beneficiaries, affectees, and other stakeholders;
- ✓ To identify environmental and social issues such as displacement, safety hazards, employment, and vulnerable persons;
- ✓ To begin establishing communication and an evolving mechanism for the resolution of social and environmental problems at local and Project level;
- ✓ To involve Project stakeholders in an inclusive manner; and
- ✓ To receive feedback from primary stakeholders on mitigation and enhancement measures to address the environmental and social impacts of the Project.

11.3 Approach and Methodology

722. A participatory approach was follow in conducting the public consultation meetings in Polder 39/2C. The consultants discussed first with the BWDB officials and then the Upazila Parishad Chairman (UZPC) and/or the Upazila Nirbahi Officers (UNOs) and the Project

Implementation Officers (PIOs) of the polder area to share the Feasibility and EIA process of the CEIP-1. The BWDB and local government officials/representatives were consulted to identify the potential stakeholders at the Polder level. With the available support from the UNOs and/or PIOs, the union level public representatives as well as the key persons were informed about the specific consultation meetings and requested them to be present in the meeting.

723. Focus Group Discussions (FGD) were carried out during in the public consultation process. In order to conduct the FGD and consultation meetings, two checklists were prepared covering the aspects including an overview of the proposed CEIP-1 (Appendix-E).Information on ongoing EIA process, and seeking information on the problems of the area with their potential solutions, the local needs and demands have been discussed by giving equal opportunity to all participants attending in the meeting. During consultation meeting all relevant issues within the water resources, land resources, socio-economic resources, and disaster aspects were discussed in detail.

724. During the FGDs and consultation meetings, the EIA team displayed maps of the Project area, shared the initial concepts on proposed interventions and facilitated the response of the participants. The stakeholders of the Polder 39/2C were asked to share their needs, problems, possible sustainable solutions, and their views on the Project interventions. The stakeholders' perceived views on Important Environmental and Social Components (IESCs) and Project's impacts on them, along with perceived benefits, risks, threats and demand from the Project identified during discussions.

11.4 Identification of Stakeholders

725. Stakeholders include all those who affect and affected by policies, decisions or actions within a particular system. Stakeholders can be groups of people, organizations, institutions and sometimes-even individuals. Stakeholders can be divided into primary and secondary stakeholder categories.

Primary Stakeholders:

726. Primary stakeholders are people who would directly benefit or impactet by a certain project intervention. In case of the proposed Project in Polder 39/2C, the primary stakeholders include the people living within the Project area particularly those who reside within and in the immediate vicinity of the Polder. The primary stakeholders of the Project include the farmers, fishermen, local business community as well as the households to be displaced, women groups, and caretakers of community properties. Primary stakeholders identified and consulted during the present EIA include communities to be benefitted and/or affected by the Project, local leaders, community members and other local representatives.

Secondary Stakeholders:

727. This category of stakeholders pertains to those who may not be directly affected but have interests that could contribute to the study, play a role in implementation at some stage, or affect decision making on Project aspects. In this Project NGOs, concerned government departments, and line agencies fall under this category.

728. Secondary stakeholders for the Project include Local Government Institutions (LGI), Bangladesh Water Development Board, the Ministry of Water Resources, Department of Forest, other government agencies, academia, NGOs, the World Bank, and public at large.

Time, Date and Venue Selection

729. Venue, date and time of meeting selected through the consultation with local people, the project proponent and the consultant. These three groups select an agreed venue considering the closeness to proposed project, easy accessibility to the venue and which is likely to be neutral. Date and time was finaliz in this way considering availability of the participants, ensuring the maximum participation, weather and compliance with other arrangement.

Enlisting and Invitation

730. A comprehensive list of potential stakeholders was prepared through the consultation. This list intended to cover all sorts of interest groups, occupational groups, socially acceptable and knowledgeable peoples.

731. Formal invitation sent to them and communicated over telephone for ensuring their presence in the meeting.

Consultation Instrument

Checklist:

732. A checklist covering all possible issues to address was prepared through consultation with the multidisciplinary study team. This checklist was use in the meeting to unveil peoples' perception and opinion along with suggestions (checklist is attachin Appendix 10).

Attendance list:

733. An inventory of the participants was maintained in attendance sheet containing contact number.

Camera:

734. For visualizing the participants, photographs were taken using camera. These photos were present in this chapter. Photos of the meeting participants are presented at the end of this chapter.

Consultation Process

735. The study team conducted the meeting. During consultation meeting, the following process was followed with sequences.

Greetings:

736. At the outset, the team spelled greetings to all participants. Welcomed them for attending and stated the entire design of the meeting.

Introduction:

737. The team members introduced themselves to the participants and gave detail description of the project, spelled out about the objectives and anticipated outcome of the meeting.

Respect to the participants:

738. The study team showed respect to all participants. They respected not only to the individuals but also to their values, cultural practices and social structures.

Ensuring peoples' voice:

739. Generally, not all participants can participate equally. In fact, a substantial number of participants tended to remain silent in any meeting. However, the study team encouraged all to participate willingly through explaining the ethics of the study.

Note taking:

740. Discussed issues and opinions written in notebook carefully. All issues given equal importance.

Recapitulation and closing the session:

741. At the end of the study, team recapitulated the session and responded to the quarries. Finally, the facilitator closed the session thanking the participants.

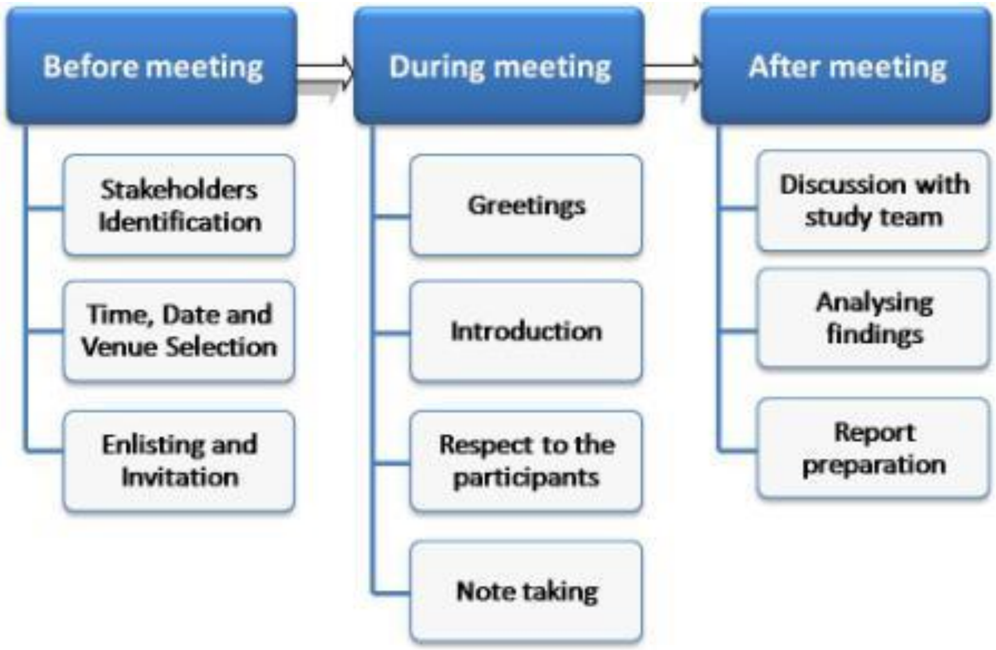


Figure 11.1: Overall consultation process

11.5 Public Consultation Meetings and FDGs

11.5.1 Consultation Process

742. A number of public consultation meetings (PCM) and FGDs were conducted in different locations of the polder 39/2C in two phases. Some of the PCMs and FGDs were carried out in 2012 when this polder was taken one the priority polder from out of five. In the meantime, the alignments of the proposed embankment have changed in 2015 latest project design based on both people's observations and engineering aspects. For this reason, another number of PCMs and FGDs were carryto spell out project impact due to its activities. The details of these meetings and FDGs are present in **Table 11.1** and some photographs of these meetings are given in **Pictures 11.1** to .**11.4**.

Table 11.1: Meeting venue including time and date

Sl	District	Upazila	Union	Meeting venue	Type of consultation	Meeting date	Time
1st phase of PCMs and FGDs' time and date							
1	Pirojpur	Bhandaria	Nadmulla	Nadmulla Union Parishad Conference room	PCM	27/05/2012	10:30
2	"	"	Nadmulla	Nadmulla Village	FGD	11/03/2012	10:00
3	"	"	Dhaoa	Rajpasha	"	12/03/2012	10:00
4	"	"	Nadmulla	Nodmullah, 6 no word	"	19/12/2012	12:30
5	"	"	"	Chorkhali	"	19/12/2012	16:30
6	"	"	"	Chorkhali launch ghat	"	20/12/2012	11:35
7	"	"	"	Darulhuda	"	20/12/2012	12:30
8	"	"	Ikri	Porchim Pasuribunia	"	20/12/2012	13:00
9	"	"	Talekhali	Junia word- 4	"	20/12/2012	14:30
10	"	"	"	Talekhali Bazaar	"	20/12/2012	16:30
11	"	"	Ikri	Rajpasha (Pona Upper)	"	21/12/2012	10:00
12	"	Mothbaria	Dhanisafa	Gulbunia (Pona Lower)	"	21/12/2012	12:30
2nd phase of PCMs and FGDs' time and date							
13	"	Bhandaria	Ikri	Ikri	PCM	14/08/2015	14:00
14	,,	"	Bhandaria	Bhandaria Upazila Conference room	PCM	17/08/2015	10:00
15	,,	"	Dhowa	Boro mia bari Govt. Primary school, Dhowa	PCM	20/08/2015	14:00
16	,,	,,	,,	Charkhali and Ikri Bazaar	FGD	23/07/2015	10:00
17	,,	,,	,,	Dhaoa Bazaar	,,	23/07/2015	12:00

Picture 11.1: PCM at Bhandaria Upazila Auditorium






Picture 11.2: Reflection of people's participation in PCM at Nadmula Union


Picture 11.3: PCM at Dhaoa Union

Picture 11.4: PCM at Ikri Union

11.5.2 Consultation Participants

743. The main participants of the consultation meetings included public representative, farmer, trader and daily-wage labourers of the Polder 39/2C and nearby areas. Total of 302 participants attended these consultations. The participant details are provided in Table 11.2 below:

Table 11.2: Participant Details

Sl	Meeting venue	Type of consultation	Type of Participants	No. of participants
1	Nadmulla Union Parishad Conference room	PCM	Primary and secondary stakeholders	54
2	Nadmulla Village	FGD	Primary stakeholders	10
3	Rajpasha	"	"	12
4	Nodmullah, 6 no word			
5	Chorkhali	"	"	11
6	Chorkhali launch ghat	"	"	8
7	Darulhuda	"	"	7
8	Porchim Pasuribunia	"	"	7
9	Junia word- 4	"	"	8
10	Talekhali Bazaar	"	"	12
11	Rajpasha (Pona Upper)	"	"	12
12	Gulbunia (Pona Lower)	"	"	9
13	Ikri	PCM	Primary and secondary stakeholders	49
14	Bhandaria Upazila Conference room	"	"	29
15	Boro mia bari Govt. Primary school, Dhaoa	"	"	52
16	Charkhali and Ikri Bazaar	FGD	Primary stakeholders	10
17	Dhaoa Bazaar	,,	,,	12

11.6 Issues discussed in FGDs and Meetings

744. At the outset of the meetings and FGDs, an overview of the proposed Project including the ongoing activities of the implementing agencies and the EIA process was share with the participants. Subsequently, the key environmental, social, and socioeconomic aspects listed below.

- Water resources:
  - ✓ Surface water (tidal flooding, drainage, salinity, siltation)
  - ✓ Water management (flood control, drainage, irrigation)
- Land resources:
  - ✓ cropping practice,
  - ✓ production and yield,
  - ✓ water logging and drainage congestion
  - ✓ crop damage.
- Socio-economic aspects:
  - ✓ Occupation and Employment (unemployment/joblessness)
  - ✓ Migration (temporary/permanent out-migration)
  - ✓ Poverty (food and income poverty)
  - ✓ Education (poor literacy rate, non-schooling, less female education, drop out etc.)
  - ✓ Health and nutrition (illness, diseases, poor nutrition)
  - ✓ Quality of life (poor housing and sanitation facilities, scarcity of drinking water, fuel and fodder)
- Disasters:
  - ✓ Cyclones
  - ✓ River erosion
  - ✓ Associated damages
- The sustainable and integrated solutions of the main problems being faced in the Polder:
  - ✓ Water resource management
  - ✓ Agriculture and fisheries management
  - ✓ Land resource management
  - ✓ Disaster management.

11.7 Community Concerns and Suggested Solutions

745. At the outset, the study team gave a brief description about the project. The participants also stated that the project authority informed them frequently about this project. However, the stated description by the study team makes them clearer about the objectives and process of the project.

11.7.1 Attitude to the project

746. The communities including the persons to affect by the Project expressed their views in favour of the Project and wanted early implementation to protect them from the tidal surges and disasters such as Aila and Sidr. They demanded adequate compensation and other benefits for the loss of their assets and livelihood, as well as alternative place for relocation of their houses and business.


Picture 11.5: FGD at Chorkhali ferry ghat and Chorkhali Bazaar


Picture 11.6: FGD at Talekhali Bazaar


Picture 11.7: FGD at Nadmullah


Picture 11.8: FGD at Junia and Gulbunia


Picture 11.9: FGD at Darulhuda and Pasuribunia

747. The outcomes of the FGDs and consultation meetings in terms of concerns and the suggested solutions noted and organized by themes are present in the **Table 11.3** below.

