Government of the People's Republic of Bangladesh

Ministry of Water Resources

Bangladesh Water Development Board

Project Name: Coastal Embankment Improvement Program, Phase 1 (CEIP-I)

Sub-Project: Polder 39/2C

(IDA Credit no. 4507-BD)

Final Report

On

Environmental Impact Assessment (EIA) CEIP-I

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House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 8817648-52, Fax: 880-2-8823128

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Abbreviations and Acronyms

ASA	Association for Social Advancement
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
CCP	Chittagong Coastal Plain
CDS	Coastal Development Strategy
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
CES	Consulting Engineering Services
CAFOD	Catholic Fund for Overseas Development
CZPo	Coastal Zone Policy
DAE	Department of Agricultural Extension
DevCon	Dev Consultants Ltd
DOE	Department of Environment
DPHE	Department of Public Health engineering
DPM	Design Planning & Management Consultants
DTW	Deep Tubewell
EA	Environment Assessment
ECA	Environment Conservation Act
ECC	Environmental Clearance Certificate
ECR	Environment Conservation Rules
ECRRP	Emergency 2007 Cyclone Recovery and Restoration project
EDS	Environmental Data Sheet
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ES	Environmental Screening
ESBN	Estuarine Set Bag Net
FAO	Food and Agriculture Organization
FGD	Focus group Discussion
FRSS	Fisheries Resources Survey System
FWIP	Future-with-Project
FWOP	Future-without-Project
GIS	Geographical Information System
GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
HTW	Hand Tubewell

HYV	High Yielding Variety
IDA	International Development Association (World Bank)
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
IS	Institutional Survey
IUCN	International Union for Conservation of Nature
KAL	Kranti Associates Ltd Bangladesh
KII	Key Informant Interview
KJDRP	Khulna-Jessore Drainage Rehabilitation Project
LLP	Low Lift Pump
MC	Main Consultant (for CEIP-I Feasiblity study)
MDP	Meghna Deltaic Plain
MOEF	Ministry of Environment and Forest
MOWR	Ministry of Water Resources
MSL	Mean Sea Level
NCA	Net Cultivated Area
NGO	Non-Governmental Organization
NOC	No Objection Certificate
NWRD	National Water Resources Database
O&M	Operation and Maintenance
PAP	Project Affected Person
PCM	Public Consultation Meeting
PCD	Project Concept Document
PID	Project Information Document
PIO	Project Implementation Office
PL	Post Larva (fish seed)
PRA	Participatory Rural Appraisal
PRSP	Proverty Reduction Strategy Paper
PWD	Public Works Department
RCB	Reinforced Concrete Box
RRA	Rapid Rural appraisal
SEA	Strategic Environmental Assessment
SEO	Secondary Education Office
SLR	Sea Level Rise
SRDI	Soils Resources Development Institute
SSO	Social Service Office
STW	Shallow Tubewell
TDS	Total Dissolved Solids
TOR	Terms of Reference
UFO	Upazila Fisheries Office
UNDP	United Nations Development Program
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WAO	Women Affairs Office

WARPO	Water Resources Planning Organization
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: When preceding a crop means broadcast (B. Aus)

Bagda: Shrimp (*Penaeus monodon),* brackish/slightly saline water species.

Bazar: Market

Beel: A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.

Bepari: Middleman in the marketing chain who transports the products to the other places, use of term depends on the location, sometimes also used synonymously with retailer.

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.

Faria: Local trader/agent/intermediary.

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.

Haat: Market place where market exchanges are carried out either once, twice or thrice a week, however not every day.

Jaal: Different types of fishing net to catch fish from the water bodies.

Jolmohol: Section of river, individual or group of *beel*s (depression), or individual pond owned by the government but leased out for fishing. They are also called Jalkar, or Fishery.

Jhupri: Very small shed for living, made of locally available materials. One type of houses 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. The channel 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).

Kua/Kuri: This is a small ditch in agricultural farm that retain water during dry period. Also used as fish-trap. This also refers to deeper sites in the beel areas wherein the water is retained all through the year including the dry periods. These are sites for the natural spawning of native fishes.

Kutcha Toilet: The earthen made latrin consist of a hole without cover.

Mahajan: Powerful intermediary in the value chain or traditional money lender.

Perennial Khal: Water available in the khal all the year round.

Pacca: Well constructed building using modern masonry materials.

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 be connected to a septic tank system.

Executive Summary

Introduction

The Government of Bangladesh has undertaken the Coastal Embankment Improvement Project, Phase 1 (CEIP-I) to rehabilitate coastal polders considering present and future vulnerabilities with climate change scenarios. In the first phase, 17 polders out of around 139 have been selected for rehabilitation/improvement works under CEIP-I. Polder 39/2C is a proposed new polder of the CEIP out of the 17 selected polders.

The overall objective of the Environmental Impact Assessment (EIA) study of Polder 39/2C is to ensure that environmental and social management practices are integrated in the design, construction, operation and maintenances of the polder.

Approach and Methodology

The EIA study has been carried out following the DoE guidelines and the Environmental Management Framework (EMF) for CEIP-I. Similarly, the World Bank's environmental safeguard policies require an environmental assessment to be carried out for projects being considered for financing. The present EIA aims to fulfill both these requirements.

Project Description

The proposed Polder 39/2C is located in two upazilas namely, Bhandaria and Mathbaria upazilas under Pirojpur district and Kathalia upazila under Jhalakati district of Bangladesh. The administrative and management control lies with BWDB's Pirojpur O&M Division under its southern zone. The polder covers a gross area of about 10,748 ha of which net cultivable area is 8,500 ha (79% of the total land).

Water related problems like saline intrusion, drainage congestion, sedimentation and shortage of irrigation water and tidal flooding have increased severely in this area. Consequently, the lives and livelihoods of the communities here have been disrupted. A 20 km long embankment exists along the Baleswar River (Kacha). The side slopes of the embankment are being damaged and eroded in different places mainly due to river erosion and wave action. The overtopping that had occurred during the cyclone Sidr (2007) had also damaged and eroded the embankment in many locations. The total length of the embankment will be re-sectioned as per the design crest level recommended in the CEIP study.

Proposed Interventions under the rehabilitation and improvement plan

To meet the objectives of the CEIP-I, the following key improvement works will be carried out in Polder 33/2C considering climate change scenario, which were projected in IPCC and in Bangladesh Climate Change Strategy Action Plan:

1	Construction of new embankment	34 km
2	Re-sectioning of embankment	18 km

2	Construction of retired embankment	10 km
4	Construction of drainage sluices	13 nos.
5	Construction of flushing inlets	15 nos.
9	Re-excavation of drainage channels	57.23 km
10	Bank protection works	2 km
11	Slope protection of embankment	2km
12	Closure dam	8 nos.
13	Afforestation on the foreshore areas	22.50 ha

Note: Proposed crest level of embankment are 5.00 mPWD and 5.50m PWD

Analysis of Alternative

Three alternatives scenarios were considered for the Project during feasibility study. These included the 'no project' alternative, the site selection alternative and the technical alternative. These alternatives have been used to prepare the rehabilitation plan of Polder 39/2C. A comprehensive multi criteria analysis was carried out to prioritize the polder the polder rehabilitation under CEIP-I.

Environmental and Social Baseline

The baseline of Polder 39/2C is illustrated in the report as existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the polder area.

Physical Environment

The climate of the project area is tropical in nature with three seasons. The trend analysis shows that the maximum temperature of around 34ºC occurs in the month of April and the average temperature of about 26º C occurs during monsoon. Annual average rainfall in the project area is 1,946 mm. Air pollution is not of much significance in the coastal areas of Bangladesh. The measured air quality parameters (SPM, SOx, NOx) lie within the range of standard values for Bangladesh.

Water Resources

Bank erosion of the Baleswar River due to wave action is a problem in the polder area. The embankment on the western side of the polder along the Baleswar River (Kacha) is *mostly damaged due to river erosion.* In the absence of any embankment on the eastern side along the Pona River, tidal water frequently enters the polder areas and damages crops.

Land and Agriculture

The net cultivable area is about 79% of the gross area. Other 112.5 % and 8.5 % of areas are covered by settlements and water bodies respectively. Around 24%, 69% and 7% of the net cultivable land falls under High land, Medium high land and Low land respectively. The soils salinity have low to very high condition in the dry season and soil salinity level and pH range from 4.9-18ds/m and 5.2-7.6 respectively.

In the polder, the total cropped area is around 12,653 ha of which rice occupies around 11,314 ha and the remaining 1,339 ha of land is covered by non-rice crops. Rice is the dominant crop in the polder area occupying around 89% of the total cropped area. Annual rice production is about 18,791 metric ton and non-rice crop production is about 7,060 metric ton. The overall cropping intensity in the study area is around 149%.

Fisheries Resources

The total fish production of the polder area is around 728 MT. A large volume of the inland fish production (73%) comes from culture fisheries. Fish production trend from capture fisheries is declining in the polder area due to silting of internal khals and indiscriminate fishing activities. Perennial khals such as *Nadmulla Khal*, *Hetalia Khal*, and *Bamoner Khal* along with other seasonal internal khals are used as feeding and shelter ground of most of the open water fishes. These khals are marked as areas of conservation significance.

Ecological Resources

The polder sites have the characteristics of one of the important bio-ecological zones of the country namely the Ganges Floodplain. The floodplain is characterized by mixed vegetation and supports a habitat of rich bio-diversity due to the presence of many stagnant water bodies and channels, rivers and tributaries. The major divisions found within the terrestrial ecosystems of the project area are i) Agricultural land, ii) Settlement/ homestead vegetation, iii) Embankment and roadside vegetation, and iv) Fallow lands. Aquatic habitat in this area includes external rivers, internal channels and homestead ponds. Beels and other water bodies support a good amount of free floating aquatic vegetation.

Scio-economic

Currently (2012), the population of the polder area is 87,861of which 42,929 male and 44,932 female, and the male-female ratio is 51:49. The estimated total household number is 20,525 and the average household size is 4.28. The density of population is about 835 persons per square kilometer. The literacy rate in the polder area is 61.6% of which male literacy is 61.9% and female literacy is 60.3%. Agriculture is the main occupation in the polder area followed by fishing and agriculture labor. A significant number of landless/marginal farmers of Polder 39/2C have migrated out from their villages in search of livelihood.

Climate Change

Bangladesh is vulnerable to current coastal hazards and anticipated Sea Level Rise (SLR) because of its low elevation. Climate change aspects in global, regional and local perspectives and the likely impacts on the project area and its surroundings have been considered during the environmental and social impact assessment. Drainage congestion and water logging are already an alarming problem in Bangladesh specifically in the polder area and likely to be exacerbated by SLR and increased river flooding. The IPCC projections have been considered during the selection of the proposed intervention for the rehabilitation/development of the polder. The following criteria have also been used for climate change scenario in 2050.

a. Sea level rise of 50 cm;
b. 10% increase in maximum wind speed of cyclones; and
c. Rainfall increase by 26% from March through May, and 13% increase from June through August.

Stakeholder Consultation and Disclosure

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 were of the opinion that its implementation would be important for their survival. They had no objection at all to the project being implemented. They also expressed the opinion that if the monitoring plan was implemented properly during the pre-construction, construction, post-construction and operation periods, they would help the implementing agency spontaneously. Public disclosure meetings have also been carried out for disclosing the impact of the Project and the Environmental Management Plan (EMP).

Significant Environmental Impacts and Mitigations

Significant environmental and social impacts caused by various activities during the project phases as well as the proposed appropriate mitigation measures have been assessed. The major environmental components in the polder to be impacted are classified as High, Moderate and Low. One of the high impact on the environmental components would be that around 97 hectares of land would be acquired for construction of new embankment, drainage and flushing sluices and retired embankment. Due to land acquisition 956 households will be displaced and air and water contamination and noise generation would be caused during the establishment and construction of site facilities. Land use pattern in the polder area will be changed temporary during the construction of labor sheds, contractor's office and material stockyard. Eight households and twenty shops will be affected during the construction of labor sheds. Traffic, excavation and filling operations may create some safety hazards for the local population as well as for the construction workers.

During construction activities, fish migration between the rivers outside the polder area and internal *khals* is likely to be affected. Similarly, khal re-excavation and construction of closures would also affect fish migration within the polder between khals and low lying. Fish migration through the internal water channels will be partially affected in the polder during construction of drainage and flushing sluices but fish migration would be fully obstructed during the construction of closures. Fish species, particularly the smaller ones such as *Chingri, Baim, Baila, Tengra, Punti, Gulsa* etc, take part in partial fish migration through bypass channels.

During the post construction phase, lateral fish migration of mild to moderate saline tolerant fish species would be hampered directly. These fish species would include Poa (*Pama pama*), Tulardandi (*Sillago domina*), Phasa (*Setipinna taty*), Chewa (*Taeniodes anguillaries*), Boal (Wallago attu) etc. Moreover, most of the brackish fish species, such as Bhetki (*Lates calcarifer*), Phasa (*Setipinna taty*), Harina Chingri (*Metapeneaus monocerus*) and freshwater fish (*Labeo rihita*, *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 the decline of fish production in the study area and ultimately affect the dependent livelihoods. On the other hand, culture fish production might be improved compared to baseline conditions due flood protection as well as saline water intrusion.

During construction, some environmental factors may be impacted negatively leading to increased noise level, air pollution, and social conflicts. These negative impacts will be reduced by proper mitigation measures, which will also change the significance of residual impacts.

Cumulative and Induced Impact

The polder is surrounded by Polder 38 (north) and 37 (west). Polder 35/1 is among the five polders under CEIP-I, located in the downstream of the Kacha River, and hydrologically connected with Polder 39/2C. The design crest level of Polder 35/1 is 6-6.5 m (above MSL) whereas the level of Polder 39/2C is 5 – 5.5 m. The implementation of CEIP-I in 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. The diverted river water may actually generate increased hydraulic pressure on the embankments of Polder 39/2C. Also over the years, the Baleswar River and Kacha River may accumulate increased amounts of silt and reduce in depth. This incident would hamper the aquatic balance and also increase chances of flood 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 lakes and rivers i.e. the Ponadon River would undergo frequent congestion. Especially during low tides, the Ponadon River becomes shallower. In the next few years, there is a possibility of the Ponadon River being filled up permanently due to accumulation of silt and lower velocity of flow.

Environmental Management Plan

The EMP has been prepared to ensure the implementation and monitoring of the mitigation measures by the study. Institutional arrangements have been planned for effective execution of the EMP, and an Environment, Sociology and Communication Unit (ESCU) will be establishedas a part of the institutional arrangements.

Capacity building and training of BWDB officials and stakeholders will carried out to facilitate proper implementation of the EMP. The following contents will be considered in the training.

- Environmental and socio-economic awareness;
- Environmental and social sensitivity of the polder area;
- Key findings of the EIA;
- Mitigations measures;
- Social and cultural values of the area;
- Road safety, vehicle movement time, defensive driving, earth material dumping, cultural values and social sensibility;
- Strengthening of water management organizations (i.e. WMGs, WMAs and WMF) and beneficiaries organizations; and

- Camp operations, waste disposal, health and safety, and natural resource conservation.