Table 11.3: Community Concerns and Suggested Solutions

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
Overall	- Water logging, tidal flooding, salinity intrusion and cyclone are the main community concerns in the polder 39/2C area.	- Comprehensive rehabilitation of the polder should taken up at the earliest with the active involvement of the local community.
Water resources	- The people of this polder have identified tidal flooding and salinity intrusion as major natural problems of water resources in the area. There is high salinity in ground and surface water. There is only 28 km embankment in the project, which is not sufficient. - There are a lot of khals namely Tentul Baria khal, Shing Khali khal, Gabtalar khal, Bamuner khal, Safa Bazaar khal, Bahar Varani khal, etc. in this polder which are open, i.e. no structures exist. There is no embankment in eastern side of the proposed polder to protect the areas that creates drainage congestion severely. - Erosion is a common problem in south-west coastal area. There is only 28 km embankment in western side of the polder along the Baleswar River (Kocha) which i damaged during cyclone Sidr and subsequently extended during Aila period. Some segment of the embankment has fallen under thrust of wave action and engulfed by the river erosion. In addition, regular tidal wave has affected the weakened embankment that makes it more vulnerable. - Sedimentation is also a problem in the polder area. The downstream of Baleswar River has sandy beds and mud banks along the shore whereas tidal creeks tend to be choked with very fine sediments. Though there are no water control structures associated with the khals, sedimentation took place in internal khals of this polder. - The most devastating cyclones (Sidr, 2007 and Aila, 2009) hit the polder. The cyclone Sidr was most disastrous for the project area than	- Re-sectioning of the embankment to protect erosion and embankment breach - The slope of the embankment at some places have fallen under the thrust of wave action and damaged during monsoon where slope protection with CC block is needed including afforestation on the foreshore area; - New embankment is required to be constructed by developing village road; - The intrusion of water might controlled by the improvement of embankment. Introduce re-excavation program in internal canals, increase height of the embankment and improvement sluice gates are very essential;

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	the Aila. The surge water entered the polder area by overtopping and through breaches in the protection embankment in bank of Baleswar River (Kocha). People reported that during Sidr surges Telikhali, Nadmulla, Dhaoa and Ikri unions were affected most in the polder area and died so many people.	
Agriculture resources	- Crop damage due to drainage congestion and water logging. - Tidal motion dominates during pre-monsoon and post monsoon period. In absence of embankment in the eastern side along the Pona River, tidal water frequently enters into the polder areas and damages crops. - Scarcity of water is another problem in the polder area during dry season. Due to malfunctioning of water control structures, lack of reserve water in khals for irrigation during dry season. Absence of embankment along the rivers also makes the surface water unavailable for the users. - Siltation of rivers and internal khals. - Lack of fresh water during dry season.	- Re-excavation of rivers and khals as per design level. - Scope of water storage will be improved dramatically within internal khals and protective ponds due to proper functioning of associated water control structures; - Connecting khals with rivers. - Repairing the sluices - Repair the embankment as per design level. - Regular operation and maintenance of regulators.
Fishery resources	- Reducing depth of internal khals and habitat quality degradation due to siltation - Fish and hatchling movement disrupted due to properly operation of water control structures. - Indiscriminate fishing by Sluice net - Entrance of saline water	- Re-excavation of khal will help to increase the richness of fish species in the polder area. - Application of fisheries rules and regulation by the government strongly - Repairing of embankment with reasonable height.
Ecological resources	- A number of trees would be felt and existing undergrowth vegetation would be damaged at construction sites for implementation of project activities - Lack of foreshore afforestation accelerate bank erosion as well as destruction of embankment by tidal surge	- Keep compensation to the proper owners/authorities against tree felling - Implement social afforestation along the embankment slopes - Proposed afforestation plan would arrest the vulnerabilities of embankment and protect bank erosion from tidal surge
Socio-economic resources	- At least 1000 no of HHs will be be displace and their life and livelihood may behampered. - The labor out-migration is estimated 25% from the study area. At least 25% of the unemployed day laborers	- Ensure proper resettlement of those household, which may affected by the project intervention of drainage sluice.

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	and farmers of the polder use to migrate out to the nearby city and towns for temporary employment. - Around 20% of the households in average are in the 'deficit' category. These deficit households were identified in the PCM as the poor households of the polder area. - The local inhabitants of the Polder 39/2C identified tidal flooding, cyclone, and riverbank erosion are major hazards those created disasters in the area. The tidal flooding is gradually becoming a severe problem in this study area. - Communication system is a vital issue of this polder. - Lack of adequate expertise and experienced manpower to carry out the O&M of the polder and the numbers of field staffs are also insufficient and inadequate in some places of the polder with respect to the actual requirement. - Deplorable health condition due to lack of access to go to trained physician. - Poor housing condition of the people in polder area.	- The embankment cum road should repair immediately in places. - Strengthening of WMGs,so that mass people can access to open water bodies easily. - The Government should rehabilitate the affected farmers who are affected by salinity intrusion; - Need awareness building about water management, health and sanitation among the communities; - Need formation of Water Management Organizations (MWOs) to manage properly water control structures i.e. embankment, sluice gate, regulator, inlets, culverts etc. and growing of consciousness among the community in the scheme; - Need awareness building among the communities about water management; - The Government should rehabilitate the affected farmers who are affected by salinity intrusion;

11.8 EIA Disclosure

748. Once finalized, the EIA report and Bengali translation of its executive summary will disclose to the public and will available on the official website of the BWDB. EIA will be sent to the WB Info Shop.

11.9 Framework for Consultations during Project Implementation

749. The stakeholder consultation is a continued process, and should be maintained throughout the project. The consultations carried out during the present EIA and reported in this Chapter are essentially a first step in this process. During the subsequent project phases as well, participation of the project stakeholders need to be ensured. Table 11.4 charts out the proposed participation framework during different project Phases.

Table 11.4: Participation Framework

Project Stage	Proposed Tool	Stakeholders to be Consulted	Responsibility
Project Design Phase	Meetings with institutional stakeholders (carried out during the present EIA and RAP preparation); meetings with grass root stakeholders (carried out during the present EIA and RAP preparation)	Institutional stakeholders; Grass root stakeholders, including the communities to be affected by the Project.	EIA consultant.
Project Construction Phase	Information disclosure (sharing of the project objectives, project components, major benefits, potential impacts, mitigation measures and Resettlement Plan with the affected communities and other stakeholders).	Institutional stakeholders; Grass root stakeholders, including the communities to be affected during the project implementation.	BWDB; Supervision Consultants; Contractors
	Consultations and liaison	The communities around the work sites, borrow areas, and access routes	BWDB; Supervision Consultants; Contractors
	Grievance, Redressal Mechanism and Social Complaint Register (discussed later in the document).	The affected communities.	BWDB; Supervision Consultants; Contractors
	Consultations with the communities during Compliance Monitoring and Effects Monitoring. (Discussed later in the document).	Affected communities.	BWDB; Supervision Consultants; Contractors
	Consultations with the project affectees / communities during the external monitoring (discussed later in the document).	Affected communities.	External monitoring consultants.
	Consultations with the project affectees / communities during the site visits by the WB monitoring mission.	Project site staff; Contractors; Affected communities.	WB monitoring mission.
Project Operation Phase	Community participation in O&M activities (see Section 4.9)	Institutional stakeholders; Grass root stakeholders, including the beneficiary communities.	BWDB

11.10 Consultations during RAP Preparation

750. A number of stakeholder consultations conducted in the Project area while preparing the RAP for the proposed Project in the Polder 39/2C. These are discussed below:

751. The local persons who would potentially be affected by the Project along with local community leaders and other stakeholders were consulted through group meetings and personal contacts. The opinion of different stakeholders regarding the Project weresought and considered in preparation of the RAP. Total of four formal stakeholder meetings were held with different communities in the Polder 39/2C. Different types of stakeholders including concerned UP chairmen/members, teachers, *imams* (prayer leaders), local community leaders, political leaders, farmers, shopkeepers, and other people to be affected by the Project attended these sessions. The salient details of these consultations carried out in Polder 39/2C are presented in Table 11.5; some photographs of these meetings are presented in Figure **11.11** and **11.12**.

Table 11.5: Consultation Meetings Held in Polder 39/2C

Location, Date and Time	Category of Participants
Poshchim Pasuribunia, Ikri UP December 20, 2012 at 13:00	UP Chairman, Ex-UP members, Service, Social Worker, farmers, fishermen and boatman.
Junia word- 4, Telikhali UP December 20, 2012 at 14:30	UP Chairman, UP members, and farmers.
Telikhali Bazaar December 20, 2012 at 16:30	UP Chairman, Social Worker, Farmers and fishermen.
Rajpasha (Pona Upper) December 21, 2012 at 10:00	UP members, farmers, Fisherman and Service.
Gulbunia (Pona Lower), Dhanisafa UP December 21, 2012 at 12.30	UP Chairman, Service, farmers, businessmen and fishermen.

Picture 11.10: Meeting at Junia, word-4

Picture 11.11: Meeting at Rajpasha (Pona Upper)

752. During these meetings, the key features of the proposed interventions in Polder 39/2C under CEIP-1, its key benefits, its potential impacts particularly relating to resettlement and displacement, the process for determining people to be affected, compensation payment procedure, GoB's laws and World Bank's policy on involuntary resettlement, and cut-off-date for listing assets to be affected were discussed. The relocation requirements and availability of alternative lands in the surrounded area suitable for relocation weredisclosed to the communities

to be affected. Views of the stakeholders obtained on the Project and its potential impacts, encroaching government land, relocation requirements, compensation process, and alternative options. Consultations conducted with women and other vulnerable groups and their views obtained on their livelihood aspects, Projects impacts, and compensation options.

753. The communities including the persons to be affected by the Project expressed their views in favour of the Project and wanted early implementation to protect them from the tidal surges and disasters such as Aila and Sidr. They demanded adequate compensation and other benefits for the loss of their assets and livelihood, as well as alternative place for relocation of their houses and business. The inputs from the stakeholder meetings have been used to develop measures and principles to address the resettlement impacts.

11.11 EIA Disclosure

754. The EIA report and Bangla translation of its executive summary was disclosed to the public on 13th January 2013 in Dacope, Khulna. The main aim of the meetings was to present the findings of the final draft report on FS and EIA and having feedback from the local stakeholders attended. The report was finaliz through incorporation of comments and suggestions -receivedfrom the meeting. The communities including the persons to affect of polder 39/2C by the Project expressed their views in favour of the Project and wanted early implementation to protect them from natural disasters. They demanded following actions to take immediately. These are:

- The intrusion of saline water to becontrolled by the improvement of embankment.
- Need awareness building among the communities about water management;
- Ensure proper compensation for affected people.
- O & M for embankments and sluice gates in the polder area
- Need formation of Water Management Organizations (MWOs) to manage properly water control structures
- New embankment is required to be constructed by developing village road.

National Dissemination Seminar 2017

A dissemination seminar on the “Environmental Impact Assessment (EIA) under Package-2 of CEIP-1 at Spectra Convention Centre, Gulshan 1, Dhaka was held on 25 January 2017. Mr. Anisul Islam Mahmud, M.P, Hon’ble Minister, Ministry of Water Resources Government of the People's Republic of Bangladesh, graced the occasion as the chief guest and Mr. Muhammad Nazrul Islam, BirProtik, M.P, Hon’ble State Minister, Ministry of Water Resources, Government of the People's Republic of Bangladesh was present as the Guest of Honour. Dr. Zafar Ahmed Khan, Senior Secretary, Ministry of Water Resources Government of the People's Republic of Bangladesh and Engr. Md. Waji Ullah, Executive Director, CEGIS were the special guests in the seminar. The meeting was chaired by Mr.Md. Mahfuzur Rahman, Additional Director General (West region), BWDB.

The program started with registration of the participants at 9:30 am. Thereafter, theseminar commenced at 10:00 am through recitation from the holy Quran. Mr. Md. Delwar Hossain, Project Director, CEIP-1, BWDB delivered the welcome speech. After that Mr. Malik Fida Abdullah Khan, Deputy Executive Director (Operation), CEGIS presented the findings of the Environmental Impact Assessment (EIA) study of six polders under package-2 of CEIP-1.

Picture 11.11: Chief Guest, Guest of Honour, Special Guests and Project Director

Picture 11.12: Welcome Speech by the Project Director of CEIP-1

Picture 11.13: Presentation of EIA findings by Mr. Malik Fida Abdullah Khan, Deputy Executive Director (Operation), CEGIS

Picture 11.14: View of Participants of the Seminar

Picture 11.15: A view of open discussion

Picture 11.16: Special Guestdelivering his speech

Picture 11.17: Special Guestdelivering his speech

Picture 11.18: Guest of Honour delivering his speech

Picture 11.19: Chief Guestdelivering his speech

Picture 11.20: Closing remarks by the Chair

National experts from multi-disciplinary fields such as engineers, agriculturists, economists, environmentalist, sociologists and other as well as local stakeholders were present in that seminar. Besides, three international Environmentalists were present in the seminar.

After the presentation, the floor was opened for all to take part in discussion on the study. A host of participants took part in discussions and expressed valuable comments and suggestions on the study.

The minutes of the dissemination seminar containing inter-alia the Comments and Responses are provided in **Appendix-12.**

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Appendix 1: Construction Schedule

Construction Schedule (Part A)

Sl No	Description	Year One								Year Two			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)												
2	Retirement of embankment (km)												
3	Construction of Drainage Sluices (Nos)												
4	Construction of Flushing sluice (Nos)												
5	Bank and Slope Protection Works (km)		Manufacture of cc blocks and procurement of hard rock										
6	Re-excavation of Drainage Channels (km)												
7	Repairing of Drainage Sluices and Flushing Inlets												
8	Constructing Roads												
9	Other works, including surveys, quality checks, testing, inspections and the like												

Part B

Sl No	Description	Year Two								Year Three			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)					Turfing							
2	Retirement of embankment (km)												
3	Construction of Drainage Sluices (Nos)												
4	Construction of Flushing Inlets (Nos)												
5	Bank and Slope Protection Works (km)												
6	Re-excavation of Drainage Channels (km)												
7	Repairing of Drainage Sluices and Flushing Inlets												
8	Constructing Roads												
9	Other works, including surveys, quality checks, testing, inspections and the like												

Part C

Sl No	Description	Year Three								Year Four			
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
1	Re-sectioning of Embankment (km)												
2	Construction of embankment (km)												
3	Construction of Drainage Sluices (No)												
5	Bank and Slope Protection Works (km)												
6	Re-excavation of Drainage Channels (km)												
7	Repairing of Drainage Sluices and Flushing Inlets												
8	Constructing Roads												
9	Other works, including surveys, quality checks, testing, inspections and the like												
10	Site clearance and clean up												

Source: Engineering Team of CEIP-1, 2015

Appendix 2: No Objection Certificate

৪ নং ইকড়ি ইউনিয়ন পরিষদ

ভান্ডারিয়া, পিরোজপুর

স্মারক নং- তারিখ- ১৫/০৮/১৮

অবস্থানগত/পরিবেশগত ছাড়পত্রের স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তিপত্রের ছক

১। আবেদনকারীর নাম ঃ প্রকল্প পরিচালক, সিইআইপি-১ (CEIP-1), বাংলাদেশ পানি উন্নয়ন বোর্ড ।

২। পিতা/স্বামীর নাম ঃ প্রযোজ্য নয়

৩। আবেদনকারীর ঠিকানা ঃ

৪। প্রকল্পের অবস্থানগত ঠিকানা ঃ ৩৯/২সি পিরোজপুর জেলা ভান্ডারিয়া ও মঠবাড়িয়া উপজেলায় অবস্থিত।

৫। প্রকল্পের তফছিল ঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমির ধরন	মোট জমির পরিমান
পিরোজপুর	ভান্ডারিয়া ও মঠবাড়িয়া				মাঝারি উচু ভূমি	হেক্টর

৬। প্রকল্পের কার্যক্রম ঃ বাঁধ উচুঁকরন, স্লুইজ গেট ও রেগুলেটর মেরামত, খাল পুনঃখনন ইত্যাদি।

উপরোক্ত তথ্যাদির আলোকে পোল্ডার ৩৯/২সি পূর্নবাসন প্রকল্প বাস্তবায়নের জন্য নিম্নেবর্ণিত অনাপত্তি প্রদান করা হলো।

শর্তাবলী ঃ

১। প্রকল্প/ স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরণ করতে হবে।
২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত ছাড়পত্র গ্রহণ করতে হবে।
৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তার নিশ্চিত করতে হবে।
৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে। এবং অগ্নিকান্ড কিংবা অন্য কোন দূর্ঘটনার সময় জরুরী নির্গমন ব্যবস্থা থাকতে হবে।
৫। বায়ু ও শব্দ দূষন করা যাবে না।
৬। প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবে না।

উপরে উল্লিখিত যে কোন শর্ত লঙ্গন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক কারখানা/প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

তারিখ ঃ

স্থানীয় কর্তৃপক্ষের স্বাক্ষর ও সীলঃ

সেন বাবু তালুকদার
/০৮/১৮
ইকড়ি ইউনিয়ন পরিষদ
ভান্ডারিয়া, পিরোজপুর।

Appendix 3: Standard for Physioco – Chemical Properties of Soil

Table 1a: Soil Salinity (ECe) class and soil reaction (p^H)

Characteristics	Salinity range (ECe=ds/m)*	Characteristics/Soil reaction class	pH range
Non Saline	0-2.0	Very strongly acidic	<4.5
Very Slightly Saline	2.1-4.0	Strong acidic	4.5-5.5
Slightly Saline	4.1-8.0	Slightly acid	5.5-6.5
Moderately Saline	8.1-12.0	Neutral	6.6-7.3
Strongly Saline	12.1-16.0	Slightly alkaline	7.4-8.4
Very Strongly Saline	>16.0	Strongly alkaline	8.5-9.0
		Very strongly alkaline	>9.0

Source: Soil and Land Utilization appraisal, SRDI; 1999

Table 1b: Classification of nutrient elements based on chemical properties of soil

Nutrientelement	VeryLow	Low	Medium	Optimum	High	Veryhigh
OM (%)	<1.0	1.0-1.7	1.8-3.4	-	3.5-5.5	>5.5
N(%)	≤0.09	0.091-0.18	0.181-0.27	0.271-0.36	0.361-0.45	>0.45
P(µg/g)(Olsenmethod)	≤7.5	7.51-15.0	15.1-22.5	22.51-30.00	30.1-37.5	>37.5
K (meq/100g)	≤0.09	0.091-	0.181-0.27	0.271-0.36	0.361-0.45	>0.45
s(µg/g)	≤7.5	7.51-15.0	15.1-22.5	22.51-30.00	30.1-37.5	>37.5
Zn(µg/g)	≤0.45	0.451-0.9	0.91-1.35	1.351-1.8	1.81-2.25	>2.25

Sources: Fertilizer Recommendation Guide, BARC, 2012

Appendix 4: List of Participants of PCM

Participants list of PCM at Nadmulla Union Parishad Conference room

Polder 39/2C

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ নদমূলা শিয়ালকাঠি ইউপি কনফারেন্স তারিখঃ ২৭.০৫.২০২২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১	সাবিতা রানী	দঃ [illegible]	01743648481	[illegible]
২	আক্তার হোসেন	সদস্য, নদমূলা	01716150882	[illegible] 27.05.22
৩	মো: নুরুল আমিন	সদস্য ইউপি	01735653773	[illegible] 27.05.22
৪	আব্দুল্লাহ মামুন	অধ্যাপক	01728852191	[illegible]
৫	মো: আবু হানিফ [illegible]	সাংবাদিক	01932064582	[illegible]
৬	মো: [illegible]	[illegible]	01716234369	[illegible]
৭	মো: [illegible]	২নং: [illegible]	0173600300478	[illegible]
৮	মো: মনিরুল ইসলাম	ইউপি সচিব নদমূলা ইউপি	01743-947490	[illegible] 27/05/22
৯	মো: [illegible]	সমাজ সেবক	01712188339	[illegible]
১০	মো: আনোয়ার	[illegible]	01752091725	[illegible]
১১	মোহ: আনোয়ার হোসেন	২নং ওয়ার্ড সদস্য	01716448819	[illegible] 27-05-22
১২	বিবেকা মারাক)	২০, [illegible]	0123884508 95	[illegible] 27/05/22
১৩	মো: আ: কুদ্দুস	২নং ওয়ার্ড সদস্য	01770145776	[illegible]
১৪	মোঃ জলিল	সাধারণ	01909189 [illegible]	জলিল
১৫	মো: [illegible] মিয়া	৮ নং ওয়ার্ড সদস্য	01718855656	[illegible]
১৬	[illegible]	[illegible]	01763-174173	[illegible]

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উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ নদমূলা শিয়ালকাঠী ইউনিয়ন পরিষদ তারিখঃ ২৭.০৫.২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১৭	মাহবুব আলম আকন	কৃষক	০১৭২১৫৬৭২১৭	[illegible]
১৮	আবদুল মান্নান তাং	কৃষক	01727057727	[illegible]
১৯	মোঃ জলিল হাওলাদার	মেম্বার	01719967246	[illegible]
২০	মোঃ মাসুদ মোল্লা	এ. ইউ - মি.	01710068776	[illegible]
২১	মোসাঃ [illegible] বেগম	ইউ. পি.	01734177295	[illegible]
২২	তহমিনা বেগম	প্রঃ শিঃ	01729549700	[illegible]
২৩	স্মৃতি রানী	প্রঃ শিঃ	01736165581	স্মৃতি
২৪	বিজয় রানী	প্রঃ শিঃ	01733833676	[illegible]
২৫	মোসাঃ হাসিনা বেগম	প্রঃ শিঃ	017383222285	
২৬	নিলিমা রানী বৈরাগী	প্রাঃ শিঃ	01748791790	নিলিমা
২৭	মাজমুন নাহার	S. J. K	01717938562	Nahar.
২৮	আলফানা	গৃহিনী	01735495077	আলফানা
২৯	কোহিনুর বেগম	ব্যবসা	01190473957	কোহিনুর.
৩০	হেলেনা বেগম	গৃহিনী		হেনা
৩১	সারমিন নাহার	দঃ শিয়ালকাঠী (গৃহিনী)	01715888157	[illegible]
৩২	হেলেনা	গৃহিনী-		হেলেনা

Polder 39/2C

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থান: নদমূলা শিয়ালকাঠী ইউপি মিলনায়তন   তারিখ: ২৭. ০৫. ২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৩৩	মোসাম্মৎ [illegible]	মেম্বার	01713965357	[illegible]
৩৪	নাসির হোসেন	ব্যবসায়ী	—	নাসির
৩৫	মো: রাকিব হোসেন		01723549608	রাকিব
৩৬	মোমেনা বেগম -	সদস্য ইউপি. সংরক্ষিত	01716-202489	মোমেনা
৩৭	মানিক চন্দ্র দাস	কৃষক	—	মানিক চন্দ্র
৩৮	ওহিদুর রহমান -	ব্যবসায়ী	—	[illegible]
৩৯	মাহমুদুল হাসান	ইমাম	—	মাহমুদ
৪০	মো: আ: জলিল	ইউপি সচিব বেলিয়াখালী	01761-888379	[illegible]
৪১	মো: মোস্তাফিজুর রহমান (মুন্না)	ইউপি (সদস্য)	01747645735	মো: মোস্তাফিজুর [illegible]
৪২	মো: নুরুজ্জামান	ইউপি সদস্য	01716786474	[illegible]
৪৩	হাবিবা আক্তার	নারী উদ্যোক্তা	01732424748	হাবিবা
৪৪	মো: মোস্তাফিজ রহমান	ইউ,পি সদস্য	01712009667	[illegible]
৪৫	মো: নজরুল ইসলাম	কৃষি	—	[illegible]
৪৬	মো: আ: রহিম	ছাত্র	-	রহিম
৪৭	সিরাজ আহম্মেদ	মৎস্য	01818770598	সিরাজ
৪৮	ইয়াকুব আলী	ব্যবসায়ী	01722845182	ইয়াকুব

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ বদরখালী নিয়ামতী ইউপি মিলনায়তন তারিখঃ ২৭/০৫/১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৪৯	মোঃ মাহমুদুর হোসেন	প্যানেল চেয়ারম্যান-১, তেলিখালী ইউ	01716-572063	
৫০	তানভীর হোসেন বাবুল	চেয়ারম্যান ইকড়ি ইউপি	01711-000684	
৫১	[illegible] টিপু	চেয়ারম্যান বাওয়ন	017158212122	
৫২	মো. আজিজুল হক	চেয়ারম্যান আমুয়া	01727332579	
৫৩	মোসাঃ শাহিলী বেগম	ইউ পি সদস্য আমুয়া	01736427545	শাহিলী বেগম
৫৪	মোঃ সরোয়ার হোসেন	এস.এ.ই, পানি উন্নয়ন বোর্ড	01762620529	27-05-012

Participant List: Participants list of PCM at Bhandaria Upazila Auditorium

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
মতবিনিময় সভা অংশগ্রহণকারীদের তালিকা

স্থান: ভান্ডারিয়া উপজেলা পরিষদ মিলনায়তন
সময়: ১০:০০
তারিখ: ১৭/০৮/২০১৫

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
১	[illegible]	UNO, ভান্ডারিয়া	01712827398	[illegible]
২	[illegible]	Vice Chairman U.Z.	01764517110	[illegible]
৩	মো: [illegible]	[illegible]	01713374337	[illegible]
৪	[illegible]	U.E.O	01753-836975	[illegible]
৫	[illegible]	URDO	01929648395	[illegible]
৬	[illegible]	Coordinator CEIP-I-KWE	01716157876	[illegible]
৭	মো: নাসির উদ্দিন	SAE, DPHE	01912589454	[illegible]
৮	[illegible] মো: [illegible]	J.P - [illegible]	01790252726	R. [illegible]
৯	মো: দেলোয়ার হোসেন	[illegible]	01712108606	[illegible]
১০	মো: [illegible]	[illegible]	0171297960[illegible]	[illegible] 17.08.15
১১	মো: [illegible]	UYDO	01716154780	[illegible] 17.8.15
১২	[illegible]	[illegible]	01718604496	[illegible]
১৩	মো: [illegible]	[illegible]	01712881818	[illegible]
১৪	[illegible]	[illegible]	01711-000634	[illegible]
১৫	[illegible]	[illegible]	01915821272	[illegible]
১৬	মো: [illegible]	[illegible]	01725598651	[illegible]
১৭	মো: [illegible]	[illegible]	[illegible]	[illegible]
১৮	[illegible]	[illegible]	01793225563	Razzak

আয়োজনে
CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
মতবিনিময় সভা অংশগ্রহণকারীদের তালিকা

স্থান: ভান্ডারিয়া উপজেলা পরিষদ মিলনায়তন তারিখ: ২৭/০৬/১৫
সময়: ১০:০০

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
১১	মো: মোস্তাফিজুর রহমান	UEO, Bhandaria	01771325682	[illegible]
১২	[illegible]	P.I.O. office	01731069533	[illegible]
১৩	[illegible]	সাংগঠনিক সম্পাদক	01740972451	[illegible]
১৪	অনিল চন্দ্র [illegible]	SUFO Bhandaria	01716-752436	[illegible]
১৫	[illegible]	UWAO ভান্ডারিয়া	01718355766	[illegible]
১৬	[illegible]	[illegible] ভান্ডারিয়া	01758406070	[illegible]
১৭	মো: [illegible]	[illegible]	01735653773	[illegible]
১৮	[illegible]	[illegible]	01716448520	[illegible]
১৯	মো: [illegible]	যুব [illegible]	01720083547	[illegible]
২০	মো: আশরাফুল আলম	[illegible]	01710501562	Ashraf
২১	[illegible]	[illegible]	01718244298	Mehedy

আয়োজনে
CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

Participant List 3: Participants list of PCM at Dhaoa Union Auditorium

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
মতবিনিময় সভা অংশগ্রহণকারীদের তালিকা

স্থান: [illegible]
সময়: ১৪:০০ তারিখ: ২০/০৮/১৫

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
৩৭	মো: জলিল (মোল্লা)	চাকুরি		[illegible]
৩৮	মো: নুরুল [illegible]	কৃষক-	01760962806	মো: নুরুল [illegible]
৩৯	মো: জাকির	কৃষক		মো: জাকির
৪০	মো: আবুল হোসেন	"	01725812855	[illegible]
৪১	মো: সোবহান	দ: [illegible]		সোবহান
৪২	মো: সোলায়মান আলি	কৃষক	01712794915	সোলায়মান
৪৩	ডা: মিজানুর রহমান	শিক্ষক	01712-286059	[illegible]
৪৪	[illegible]	সা: [illegible]	01716521546	[illegible]
৪৫	মো: মোস্তাফিজুর রহমান	ব্যবসায়	01725300066	[illegible]
৪৬	[illegible] আলী	কৃষক	01199238076.	[illegible]
৪৭	মো: [illegible]	[illegible]		
৪৮	[illegible]	[illegible]	01716877365	[illegible]
৪৯	মো: [illegible]	[illegible]		
৫০	[illegible]	[illegible]		[illegible]
৫১	[illegible] কবির হো:	ব্যবসায়		
৫২	মো: সোলায়মান আলি	কৃষক	01712794915	সোলায়মান
৫৩				
৫৪				

আয়োজনে
CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

Participant List 4: Participants list of PCM at Ikri Union Auditorium

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব নিরূপণ, প্রশমনের উপায় ও ব্যবস্থাপনা বিষয়ক
মতবিনিময় সভা অংশগ্রহণকারীদের তালিকা

স্থান: ইকড়ি ইউনিয়ন অডিটোরিয়াম
সময়: ১৪:০০

তারিখ: ১৬/০৮/১৫

ক্রমিক নং	নাম	পদবী/ ঠিকানা	মোবাইল নম্বর	স্বাক্ষর
১৯	মো: জাকির	[illegible]	01768764977	[illegible]
২০	[illegible]	চর বেমলা		[illegible]
২১	আজাহার মোল্লা	চর বেমলা		আজাহার
২২	মো: নকুল আমিন ইউ.পি. মেম্বার	৩ নং ওয়ার্ড বেমলা	~~0173565377~~ 01735653773	[illegible]
২৩	আবদুর রশিদ	চর বেমলা		আবদুর রশিদ
২৪	কামরুল	চর বেমলা		কামরুল
২৫	মো: আবুল মনসুর	[illegible]	01759023 743	মো: আবুল মনসুর
২৬	মো: আ: [illegible]	ফুলকাঠি		[illegible]
২৭	মো: [illegible]	ফুলকাঠি	01734386199	Md. [illegible]
২৮	[illegible]	চর বেমলা		[illegible]
২৯	[illegible]	ঐ	01782099063	[illegible]
৩০	আবদুল্লাহ	ঐ	01784103366	Abdullah 16-8-15
৩১	মো: মেহেদী হাসান	×	01781947417	Mehedi
৩২	[illegible]	অফিস	নাই	[illegible]
৩৩	[illegible]	২নং / চর বেমলা	01703556990	[illegible]
৩৪	মো: নবিউল ইসলাম	চর বেমলা	01790618930	নবিউল
৩৫	[illegible]	চর বেমলা	01791010543	[illegible]
৩৬	ফিরোজ	চর বেমলা	01756481398	ফিরোজ