Environmental Mitigation and Monitoring Plan during pre-construction and construction phase

- Compensation will be provided to actual PAPs according to the RAP. Involvement of local government authority such as Union Parishad Chairmen and Upazila Nirbahi Officers (UNO) will be ensured.
- Labor sheds will be constructed on fallow land to avoid cutting down trees as much as possible . The contractor will carry out vegetation census to find out how many trees would need to be cut down or removed.
- Construction work will be avoided during crop harvesting and fish migration periods.
- Re-sectioning work will be done segment-wise. The time for earth work for re-sectioning of embankment during market (haat) days could be shortened for easy movement of local people.
- Surface soil will be kept in separate areas during construction. After completion of the works, that soil will be placed on the surface.
- Water will be sprayed on soil and temporary fences will be put up at the construction sites.
- Construction machineries and vehicles will be kept in good working condition and properly operated. A traffic management plan will be made and applied properly. The movement of vessels or engine boats will be avoided during foggy and bad weather.
- Wildlife or local livestock will not be harassed, captured, hunted, eaten or killed.
- Noise pollution will be restricted during the day and noise levels will be properly monitored
- Diversion channels will be provided to avoid obstacles for fish migration. Construction works will be avoided during fish migration periods e.g. from May- July and September-October.
- Dredging activities will be implemented in the proposed locations of the Baleswar (Kacha) and Pona rivers. The dredging activities will be conducted with intervals of a certain number of days in order to ensure revival of benthic communities.
- Weather signals will be considered by the contractor during construction works. Radio and television will be kept in all the labor sheds for getting daily weather forecast.
- All workers will be provided with and use appropriate Personal Protective Equipment (PPE). First aid will be provided with procedures in place to access appropriate emergency facilities.
- Public awareness training and workshops on safety and health risks will be conducted for local communities prior to and during construction operations.
- Proper turfing will be done using local grasses (eg: Durba) along the embankment slopes after completion of re-sectioning; Plantation of suitable species (e.g. Babla, Rain tree etc.) on the embankment slopes and structures on the ground should be made after completion of construction.

Environmental Mitigation and Monitoring Plan during pre-construction and construction phase

- Water Management Group (WMG) will be formed before the construction or re-sectioning work of the embankment. Funds will be allocated for the WMG to help them tackle all emergency situations.
- Involvement of Community Based Organizations (CBOs) in monitoring the WMG will be ensured.
- Fish friendly structures will be constructed at Upper Pona Khal, Lower Pona Khal and Nodmollar Khal.
- Operation and Maintenance (O & M) of all water regulatory structures will be strengthened.
- Proper operation of water regulatory structures and timely opening of structure gates will be ensured during fish breeding period.
- A gate operation manual will be prepared and provided to the WMOs for proper handling of the structures. The manual will be translated into Bangla.
- Fish species should be conserved through construction of deep pools in major khals like Nodmollar Khal, Hetalia Khal and Bamoner Khal.
- Net pen culture will be introduced in Darulhuda Khal, Hainter Khal, Poddarer Khal and Mollar Khal.
- Integrated pest management (IPM) and integrated crop management (ICM) will be practised.
- Structural measures such as geo bags, sand bags etc. will be stored on local BWBD office premises for emergency hazard management.

The cost for implementing the EMP is estimated to be BDT 106.55 million (1.323 million US$) only. The total implementation cost for the project including EMP cost is BDT 4290.4 million (52.32 million US$D).

The EIA study has indicated that the proposed interventions for the rehabilitation and strengthening of Polder 39/2C may not have any major irreversible adverse impact on the environment. Instead, the proposed interventions will help to protect the lives and livelihoods of the communities within the polder area from daily tidal inundation, cyclones and tidal surges, salinity intrusion, water logging as well as vulnerabilities from climate change induced sea level rise.

1. Introduction

The Government of Bangladesh (GoB) is planning to implement the Coastal Embankment Improvement Project, Phase I (CEIP-I), under which seventeen polders will be rehabilitated and improved in the coastal area of the country. The GoB is seeking 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 the first batch of five polders have been carried out. This document presents the EIA report of Polder 39/2C, which is one of these five polders. The remaining four EIA reports are presented separatly.

1.1 Background

Bangladesh is a low lying country. 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 strength of the tides and the flatness of the delta causes the tides to influence river processes a long way upstream in the southern estuaries. This entire area is called the coastal zone. The coastal zone, in its natural state, used to be subject to inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges.

In the 1960s, polderization was started in the coastal zone of the country to convert this area into permanent agricultural lands (see **Figure 1.1** for coastal polders). 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. The polders lands are slightly higher than sea level. The polders were designed to keep the land safe from daily tide to allow agriculture activities. Without embankments the coastal communities would be exposed to diurnal tidal fluctuations. These polders are equipped with inlet and outlet sluice gates to control the water inside the embanked area.

The coastal embankment system of Bangladesh was originally designed without much attention to storm surges. Recent cyclones brought substantial damage to the embankments and further threatened the integrity of the coastal polders. In addition to breaching due to cyclones, siltation of peripheral rivers surrounding the embankments have caused the coastal polders to suffer from water logging**,** which ha led to large scale environmental, social and economical degradation. Poor maintenance and inadequate management of the polders have also contributed to internal drainage congestion and heavy external siltation. Soil fertility and 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 readjust its strategy on the coastal area from only ensuring protections against high tides to providing protection against frequent storm surges as well. The long term objective of the government 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 of embankment improvement and rehabilitation will be adopted over a period of 15 to 20 years. The proposed CEIP-I is the first phase of this long term program.

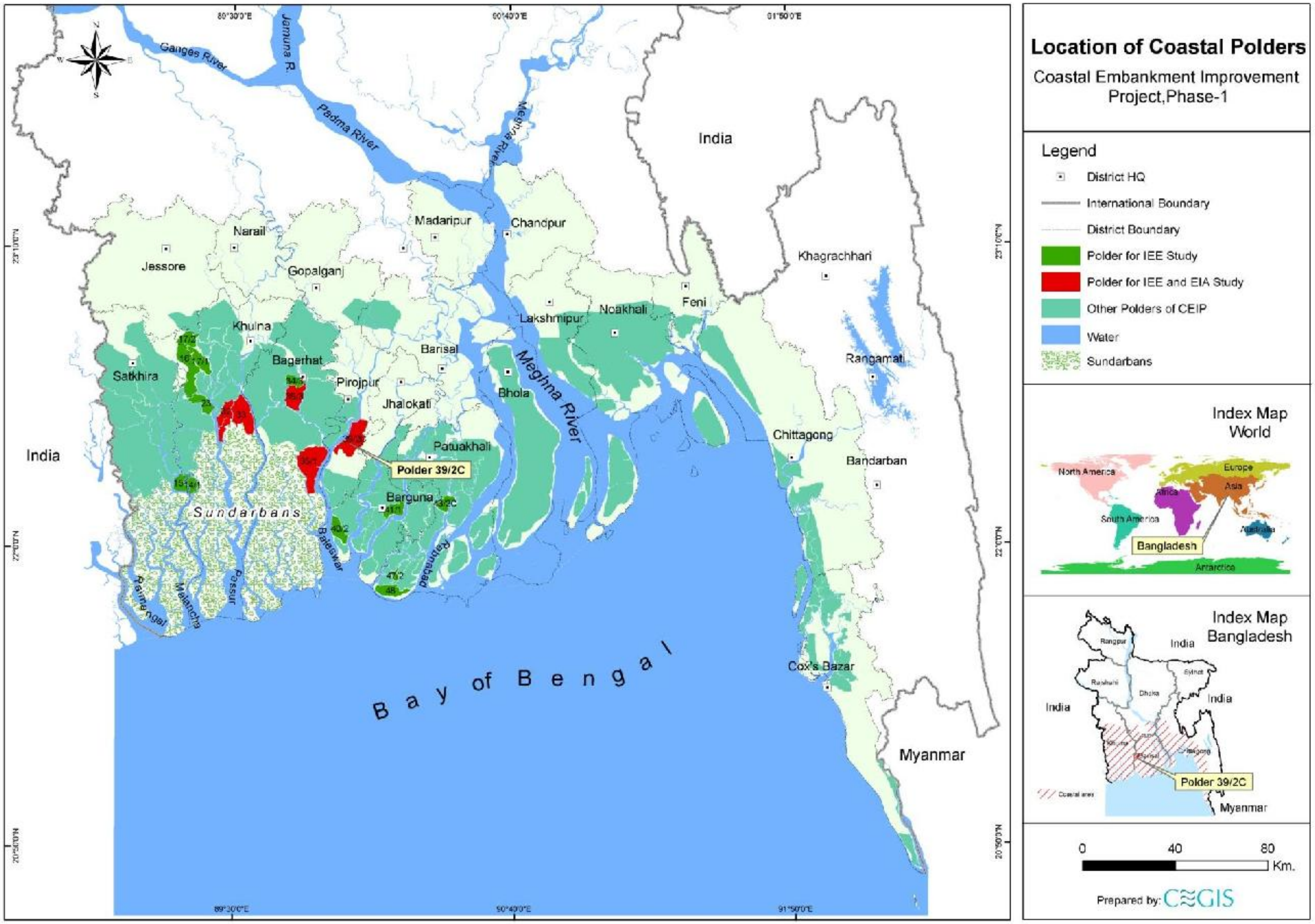

Figure 1.1: Coastal Polders

1.2 Project Overview

Polder 39/2C is located in two upazilas namely, Bhandaria and Mathbaria under Pirojpur district and Kathalia upazila under Jhalakati district of southern Bangladesh (see **Figure 1.2**). The polder covers a gross area of 10,748 hectare (ha) of which net cultivable area is 8,500 ha. 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. To meet these objectives, the following key improvement and rehabilitation works (see **Table 1.1**) will be carried out in Polder 39/2C:

Table 1.1: List of development works under different components

Sl. No.	Components	Quantity
1. Earth work (Embankment)		
a.	Construction of new embankment *(Design crest level from 4.5 mPWD to 5.50 m PWD)*	38 km
b	Re-sectioning of embankment	18 km
c	Retired embankment	10 km
2. Protective works		
a.	Slope protection of embankment	2 km
b.	Bank protection	2 km
3. Structural Works		
a.	Construction of drainage sluice	13 Nos
b.	Construction of flushing inlets	15 Nos
4. Re-excavation works		
a	Re-excavation of drainage Channels	57.23 km
5	Closure dam	8 nos
6	Afforestation	22.50 ha

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

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

Further details of the Project are presented later in the document.

1.3 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 to be carried out for projects being considered for its financing. The present EIA fulfills both of these requirements.

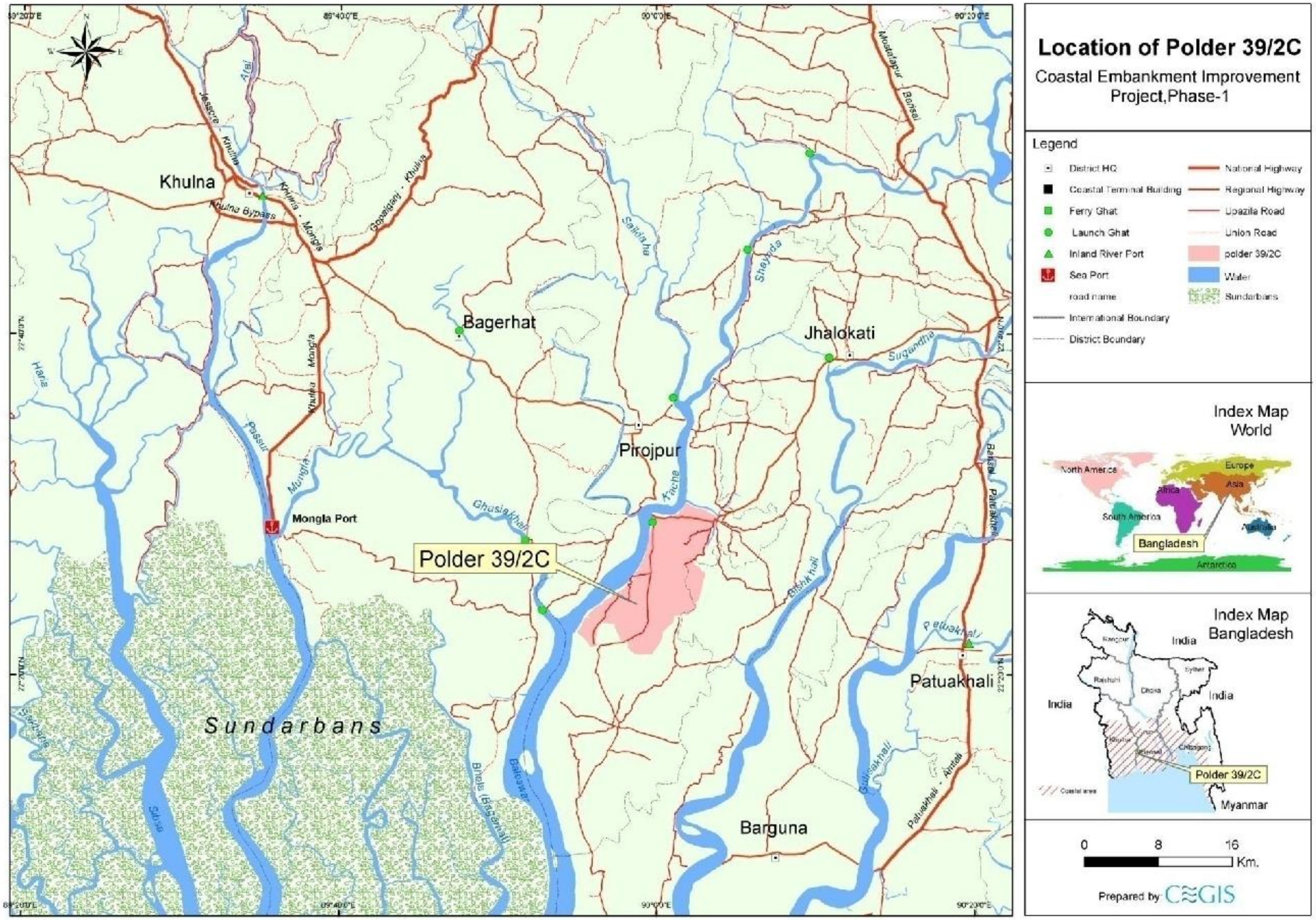

Figure 1.2: Location of Polders 39/2C

1.4 Objectives of the Study

The overall objective of the EIA study of Polder 39/2C is to ensure that environmental and social management practices are integrated in the design, construction, operation and maintenance of the polder. 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 existing environmental and social conditions of the Project area (the project area is defined as the entire area inside the polder, work area outside the polder embankments, borrow areas and spoil disposal 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 Environmental Management Plan (EMP).