আয়োজনে
CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

Table: Nodmullah, 6 no word, Nadmulla, Bhandaria, Pirojpur (FGD-5)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Tofazzal Hossain	55	Village.Pollice	01739417058
2	Md. Sahadat Howlader	40	Farmer	Nodmullah
3	Md. Kobir Sikder	40	Businessman	01745848884
4	Md. Rohul Amin	42	Farmer	Nodmullah
5	Md. Sohag Forazi	25	Business	01757841291
6	Md. Abdul Alim	50	Business	01740997063
7	Md. Moniruzaman Matubur	34	Driver	01930627044
8	Md. Nanna mier	48	Farmer	01728639451
9	Md. Kholelur Rahman	35	Farmer	01719967246
10	Md. Monirul Islam	52	Business	Nodmullah

Table: Chorkhali, Nadmulla, Bhandaria, Pirojpur (FGD-6)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Idries Choukider	40	Fisherman	Chorkhali
2	Md. Siddukur Rahman	60	Farmer	01933192273
3	Md. Abul Hasnat	17	Student	01758147105
4	Md. Uniuse	27	Fisherman	Chorkhali
5	Md. Joinal Abiden	65	Farmer	Chorkhali
6	Md. Abdur Rajjak	30	Fisherman	01929886167
7	Md. Ripon Choukider	25	Fisherman	Chorkhali
8	Md. Chunnu Chaprasi	40	Fisherman	Chorkhali
9	Md. Sultan Halder	60	Fisherman	Chorkhali
10	Md. Samsul Halder	55	Fisherman	Chorkhali
11	Md. Abdullah	52	Fisherman	Chorkhali

Table: Chorkhali launch ghat, Nadmulla, Bhandaria, Pirojpur (FGD-7)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Saim Sarder (Bachhu)	45	Farmer	01725849917
2	Md. Lavlo Gazi	45	Farmer	Chorkhali
3	Md. Nozrul Halder	55	Farmer	Chorkhali
4	Md. Harun Gazi	52	Farmer	Chorkhali
5	Md. Hadi Gazi	26	Student	01723239131
6	Md. Sayem Shake	32	Business	Purbo Chorkhali
7	Md. Anishur Rahman	35	Service	Chorkhali
8	Md. Rahaman Mia	54	Fisherman	Chorkhali

Table: Darulhuda, Nadmulla, Bhandaria, Pirojpur (FGD-8)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Sakil Khan	35	Business	01716724860
2	Allhaz Joinal Abiden	65	Retired Teacher	Darukhuda
3	Md. Samsur Rahman (Lal)	62	Farmer	01732517146
4	Md. Faisal Halder	26	Fisherman	Darukhuda
5	Md. Ainal Haque	36	Fisherman	Darukhuda

6	Md. Dulal Halder	40	Fisherman	Darukhuda
7	Md. Rajjak Halder	45	Farmer	Darukhuda

Table: Porchim Pasuribunia, Ikri UP, Bhandaria, Pirojpur (FGD-9)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Rofiqul Islam	48	Ex. UP Member	01749509686
2	Md. Ariful Islam	34	Farmer	01755411912
3	Md. Rokib Halder	26	Fisherman	Pasuribunia
4	Md. Azazul Haque	45	Fisherman	Pasuribunia
5	Md. Ariful islam	29	Business	Pasuribunia
6	Md. Hafizul Haque	36	Boatman	Pasuribunia
7	Md. Hafijul Islam	40	Business	Pasuribunia

Table: Junia word- 4, Telikhali UP, Bhandaria, Pirojpur (FGD-10)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Manik Halder	50	Fisherman	Junia
2	Md. Salim Talukder	28	Businessman	01716804877
3	Md. Abdul Hai Talukder	58	Farmer	01748723721
4	Md. Alomgir Hossain	44	Fisherman	Junia
5	Md. Joinal Talukder	40	Fisherman	Junia
6	Md. Golam Mostsffa	44	Farmer	Junia
7	Md. Abdul Kader	27	Farmer	Junia
8	Md. Sahabul Islam	28	Service	01671069604

Table: Talekhali Bazaar, Telikhali UP, Bhandaria, Pirojpur (FGD-11)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Mizanur Rahman	34	Business	01718444311
2	Md. Masum Talukder	19	Student	01736239030
3	Md. Abdul Satter Mirdha	57	Service	01748725404
4	Md. Babul Matubur	38	UP Member	01763905543
5	Md. Golam Khan	35	Farmer	01726572409
6	Md. Ali Akber	52	Farmer	Talekhali
7	Md. Sultan Ahmed	56	Business	01775186353
8	Md. Rofiqul Islam	27	Farmer	Talekhali
9	Md. Malek Matubber	46	Business	01745425922
10	Md. Sultan Mirdha	27	Fisherman	Talekhali
11	Md. Hasam Mirdha	40	Business	Talekhali
12	Md. Sofiqul Halder	35	Fisherman	Talekhali

Table: Rajpasha (Pona Upper), Ikri UP, Bhandaria, Pirojpur (FGD-12)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Khokon Haolader	35	Farmer	Rajpasha
2	Md. Tariqul Islam	20	Farmer	01724151084
3	Mosarraf Hossain Haolader	55	Ex, UP member	01710864044
4	Md. Sobur Mridha	40	Farmer	01710863358
5	Monoranjon	48	Farmer	Rajpasha
6	Md. Mizanur Rahman	50	Business	Rajpasha
7	Md. Alamgir Haolader	38	Farmer	01735156620
8	Mofazzel Hossain	40	Business	Rajpasha
9	Md. Sohel Haolader	30	Farmer	01724542950
10	Md. Kuddus Haolader	52	Farmer	01770223851
11	Kobir Mridha	47	Farmer	01762220250
12	Jobber Mridha	45	Service	01711221501

Table: Gulbunia (Pona Lower), Dhanisafa UP, Mothbaria, Pirojpor (FGD-13)

Sl No	Name of Participants	Age	Occupation	Address/Mobile
1	Md. Masum Matobbor	50	Business	01736026112
2	Md. Nilchand Mondol	52	Farmer	01754356263
3	Abul Kalam	40	Business	01735328313
4	Md. Humaon Kabir	36	Farmer	01821812095
5	Md. Salah shake	42	Fisherman	Gulbunia
6	Md. Nuruzaman Mondol	47	Farmer	Gulbunia
7	Md. Awal Halder	35	Fisherman	Gulbunia
8	Md. Satter shake	30	Fisherman	Gulbunia
9	Sujit Saha	33	Farmer	Gulbunia

Appendix 5: Photo Album

Picture 1: Proposed closure at Hetalia khal

Picture 2: Proposed closure at   khal

Picture 3: Local people closing the upper Pona khal at Rajpasha

Picture 4: Horinpala 2 vent Drainage Sluice on Padma khal

Picture 5: Proposed closer on Lower Pona khal

Picture 6: Proposed closure at Bamner khal

Picture 7: Proposed closure at Nadmulla khal

Picture 8: Proposed closure at Juniar Khal

Picture 9: Baleswar River bank erosion at Charkhali

Picture 10: Existing embankment inside the Polder

Picture 11: Water salinity test inside the Polder

Picture 12: Water salinity test inside the polder

Picture 13: Kutcha road inside the polder

Picture 14: Herringbone road near Charkhali launchghat

Picture 15: Pucca road inside the Polder area

Picture 16: Pucca road in the Polder area

Picture 17: Traditional Communication System

Picture 18:Wodden+Steel made bridge

Picture 19: Charkhali ferry ghat

Picture 20: Bhandaria launch ghat

Picture 21: Navigation in Baleswar river

Picture 22: Navigation at Pona river

Picture 23: Internal navigation at Junior Khal

Picture 24: Internal navigation at Pona River

Picture 25: Fishing by Lining (Borshi)

Picture 26:Fishing by chargora jal

Picture 27:Tara Baim

Picture 28:Bhetki mach

Picture 29: 50 Bed Upazila Health Complex

Picture 30: Dhawa Union Health Complex

Picture 31:Purbo Posheare Bonia primary School

Picture 32: Talekhali High School

Picture 33: Seailkati High School

Picture 34: B P M Dakhil Madrasha

Picture 35: Ikri Jam-e -Mosque

Picture 36: Dhawa Jam-e- Mosque

Picture 37: Source of Drinking Water

Picture 38: Source of Drinking Water

Picture 39: Pucca house in the Polder

Picture 40: Kaccha house in the Polder

Picture 41: Katcha house in the Polder

Picture 42: Jhupri house in the Polder

Picture **43**: Pucca toilet in the polder area

Picture 44: Ringslub toilet in the polder area

Picture 45: Katcha toilet in the polder area

Picture 46: Katcha toilet in the polder area

Picture 47: Nadmullah Cyclone Shelter cum Primary School

Picture 48: Nolbunia Cyclone Shelter cum Primary School

Picture 49: FDG at Nadmullah Union

Picture 50: FGD at Poshchim Pasuribunia

Picture 51: FGD at Rajpasha (Pona Upper)

Picture 52: FGD at Gulbunia (Pona Lower)

Picture 53: FGD at Chorkhali

Picture 54: Chorkhali launch ghat

Picture 55: FGD at Darulhuda

Picture 56: FGD at Talikhali Bazar

Picture 57: PCM at Nadmulla UP

Picture 58: PCM at Nadmulla UP

Picture 59: Discussion with local people

Picture 60: Discussion with local people

Picture 61: Discussion with local people

Picture 62: Discussion with local people

Picture 63: Discussion with local people

Picture 64: Discussion with local people

Picture 65: Discussion with local people

Picture 66: Discussion with local people

Appendix 6: DoE's Approved Terms of Reference (ToR)

scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

8. Management Plan/Procedures:
   For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not mitigable, will be identified as residual impacts Both technical and financial plans shall be incorporated for proposed mitigation measures.
   An outline of the Environmental Management Plan shall be developed for the project.
   In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).
9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)
   Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)
10. Conclusion and Recommendations

IV. Without approval of EIA report by the Department of Environment, the project authority shall not be able to open L/C in favor of importable machineries.

V. Without obtaining Environmental Clearance, the project authority shall not be able to start the physical activity of the project.

VI. Violation of any of the above conditions shall render this clearance void.

VII. The project authority shall submit the EIA along with an application for Environmental Clearance, the applicable fee in a treasury chalan and the no objection certificates (NOCs) from the local authority to the head office in Dhaka with a copy to the Khulna and Barisal Divisional Office of DOE.

VIII. This clearance is valid for one year from the date of issuance and the project authority shall apply for renewal to Head Office with a copy to the Khulna and Barisal Divisional Office of DOE at least 30 days ahead of expiry.

IX. This Site Clearance Certificate has been issued with the approval of the appropriate authority.

05.06.2013

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

Mr. Md. Sarafat Hossain Khan
Superintending Engineer & Project Coordinator
Coastal Embankment Improvement Project (Phase-I)
Bangladesh Water Development Board (BWDB)
72, Gre[illegible] Dhaka-1205.

<u>**Copy Forwarded to :**</u>

1) PS to Secretary, Ministry of Environment and Forest, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Khulna/Barisal Divisional Office, Khulna/Barisal.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

2/2

Appendix 7: Comments and Responses

Comments, response and actions taken on Draft EIA Report of Polder 39/2C under CEIP-1

Chapter	Page No/ Article/ Paragraph No	Comments	Response
Executive summary	Pg xxvii	The gross area of the Polder is about 10,748 ha. The total cropped area is around 12,650 ha. How total cropped area be higher than the gross area?	Total cropped area is higher than gross area as this includes crops grown in Kharif-1, Kharif-2 and Rabi seasons (Article 5.3.5 & Table 5.17).
Introduction	Pg 2, art 1.2	The Polder covers a gross area of 10,748 hectare (ha) with net cultivable area of 8,500 ha. But in executive summary, it is mentioned that total cropped area is around 12,650 ha. Which information is correct?	All the information are correct. Area under different crops grown in Kharif-1, Kharif-2 and Rabi seasons are added to derive the total cropped area which is higher than the net cultivated area because of double and triple cropping (Article 5.3.5 & Table 5.16).
	Pg 2, art 1.2	The new embankment length mentioned in executive summary is 34 km and in article 1.2, it is 33 km. Construction of flushing inlets numbers are 15 in executive summary and 12 in article 1.2.	Thanks for the comments. Actual length of embankment and number of flushing inlets has been provided in the report (article, 1.2, para 6, page 2 & 3).
Description of Proposed Interventions in Polder 39/2C	Pg 49, art 4.5.4	Dumping location of excavated soil is not provided.	The excavated soil will be used for strengthening the *khal* banks and additional soil will be used for construction of embankments. Therefore, no dumping location is required. Details are described in the respective section (Article 4.5.4)
	Pg 50, art 4.5.6	For afforestation, how and who selected the location is not mentioned. Only chainage and length is provided. Detailed plan for afforestation should be added.	Since BWDB acquired only the base area necessary for the construction of this polder, there is no foreshore land available for afforestation. Tentative embankment slope afforestation plan has already been discussed in the report according to comments of World Bank (Article 4.5.6)
	Pg 51, fig 4.3	The details of proposed structures need to be provided in a tabular form. The information in the maps are wrong. The chainage of retired embankment is written in a	Details of proposed structures have already been presented in Tabular form (Tables 4.3 & 4.4) 11.11.1 The chainage of the retired embankment has been written properly (Table 4.2). All data in map