1.5 Scope of Works

The scope of work under the present EIA study for Polder 35/1 includes the following:

- Carry out detail field investigation of required parameters of environmental and social baseline, especially on the critical issues.
- Determine the potential impacts of project through identification, analysis and evaluation of sensitive areas (natural habitats; and sites of historic, cultural and conservation importance), settlements and villages/agricultural areas or any other identified Important Environmental and Social Component (IESCs).
- Determine cumulative environmental impacts of the project that may occur inside and outside the project area.
- Distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, and unavoidable or irreversible impacts.
- Identify feasible and cost effective mitigation measures for each impact predicted as above to reduce potentially significant adverse environmental impacts to acceptable levels.
- 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 be generated by the project. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing fish migration routes, destruction of local habitats, and water logging.
- Consult with modeling consultants to establish conformity of the impact assessment with existing and ongoing mathematical models on climate change developed by a

number of reputed firms. The developed models may be available from the Main Consultant and implementing agency;

- Prepare (a) an estimate of economic costs of the 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 of the mitigation and enhancement measures that the project is likely to require, and financial benefits, if any; the damage/ cost and benefits should be estimated in monetary value where possible, or otherwise describe in qualitative terms.
- Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives that would 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 be 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.
- Identify the specific reciprocal impact of climate change and polder. Check the suggested polder height with respect to Sea Level Rise (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 pass should be provided to ensure free movement of fish or drainage facility should be provided to avoid water logging in the surrounding area.
- Prepare detailed Environmental Management Plans separately under the respective EIA to monitor the implementation of mitigating measures and the impacts of the project through other inputs (such as training and institutional strengthening) needed during construction and operation. Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strengthening) needed to implement the plan.
- Ensure means of addressing occupational health and safety in the EMO for the construction workers;
- Develop an Environmental monitoring format for regular monitoring of the project at the pre-construction, construction and operational stage;
- Prepare the EIA report

1.6 EIA Study Team

A multidisciplinary team from CEGIS has conducted the EIA study. The study team was comprised of the following:

Water resources engineer/ team leader:	Mohammed Waji Ullah

Water resource expert	Mohammed Sarfaraz Wahed
River morphologist:	Nazneen Aktar
Socio-economists:	Dilruba Ahmed Subrata Kumar Mondal
Soil and agriculture specialist:	Mujibul Huq
Agronomist	Anil Chandra Aich
Fishery specialists:	Mohammed Mukteruzzaman Ashraful Alam
Ecologist/Junior ecologists:	Ashoke Kumar Das Mohammed Amanat Ullah Mohammad Kamruzzaman
Environmentalist:	Ashraful Alam
Geographical information system (GIS)/remote sensing (RS) specialist:	Kazi Kamrull Hassan
GIS/RS analysts:	Mohammed Saidur Rahman Hasan Tawfique Imam
Junior engineers/Junior environmental engineers:	Syed Ahsanul Haque, Mohammed Shibly Shadik Mohammed Shakil Ahmed Mohammed Jafrul Alam Kanak Kanti Kar

The report has been reviewed by K.B. Sajjadur Rasheed, PhD, Environment Specialist, former Professor of Geography and Environment, University of Dhaka.

1.7 Structure of the Report

Chapter 1 ***(Introduction)*** describes the background of the project, project overview, regulatory and policy framework, objectives of the study, and scope of works with a list of the EIA study team.

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

Chapter 3 (***Policy, Legal and Administrative 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 (***Project Description***) provides a simplified description of the Project and its phases, key activities, manpower, equipment, and material requirements, implementation arrangements, implementation schedule, and other related aspects.

Chapter 5 (***Analysis of Project Alternatives***) discusses various alternatives considered during the feasibility and design stage of the Project, and their environmental and social considerations.

Chapter 6 (***Environmental and Social Baseline***) describes the existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the project area.

Chapter 7 (***Climate Change***) discusses the climate change aspects in global, regional and local perspectives and the likely impacts on the project area and its surroundings.

Chapter 8 (**Stakeholder Consultations and Disclosure**) provides details of the consultations held with the stakeholders at the project site and the framework for consultations to be carried out during the construction phase. Also included in the chapter are the disclosure requirements for the EIA.

Chapter 9 (***Significant Environmental Impacts and Mitigations***) assesses the potential impacts of the proposed interventions on the environmental components. The chapter also proposes appropriate mitigation measures to eliminate, offset, or reduce the potential impacts.

Chapter 10 (*Cumulative and Induced Impacts*) assesses the impact of the project on the upstream and downstream surrounding areas considering spatial and temporal induced impacts.

Chapter 11 (***Environmental Management Plan - EMP***) specifies the implementation arrangements for the mitigation measures identified during the EIA study and described in the previous chapter. The EMP includes among others mitigation plan, an enhancement plan, a contingency plan and the environmental monitoring plan.

2. Approach and Methodology

This chapter presents the detailed approach and procedure employed to conduct the EIA study. Also described in the chapter are data sources and methodology of data collection, processing and impact assessment.

2.1 Overall Approach

The EIA study for the rehabilitation of polder 39/2C has been carried out following the DoE guidelines and the Environmental Management Framework (EMF) for the CEIP-I. The overall approach of the study is shown in **Figure 2.1** below.

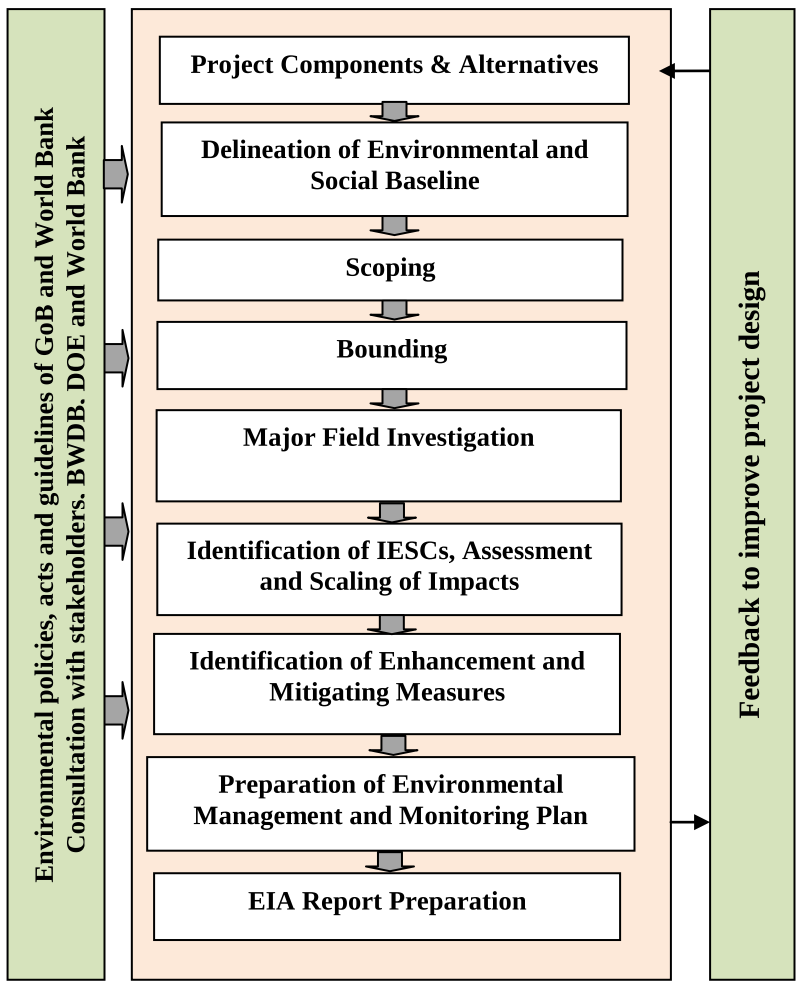

Figure 2.1: Overall approach of the EIA study

2.2 Methodology

The step-wise detailed methodology followed for the EIA study is briefly described below.

2.2.1 Project Area of Influence

At the outset of the study, the Project area of influence (or project area for short) was broadly demarcated. This included the area inside the polder where most of the project interventions would take place, 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.

2.2.2 Analysis of the Project Components and Alternatives

Detailed information on the proposed project including objective, nature and location of interventions, construction works, and other related aspects was obtained from the Main Consultant of CEIP-I.

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

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.

2.2.3 Data Collection for Environmental and Social Baseline

Initially a reconnaissance field visit was conducted in the project area to identify the project and location and its functional objectives. Subsequent to this, Rapid Rural Appraisals (RRAs), Participatory Rural Appraisals (PRAs), Focused Group Discussions (FGDs) and interviews with key informants were conducted to collect data and information on the environmental and social aspects of the Project area. Local knowledgeable persons including community representatives, traders, teachers, 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.

The baseline condition of the project area was drawn according to the information collected from secondary and primary data sources through literature review, field investigations and consultations with different stakeholders. The baseline condition has been established with respect to water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic conditions including identification of problems in respect of the proposed project sites and adjoining areas.

The source and methodology of baseline data collection on water resources, land resources, agriculture, livestock, fishery, ecosystems, and socio-economic resources are presented in the following sections.

Water Resources

Water resource data in connection with river hydrology, river morphology, surface and ground water availability, drainage pattern, ground and surface water quality and water use were collected from secondary sources and primary data collection and analysis as well as observations by the professionals of the multi-disciplinary team backed up by feedback from the local people during field visits to the Project area. Major river systems were identified for hydrological and morphological investigation through historical and current 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), flash flood, risk of erosion and sedimentation.

Field visits at different stages of the study were made to the Project area and primary data on water resources components were collected. A checklist (Annex1) was developed and used to obtain the information on different resources. Local knowledgeable persons and community representatives were also interviewed. During field visits, the multidisciplinary EIA study team members made professional observations pertaining to their individual areas of expertise.

Meteorological data such as temperature, rainfall, evapo-transpiration, and humidity were collected and analyzed for assessing local climate which are directly related to water resources of the study area and the project area. Meteorological data for selected stations were collected from the National Water Resources Database (NWRD) of Water Resources Planning Organization (WARPO), which contains long series of temporal data showing daily values for meteorological stations maintained by the Bangladesh Meteorological Department (BMD). The topographical data were collected from Geological Survey of Bangladesh and NWRD.

Land Resources

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). The land type and soil texture data was collected from Upazila[1] Land and Soil Resources Utilization Guide of Soils Resources Development Institute (SRDI). The secondary data of these parameters was verified at field level through physical observations as well as consultations with the local people and officials of the Department of Agriculture Extension (DAE) during field visit. Land use information and maps were prepared from satellite image classification with field verification.

Agricultural Resources

Data on agricultural resources which included existing cropping patterns, crop variety, crop calendar, crop yield, crop damage, and agricultural input used were collected from both secondary and primary sources. Agriculture data were collected through extensive field surveys with the help of questionnaire and consultations with local people and concerned agricultural officials. Agricultural resources data were also collected from secondary sources from the DAE. Crop production was determined using the following formula:

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

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 were collected from the field for the last three years.

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

Livestock Resources

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 PRA, and RRA. Livestock resources data were also collected from secondary sources from Upazila Livestock Office.

Fish and Fisheries

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.

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 river, *khal* (water drainage channel), floodplain, borrow pit, and *beel* (a natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system). The culture fish habitats included homestead culture fish pond, commercial fish farm, shrimp *ghers* (farm lands converted into ponds with low dykes and used for cultivation of shrimp/prawn/fish).

Capture fish habitat was assessed on the basis of species diversity and composition, identification of species of conservation significance, identification of potential fish habitat prescribing to restore for fish conservation, fish migration survey, habitat identification for fish conservation. Culture fish habitat was assessed through homestead culture fish pond survey and commercial fish farm/ *gher* survey.

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

Relevant secondary data were collected from the UFO’s annual reports and various literature/study reports.

Fish productions for individual habitats were obtained from secondary information that was collected from the UFOs and literatures were blended with primary data in production estimation.

Ecological Resources

The ecological component of the EIA study focused on terrestrial and riverine ecology including flora, birds, reptiles, amphibians, mammals, and migratory birds. 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 ecosystem was generated through analysis of recent satellite imagery. Field investigation methods included physical observations, transect walk, habitat survey and consultations with local people. Field visits were carried out for establishing the ecological baseline condition. Public consultation meetings were carried out through FGD and Key Informants Interview (KII) methods. Inventory of common flora and fauna was developed based on field survey and data base of the International Union for Conservation of Nature (IUCN).

Socio-economic Data

Demographic information, such as population, occupation and employment, literacy rate, drinking water, sanitation, and electricity facilities were collected form 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.

The steps followed for collecting socio-economic data are as follows:

- Data were collected from Bangladesh Bureau of Statistics (BBS), 2001 and enumerated for 2010 the relevant literatures from BWDB and main consultant was also reviewed;
- Reconnaissance field visit and discussions with BWDB officials and local stakeholders were for primary data collection;
- PRA /RRA, FGDs, KII were carried out for primary data collection;

Institutional survey was conducted for primary data collection from district and upazila level.

2.2.4 Scoping

A structured scoping process was followed for identifying the Important Environmental and Social Components (IESCs) which would potentially be impacted by the proposed Project. This was achieved in two stages as follows. The EIA team made a preliminary list of the components which could be impacted by the Project. The second stage included village scoping sessions 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.

2.2.5 Assessment and Scaling of Impacts

At this stage, attempts were made to quantify the impacts of the proposed interventions of the Project as much as possible. Where quantification was not possible, qualitative impacts were assessed and scores were assigned with (+) sign for positive impacts and (-) sign for negative impacts. The magnitude of both positive and negative impacts was indicated in a scale of 1 to 10 based upon extent, magnitude, reversibility, duration and sustainability considerations. 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 future-without-project (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 Project area. Changes expected to be brought about due to proposed interventions under the Project were assessed to generate the future-with-project (FWIP) condition. Comparison and projection methods were used for impact prediction.

2.2.6 Identification of Enhancement and Mitigating Measures

From literature survey, applying expert judgment and consultation with stakeholders, possible enhancement and mitigating measures were identified for beneficial and adverse effects respectively.

2.2.7 Preparation of Environmental Management and Monitoring Plan

An environmental management plan (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.

2.2.8 EIA Report Preparation

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

3. Policy, Legal and Administrative Framework

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.

3.1 Relevant National Policies, Strategies and Plans

The key national policies, strategies, and plans relevant to environmental management and water resource management are briefly discussed below.

3.1.1 National Environment Policy, 1992

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
- 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.

The Policy is applicable to the CEIP-I and 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.

3.1.2 National Environment Management Action Plan, 1995

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.

3.1.3 National Water Policy, 1999

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.

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 be 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: Give full consideration to 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.

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

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

The National Water Management Plan (NWMP) 2001, approved by the National Water Resources Council in 2004, envisions to establish an integrated development, management and use of water resources in Bangladesh over a period of 25 years. Water Resources Planning Organization (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 a total of 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.

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

3.1.5 Coastal Zone Policy, 2005

The Government has formulated the Coastal Zone Policy (CZP) 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.

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.

The CIEP-I addresses some aspects of this Policy particularly those relating to the polder improvements.

3.1.6 Coastal Development Strategy, 2006

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

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

3.1.7 National Land Use Policy (MoL, 2001)

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 be not possible through artificial land reclamation process, which is cost-effective only in the long run. 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 be maintained. 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.

The CEIP will be designed in accordance with this Strategy and will comply with the above listed requirements.

3.1.8 National Agriculture Policy, 1999

The overall objective of the National Agriculture Policy is to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable food security system for all. Although the policy does not emphasize the coastal zone separately, all specific objectives are applicable to the development of coastal zone agriculture. The policy particularly stressed on minor irrigation capturing tidal water in reservoirs in coastal areas and research on the development of improved varieties and technologies for cultivation in coastal, hilly, water-logged and salinity affected areas. The policy also recognizes that adequate measures should be taken to reduce water-logging, salinity and provide irrigation facilities for crop production.