Chapter	Page No/ Article/ Paragraph No	Comments	Response
		format i.e., 38.8 km to 37 km and 55km to 54.5 km. Is this proper format to write chainage? All data in map need to be corrected.	have been focused correctly (Map 4.2)
	Pg 59, art 4.5.2	For polder 39/2C, the number of skilled labor and unskilled labor is 4,893 and 1, 28,401 respectively which is higher than any other polder. What is the basis of determining the number of labor and why the number is higher for this polder (especially unskilled)?	Polder 39/2C is a new polder. Moreover, the gross area of this polder is about 10,748 ha which is higher than other polders of CEIP. About 60 km of embankment, and 35 number of water control structures will be constructed in this polder. For which, the requirement of labour will be higher than the other polders of the project. The number is determined on the basis of earth works for embankment required which executed manually. The skilled and unskilled labour ratio is 20:1. Therefore, the figure of unskilled labour is high and is correct.
	Pg 64, art 4.5.5	The locations of labor camp need to be selected.	The location of labour camps/sheds have been selected and shown in the map (Map 4.4).
Environmental Baseline and Existing Conditions	Pg 75, art 5.1.3	Polder 39/2C falls under zone I not under zone III.	It has been considered and corrected as per comments (Map 5.2)
	Pg 84, Art 5.1.6, rainfall	No area-weighted average values of monthly rainfall in Polder 39/2C have been plotted in Figure 5.8. it is only mentioned in the text but no figure is given.	It was mistakenly mentioned in the report. This sentence has been omitted from this section.
	Pg 89, Surface Water Levels, fig 5.15	The graph shows negative value for minimum, but not mentioned in the text. 11.11.2	This issue has been mentioned in the report (para 316)
	Pg 90, fig 5.17, fig 5.18	The R^2 value for variation of GWT in March (1979-2013) is 0.028 and an increasing trend is observed. From the R^2 value it is clear that the interpretation of increasing trend is wrong. In dry period, the GWT cannot follow an increasing trend.	This section has been omitted for such contradictory result, and this is due inaccuracy in data.
	Pg 93, table 5.6	Salinity should be measured in dry season not in monsoon.	The duration of the EIA study for the said polder under Package-2 was

Chapter	Page No/ Article/ Paragraph No	Comments	Response
			four months (June to October) which is wet season. Furthermore, salinity in the dry season has been measured (Table 5.7).
Environmental Impacts and Mitigation Measures	Pg 143, art 6.4.1	Who will ensure that drainage channels are not obstructed or clogged by the construction activities?	Actually, the Contractor will ensure that drainage channels will not be obstructed or clogged by the construction activities. It has been mentioned in the report (para 453)
	Pg 145, art 6.4.4	In the mitigation measures of hindrance of Fish Habitat and their Migration, it is written that contractor will maintain liaison with communities. How it will mitigate the impact from "MAJOR" to "LOW"?	This issue has been considered. The mitigation measures have been revisited and improved according to existing situation of the polder. It is mentioned here that impact will be Major to Moderate after taking mitigation measures (para 468)
	Pg 147, art 6.4.7	According to article 6.4.7, it is estimated that more than 2,00,615 trees of different species and varying sizes exist along the marginal dyke of the Polder 39/2C. Where as in executive summary it is stated that 2,02,715 matured tree will be affected. How the number of affected trees is higher than the existing trees? If these much trees are affected, then the locations of proposed intervention need to be revised. How it is possible to identify that huge number of trees?	The numbers of trees have been changed according to recent RAP data (Table 6.5)
	Pg 161, art 6.5.7	It is not mentioned who will provide training on improved culture technology.	Training on improved culture technology have been discussed in the respective section (article 6.5.7, para, 551)
	Pg 236, table 10.2	For surface water quality, the frequency is half yearly. It should be mentioned that quality should be checked except wet season. Because of heavy water flow in wet season, the concentration could be diluted.	It has been considered and mentioned in the report (Table 10.2).

Appendix 8: Comments by Mr. Marcelo (WB) and Responses by CEGIS

All comments for Polder 47/2 are not applicable for other polder. Relevant comments have been addressed for 39/2C.

Sl. No.	Comments by Marcelo Hector Acerbi (WB)	Responses by CEGIS
1	Overall: the reports needs of a better correlation among baseline, analysis of impact and mitigation measures. This is not very well articulated. Some issues raised by the baseline are not addressed by the impact analysis and vice versa, etc.	Baseline data and information of physical, environmental, biological and social resources of the study area have been collected and incorporated in the report. Most of these bassline have been used in the EIA study.
2	Overall: is there a study (model) that has analyzed how the polder system works with and without the proposed intervention? This is an important analytical piece to determine if the proposed intervention would address the already existing issues. There are multiple factors and scenarios that could be backed with the project implementation (erosion, salinity, flooding, soil productivity, hydrodynamics, etc.) that need to be backed a solid analytics. Where is the water management plan and the operational targets? Have they been prepared? These are critical pieces to feed the EIA report.	Both with and without proposed interventions have been considered in model and this EIA studies Drainage modelling of the coastal polder has been carried out by IWM to find out the design parameters for drainage canal systems, drainage regulator, river bank, slope protection works. Climate resilient coastal embankment crest level has been design considering the combined effects of cyclone storm surge effects and cyclone induced wind wave. The model has been developed and simulated considering climate change condition. The impact of proposed interventions on drainage, flooding, river dynamics has also been analyzed through modeling. The model results have been utilized in the EIA study. The water management plan and the operational plan have been elaborately provided in section 4.10 (**re-name Water Management and Operational Plan**) which mainly focuses on water management and operational plan after the implementation of the proposed interventions.
3	It is clear that the proposed intervention will take place in a system that was modified in the past, that is not working properly well and that the social and physical	Agreed

Sl. No.	Comments by Marcelo Hector Acerbi (WB)	Responses by CEGIS
	environment is being affected. Therefore the proposed project is absorbing those liabilities.	
4	Description of construction activities. It is not explained how is the necessary transport movement to get to the various project sites with machinery and ancillary interventions.	Transportation modes for carrying construction instruments and materials to the site has been described in article 7.4.4.
5	Table 4.8 should be used in an integrated manner with the EMP which is pretty general in terms of specifications.	This issue has been addressed as per suggestions
6	Impacts from borrow pits should be analyzed.	There would be no impact of borrow pit which has been discussed in same para of the report
7	Section 4.8 on implementation arrangements. This section suggests that the implementation arrangement are not effective. Is that correct?	The implantation arrangements is effective which are being followed in Package-1 under CEIP
8	To what extent the local participation schemes present in section 4.15.2 have consulted, accepted by stakeholders involved and implemented? Is there capacity to do that? Who is going to deliver training?	Section 4.15.2 has discussed the previous experience of local participation in water management. In case of CEIP, stakeholder involvement, capacity, training issues have already been discussed in section 4.16.1-5 respectively
9	The document mixes two different concepts. Land use and soil productivity. It would be good to fix it in item 5.1.4 to determine if the existing baselines condition with the project footprint would be leading to (i) land use changes, that is to say from agricultural to residential use and/or (ii) changes in soil productivity.	Land type will be changed but land use will not be changed. Such changed is related to the crop productivity. Soil productivity will also be changed which would increase cropping intensity and productivity. Impact on agriculture land has been analyzed in this study i.e. to what extent of agriculture land would be increased due to proposed interventions
10	To what extend factors such as wind speed or other meteorological elements are related to the project? This is not factored later in the document as part of the EIA.	Wind speed and other meteorological elements have been provided as baseline information. However, these parameters could have been used in Model study by IWM for storm surges analysis.
11	Describes key environmental baseline conditions that would be reverted by the project and that need to be better predicted by the EIA such as surge flooding, drainage	All the issues and key issues have been addressed. But have not been prioritized.

Sl. No.	Comments by Marcelo Hector Acerbi (WB)	Responses by CEGIS
	congestion and water logging, salinity, navigation, water use, sedimentation and erosion. The report needs to be specific on these aspects which are key.	
12	Section 5.2.1. It is important to clarify the implications of this classification for the project and what does it means that it have been identified by IUCN. This needs to be handled with care to avoid confusions with the WB natural habitats concept.	The whole Bangladesh has been divided into 25 Bio-ecological zones by IUCN depending on the biodiversity in the respective area.
13	In regards to fauna species, we recommend the present a table including all species, with the conservation taking into account CITES and IUCN classification and local classifications, if applicable.	Agreed and presented in a Table-5.12a [section 5.2.4]
14	The section 5.2.5 on ecosystem services is too light. It mixes de concept of services with goods. In my opinion, for example, the project would have a positive impact in soil productivity which is clearly an environmental service.	This section has been updated
15	Table 5.14 provides the basis for specific management actions that I do not seen proposed as part of the EMP.	It has been considered in the EMP
16	Para 413 on pesticides. It would be important to know if the polder interventions would incentivize the use of pesticides in a context of improved agricultural activities that might need more inputs.	Yes, because farmers will grow more High Yielding Variety of crops after implementation of the project interventions.
17	Has the Bank reviewed the RAP?	Yes, the RAP report has been reviewed by World Bank
18	How the potential impact on social network would be addressed?	This issue has been addressed in the respective paragraph
19	Section on land use change. In fact this is not land use change!. This is the impact on lands.	This section is correct. Land will not be changed because this land will be used for construction of labour camps as a temporary facilities and it would be brought back to original use
20	Which is the impact of dewatering channels?	Dewatering is not essential for excavator cutting , it is only for manual excavation

Sl. No.	Comments by Marcelo Hector Acerbi (WB)	Responses by CEGIS
21	Section 6.4.5. On one had the EIA says there will be no impact on crops but on the other, suggests to compensate if that happens.	Rightly mentioned but crop damaged will not be occurred due to borrow pit while transportation of earth materials may cause crop damage in the surrounding area.
22	Benthic fauna has not been developed as part of the baseline section.	Information regarding benthic fauna has been mentioned in the baseline section (5.2.8)
23	There is not mention to water related diseases such as Malaria.	There is no Malaria disease in the polder area.
24	The EIA chapter mixes project actions with impacts. This need to be harmonized. The impact of tidal flooding is something the project comes to resolve and is not an impact of the project. The same with Drainage congestion and increased sedimentation.	Agreed. This chapter has been harmonized and updated accordingly
25	The WB 2010 report is not mentioned in the list of references.	It has been included in the list of references
26	I would suggest to revisit the EMP to state clearly in each of the mitigation actions who is the responsible, the timeframe and the budget. How these measures become mandatory as part of the contract?	It has been considered and mentioned in Table 10.5.
27	Table 10.2. Is turbidity going to measured? Is it a relevant variable?	Most of the canals inside the polder will be re-excavated under this project. After re-excavation of canals, turbidity of the water may be increased.
28	Table 10.5 raises some issues: is the construction of a fish sanctuary included as a mitigation measure? What is the awareness program about? Why to monitor aquatic mammals and which are the mammals? This was not mentioned in the baseline.	Fish sanctuary could be established in the perennial Khal with the co-management of the local fisheries office and the local people. In this regard, local people can be trained up on the sanctuary issue. The Fisheries Department can be involved in this process. Water management organization will be given responsibility of awareness building program to the local people. Mammals has been deleted from the EMP as there is no aquatic mammals inside the polder
29	I do not understand. The draft was never disclosed? So which is the basis for a meaningful consultation process.	Regional level disclosure meeting will be conducted in the first week of December,2016

Appendix 9: Pest Management Plan

Pest Management

A Pest Management Plan should be prepared for specific areas where needed, considering the type of pest/insects and their possible impacts. Plant diseases and insect pests control should use precaution and microbiological processes. The 1st species of first and second category of pesticides are forbidden to use. The first year of the planting farmyard manure will be applied and then the organic fertilizers will be used after. These will improve the physical and chemical properties of soil, and cause slight adverse environmental impact. Besides, the packing receptacle of the pesticides and fertilizers should be collected and treated centralized, and also the vessel must be forbidden to wash in the river or lake.

A. Culture Method

- Tillage operation
- Selection seeds and cultivars
- Destruction of alternative host
- crop production
- Use of resistant variety
- Nutrient Management
- Strip farmers
- Pruning and thinning
- Variation in timing of plant and harvest

B. Mechanical Method

- Trenching
- Burring
- Sieving
- Netting & bagging

C. Physical method

- Temperature
- Moisture
- Sound
- Electromagnetic filed

D. Biological Method

- Parasitoids & predators
- Microbial agent

E. Chemical Method

- Insecticides
- Attractant
- Repellent
- Sterilants

1. Integrated Pest Management (IPM)

Recently, Integrated Pest management (IPM) is practiced in many areas that were covered by the study. In this system, insects are controlled biologically. Farmers of the IPM areas use branches of trees, bamboo and jute sticks etc to make favorable perches for birds in fields with standing crops. The birds eat the insects which help control infestation. In this process, the crops are protected without applying pesticides.
Light trap is another technique for controlling pests under IPM. This system is used in the agriculture fields especially on HYV rice and vegetables for attracting insects. At the base of the light trap, there is a sheet generally made of steel that slopes downward. The light trap is installed on a water basin. At night, when the light trap is emitting light,

Component/ Element of IPM

- Conservation of beneficial insect, animal
- There are many pathogen (fungi, bacteria &viruses) which can attack and kill many pests
- There are many insectivorous plants, which also plays some role in controlling pests.