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

3.1.9 National Fisheries Policy, 1996

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.

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.

The CEIP-I interventions may facilitate fisheries production in coastal area. The guidelines of NFP may be integrated while designing and implementing the CEIP-I interventions. However, conflicts over agriculture and fisheries cultivation may accelerate in future.

3.1.10 National Livestock Development Policy, 2007

The National Livestock Development Policy (NLDP) 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.

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-I interventions will contribute to the safety of livestock and thus increase livestock productivity in coastal areas.

3.1.11 Standing Orders on Disaster, 2010

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 shelter center. 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, 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 neighboring 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.

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

3.1.12 National Adaptation Programme of Action (NAPA)

In 2005, the Ministry of Environment and Forest (MOEF), Government of the People's Republic of Bangladesh has prepared the National Adaptation Program of Action (NAPA) for Bangladesh, as a response to the decision of the Seventh Session of the Conference of the Parties (COP7) of the United Nations Framework Convention on Climate Change (UNFCCC). The basic approach to NAPA preparation was along with the sustainable development goals and objectives of the country where it has recognized the necessity of addressing climate change and environmental issue 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.

The CEIP-I broadly contributes toward achieving g the aims and objectives of the climate change adaptation strategies.

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

The Government of Bangladesh 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.

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

3.2 National Environmental Laws

3.2.1 Bangladesh Environment Conservation Act (ECA), 1995

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 industrial unit or 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.

In accordance with this Act, the CEIP-I will 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 coastal zone, defined by DOE under this act, will be considered while planning and designing of the CEIP-I project interventions.

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

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

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.

3.2.3 Bangladesh Environment Conservation Rules (ECR), 1997

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.

The Rule 3 defines the factors to be considered in declaring an area 'ecologically critical area' (ECA) as per Section 5 of ECA 95. 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 Sundarban, Cox's Bazar - 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. Beside these, recently the government of Bangladesh has declared four rivers such as Buriganga River, Turag River, Shitalakha River and Balu River around the Dhaka City as ECA.

The Rule 7 classifies industrial units and projects into four categories depending on environmental impact and location for the purpose of issuance of ECC. These categories are: Green, Orange A, Orange B, and Red.

All existing industrial units and projects and proposed industrial units and projects, that are considered to be low polluting are categorized under "Green" and shall be granted Environmental Clearance. For proposed industrial units and 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 industries has been given in Schedule-1 of ECR'97. Apart from general requirement, for every Red category proposed industrial unit or project, the application must be accompanied with feasibility report, Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA) based on approved ToR by DOE, Environmental Management Plan (EMP). As per ECR’97, water resources development projects fall under ‘Red’ category project. Therefore CEIP-I project is ‘Red’ category project which requires IEE, EIA and EMP for environmental clearance from DOE.

The ECR'97 describes the procedures for obtaining Environmental Clearance Certificates (ECC) from the Department of Environment for different types of proposed units or projects. Any person or organization wishing to establish an industrial unit or project must obtain ECC from the Director General. 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 favor of the Director General. 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.

3.2.4 Bangladesh Environment Court Act, 2010

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.

3.2.5 The Acquisition and Requisition of Immovable Property Ordinance, 1982

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).

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.

The land owner 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 land owners 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).

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

The State Acquisition and Tenancy Act (Sections 86 and 87) also define the ownership and use right of alluvion (*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.[2] However, the "original" owner(s) can claim the land if it reappears through natural process within 30 years. The original private owners cannot claim any eroded land if developed by the government through land filling for use in public purpose.

[2] 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.

3.2.7 Constitutional Right of the Tribal Peoples Rights

In the context of People's Republic of Bangladesh, the Constitution of Bangladesh does not mention the existence of the 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 favor 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.

3.2.8 Ethnic Minority Rights in PRSP 2005

Relevant strategic suggestions in the 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 property the 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.

3.2.9 GoB Laws on Land Acquisition

The principle 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 Government of Bangladesh 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 no property 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.

Inadequacies of 1982 Ordinance

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 Bank'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 lease-holders (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 productive base of affected farm families and infringe impoverishment risks to those physically or economically displaced due to undertaking of infrastructure projects.

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 almost always results in

prices that are far below the actual market prices[3]. 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[4].
- *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 for ensure economic rehabilitation and social reintegration of the displaced persons.

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.

3.2.10 Other Relevant Acts

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.

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

[3]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.

[4]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.

Act/Law/Ordinance	Brief description	Responsible Agency
Rules for Removal of Wrecks and Obstructions in inland Navigable Water Ways (1973)	Rules for removal of wrecks and obstructions	IBWTA
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 Forest Act (1927)	Regulates the protection of forests reserves, protected forests and village forests	MOEF
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 World Bank's Environmental Safeguard Policies

Developers seeking financing from the World Bank 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.

3.3.1 Environmental Assessment (OP 4.01)

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 4.1 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.

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

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.

The proposed CEIP-I has been classified as Category A, since some of the potential impacts are likely to be significant and diverse. Furthermore, Sundarban – a protected area – is in the close vicinity of the Project location, and if appropriate safeguards are not integrated in the Project design and implementation, the adverse impacts can potentially extend to this sensitive area.

3.3.2 Natural Habitats (OP 4.04)

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.

This OP is not triggered for the proposed Project since the proposed activities will be undertaken in an area where natural habitat has already been modified to farm lands 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 Sundarban, which is a protected area.

3.3.3 Water Resources Management (OP 4.07)

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 also 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.

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

3.3.4 Physical Cultural Resources (OP 4.11)

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. [5]

- 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 so as 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.

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

- 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.

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.

3.3.5 Forestry (OP 4.36)

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 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.

This OP is not triggered since the proposed Project is not located in any forested area and will therefore not have any direct impact on forests. Any potential impacts on the nearby Sundarban forest will be forestalled with the help of appropriate mitigation measures included in the EMP, as stated earlier as well.

3.3.6 Projects on International Waterways (OP 7.50)

Projects on international waterways may affect the relations between the World Bank 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.

No Project activities are to be carried out in the rivers except some transportation. However this will not have any effect whatsoever on the upper riparian water usage or availability. Hence this OP is not triggered.

3.3.7 Pest Management (OP 4.09)

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.

The interventions under the proposed Project may result in an increased availability of irrigation water through cleaning and excavation of water courses in the Polder. This increased water availability can in turn potentially increase the usage of chemical fertilizers and pesticides. Hence this OP is triggered and an IPMP will be prepared during the Project implementation.

3.3.8 Indigenous Peoples (OP 4.10)

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:[6]

- 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.

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

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.

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.

3.3.9 Involuntary Resettlement (OP 4.12)

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.[7]

The overall objectives of the Policy are given below.

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.

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

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

- 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.

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.

3.3.10 Projects in Disputed Areas (OP 7.60)

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 neighboring 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.

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. [8]

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

3.3.11 Safety of Dams (OP 4.37)

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.

3.3.12 Public Disclosure of Information (BP 17.50)

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

Once finalized, the EIA report and Bengali translation of its executive summary will be disclosed to the public and will also be available on the official website of the BWDB. EIA will also be sent to the WB InfoShop.

3.3.13 Environment, Health and Safety Guidelines

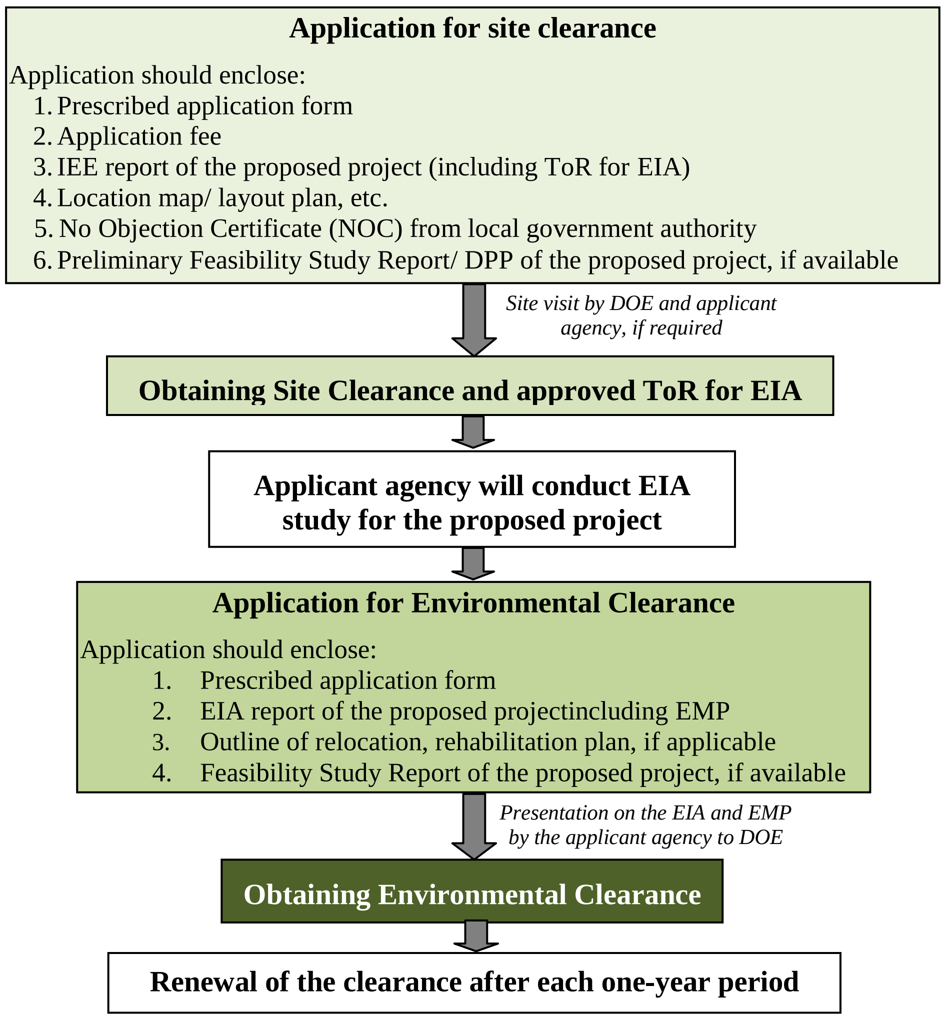
The Environment, Health, and Safety (EHS) Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities or project by existing technology at reasonable costs. These Guidelines will be applicable to the Project.

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

3.4 DOE Process for Environmental Clearance

The application procedure for obtaining site clearance and environmental clearance for the CEIP-I is shown in **Figure 3.1** below.

Figure 3.1: Process of obtaining Clearance certificate from DOE



3.5 International Treaties

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

Treaty	Year	Brief Description	Relevant Department
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
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 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

4. Project Description

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

4.1 Polder Overview

Polder 39/2C is located in three upazilas namely, Bhandaria and Mathbaria upazila of Pirojpur district and Kathalia upazila of Jhalakati 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 under Mathbaria and part of Chenchri union under Kathalia Upazila. The polder is 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 upazila Amua-Bharani and Pona Don to the south (Figure 4.1).The polder covers an area of 10,748 ha of which Net area available for cultivation is 8,500 ha.

About 28 km of embankment has been constructed out of a total of 61.50 km. No sluices have been constructed and all the internal Khals were kept open to the river. Since the peripheral boundary is 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 drainage congestion in the low lying areas.

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

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 the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.

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

In the polder area, the elevation of most of the cultivable land is between 1.40m (PWD) to 1.60 m (PWD). There are some low pockets where land elevation is less than 0.90m (PWD). The land elevation gradually goes down from the river bank 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 tide. Tidal water along with rainfall runoff remains stagnant at a depth of 1m to 1.5m over the land during monsoon and delays the cultivation of T-Aman. Sometimes seedlings and T. Aman are damaged due to overland deposition of sands 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 till 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.

The embankment segments damaged by Sidr and re-constructed by BWDB have been damaged by Aila again. Some segments of the embankment have fallen under the thrust of wave action and some are engulfed by river erosion. No sluices and embankment have yet been constructed along the Bahar Khal Bhuter Khal. There is metalled road constructed by LGED along Pona river in the South and in the North. The internal drainage channels have become silted up which needs to be re-excavated to improve local drainage.

Water related problems like saline intrusion, drainage congestion, sedimentation and shortage of irrigation water and tidal flooding have increased severely in this area. Consequently, the life and livelihood of polder's community have been disrupted. In this situation, new embankments including all kinds of structures of polder 39/2C need to be constructed under the CEIP to improve socio-economic condition as well as quality of life of the people of the polder.

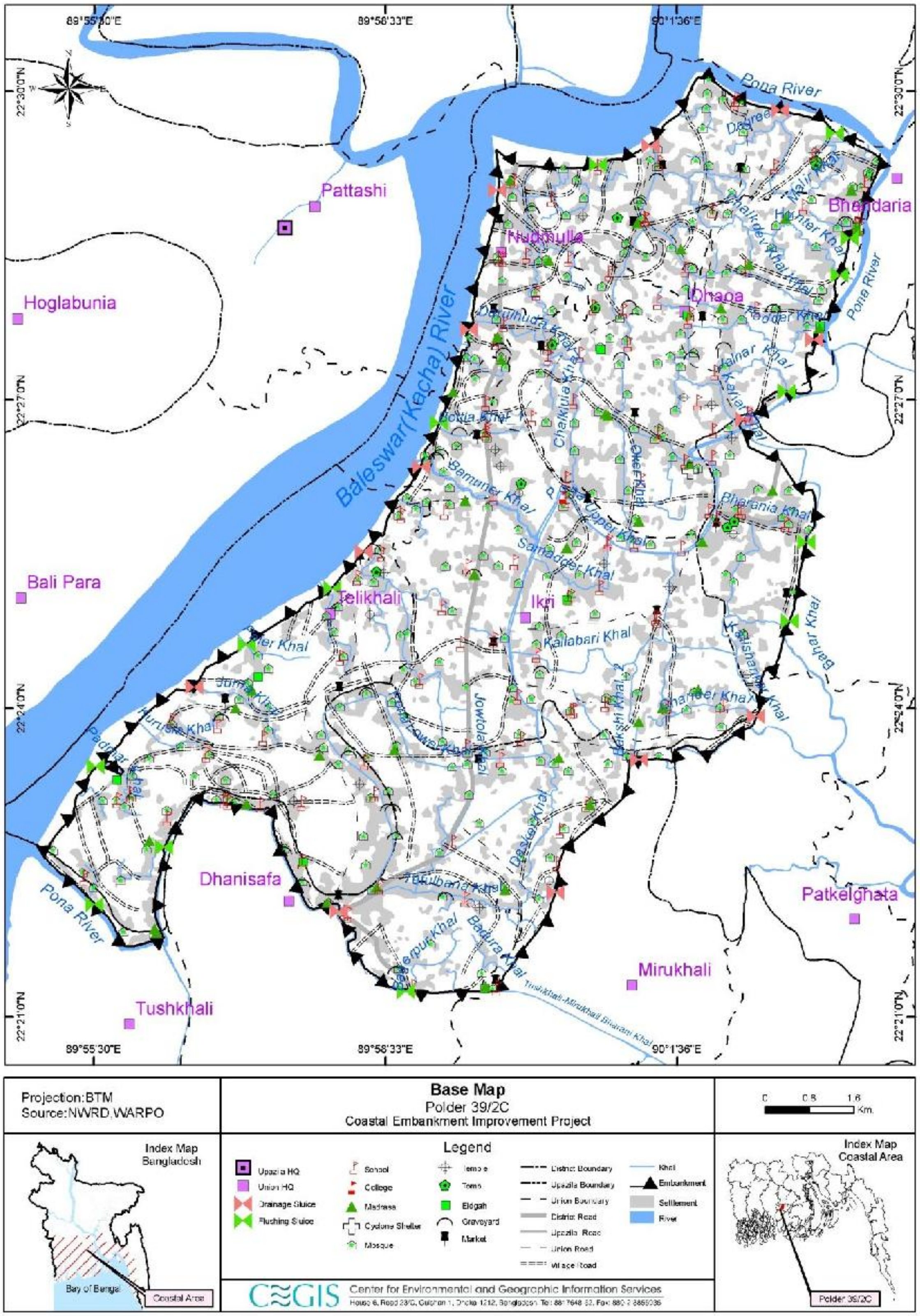


Figure 4.1: Alignment of the embankment and existing structures of the polder

4.4 Description of the Polder and proposed intervention

The embankment is proposed to be constructed for this proposed new polder under CEIP as per present context based on surge height and sea level rise due to climate change scenarios. Two types of embankment has been proposed (1) “Interior-dyke” having side slopes C/S 1:2 and R/S 1:3 with crest level 5.50mPWD from km 33.70 to km52.20 along the bank of Baleswar (Kocha), to the West and crest level 5.00mPWD from km 52.20 to km 61.50 along the bank of Pona River, and (2) Marginal -dyke with crest level 4.50mPWD 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.