2. Disease resistance variety

- BRRI Dhan 28is moderately resistant to blast and leaf blight
- BRRI Dhan 29 is moderately resistant to leaf blight

3. Modern cultivation method

- Use of healthy Seeds
- Proper crop rotation
- Line sowing with proper spacing
- Proper management of water in the crop field
- proper crop rotation
- Weed free cultivation
- Use of balasnced fertilizer
- Water management by planting at appropriate distance

4. Mechanical & physical control management

- By cutting infected leaves or plant parts
- By using hand net
- By perching in the field
- By using light trap

5. Chemical control management

Chemical control method shoud be applied only when the other control methods fails to control the pest. That means pesticides should be used only as a last resort and in doing so right pesticide with right dose at right time and with right method of application should be taken in to consideration. Pesticides should be handled with proper care because all pesticide are poisonous

Appendix 10: Checklist for Stakeholder Consultation

Environmental Impact Assessment (EIA) under CEIP-1

Issues of the Public/Stakeholder Consultation Meeting

The possible issues that would be discussed in the public consultation meetings are:

1. Productivity (e.g. agriculture and fishery)
2. Livelihood options
3. Vulnerability issues
4. Ecological imbalance
5. Resource redistribution
6. People’s perception, opinion and attitude
   - 6.1. Major problems
     - 6.1.1. Problems in productivity
     - 6.1.2. Problems in service and facilities
     - 6.1.3. Infrastructural problems
   - 6.2. Attitude of the people towards the project
   - 6.3. Impact (positive and negative) of the project and mitigation measures
     - 6.3.1. Alternative sites
     - 6.3.2. Mitigation measures for planners
     - 6.3.3. Mitigation measures of implementing agency
7. Income restoration and generation issues
   - 7.1. Current income generating activities
   - 7.2. Type of occupation
   - 7.3. Income-generating activities
   - 7.4. Current market situation (job opportunities, competition, land price and market price situation)
   - 7.5. Skill development and IGA
8. Social development support
   - 8.1. Name of NGOs prevailing in the study area
   - 8.2. Social safeguard and safety nets
   - 8.3. Community interventions
9. Gender issues
   - 9.1. Unemployment of female labor force
   - 9.2. Literacy rate of female students
   - 9.3. Anticipated changes in the wage rate
   - 9.4. Health issues of women
10. Participation of women in service and facilities

FGD issues

The possible issues that would be discussed in the focus group discussions are:

1. People's perception, opinion and attitude
    1.1. Initial discussion about the selected Important Social Components (ISCs)
    1.2. Attitude of the people towards the project
    1.3. Impact (positive and negative) of the project and mitigation measures
2. Demographic distribution
    2.1. Population distribution
    2.2. Major age group
    2.3. Dependency ratio/status)
3. State of Education
    3.1. Impact of illiteracy
    3.2. Variation in school Attendance between girls and boys
    3.3. Variation in drop-out between girls and boys
4. Health Situation
    4.1. Prevalent diseases
    4.2. People's health seeking behavior
    4.3. Local health facilities
5. Employment and Occupation
    5.1. Existing occupations in the locality
    5.2. Major occupations
    5.3. Reasons of unemployment
    5.4. Impacts of unemployment
    5.5. Occupation problems/conflict
    5.6. Impacts of variation in water level on employment
6. Service and Facilities)
    6.1. Existing housing tenancy and structure
    6.2. Drinking water and sanitation facilities in the locality
    6.3. Energy Facility
    6.4. State of market Facility
7. Gender Issues
    7.1. Unemployment of female labor force
    7.2. Literacy rate of female students
    7.3. Anticipated changes in the wage rate
    7.4. Health issues of women
    7.5. Participation of women in service and facilities
    7.6. Women leadership
8. Poverty and food security status
    8.1. Number of working days, disaggregated by seasons and occupations
    8.2. Status of subsistence, disaggregated by seasons
    8.3. Usual food menu
    8.4. Adaptation strategies during poverty state
9. Ethnicity
    9.1. Major ethnic groups
    9.2. Cultural conflict and coexistence
    9.3. Potential impacts of project on ethnic groups
10. Archaeological/heritage sites
    10.1. Major archaeological/heritage sites
    10.2. Cultural values
    10.3. Potential impacts of project

Appendix 11: Gate Operation Plan (Bengali)

পোল্ডারের স্লুইস গেট পরিচালনার ক্ষেত্রে নিয়মাবলী

অতীতে পানি উন্নয়ন বোর্ডের কর্মচারীর মাধ্যমে স্লুইস গেটগুলো পরিচালিত হতো। বাজেট স্বল্পতার কারণে সে পদগুলো এখন স্থগিত করা হয়েছে। বর্তমানে গেটগুলো পরিচালনার দায়িত্ব সুবিধাভোগীদের উপর অর্পন করা হয়েছে। প্রতিটি পোল্ডাওে এ জন্য পানি ব্যবস্থাপনা সংস্থা (WMG, WMO, WMA) গঠন করা হয়। কৃষি উন্নয়ন ও মৎস্য সম্পদের কথা বিবেচনা করে পোল্ডার ৩৯/২সি এর গেটপরিচালনায় পানি ব্যবস্থাপনা সংস্থাগুলোকে নিম্নোক্ত বিষয়গুলো বিবেচনা করতে হবে:

- কৃষি ও মৎস্য সম্পদ ব্যবস্থাপনার সাথে সামঞ্জস্য রেখে একটি নির্দিষ্ট নিয়মের মধ্য দিয়ে প্রতিটি রেগুলেটরের গেট অবশ্যই নিয়ন্ত্রিণ করতে হবে ;
- প্রকৃত পানি ব্যবস্থাপনা বিশেষ করে কৃষি ও মৎস্য সম্পদের প্রয়োজনীতার ভিত্তিতে পানি উন্নয়ন বোর্ডের পরিচালনা ও রক্ষণাবেক্ষণ শাখা সুবিধাভোগী সংস্থা, কৃষি সম্প্রসারণ অধিদপ্তর এবং মৎস্য অধিদপ্তরের মাঠ কর্মীদের যৌথ পরামর্শক্রমে গেট পরিচালনা করতে হবে;
- শুধুমাত্র মেরামত ও ফ্ল্যাশিং ব্যতীত রেগুলেটরের ফ্ল্যাপ একটি নির্দিষ্ট স্থানে সব সময় একই অবস্থানে রাখতে হবে;
- খালে পানি সংরক্ষণ করে কৃষি কাজে সেচের জন্য বর্ষার পূর্বে (মার্চ - মে) গেট বন্ধ রাখতে হবে;
- বর্ষার সময় (জুলাই -সেপ্টেম্বর) গেট সাধারণত বন্ধ থাকবে তবে পোল্ডারের ভিতর ও বাহিরের পানির স্তর একটি নিরাপদ লেভেলের বাইরে যাতে চলে না যায় সেদিকে লক্ষ্য রাখতে হবে। এক্ষেত্রে, প্রতিদিনের বৃষ্টিপাত, নদীর অবস্থা,নদীর এবং পোল্ডারের ভিতরের পানির লেভেল বিবেচনা করে যথাযথ সিদ্ধান্ত নিতে হবে;
- মাছের সর্বোচ্চ প্রজননের সময় ডিমসহ মা মাছ (ব্রুড মাছ) ও মাছের পোনা অভিগমনের বিষয় বিবেচনা করে মে হতে জুন মাস পর্যন্ত গেট খোলা রাখতে হবে;
- বর্ষাপরবর্তীসময় (অক্টোবর-নভেম্বর) গেট এমনভাবে পরিচালনা করতে হবে যাতে খালে শুষ্ক মৌসুমেও পর্যাপ্ত পানি থাকে। এক্ষেত্রে লক্ষ্য রাখতে হবে যেন খালের পানি তীর উপচে না যায় এবং কৃষি কার্যক্রম ব্যাহত না হয়;
- ফ্ল্যাশিং স্লুইস ও পাইপ ইনলেট পরিচালনার ক্ষেত্রেওএকই নিয়ম অনুসরণ করতে হবে;
- কৃষি কার্যক্রম, শষ্যের নমুনা ও ধরণ, মাছের প্রজনন সময় ও অভিগমন ইত্যাদি পরিবর্তনশীল বিধায় সময়ের সাথে সুবিধাভোগী সংস্থার (কৃষক, মৎস্যজীবি,মৎস্যচাষি) সাথে নিয়মিত পরামর্শ করতে হবে;
- কৃষি ও মৎস্য উভয় সম্পদ বিবেচনায় নিয়ে পানি ব্যবস্থাপনা সংস্থাগুলোকে (WMG, WMO, WMA) সমন্বিত পানি ব্যবস্থাপনার উপর প্রশিক্ষণ প্রদান করতে হবে।

Appendix 12: Minutes of the National Dissemination Seminar held on 25 January, 2017

A dissemination seminar on the “Environmental Impact Assessment (EIA) under Package-2 of CEIP-1 was held at Spectra Convention Centre, Gulshan 1, Dhaka on 25 January 2017. Mr. Anisul Islam Mahmud, M.P, Hon’ble Minister, Ministry of Water Resources, Government of the People's Republic of Bangladesh, graced the occasion as the chief guest and Mr. Muhammad Nazrul Islam, Bir Protik, M.P, Hon’ble State Minister, Ministry of Water Resources, Government of the People's Republic of Bangladesh was present as the Guest of Honour. Dr. Zafar Ahmed Khan, Senior Secretary, Ministry of Water Resources Government of the People's Republic of Bangladesh and Engr. Md. Waji Ullah, Executive Director, CEGIS were the special guests in the seminar. The meeting was chaired by Mr.Md. Mahfuzur Rahman, Additional Director General (West region), BWDB. The photographs of the seminar is provided herewith as Appendix A.

The program started with registration of the participants at 9:30 am. Thereafter, the seminar commenced at 10:00 am through recitation from the holy Quran. Mr. Md. Delwar Hossain, Project Director, CEIP-1, BWDB delivered the welcome speech. After that Mr. Malik Fida Abdullah Khan, Deputy Executive Director (Operation), CEGIS presented the findings of the Environmental Impact Assessment (EIA) study of six polders under package-2 of CEIP-1.

About 100 NationalExperts from multi-disciplinary fields such as engineers, agriculturists, economists, environmentalist, sociologists and others as well as local stakeholders were present in the seminar. Besides, three international Environmentalists were present in the seminar. A List of participants attending the seminar is given as Appendix-B.

After the presentation, the floor was openedto the participants for their comments/suggestions on the study. Many valuable comments and suggestions received from the Honourable Chief Guest, Guest of Honour, special guests and participantswhich are furnished below.

1. Mr. Anisul Islam Mahmud, M.P, Honourable Minister, MoWR stated that the provisionfor re-excavation/dredging of peripheral rivers of the polders should be included under the CEIP project.

2. Dr. Zafar Ahmed Khan, Senior Secretary, MoWR informed that the Government of Bangladesh has specific development targets by 2021 and 2041. As such the polder rehabilitation process, should be considered on the basis of past experience and future challenges particularly climate change issue. He saidthat we should think about WMO for polder maintenances and how this association can work properly.He further added that we have gathered various ideas and knowledge from today’s dissemination seminar on Coastal Embankment Improvement Project, Phase-1,(CEIP-1) which may play vital role for decision making in future for effectiveness of this project.

3. Mr. Md. Habibur Rahman, PD, ECRRP, BWDB informed that the polder rehabilitation plan is good initiative which has already been done by ECRRP. At present, CEIP-1 polder rehabilitation works should be conducted considering climate change scenarios and sea level rise. He also mentioned that polder works should have scope for green belt along the polder which should be monitored by Water Management organization (WMO) for proper maintenances of the polders.

4. Mr. K.M. Fakhrul Islam, Chief Engineer, Central Zone, BWDB made questioned How WMO will be involved in the rehabilitation work of all polders? In addition, he also told that sufficient training programs should be introduced for the WMOs of the polder.

5. Dr. Khondaker Azharul Haq, President, Bangladesh Water Partnership (BWP) expressed that the presentation is quite good but why only few polders have been considered for rehabilitation out of 139 polders. We should take initiatives for engaging NGOs/private sector for monitoring of the polder maintenance as the WMO does not sustain in most of the cases. Coastal polders are very vulnerable due to climate change. So we should look for new operation system for polder rehabilitation.

6. Mr. Md. Zaid Hussain Bhuiya, Deputy Chief Conservator of Forest (DCCF), Department of Forest suggested that Social forestry based green belt system should be included in polder rehabilitation work process. He also proposed to initiate social forest co-management system along embankment and also in the protected areas.

7. Mr. Giasuddin Ahmed Chowdhury, Deputy Team Leader, Delta Plan Project, Mott McDonald suggested that internal water management system is very important for rehabilitation of the polders. The polder works should include plan for eco system service providers.

8. Mr. Abani Kumar Thakur, DCCF, Department of Forest (DoF) mentioned that we know that coastal Greenbelt is a measure to prevent coastal erosion and reduce other natural hazards by planting trees and creating forests along the coasts. As such more exclusive green belt project should be implemented which has recently been studied by DoF.

9. Mr. Mohammad Alamgir, Principal Scientific Officer, WARPO commented that fish management plan is still missing in CEGIS power point presentation. Thus he insisted a comprehensive plan including polder rehabilitation work along with fish management plan.

10. Professor Dr. KB Sajjadur Rasheed, Environmentalist and Advisor, CEGIS expressed that CEGIS presentation was good for understanding. He enquired whether the crest level of the embankment of the polder has been designed considering climate change scenario.

11. Mr. Mahbub Murshed, Reporter, The Daily Naya Diganta informed that in future, the Koshi dam in Nepal and Ganges Barrage in Bangladesh would be constructed which will be the source of huge quantity of fresh water to the south western region of Bangladesh. Whether this issue has been considered in the study?

11. Mr. Md. Harun ur Rasheed, BWDB suggested that aseparate tree plantation plan should be included here for cutting of trees in the polder during intervention works. He also said why WMO are not working successfully in Bangladesh which is successfully working in other countries of the world?

12. After the comments and suggestions from the floor, the Chief Guest, Guest of Honour , Special Guests and Chairperson of the seminar delivered their valuable speeches .

13. The comments and responses are given as Appendix-C

Dr. Maminul Haque Sarker, Deputy Executive Director (Development) gave vote of thanks to theChief Guest, Guest of Honour , Special Guests and Chair, participants and representatives of media for their kind presence and active participation in the seminar.

Appendix A: Photographs of Seminar

Chief Guest, Guest of Honour, Special Guests and Project Director

Welcome Speech by the Project Director of CEIP-1

Presentation of EIA findings by Mr. Malik Fida Abdullah Khan, Deputy Executive Director (Operation), CEGIS

View of Participants of the Seminar

A view of open discussion

Special Guestdelivering his speech

Special Guestdelivering his speech

Guest of Honour delivering his speech

Chief Guestdelivering his speech

Closing remarks by the Chair

Appendix-B: List of Participants of Seminar

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
1	Dr SMA Rashid	IWM/CEIP	rashidsma@yahoo.co.uk 01717318906	Titon 01914618745	[signature] 25/01/17
2	Abu Bakr Siddique	CEIP-1	abs-1947@yahoo.com 01795095607		[signature]
3	Henk Blok	CEIP-1	henk.blok@nhdhv		[signature]
4	Md. Mahfuzur Rahman ADG (West Region)	BWDB	01741-382772		[signature]
5	A.K. Manzur Hasan Chief Engr ~~BWDB~~	BWDB	01711175477	Jewel. 01921985023	[signature]
6	Mollah Ruhul Alam Adviser water resou	CEGIS	01715406565		[signature]

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
7	SYED ALI AHSAN PS TO SENIOR SECRETARY (D-S)	MOWR	ahsan.en@gmail.com 01711431009	MAHFUL 01915531903	[signature]
8	Ebrahim Akand	CEGIS	ebrahimakhd@yahoo.com	01675507173	[signature]
9	Md Zaid Hussain Bhuiyan Deputy chief conservator of forest	FD	dccf-adtn@bforest.gov.bd	01712-074350	[signature]
10	Md. Delwar Hossain PD/CEIP-1	BWDB.	Pdpmuceip@gmail.com	Rashed. 01723881698	[signature]
11	MD CHAN MIA	P.I.D	chanmia820@gmail.com	01712223881	[signature]
12	Md. Abdul Hannan XEN, CEIP, BWDB	BWDB	xen.ceip1.khulna@gmail.com	Taleb	[signature] 25/1/17

2

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
13	Jahangir Alam PRO, MOWR	MoWR	pro@mowr.gov.bd 01935105850	Shafiqul Islam 01728912590	[signature] 25.01.17
14	Md Nawuzzaman Ass Director	MOWR	01911282778		[signature]
15	Md. Habibur Rahman	CEIP-1	01199808796	Rangu	[signature]
16	Subrata Kr Mondal	CEGIS	01715669850		[signature] 25/1/17
17	Dilruba Ahmed	CEGIS	dahmed@cegisbd.com		[signature] 25.01.17
18	Md. Anwar Kadir SDE	JRC	01817527677 anwarkadir07@gmail.com	Saiful 01739259695	[signature] 25-01-17

3

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
19	Md. Azizul Haque Adviser	CEGIS			ah
20	Md. Maqbul-E-Elahi	CEGIS			[illegible]
21	Jalal Ahmed Choudhury	CEGIS		01938242287	Jalal
22	K B S Rashid	CEGIS		01730320305	[illegible]
23	Mir Sajjad Hossain	CEGIS			[illegible]
24	Sakib Mahmud	IWA		01852833381	[illegible]

4

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
25	Anders Malmgren Manager CEIP Int'l Environmental Specialist	DHI			[illegible]
26	MOTAHER HOSSAIN CE. Ganges Barrage	BWDB	motaher_hossain@yahoo.com		[illegible]
27	Md. Abdur Rahman Akanda ADG(P)	BWDB			[illegible]
28	Md. Mahbubur Rahman	CEIP			[illegible]
29	Md. Abul Kausar SE/BWDB	BWDB	sami_kausar3@yahoo.com	Md Ahsanullah vehicle no: 3083	[illegible]
30	GERARD PICHEL	RHDHV	fattyzebra@gmail.com		[illegible]

5

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
31	Mobasher Bin Ansari	Jr. Specialist	mansari@cegisbd.com 01718 244298		Mobasher
32	Muhammed Aziz Rah	PLA	mazizur@ ...		Aziz
33	Glandhy Chan	BDP2100			
34	Saika Nowshin Junior consultant	CEGIS	nowshin.saik@gmail.com 01673...		Saika
35	Shihab Monjur Research consultant	CEGIS	shihab.186@live.com 01735363323		S.Monjur
36	AKM Hasan	CEGIS	01911364049		

6

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
37	Kazi shahidur Rahman Sub-divisional Engr	JRC	shahid.21cece@...com 01712831502		
38	Khair Reporter	Metar	01916143377		
39	Md. Sarfaraz Wahed	CEGIS	01712209367		Mow
40	Faria Tuz Zahura	CEGIS	01675489594		
41	Dr. Maminul Haque Sarker	CEGIS	01817606781		
42	Asma Akter	CEGIS			Asma

7

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
43	Mohad. Hassan	Deputy Manager	01711260139	-	Mohad.
44	Khaleda Saladin	CEGIS			Saladin
45	K. Kamal Hossain	CEGIS			
46	Dr. Ashadul Alam Sr. Env. Specialist	PMU,CEIP-I BWDB	01747215770		25.01.2017
47	Shaheen Afroze	CEGIS	01715304133		25/01/2017
48	Chaitanya Kumar Das Director Field service wing DAE	DAE	01718956169 kbdaldas@yahoo.com	Lookman	25.1.17

8

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
49	Jan T. Twarowski Team Leader M+E Consultants	Sheladia Associates USA	jant@sheladia.com	Ali	Jan T
50	Dr. Kazi Noor Newaz Advisor,	CEGIS	knoornewaz@cegisbd.com		
51	Dr. Sajid	C3ER BRAC Uni	sajid_ru@yahoo.com	01921x982934	
52	Dr. Monowar Hossain	IWM	mnh@iwmbd...		
53	Md. Gulzer Hossain	CEIP-I		-	
54	ANISUR KAWSAR WANE SI	BETS			

9

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
Venue: Spectra Convention Centre, House 19, Road 7, Gulshan-1
Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
55	K. M. Aminul Haque	BWDB	01552397776	Dhalu	[signature]
56	Jasim Uddin Ahd	BWDB/Hang	01716209774		[signature]
57	Dr. AZHARUL HAQ	BWP	01819212996	Iskandar	[signature]
58	Dr. Ashraful Alam	CEGIS	01818270847		[signature]
59	Md. Nazmul ...	CEGIS	01715712614		[signature]
60	Anjuman Ara Baby	CEGIS	01711-377-306	—	[signature]

10

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Date: 25 January, 2017 **Time:** 9.00 to 1.30
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Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
61	Kh. Khalequzzaman Chief Planning	BWDB	01822822662 cplan.wdb@yahoo.com	Zahangir	[signature]
62	Md. Abu Hasnat	CEGIS	01911597899		[signature]
63	AKM Tahmidul Islam	BWDB	01712173124	Selim	[signature]
64	Abani B. Thakur Deeff	Forest Dept.	01720543473	Nur Mohammad	[signature]
65	Md. Harun ur Rashid	BWDB	01711383744	Harun 6205	[signature] ... DC-2
66	RAKSHANDA RABBI	CEGIS			

11

Dissemination Seminar on
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Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
67	Md Habibur Rahman PD/ECRRP	BWDB	01712008322	Md. Suman	[illegible]
68	MD. SHAHJAHAN X-DG, WARPO		01715078833		[illegible]
69	Mihir Biswas	BAPA	01700678233		[illegible]
70	[illegible] Ali	BTV	01911988790	[illegible]	[illegible]
71	MUSA NURUR RAHMAN SUPERINTENDING ENGR	BWDB	01715740505	Oli	[illegible] 25.1.17
72	Mohammad Alamgir Principal Scientific Officer	WARPO	01556555684		[illegible]

12

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Date: 25 January, 2017 **Time:** 9.00 to 1.30
Organized by: CEGIS

Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (If any)	Signature
73	Md. Jahid H Jahangir former Member, JRC				[illegible]
74	[illegible]	BTV		01212354990 [illegible]	[illegible]
75	A. Latif	Gm		01710089153 [illegible]	[illegible]
76	Syed Mahbub Murshed	Republic Naya Diganta		own 01718417181	[illegible]
77	Mantu Kumar Poddar Joint Chief	Ministry of Wtr	aditya_suditya @yahoo.in	01772143441 Ms. Razzak Driver.	[illegible]
78	Mohammad Abdur Rashid	CEGIS			[illegible]

13

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
79	Fakhrul Islam Chief Engineer Central Zone, DhK	BWDB	fakhrulbwdb@yahoo.com 01670-757384	Monju 01774-218775	[signature]
80	AKM. SAHADAT HOSSAIN. SE, IWRM	LGED	sahadat_ed@yahoo.com 01712209194	JAHID	[signature]
81	Md. Zahid Hasan Dhali	CEGIS	zahiddhali@yahoo.com 01816399598		[signature]
82	Roland Nathan Mandal	CEGIS	fish03nath@gmail.com 01758188740		[signature]
83	Md. Jaforul Alam	CEGIS	[illegible]@yahoo.com 01737097[illegible]		[signature]
84	Md. Ashraful Alam	CEGIS	01722602667		[signature]

14

Dissemination Seminar on
Environmental Impact Assessment (EIA) under Package-2 of CEIP
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Registration Form

Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
85	Mirza Golam Shoket	CEGIS	01729-088099		
86	Dr. Engr. Md. Lutfor Rahman	RRI	01715-039646	Paritosh kumar Biswas	[signature] 25/01/17
87	Vimal Kumar Saha Ecologist	CEGIS	gourbu[illegible]@gmail.com 01911686707		Vimal Saha
88	Muhammad Shahidur Rah	CEGIS	shahidurrahman03@gmail.com 01715-865525		[signature]
89	Ashoke Kumar Das Fisheries Expert	CEGIS	ashoke@cegisbd.com	-	[signature]
90	Md. Shakil Ahmed	CEGIS	sahmed@cegisbd.com		[signature]

15

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Sl. No.	Name with Designation	Organization	E-mail address & Mobile Number	Name & Mobile No. of Driver (if any)	Signature
91	SHAHED	BTV	—	—	
92	Badal Md. Faruque principal Specialist	CEGIS	BFARUQUE@CEGISBD.COM 01715111661		
93	Motaleb H. Sarker Director Ecology	CEGIS	017150154[illegible]		
94	[illegible] Mamun	Somoy TV	0196444912[illegible]		
95	Md. Amanat Ullah	CEGIS	01717443291		
96	Mashuda Parvin	CEGIS	01705066867		

16

Appendix-C: Comments and Suggestions

Sl.	Comments/suggestions	Responses
1	**Mr. Anisul Islam Mahmud, M.P, Honourable Minister, MoWR** The provision for re-excavation/dredging of peripheral rivers of the polder should be included in the polder rehabilitation activities	The provision for re-excavation/dredging of peripheral rivers in Polder 48 from km. 9.00 to km 17.00 (Mohipur Khal) and Polder-41/1 from km. 15.00 to km 20.00 (Bashbonia Khal) have been made as these rivers are narrow and shallow in depth. On the other hand, the peripheral rivers of other polders in this package are wide and deep. As such, re-excavation/dredging has not been considered.
2	**Dr. Zafar Ahmed Khan, Senior Secretary, MoWR** The Government of Bangladesh has specific development targets by 2021 and 2041. As such the polder rehabilitation process should be considered on the basis of past experience and future challenge particularly climate change issue. He said	The coastal polder since it implementation have appreciably contributed to the food production in Bangladesh as well as provided safety to the people of the polders against saline water intrusion and tidal surges.

Sl.	Comments/suggestions	Responses
	that we should think about WMO for polder maintenances and how this association can work properly. He further said that we have gathered various ideas and knowledge from today's dissemination seminar on Coastal Embankment Improvement Project (CEIP) which may play vital role for decision making in future for effectiveness of this project.	The rehabilitation of the polder is being done considering climate change scenarios and other current water management concepts. As such, the rehabilitation of the polder would greatly contribute to the development targets of 2021 and 2041. The involvement of the WMA for operation of the polder have been emphatically suggested in the study. In this regard, capacity building and training to the WMOs regarding gate operation, post project monitoring etc. has been included for their involvement in the project operation phase.
3	**Md. Habibur Rahman, PD, ECRRP, BWDB** The polder rehabilitation plan is good initiative which has already been done by ECRRP. At present, CEIP polder rehabilitation work should be conducted considering climate change impact and sea level rise. He also mentioned that polder works should have scope for green belt along the polder which should be monitored by Water Management organization (WMO) for proper maintenances of the polder.	It has already been considered in the study.
4	**K.M. Fakhrul Islam, Chief Engineer, Central Zone, BWDB** How WMO will be involved in the rehabilitation work of all polders?	As per bid document of CEIP-1, there is no scope for involvement of WMO in rehabilitation works because the polder construction works will be implemented by the contractor, engaged through the International bidding process. However, capacity building and training to the WMOs regarding gate operation, post project monitoring etc has been included for their involvement in the project operation phase.
5	**Dr. Khondaker Azharul Haq, President, Bangladesh Water Partnership (BWP)** The presentation is quite good but why only few polders have been considered for	A total of 17 most vulnerable polders have been selected for rehabilitation under CEIP-1. During selection of polders, a screening matrix in the form of multi - criteria analysis has been done

Sl.	Comments/suggestions	Responses
	rehabilitation out of 139 polders. We should take initiatives for engaging NGOs/private sector for monitoring of the polder maintenance as the WMO does not sustain in most of the cases. Coastal polders are very vulnerable due to climate change. So we should look for new operation system for polder rehabilitation.	considering the physical condition of the structures as well as environmental, social and economic conditions of the polder area. BWDB has planned to rehabilitate the remaining vulnerable polders after successful completion of rehabilitation works of polders under Phase-II, on priority basis. Climate change issue has been considered in rehabilitation of the polders.
6	**Md. Zaid Hussain Bhuiya, Deputy Chief Conservator of Forest (DCCF), Department of Forest** Social forestry based green belt system should be included in polder rehabilitation works process. He also proposed to initiate social forest co-management system along embankment and also in the protected areas.	It has been considered in the project
7	**Mr. Giasuddin Ahmed Chowdhury, Mott McDonald** Internal water management system is very important for rehabilitation of the polders. The polder works should include plan for eco system service providers	To ensure fresh water availability as well as enrichment of ecosystem inside the polder, provision for internal khal re-excavation has been considered in this project. The plan for eco-system service provider has also been made in the study.
8	**Abani Kumar Thakur, DCCF, Department of Forest (DoF)** We know that coastal Greenbelt is a measure to prevent coastal erosion and reduce other natural hazards by planting trees and creating forests along the coasts. As such more exclusive green belt project should be implemented which has recently been studied by DoF.	The rehabilitation of the polders inter-alia includes foreshore afforestation program, The green belt project may be implemented in future.
9	**Mohammad Alamgir, Principal Scientific Officer, WARPO** Fish management plan is still missing in CEGIS power point presentation. Thus he insisted a comprehensive plan including polder rehabilitation work along with fish management plan.	The detailed fishery management plan has been provided in the study which could not be presented in the dissemination seminar due to time limit.