The proposed interventions in Polder 39/2C under CEIP-I are listed in **Table 4.1** and shown in **Figure 4.3**.

Table 4.1: Proposed Interventions in Polder 39/2C

1	Construction of new embankment	34 km
2	Re-sectioning of embankment	18 km
2	Construction of retired embankment	10 km
4	Construction of drainage sluices	13 nos.
5	Construction of flushing inlets	15 nos.
9	Re-excavation of drainage channels	57.23 km
10	Bank protection works	2 km
11	Slope protection of embankment	2km
12	Closure dam	8 nos.
13	Afforestation on the foreshore areas	22.50 ha

Source: Feasibility Report of CEIP, 2012

4.4.1 Works on Embankments

Under the proposed interventions for the development of new polder, a total of 18.00 km of embankments will be re-sectioned and their height will be increased to 5.50mPWD (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 mPWD (Ch. 54.50km- 55.00 km and Ch. 55.50km- 62.30 km) under the proposed interventions in the Polder 39/2C. Moreover, a total of 7.60 km of embankments will be retiredas shown in the **Table 4.2** below.

Table 4.2: Detail of Works on Embankments

	Description	Chainage (km)	Height m (PWD)	Length (km)
1.	New embankment	0.00 to 34.00	4.50	34.00

	Description	Chainage (km)	Height m (PWD)	Length (km)
2.	Re-sectioning (Increasing the height of embankments)	34.00 to 34.20 36.00 to 37.00 38.80-39.60 42.80-51.50 54.50-55.00 55.50-62.30	5.50 5.50 5.50 5.50 5.00 5.00	0.20 1.00 0.80 8.70 0.50 6.80
3.	Retirement	34.20to 36.00	4.50	1.8
4.		37.00 to 38.50	5.00	1.8
5.		39.6 to 42.8	5.50	3.2
6.		51.50 to 54.5	5.00	0.3
7.		55.00 to 55.50	5.00	0.5

Source: Feasibility Report of CEIP, 2012

Description of construction activities

During pre-construction phase, labor sheds should be constructed with proper sanitation and other required facilities before the commencement of construction activities for embankment works. A suitable site shall be selected and prepared by cleaning bushes, weed, trees etc. Alignment of embankments has to be fixed with adequate base width. Base stripping and removal of trees, weed etc will be done as per instruction of the Engineer in charge. The tools required for construction of embankments will be procured during this period. After validating the final design, excavation of soil/carried earth will be followed and deposited in a selected area. Soil will be dumped with layers. 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 be developed after proper compaction of layers. Then required turffing with grass will be provided on embankment. Watering and fertilizing will also be provided.

4.4.2 Construction/Repairing of Drainage Sluices

A total of 13 number of new drainage sluices will be constructed under the proposed interventions of the rehabilitation works of the Polder 39/2C. The detailed description of these sluices has been given in **Table 4.1**.

Description of construction activities

During pre-construction activities for construction of drainage sluices i.e. construction of labor shed, development of sanitation and other facilities etc should be done at the commence of the work i.e.. During this period, required construction materials (sand, cement, wood, shuttering materials etc.) will be procured by the contractor as per tender schedule. Meanwhile, a suitable site will be selected and prepared for construction of the sluices. Before starting the construction activities of drainage sluices, Ring bundh and diversion channel will have to be constructed. After that the foundation treatment required for the structure will be carried out. The CC and RCC works along with cutting, bending and binding of rods will then be 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 be carried out. Gates will be properly painted. The intake and outfall of the gate will be constructed as per design. The CC blocks will be made for river training works and pitching works will then be conducted

4.4.3 Construction/Repairing of Flushing Inlets

Fifteen numbers of new flushing inlets will be constructed under the proposed interventions for the development work of Polder 39/2C. The detailed description has been given in **Table 4.1**.

Description of construction activities

A labor shed 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 be procured simultaneously. A suitable site of the structure will then 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 be carried out. Then the RCC works, pipe and machine pipe along with construction allied and fittings will be made along with construction of and collar joints will be made as and where required. After few days of constructions the gates both in the upstream of each flushing inlets will be executed. 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 make the flow to be channeled through the flushing gate.

4.4.4 Re-excavation of Drainage Channels

A total 57.23 km length from eleventh channels of the polder will be re-excavated to continue water flow and decrease the drainage congestion. An estimated volume of 0.0269 million cubic meters of soil/silt will be excavated from these channels. The excavated soil will be used for strengthening the *khal* banks, in addition to making it available to the farmers. The water channels to be re-excavated under the project are presented in **Table 4.3.**

Description of construction activities

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 will be made for the re-excavation more and the design depth and width of excavation are to be noted. The entire channel will then be divided into a number of reaches. The excavation will be started from the upstream of the channel. Cross dams are to be provided of the starting and final locations of the reach, and then soil from the channels will be removed upto required depth and width. The excavated soil/sludge should be disposed into a suitable place, specified by the Engineer in charge, from where the sludge or soil will not affect the channel flow by any means. After finalizing excavation on one reach, the other reach in the downstream would be excavated using the above procedures.

Table 4.3: Channels to be Re-excavated

	Name of Khal (Channel)	Length (km)	Chainage(km)
1	Chokedev	5.50	3.80
2	Pona Upper	20.00	6.30
3	Baksih	3.00	15.25
4	Dasher	3.75	19.0
5	Junia	3.00	39.10
6	Telikhali	4.50	43.25
7	Chakluia	5.50	48.10
8	Hetalia	3.50	50.75
9	Nodmullar	4.00	54.45
10	Degrer	2.00	57.60
11	Bamuner	2.48	44.35
	Total	**23**	

Source: Feasibility Report of CEIP, 2012

4.4.5 Bank Protection and Slope Protection Works

Slope and bank protection works has been considered under the proposed intervention of the development works in the polder. Under the proposed intervention, two km slope and two km bank protection works along the Baleswar (Kocha) river will be carried out from chainage in between 34.00 km to 56.00 km and 51.50 to 54.50 km respectively (**Figure 4.3**).

Description of construction activities

The construction of labor shed, creation of sanitation facility and procurement of construction materials (sand, cement, wood, shuttering materials etc.) will be carried out before the starting of construction activities. At first the slope of the river bank as per design will be developed by earth. At the same time, the required CC blocks will be casted or manufactured and guard walls will be constructed. After completion of the preparation of CC blocks, Geo-textile bags will be placed 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 will be completed up to toe of the river banks. Finally, turfing will be made on the slope or crest of the embankments. Proper drainage provision will be kept to avoid formation of rain cuts for surface run off.

4.4.6 Afforestation

Afforestation is another intervention for development of the proposed new polder 39/2C. About 9 km afforestation will be made in the foreshore area around the embankment as protection against tidal surges, wave attack and strong winds in order to reduce toe erosion and to stabilize the embankment. Of the total area, 16 ha will be kept for timber (*Keaora, Baen, Chaila/Ora etc*.) species plantation and 6.5 ha will be kept for Golpata (*Nypa fruticans*) plantation. Before plantation, a temporary nursery will be established in the polder area to ensure the availability of seedlings. The spacing of seedling plantation will be 1.5m X 1.5 m. Suitable climate resilient mangrove species have been selected for the foreshore afforestation.

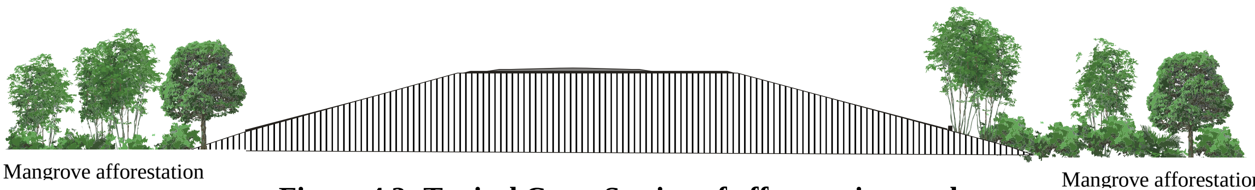


Figure 4.2: Typical Cross Section of afforestation works

Detailed information of afforestation with chainage is shown in **Table 4.4** below:

Table 4.4: Detail works of afforestation

Sl	Description	Chainage (km)	Length (km)
1	Afforestation	34.10 to. 35.21	1.11
2		37.00 to 40.17	3.17
3		50.75 to 52.13	1.38
4		56.13 to 59.25	3.12
	Total		**08.78**

4.5 Construction Details

4.5.1 Construction Schedule

The construction works of proposed new Polder 39/2C under the CEIP-I are expected to be completed in four years. The construction schedule is present in **Table 4.5**.