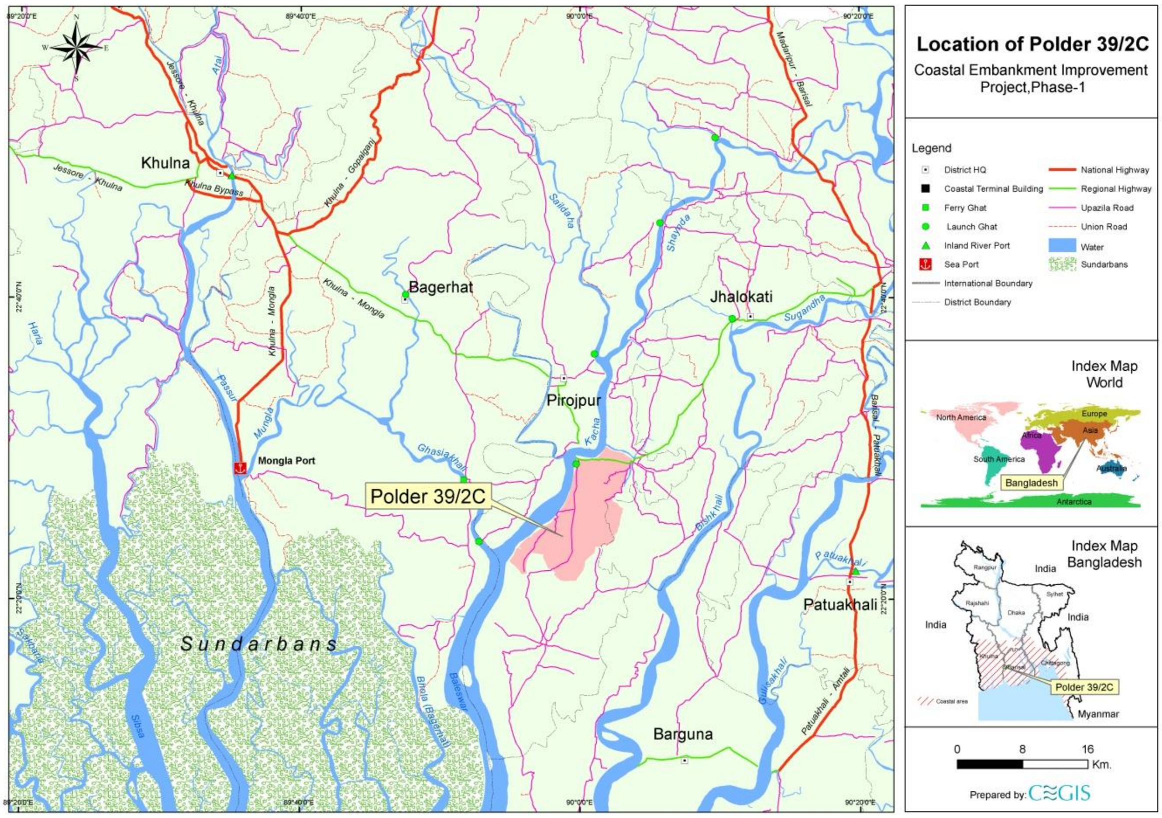
Sl.	Comments/suggestions	Responses
10	**Professor Dr. KB Sajjadur Rasheed, Environmentalist and Advisor, CEGIS** CEGIS presentation was good for understanding. He enquired whether the crest level of the embankment of the polder has been designed considering climate change scenario.	Yes, the crest level of the embankment has been designed considering the climate change scenarios.
11	**Mr. Mahbub Murshed, Reporter, The Daily Naya Diganta** In future, the Koshi dam in Nepal and Ganges Barrage in Bangladesh would be constructed which will supply huge amount of fresh water to the south western region of Bangladesh. Whether this issue has been considered in the study ?	In the cumulative impact assessment of the EIA study, Ganges Barrage has been considered.
12	**Md. Harun ur Rasheed, BWDB** A separate tree plantation plan should be included here for cutting trees in the polder during intervention works. He also said why WMo are not working successfully in Bangladesh which is successfully working in other countries of the world?	A detailed tree plantation plan has been provided in the study report. The involvement of the WMO for operation of the polder has been emphatically suggested in the study. In this regard, capacity building and training to the WMOs regarding gate operation, post project monitoring etc. have been included for their involvement in the project operation phase.

Government of the People's Republic of Bangladesh

Ministry of Water Resources

Bangladesh Water Development Board

COASTAL EMBANKMENT IMPROVEMENT PROJECT, PHASE-1 (CEIP-1)



Consultancy Services for Detailed Design, Construction Supervision and Project Management Support

ADDENDUM TO

ENVIRONMENTAL IMPACT ASSESSMENT POLDER- 39/2C FOR PACKAGE-2

February 2017

Royal HaskoningDHV Enhancing Society Together
DevCon Leading Today for Tomorrow
dpm
IWM
DHI

The following recommendations are considered to ensure that all 6 EIA Reports in CEIP Package-2 fully cover environmental risks and impacts under the project and clearly communicate those risks and impacts and corresponding mitigation measures and that it's an effective management tool.

Strategic/Sectoral Assessment: The rationale of Coastal Zone Policy states three reasons as the basic principles:

a) Coastal zone is lagging behind in socio-economic developments
b) Poor initiatives to cope with disasters
c) Coastal zone has potential to contribute to national development.

The CEIP-1 Project fulfils all the three features/ criteria to be selected as development area.

Strategic or Sectoral Environmental Assessment in relation to the Coastal Zone Policy (2005) and the Coastal Development Strategy (2006) was not considered because the Coastal Development Strategy defines 9 priorities which mainstream environmental considerations, i.e. the following relevant ones:

-ensuring fresh and safe water availability

-safety from man-made and natural hazards

-improving of livelihood conditions of the polder dwellers

-environmental mitigation and conservation.

The CEIP-1 Project is conceived as a water infrastructure Project, aiming to retrofit the sluices, embankment, canals and bank protection with climate change impacts mitigation. In that sense, sustainability is incorporated. No fundamental modification of the basic concept of polderization is operated. When the 139 coastal polders were designed/built in 1970s, this all was done in a purely civil engineering approach. Ever since, IPCC report has been published and it has given impetus to more eco-engineering approach in design and construction. Idem ditto for the designs and construction under BWDB, however with core focus on water management infrastructures improvement (raison d'être of BWDB agency). This CEIP-1 Project design is adapted to the climate resiliency objectives with design of the infrastructures alone and its environment-compliant implementation. As the 139 Polders have undergone so many rounds of rehabilitations over the past 50 years, this is the living proof that the coastal polders have sustained half a century. This CEIP-1 brings in climate resiliency as added value to design and construction.

It can be assured that the CEIP-1 Project does not and will not worsen the present coastal situation whatsoever. Moreover, the said infrastructures are built inside the perimeter of the polders and no construction is done to protrude onto the surrounding rivers and existing waterscape/landscape systems and other surrounding sensitive ecosystems. On the operational level at construction sites, mitigation measures have been inserted in the EMP/EAP manual of all Contractors. This is a sufficient safeguard measure for pre, during, and post-construction stages.

Selection Criteria: All the 17 Polders in CEIP-1 including Polder 41/1 out of total 139 were selected by multi-criteria analysis based on physical conditions of existing infrastructures of the Polders. The physical conditions mainly include breach of embankment, overtopping, river erosion, wave action, internal drainage congestion etc. which relates to environmental components.

Past Experiences: In the tidal estuarine dynamics of the South West region of the country, a large scale water logging problem has been created through these polders.

CEGIS has recommended Tidal River Management (TRM) for sustainable solution of water logging problem.

Prior to the proposed interventions, polder areas faced several environmental adverse impacts as follows:

In general, the natural flow of rivers has been restricted for the construction of the Polders causing siltation of the river bed which create obstacles of navigation as well as drainage congestion.

There is no organized track record of the Government in managing such impacts but observation of the polders indicates that there has been increased siltation; reduction of open water fisheries, birds, wild animals; Reduction of soil fertility; deterioration of Water quality over time.

Brownfield vs. Greenfield: The Project mostly entails outright rehabilitation worksof infrastructure where their spatial domain already exists. The structure as indicated in Table 4.3 of EIA Reports is being replaced on the footprint of existing old structures. There are about 4.0 km of new embankment to be constructed; rest of the embankment is re-sectioning of the existing embankment. Hence, very few new impacts are likely to arise.

Gap Analysis: The differences between GOB/Local legal safeguards policies and the WB safeguards policies are highlighted in the Table below:

Comparison between GoB and WB Guidelines

After reviewing the laws of GOB and World Bank Safeguards guidelines, it is necessary to identify the similarities and differences between those so that the more stringent requirements can be applied for the Projects. In general OP 4.01 and OP 4.12 requirements are more comprehensive when compared with the requirements of Bangladesh legal system. The differences have been addressed by the measures proposed by the EIA reports and to be adopted by the Project. Table below lists some key comparisons between GOB and World Bank Safeguards guidelines.

Table: Comparison between GOB and World Bank Safeguards Guidelines

Sl	Criteria	Requirements as per GoB law	Requirements as per OP 4.01
1	Type of Environmental Analysis	Project specific	Project specific, regional and sectoral
2	Basis for Categorization	Currently, screening criteria available only for industrial projects, where assessment is done based on: • Level of pollution emission • Type of project and location • Scale of project • Operational activities Non–industrial projects are reviewed on a case by case basis by DOE	Detailed screening criteria for all projects based on • Sensitivity • Nature and magnitude of potential impacts

Sl	Criteria	Requirements as per GoB law	Requirements as per OP 4.01
3	EA Outputs	Since detailed rules and regulations for EA have not been prescribed, EA outputs are not specified. However, the industrial sector guidelines, the water sector guidelines and the road sector guidelines have specific EA output requirements, such as: • Baseline survey • IEE/EIA Report • Site clearance • Risk analysis and management • Analysis of alternatives	• EA Report • Analysis of alternatives • Environmental Management Plan
4	Public Consultation	No special mention is made for public consultation in BECA. Sectoral guidelines mentioned above have prescribed consultation.	Mandatory at the stage of • Preparation of EA • Project appraisal • Project design • Project implementation and monitoring
5	Disclosure of Information	BECA makes no reference to disclosure. The Sectoral guidelines prescribe some provisions for disclosure	Mandatory at • Summary of project description an potential adverse impact • Summary of EA report and conclusion • EA report
Social/Resettlement		**1982 ORDINANCE**	**OP 4.12**
6	Coverage	Legal owners Share-croppers Tenants	All affected parties, including squatters and illegal occupant
7	Compensation	Based on market values over previous 12 months No provision for restoration of income streams	Replacement cost at current market price Requires livelihood restoration component.
8	Uses of material from dismantled structures	Material is to be auctioned after being compensated for it	Material can be taken and re-used by affected party
9	Minimization of impacts	Discourages unnecessary acquisition but no mechanisms to monitor	Alternative analysis required to justify avoidance and/or mitigation of impacts
10	Cut-off dates	Not addressed	Important to ensure that squatters are included in compensation and to prevent rent-seeking behavior of additional squatters settling onto project land

Sl	Criteria	Requirements as per GoB law	Requirements as per OP 4.01
11	Consultation	No consultation required	Consultation as core issue in RAP preparation and implementation
12	Livelihood restoration	Not addressed	Livelihood restoration component and attention to post-resettlement required

Construction Camps: All Labor Sheds/camps will be built for the workers, although most of the local workers from the surrounding villages who prefer to stay in their houses. During construction of camps for accommodation of workers internationally recognized guidelines such as IFC/EBRD workers accommodation guidelines will be ensured.

Traffic Management: There are some bazars (markets) and shops beside the embankment of the Polders, which are important for socio-economic and livelihood of the people of the polder area. The construction activities along the embankment may temporarily disrupt the market activities causing hindrance to movement of the local people, who will suffer due to their limited roadway movements during construction.

Mitigation measures:

- The works on the embankment will be carefully scheduled in consultation and coordination with local representatives to minimize the impacts on local markets and transportation routes.
- The embankment works will be carried out in segments and the soil will be placed linearly on half of the embankment, leaving the other half to be used as track. After the completion of the first half, it will be opened for the local traffic and then the work for the other half of the embankment will be undertaken.
- Local routes will be kept free, as far as possible, if unavoidable, alternative routes will be identified in consultation with the local community.
- The Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock.
- The works shall not interfere unnecessarily or improperly with conveyance of public to use public or private roads or footpaths.
- Special consideration will be given for preparation of the traffic control plan to the safety of pedestrians and workers at night.
- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the cross section.

In regards to the increase of Vehicular Traffic during mobilization – EIAs include procedures to ensure: adequate signaling for traffic and pedestrian safety, speed limits for project-related trucks when crossing heavily populated areas and dust control measures and to manage noise levels. This also applies to 6.4.5 Hindrance of Pedestrian and Vehicular Movement. These aspects are comprehensively covered by the EHS Guidelines, as per the said web-link:

http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

Mangrove Afforestation: Afforestation for polders 41/1, 40/2, 47/2 and 43/2C is envisaged. Mangrove vegetation has immense contribution to protect the embankments and char land from tidal surge, provides fuel and thatch materials to the local inhabitants as well as creates ideal habitats for the local avifauna and other wild animals. Given the importance of mangroves, and the fact that survival rates of replanted mangroves tends to be very low, Mangrove afforestation will be carried out as per a specific afforestation plan volume-V Part-C (1- Forestry). These activities will be guided by a Sr. Forestry Expert for which there is a provision under PMU.

EHS Guidelines: Section on *Environment, Health and Safety Guidelines* for all 6 EIAs polder will follow the EHS Guideline 1 (General). The link to the document is as follows:

http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehsguidelines

Pesticides: The CEIP-1 is basically an infrastructure improvement project and not an agricultural project. The handling of pesticides is not a part of project activities. Although intensive afforestation is a part of project activity, the provision of nursery is not included in project activities. The interventions under the proposed project may result in an increased availability of irrigation water through cleaning and excavation of watercourses in the Polder. This increased water availability can in turn potentially increase the usage of agro-chemical fertilizers and pesticides. To address this eventuality, linkages will be developed with the up-coming Consultancy Services (NGO), the TOR is consistent with Integrated Pest Management policy that would address the indirect impact highlighted by the EIAs.

The Department of Agriculture Extension (DAE) is mandated for all types of agricultural extension activities including the preparation and implementation of Integrated Pest Management Plan (IPMP) and Integrated Crop Management Plan (ICMP). The DAE conducts capacity building both for IPMP& ICMP. The scope of project activities did not include DAE. The DAE will start its activities after successful completion of the project.

However, the pollution will be cross checked through testing of soil and water parameters as approved by ECR, 1997, DOE, Bangladesh throughout the Project period (see table below).

Table: Standards for Inland Surface Water

Sl. No.	Designated best use classification	Values			
		pH	BOD (mg/l)	DO (mg/l)	Total Coliform (number/100m l)
A.	Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less

Sl. No.	Designated best use classification	Values			
		pH	BOD (mg/l)	DO (mg/l)	Total Coliform (number/100m l)
B.	Water usable for recreational activity	6.5-8.5	3 or less	5 or more	200 or less
C.	Source of drinking water for supply after conventional treatment	6.5-8.5	6 or less	6 or more	5000 or less
D.	Water usable by fisheries	6.5-8.5	6 or less	5 or more	----
E.	Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
F.	Water usable for irrigation	6.5-8.5	10 or less	5 or more	1000 or less

Source: Standards for Water Schedule 3 of Environment Conservation Rule 1997

Periodic Maintenance Works: The BWDB monitoring unit has postings of 4 Assistant Chiefs and 2 Deputy Chiefs to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP-1, the Environment Social Communication Unit will provide training to the BWDB people responsible for monitoring of environmental compliance. Thus, a smooth transition to BWDB will happen to ensure environmental compliance during the O&M after the project completion. These staff will be responsible to manage the environmental aspects of the operation and maintenance of polder, its water control structures, and other relevant issues such as protection of key environmental resources of the older and maintain fish migration. Water Management Organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (November 2000) and involve the beneficiary communities. WMOs will be trained by BWDB to ensure environmental management during project operation. The Environmental Management Unit of BWDB will ensure and oversee the environmental management during project implementation and operation. The Water Management Organization will also be trained and involved in EMP implementation during the operation phase.

Mitigation Measures: Chapter 6 addresses location specific impacts and mitigation measures. Whereas, Table 10.1usually presents measures for environmental code of practices based on the experience and generic mitigation measures for EMP. Table 10.1 also uses in conjunction with polder specific measures. Thus, measures mentioned in Chapter 6 are not concur with each and every code of practices in the Table 10.1.