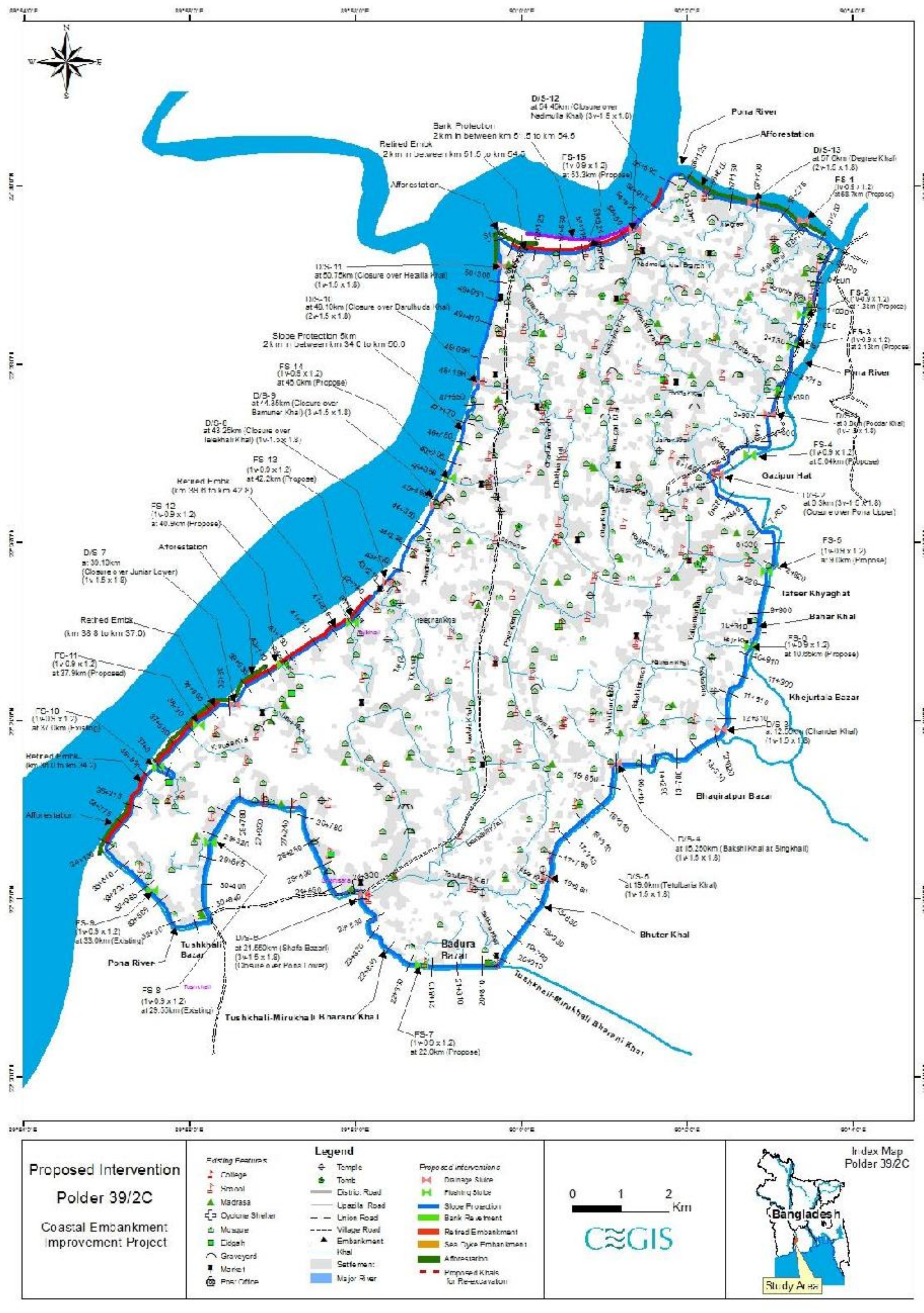


Figure 4.3: Location of Proposed Interventions

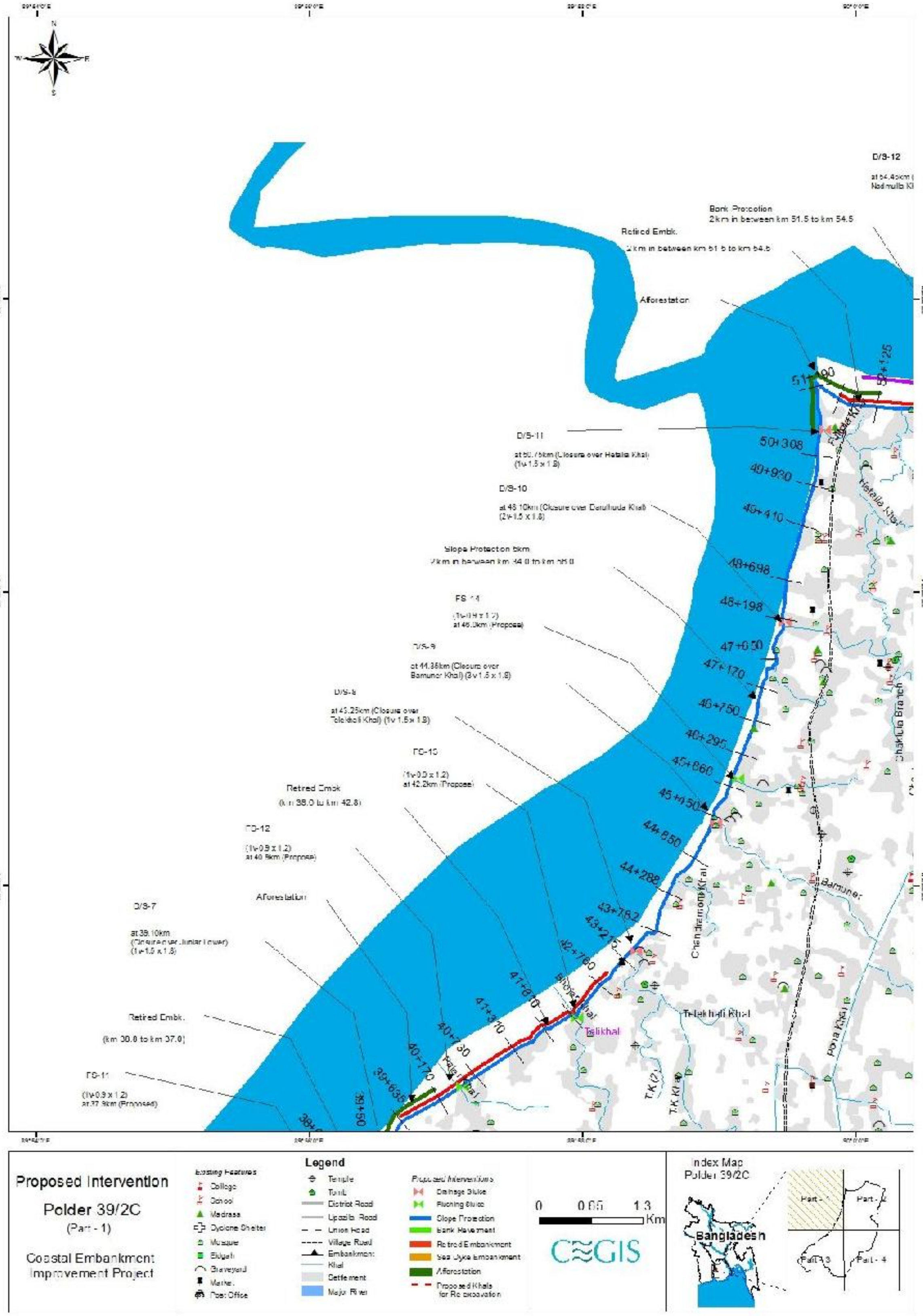


Figure 4.3 (a): Location of Proposed Interventions (Part 1)

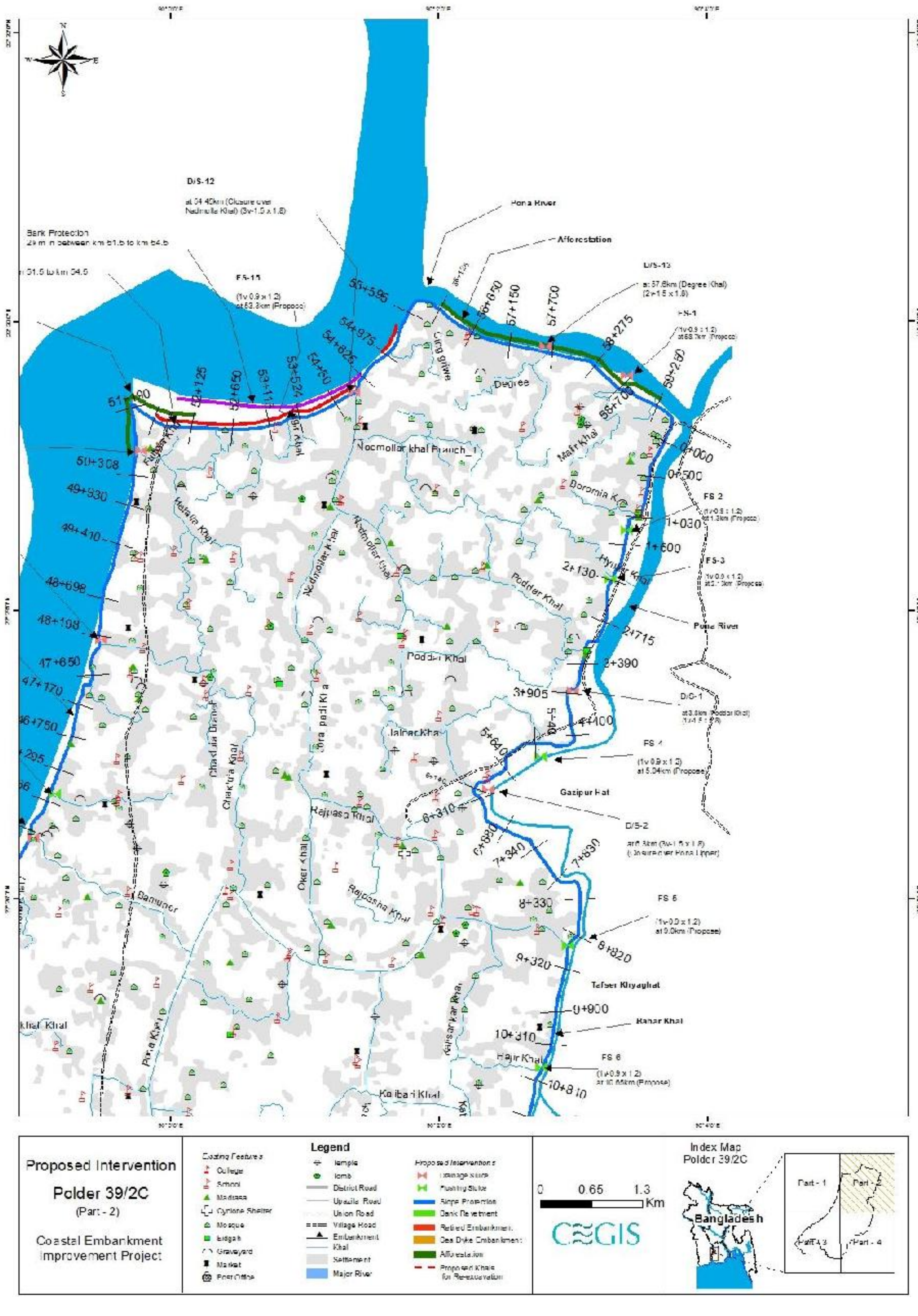


Figure 4.3 (b): Location of Proposed Interventions (Part2)

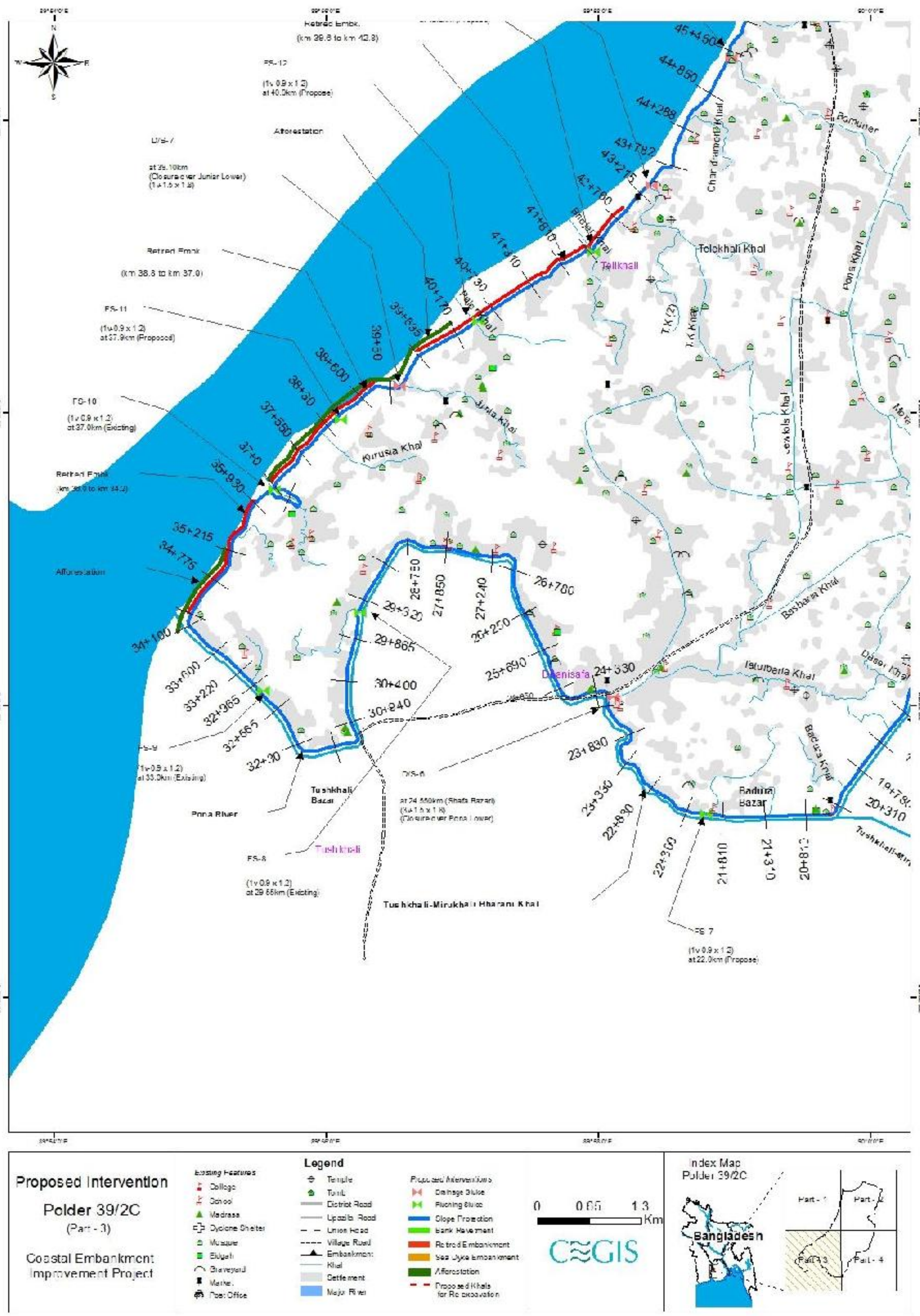


Figure 4.3 (c): Location of Proposed Interventions (Part3)

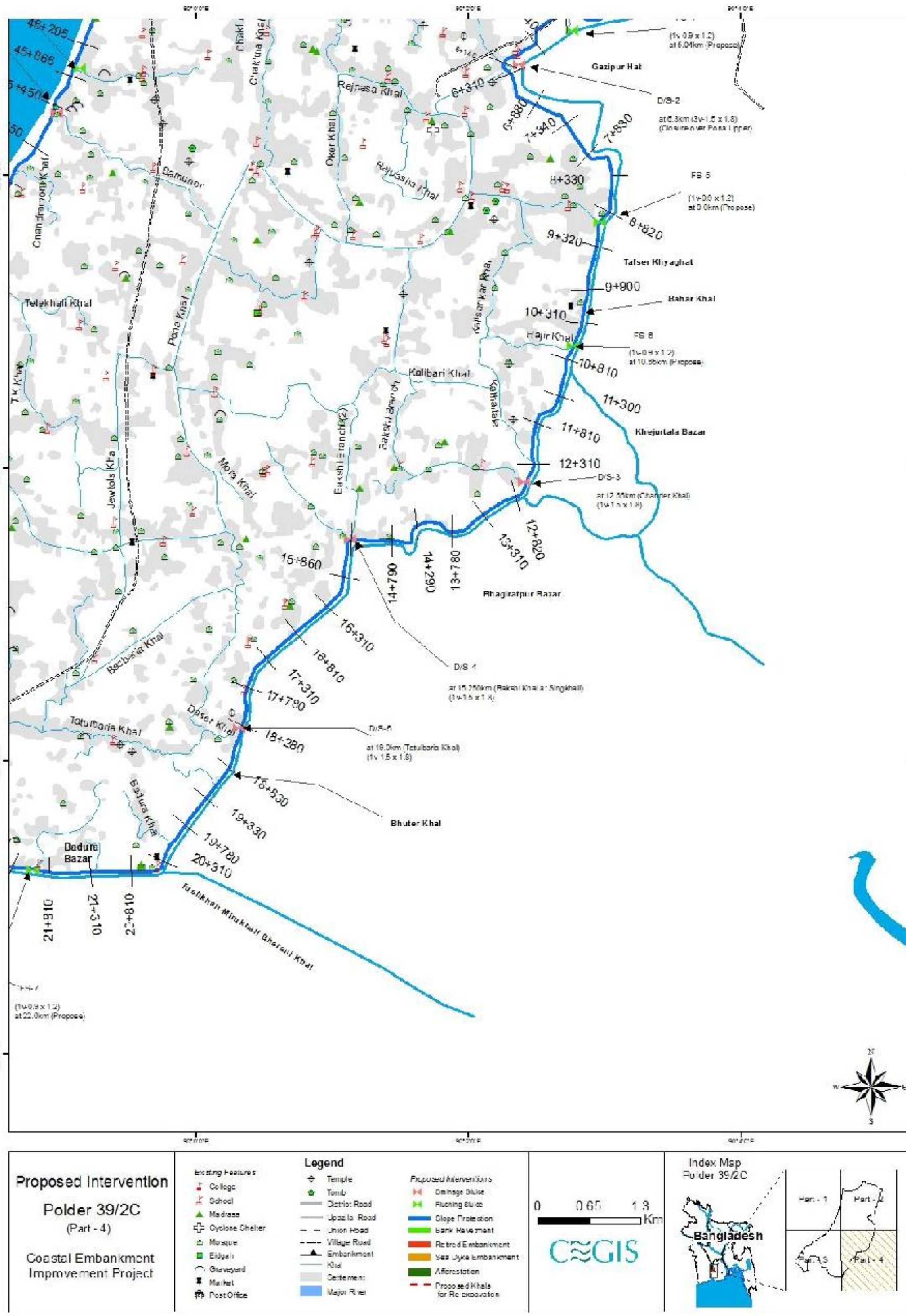


Figure 4.3 (d): Location of Proposed Interventions (Part4)

Table 4.5: Construction Schedule

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A.	**Pre-Construction Activities**																
A1	Discussion with local stakeholders about the project and interventions																
A2	Disclose rehabilitation plan																
A3	Distribute acquisition and requisition money before the construction works																
A4	Display Bill board on the intervention site for public awareness																
A5	Preparation of Stockyard for construction materials																
A6	Mobilization and site preparation																
A7	Higher Contractors through tendering procedure																
A8	Construction of labor shed and site office																
A1	*Labor shed and site office preparation*																
A2	*Installment of water and sanitation facilities*																
A3	*Installment of Garbage disposal system*																
B.	**Construction activities**																
C	**Procurement system of the project**																
C1	Procurement of construction																

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
	materials																
C2	Procurement of construction machineries and equipments																
D	**Rehabilitation of embankment**																
D1	Collection of earth materials from the borrow pit area from outside of the embankment through excavator, pay loader and dump truck and trolley																
D2	Collection of earth materials from Baleswar river through dredging																
D3	Use slow moving vehicles/head load for carrying earth materials																
D4	Dumping of earthen materials on the embankment																
D5	Keeping earthen materials for drying																
D6	Breaking dried earthen materials through Clod Breaker																
D7	Embankment surface labeling through dumper machine																
D8	Embankment slope pitching and turfing																
E	**Re-excavation of Canal**																
E1	Bailing out of water with all leads and lifts by manual labor or pump, with all arrangements for protection of ring bund and side slopes of foundation pit against erosion and washout																
E2	Earth work by manual labor with clayey soil (minimum 30% clay,																

	Description	Year 1				Year 2				Year 3				Year 4			
		Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
	0-40% silt and 0-30% sand) in construction of cross bund as per design and specification with all leads and lifts, throwing the earth in layers not exceeding 150 mm in thickness including breaking clods, rough dressing, cleaning the jungle, removing stumps, dug baling and 75mm cambering complete as per direction of Environmental specialist.																
E3	De-silting works of canal through excavator																
E4	Deposited the spoil earth both bank of the canal through pay loader , dump truck and trolley if necessary using head load as per design and specification																
E5	Earth work by manual labor in all kinds of soil in removing the gross bund/ring bund, including all leads and lifts complete and placing the spoils to a safe distance (minimum 15m apart from the bank) as per design																
F	**Replacement and repairing of regulator**																
F1	construction and repairing of drainage sluices																
F2	construction and repairing of flushing inlets																
G	**Bank revetment and slope protection works**																

	Description	**Year 1**				**Year 2**				**Year 3**				**Year 4**			
		Jan-Mar	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**	**Jan-Mar**	**Apr-Jun**	**Jul-Sep**	**Oct-Dec**
H	***Afforestation***																
H1	Land preparation																
H2	Fencing preparation and setting																
H3	Plantation of mangrove trees																

4.5.2 Construction Manpower Requirement

Skilled manpower is a major concern for construction and infrastructure development of any project. Technical and nontechnical manpower will be required for the Project construction works. The will include engineers, technicians, supervisors, surveyors, mechanics, foremen, machinery operators, drivers, and skill and un-skilled labors. Around 60 percent of labor will be engaged from the local area and remaining will be from outside. The estimated manpower requirement is presented in **Table 4.6**.

Table 4.6: Required manpower for construction

	Required Manpower	Number
1	Engineer	5
2	Driver	77
3	Mechanics	4
4	Surveyor	6
5	Skill labour	4,893
6	Un-skill labour	1,28,401

Source: FS Report, 2012

4.5.3 Construction Material

The construction materials required for new embankment, re-sectioning and retired embankment, water regulatory sluices and flushing inlets, and slope and bank protection work will include soil, cement, steel, and sand. Estimated quantities of these materials are presented in **Table 4.7**.

Table 4.7: Construction Materials

	Description	Quantity	Sources
Re-sectioning and retired embankment			
1	Earth work	19,55,201 m^3	Borrow pits, dredging spoils from re-excavation of drainage channels
Construction of sluices and flushing inlets			
2	Cement	2,16,795 bag	To be procured from local market
3	Sand	12548 m^3	To be procured from Khulna
4	Stone	28,233 m^3	To be procured from Khulna
5	Steel	553.0 Ton	To be procured from Khulna
Bank protection			
6	CC Blocks	2,49,375 nos	To be made at construction site during construction
7	Stones	79,2000 m^3	To be collected from Khulna

The carried earth for embankment rehabilitation will be collected from the offshore area of the polder 39/2C. The spatial location of the borrow pit areas are delineated in the Figure 1 under Annex 4. The details of borrow pit area are attributed in the following **Table 4.8**:

Table 4.8: Availability of earth in the 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)	
1	i) 1.10 km to 1.60 km	500m X10m X 1m	5,000 m^3	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 trace of sand
	ii) 1.60 km to 2.20 km	600m X 20m X1.5m	18,000 m^3			
	iii) 2.20km to 2.90 km	500m X10m X 1.5m	7,500 m^3			
	iv) 2.90 km to 3.40 km	500 m X5m X 1.5 m	3,750 m^3			
	v)3.80 km to 4.80 km	1km X20 m X1.5 m	30,000 m^3			
			64,250 m^3			
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 trace of sand
	ii)6.00 km to 9.00 km	3 km X 20m X 1.5m	90,000			
			97,500 m^3			
3	i) 9.00 km to 12.50 km	3.50 km X 20m X 1.5m	105,000 m^3	Bahar Khal	9.00 km to 12.50 K.m	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 m^3	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 trace of sand

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)	
	ii)13.80 km to 14.8 km	800 m X 25 m X 1.5 m	30,000 m^3			
			49,500 m^3			
5	i) 14.80 km to 20.80 km	6 km X 20 m X 1.5 m	180,000 m^3	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 trace of sand
6	i) 20.8 km to 23.80 km	3km X 20 m X 1.5 m	90,000 m^3	Mirukhali Bharani Khal	20.80 km to 23.80 km	Earth is available at borrow pit area
7	i) 23.80 km to 34.00 km	10 km X 15m X 1.5 m	225,000 m^3	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 trace of sand
8	i) 34 km to 36 km	i) 2 km x50mx1.5m	150,000 m^3	Locha	1) 34 km to 37 km	Earth is available at borrow pit area.
	ii) 36 km to 37 km	ii) 800mx10mx1.5m	12,000 m^3			
			162,000 m^3			

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)	
9	i) 37 km to 38.10km	1k m X 50m X 1.5m	75,000 m^3	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 m^3			
	iii) 39.60 km to 43.25 km	3.5 km X 50m X 1.5m	262,500 m^3			
	iv) 43.25 km to 44.20 km	800 m X 7m X 1.5m	8,400 m^3			
	v) 44.20 km to 48.10 km	3.5k m X 50m X 1.5m	262,500 m^3			
			644,400 m^3			
10	i) 48.1 km to 48.7 km	200m X 10m X 1.5m	3,000 m^3	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 m^3			
	iii) 49.10 km to 50.30 km	1.5 km X 50m X 1.5m	112,500 m^3			
	iv) 50.30 km to 50.75 km	0.4 km X 10m X 1.5m	6,000 m^3			
			130,500 m^3			
11	i) 51.20 km to 52.50 km	1 Km X 40m X 1.5m	60,000 m^3	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 m^3			
			240,000 m^3			
12	i) 55.50 km to 56 km	0.50 km X 10m X 1.2m	6,000 m^3	Pona	55.50km to 59.50 km	60% earth is available at borrow pit area and the rest quantity is to be
	ii) 56 km to 57.00km	1 km X 25m X 1.2m	30,000 m^3			
	iii) 57.00 km to 58 Km	1 km X 20 m X 1.2m	24,000 m^3			

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)	
	iv) 58.00 km to 59.50 km	1.2 km X 20m X 1.2m	28,800 m^3			collected from river bed
			88,800 m^3			
13	i) 59.50 km to 0.60 km	500 m X 15m X 1.2m	9,000 m^3	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 m^3			
			18,000 m^3			

4.5.4 Construction Machinery

Different type of construction machinery and equipment would be required for the construction activities in the Polder. A tentative list of these machinery and equipment is presented below.

Table 4.9: List of Construction Equipment and Machinery

Sl	Description	Quantity (number)
1	Boll-dozer	4
2	Dump- truck	7
3	Pay Loader	4
4	Excavator	4
5	Burge	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	Leveling Instrument	3
15	Total Station	1
16	De-watering System	13
17	Low lift pump	13

4.5.5 Construction Camps

Camp for labour will be constructed in all construction sites. A total of 70 camps for labor will be established during construction period. Out of the total camp, 40 camps for embankment works, 13 camps for sluice works, 12 camps for flushing inlet works, one camp for slope protection works, two cams for bank protection works, and one camps for closure dam works will be established. Contractor will select the location of the camp through consultation with local union parishad chairman and the local community inside the Polder, and after obtaining permission from the Supervision Consultants (Engineer).

Drinking Water and Sanitation System of Camps

At the labor camp premises near the all of construction sites, a total number of 47 tube wells will be installed for obtaining drinking water for camps and also for construction activities. Latrines with septic tanks along with safe disposal of sewage will be constructed for sanitation.

4.5.6 Vehicular Traffic during Construction

For development of the proposed polder, major quantity of earth will be carried to the embankment by mechanical equipment like excavators, pay loaders, dump trucks, trolleys and some minor quantity by manual labor.

The polder is surrounded by Baleswar (Kocha) River (west and north) and Pona River (east and south). All rivers are navigable throughout the year. There is no direct road communication between polder and upazila and district head quarters. During construction of works, the trucks or other vehicles will be used for district road coming from Pirojpur crossing the Char khali on ferry. Heavy equipment and construction materials including hard rock dumping materials and sluice gate equipment will be transported from Khulna on water vessels through Passur River and Baleswar River.

The construction materials would be collected from the stock yard and then would to be transported to the individual work sites through engine boat 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.

4.5.7 Jetty Construction

A temporary jetty near the location of stock yards will be constructed for unloading of construction materials during construction period.

4.6 Project Implementation Arrangements

Overall Project Management: 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 the 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): 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): BWDB will set up a PMU to oversee the development and management of the project. The PMU will be led by a project director 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.

The Procurement and Finance 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.

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.

A 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 Specialists, a Sr. Forestry Specialist a Revenue Staff and a Communication Specialist.

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

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.
- A *Design and Construction Supervision Consultancy* Firm 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 Project Supervision Consultant 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.
- A *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 5 renowned experts in the field of: morphology/river engineering; tidal river management/sediment specialist; geotechnical specialist, social specialist and environment/polderization specialist.

4.7 Community Participation

4.7.1 People's Participation of WMO/CBO

The National Water Policy (NWP) through its various provisions emphasizes the issues of participatory water management and highlights the importance of stakeholder participation for sustainable operation of the project. To ensure the stakeholders participation, Ministry of Water Resources, GoB has prepared guidelines namely *The Guidelines for Participatory Water Management (MoWR 2001)* usually known as GPWM. The aim and objectives of GPWM are as follows:

- Manage, operate and maintain the Project/ Sub-project/ Scheme;
- Maintain liaison with the Implementing Agencies, other concerned Public Sector Agencies, Local Government Institutions, Non-Government Organizations and Community Self-help Groups;
- Plan and coordinate the activities of the local stakeholders;

Mobilize local resources for contribution towards construction operation and maintenance costs.

BWDB managers and field staffs in divisions, sub-divisions and sections offices do not have adequate expertise and experienced manpower to carry out the O&M of coastal polders properly. Moreover at many places the numbers of field staffs are also insufficient and inadequate to the actual requirement. In this case to ensure sustainable operation of the project, participation of Water Management Organization (WMO) and Community Based Organizations (CBOs) is needed.

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) which has been considered in this project.

4.7.2 Water Management Groups (WMGs)

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 be treated as the primary society. The entire command area of the Polder will be sub-divided into few hydrological units preferably on the basis of 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, turn-outs 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 two or three villages and part thereof. One WMG may therefore include several hundreds to a few thousand as its primary members. As per GPWM, the registration of WMG is a must.

4.7.3 Water Management Association (WMA)

A numbers of WMGs functioning in Polder area will form a Water Management Association (WMA) 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 are chosen as 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. Registration of WMA is a must.

4.7.4 Water Management Federation (WMF)

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 requirement of WMF's registration may therefore be kept optional. 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 chair-person 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.

4.7.5 Participation of Community Based Organizations

Community Based Organizations often termed as CBOs can also play a vital role in maintenance activities. While engaging any of the functional groups of these CBOs in this polder, care should be 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. Under this project, CBOs are conceived to have been 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.

The Following CBOs have been recommended for this polder under CEIP.

Embankment Settler (ES)

ESs are families selected from squatters and project affected persons who do not have any land or lost it by land acquisition. They can be organized in functional groups for taking part in preventive maintenance of the embankments in specified reach (approximately 0.5 ha) where they are allowed to settle on 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 for certain period.

Embankment Maintenance Group (EMG)

EMGs are the groups formed from the destitute women (maximum 10 members per group) selected from landless families, who are responsible for carrying out preventive earthwork maintenance of a specified reach of embankment including grass turfs lying. They are the paid laborers on a daily basis payment.

Canal Maintenance Group (CMG)

CMGs are the groups consisting of 10 members selected from landless people and destitute women. Under this concept, they will be responsible for preventive maintenance of canals capacity improvement inside the polder and outfall drains. Activities of CMG 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.

Landless Contracting Society (LCS)

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 to carryout earthworks only up to a limit of Taka 3.00 lacs in a single contract. During formation of CBOs women participation in above mentioned groups will be ensured.

4.8 Operation and Maintenance Plan

Coastal polders surrounded by embankments in the coastal region protect 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. Most of the polders were constructed in the pre-liberation period i.e during the decades of sixties and early seventies. Over and above 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. But these are vulnerable to storm surges; high tides; annual floods; land erosion and drainage congestion. In many cases the structures as built have not been found adequate to cater to the diverse needs of the local people. Changes in the land use pattern also have created water management conflicts and newer dimension needs asking the structures to allow flows of water both ways. So maintaining the polder system with embankments and structural elements built over there has become a permanently important task.

The Coastal Embankment Improvement Program (CEIP) is one of the latest such interventions to address a systematic restoration and upgrading of 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 stakeholders participation and need based budgeting will continue to remain at the apex.

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 to prepare O&M plan for CEIP. Moreover, all the pros and cons of polders' O&M issues with BWDB's field staffs and local stakeholders have been considered for preparation of polder O&M planning. A brief description of O&M is given below.

4.8.1 Operational Plan

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. The activities given below have been recommended for the operation plan of Polder 39/2C.

Regulation of Gates

During the pre-monsoon period, the vertical lift gates of each regulator should remain closed for retention of water for irrigating Aus rice (group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season) crops by LLPs (Low lift pumps). 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.

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 are changing over time. 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.

Frequent Watching of Embankments

This is a typical monitoring activity to be carried out 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.

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.

Regular Checking of Structures

This is also a typical monitoring activity to be carried out 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. The functional groups under WMGs in the polders will assist the O&M Sectional Office of BWDB to identify and report the damages for rectification.

Condition Survey and Engineering survey

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

Supervision of Preventive Maintenance Works

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 and are implemented more or less continuously. The field staffs of O&M section of BWDB supervise all preventive maintenance works.

A good planning for operation of structures is very essential to avoid social conflict. In this situation, 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 needs of adjusting the operational measures.

Participation of beneficiaries vis-à-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.

4.8.2 Maintenance Works

Maintenance of embankments and structures is the most important item of activities in the coastal polders. It is necessary and cannot be avoided because 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.

In the coastal Polder 39/2C, only those works which directly serve water management should be regularly maintained.

Preventive or Routine Maintenance

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 round the year, almost continuously or as and when required. The works are mentioned 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

Periodic Maintenance

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 are implemented by LCBs, LCSs, and PICs (food for works). Periodic maintenance has the character of repair works and is identified during the field assessment at (more or less) regular intervals.

- Minor Periodic Maintenance Works
- Minor earth works on the embankments by LCSs, 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; and
- Re-excavation of Khals (costs< Tk.2.0 lacs/km) and removal of earthen cross dams by LCSs and / or PICs;
- 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;
- Re-excavation of Khals (costs > 2.0 lacs/km) by LCSs / PICs.
- Total estimated cost for maintenance including preventive and periodic cost as Tk. 547.42 lacs for polder 39/2C.

Emergency Maintenance

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. 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. The estimated emergency maintenance amount is at Tk. 250.00 lacs. The budget items do not cover unforeseen works as a result of major calamities like cyclones or tidal surges. Other sources of funding viz. donor assisted emergency programs should also be explored.

4.9 No Objection Certificate

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 name of the unions in the polder is: a) Nadmulla, Telikhali, Daowa and Ikri under Bhandaria upazila b) Mirukhali under Mathbaria and c) Chenchri union under Kathalia upazila. There are no archeological sites or any cultural heritage in the polder area that might be affected by polder development/rehabilitation interventions. No Objection Certificates (NOC) from the union chairmen are collected and are attached in Annex 2.

5. Analysis of Project Alternatives

This chapter presents an analysis of various alternatives considered during the Project feasibility and design stage including the 'no project' alternative. As much as possible, environmental and social considerations of these alternatives have also been discussed.

5.1 'No Project' Alternative

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-I. The present situation of the polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, as described in **Section 1.1** of the present EIA. 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.

The interventions proposed in Polder 39/2C under CEIP-I are planned 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 compared in **Table 5.1** below.

Table 5.1: Comparison of 'No Project' and 'With Project' Scenarios

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
Construction of new embankments (38.00 km)	No protection at all at most parts of the polder. 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 property of local people.	New embankments will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, reduction in loss of lives and assets caused by the natural disasters.
	During monsoon, transportation system would deteriorate heavily 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 situation for 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 increased area for cultivation, thus increasing agriculture output.
	Continued silt deposition inside the	Decreased silt deposition in the Polder

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	Polder due to cyclonic surges and floods would increase and cause water logging, drainage congestion and other associated problems.	will result into improved drainage and navigation in internal lakes/khals, increased usage of surface water for irrigation, and reduced 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 for 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.
Re-sectioning of embankments (18.00 km)	At a number of locations, the embankments will further deteriorate 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. Hence, reduction in loss of lives and assets caused by the 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 situation for farmers from January to April (salinity intrusion) and May to August (flooding).	Re-sectioned embankments will provide enhanced protection to 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 increase and cause water logging, drainage congestion and other associated problems.	Decreased silt deposition in the Polder will result into improved drainage and navigation in internal lakes/khals, increased usage of surface water for irrigation, and reduced water logging problem.
	Local farmers and labor will remain	Enhanced agricultural activity will

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	financially stressed. Livelihood opportunities will remain limited, and local people will migrate outside the Polder for employment.	increase the demand for 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.
Construction of retired embankment (10.00 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 salinity intrusion.	Retirement/relocation of embankments will result into enhanced protection against floods and wave action, decreased salinity intrusion, and increased agricultural productivity.
	Further damage to the non-retired portion of embankments, further deteriorating 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 increase and cause water logging, drainage congestion and other associated problems.	Decreased silt deposition in the Polder will result into improved drainage and navigation in internal lakes/khals, increased usage of surface water for irrigation, and reduced water logging problem.
Bank revetment (2.00 km)	River bank erosion would further deteriorate the embankments and land resources would be damaged/ lost.	Bank revetment will provide enhanced protection against erosion by wave action, storm surges and currents, and will result into preservation of Polder and its land/agriculture resources.
	Further subsidence of the embankments and further damage to transportation routes.	The bank revetment will protect the embankments and facilitate transportation within the Polder.
Slope protection (2.00 km)	Continued 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.
Replacement of drainage sluices with drainage-cum-	Continued use of the existing drainage sluices for both flushing and drainage would cause further damage to these	Drainage-cum-flushing sluices will be more efficient and dry season rice cropping practice will be possible as

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
flushing sluices.	structures. As a result, water logging and drainage congestion would be increased due to malfunctioning of the sluices.	sweet water can be stored and used later in the dry season for irrigation.
Replacement of the existing flushing sluices	No dry season agriculture practice will be possible. Shrimp culture during January to May, as sweet water cannot be used in the periods of low rainfall.	Replaced flushing sluices will facilitate better agriculture practices, increased dry season rice cropping, and reduced shrimp culture - thus benefiting the poor farmers.
Construction of new flushing sluices	Cultivable lands and irrigable lands will further decrease in future.	New flushing sluices will facilitate increased availability of surface water, better control on irrigation during periods of low rainfall and increased agricultural production.
Aforestation (22.50 ha)	Wind and wave action during cyclones would cause severe damage.	Effects of cyclone surge, wave action and wind could be mitigated to some extent, reducing loss of lives and assets.
Closure Dam (8 nos)		
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.

5.2 Site Selection Alternatives

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 presented in **Table 5.2**.

Table 5.2: Results of Multi-criteria Analysis to Prioritize Polder Rehabilitation

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
1	63/1A	SD, ID, MD	Anowara	7500	48	7	11	17	6	10	6	HRZ	15	0	0	MV	15	117	5		0	59	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
2	35/3	ID	Bagerhat	6790	40	9	14	8	3	8	5	MRZ	10	0	0	MV	15	89	10		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
3	32	MD	Dacope	8097	50	3	4	5	2	25	15	HRZ	15	1215	1	MV	15	108	5		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
4	59/3C	SD, MD	Companigonj	16200	42	8	13	-	0	5	3	MRZ	10	0	0	MV	15	115	5		0	46	Breach caused by the cyclonic surge and wave action.
5	48	SD, ID	Kalapara	5400	38	-	0	3	1.125	7	4	HRZ	15	0	0	MV	15	112.19	5		0	40	Severe damage of embankment due to wave action
6	14/1	ID	Koyara	2933	25	5	9	14	5	-	0	LRZ	5	450	0	MV	15	88	10		0	44	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
7	47/5	SD, ID, MD	Kalapara	7500	33	2	3	7	3	5	3	HRZ	15	0	0	MV	15	103.61	10		0	49	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
8	46	SD, ID	Kalapara	4697	40	5	7	3	1	-	0	HRZ	15	0	0	MDV	10	124.24	5		0	38	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
9	15	ID	Shymnagar	3441	27	3	5	22	8	-	0	LRZ	5	516	0	MV	15	68	15		0	48	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
10	64/2B	SD, ID, MD	Chakoria	7736	96	5	7.167	15.500	6	-	0	HRZ	15	0	0	MV	15	163	5		0	48	The embankment section is partly damaged due to erosion & wave action.
11	71	SD	Kutubdia	5116	40	0	0	20	8	-	0	HRZ	15	0	0	MV	15	72	10		0	48	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
12	47/1	SD, ID	Kalapara	2478	22	4	6.371	-	0	2	1	HRZ	15	0	0	MV	15	71	10		0	48	Breach caused by the cyclonic surge and wave action during SIDR & AILA
13	42	SD, ID, MD	Barguna Sadar	2794	28	-	0	3	1.125	2	1	LRZ	5	0	0	MV	15	80	10		0	32	Embankment damaged and erosion cost due to wave action.
14	41/6B	ID, MD	Barguna Sadar	7280	44	2	2.389	6	2.250	5	3	LRZ	5	0	0	MV	15	74	10		0	37	Embankment damaged and erosion cost due to wave action.
15	41/5	SD, ID, MD	Barguna Sadar	3880	50	4	6	3	1	1	1	HRZ	15	0	0	MV	15	104	10		0	47	Breach caused by the cyclonic surge(SIDR & AILA) and wave action. The embankment section is partly damaged due to erosion
16	65	ID	Chakaria	6649	48	-	0	16	6	2	1	HRZ	15	0	0	MV	15	119	5		0	42	The embankment section is

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																							partly damaged due to erosion
17	58/1	SD, ID	Manpura	4200	32	1	1	2	1	-	0	HRZ	15	630	1	MV	15	58	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
18	69/NE	ID	Moheshkhali	2226	16	2	4	8	3	-	0	HRZ	15	0	0	MDV	10	36	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
19	66/2	ID	Cox's Bazar & Ramu	2621	20	-	0	5	2	-	0	HRZ	15	0	0	MV	15	43	15		0	47	The embankment section is partly damaged due to erosion
20	66/4	ID	Chakaria	3324	24	9	15	5	2		0	HRZ	15	0	0	MDV	10	53	15		0	57	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
21	65/A	ID	Chakoria	806	9	-	0	5	2	-	0	HRZ	15	0	0	MV	15	18	15		0	47	The embankment section is partly damaged due to erosion
22	66/1	SD, ID, MD	Cox's Bazar	4930	20	1	1	1	0	1	1	HRZ	15	0	0	MV	15	61	15		0	47	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
23	62	SD	Bandar, Patenga & Pahartali	5600	22	-	0	5	2	-	0	HRZ	15	0	0	MV	15	59	15		0	47	The embankment section is partly damaged due to erosion
24	41/7	ID, MD	Mirzaganj	6984	51	6	10	1.50	0	3	2	LRZ	5	0	0	MV	15	84	10		0	41	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
25	56/57	ID	Bhola Sadar, Borhanuddin, Charfassion, Daulatkhan	123800	250	5	7	15	6	15	9	HRZ	15	5571	5	MV	15	534	-10		0	46	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
26	33	ID	Dacope	8100	52	3	4	10	4	12	7	HRZ	15	1215	1	MV	15	128	5		0	51	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
27	65/A1	ID	Chakaria	2800	20	-	0	2	1	0	0	HRZ	15	0	0	MV	15	40	15		0	46	The embankment section is partly damaged due to erosion
28	58/3	SD	Manpura, Sudaram	1308	17	-	0	7	3	5	3	HRZ	15	0	0	MDV	10	31	15		0	46	The embankment section is partly damaged due to erosion
29	58/2	SD	Manpura	4312	28	-	0	7	2	4	2	HRZ	15	647	1	MV	15	50	15		0	50	The embankment section is partly damaged due to erosion
30	64/1C	SD, ID	Bashkhali	2151	23	1	1.115	11	4.031	-	0	HRZ	15	0	0	MDV	10	53	15		0	45	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
31	63/1B	ID, MD	Anowara	7300	21	-	0	-	0	-	0	MRZ	10	0	0	MV	15	36	15		0	40	-
32	72	SD, MD	Swandip	22700	58	9	15	-	0	-	0	HRZ	15	0	0	MDV	10	192	5		0	45	Breach caused by the cyclonic surge(SIDR) and wave action
33	17/1	ID	Dumuria	5020	45	-	0	37	14	-	0	LRZ	5	753	1	MV	15	88	10		0	44	The embankment section is partly damaged due to erosion
34	7/1	ID	Assasuni, Shamnagar	3110	34	1	1	18	7	-	0	LRZ	5	467	0	MV	15	81	10		0	38	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is

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																							partly damaged due to erosion
35	55/3	SD, ID	Galachipa, Charfassion	9845	56	-	0	-	0	5	3	HRZ	15	0	0	MV	15	236	-10		0	23	-
36	55/2D	SD, MD	Patuakhali, Dashmia	8540												MV		99					
37	55/2E	MD, ID	Patuakhali, Dashmina, Bouphol	1053 5												MV		123					
38	67/B	ID	Teknaf	900	8	-	0	7	3	-	0	MRZ	10	0	0	MD V	10	26	15	Naf Rive r	5	43	The embankment section is partly damaged due to erosion
39	69/P1	SD	Moheshkhal i	1800	13	1	1	5	2	-	0	HRZ	15	0	0	MD V	10	96	10		0	38	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
40	64/1B	ID, MD	Bashkhali	8000	53	5	7. 16 7	-	0	-	0	HRZ	15	0	0	MD V	10	144	5		0	37	Breach caused by the cyclonic surge(SIDR & AILA) and wave action.
41	61/1	SD	Sitakunda	8769	27	1	2. 15 0	-	0	-	0	HRZ	15	0	0	MD V	10	107	5		0	32	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
42	67/A	MD	Teknaf & Ukhiya	1500	13	0	0	5	2	-	0	MRZ	10	0	0	MD V	10	48	15	Naf Rive r	5	42	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
43	70	SD, ID, MD	Moheshkhal i	3025	32	-	0	5	2	-	0	HRZ	15	0	0	MD V	10	122	5		0	32	The embankment section is partly damaged due to erosion
44	67	ID	Teknaf	2000	13	-	0	5	2	-	0	MRZ	10	0	0	MD V	10	46	15	Naf Rive r	5	42	The embankment section is partly damaged due to erosion
45	65/A3	ID	Chakaria	604	10	0	0	-	0	1	1	HRZ	15	0	0	MD V	10	26	15		0	41	Breach caused by the cyclonic surge and wave action
46	59/2	ID	Ramgati	2125 5	82	6	9	4	1	1	1	MRZ	10	0	0	MV	15	190	5		0	41	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
47	3	ID	Debhata, Kaliganj	2226 7	64	1	1	1	0	2	1	LRZ	5	3340	3	MV	15	155	5	Issa moti Rive r	10	40	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
48	41/1	SD, MD	Barguna Sadar	4048	34	-	0	-	0	1	0	MRZ	10	0	0	MV	15	83	10		0	35	-
49	36/1	ID	Bagerhat, Chitalmari, Fakirhat, Morelgonj, Rupsa	4034 3	95	0	0	40	15	-	0	LRZ	5	6051	5	MD V	10	190	5		0	40	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
50	47/2	ID, MD	Kalapara	2065	17	-	0	-	0	1	0	HRZ	15	0	0	MD V	10	39	15		0	40	-
51	47/4	SD, ID, MD	Kalapara	6600	57	0	0	-	0	-	0	HRZ	15	0	0	MV	15	150	5		0	35	Breach caused by the cyclonic surge(SIDR) and wave action
52	40/1	SD, ID, MD	Pathargatha	2105	23	-	0	-	0	-	0	MRZ	10	0	0	MV	15	91	10		0	35	-
53	40/2	SD, ID, MD	Pathargatha	4453	36	-	0	-	0	-	0	MRZ	10	0	0	MV	15	85	10		0	35	-
54	45	SD, ID	Amtali	4089	27	-	0	-	0	-	0	MRZ	10	0	0	MV	15	96	10		0	35	-

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55	23	ID	Paikgacha	5910	37	1	2	19	7	-	0	LRZ	5	887	1	MDV	10	123	5		0	30	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
56	66/3	SD, ID, MD	Cox's Bazar	4832	52	-	0	11	4	-	0	HRZ	15	0	0	MDV	10	133	5		0	34	The embankment section is partly damaged due to erosion
57	55/1	SD, ID	Galachipa	10325	46	1	1	0	0	5	3	LRZ	5	0	0	MV	15	145	5		0	29	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
58	55/2B	ID, MD	Galachipa	2600	30	2	2	1	0	2	1	LRZ	5	0	0	MV	15	81	10		0	34	Breach caused by the cyclonic surge(AILA) and wave action. The embankment section is partly damaged due to erosion
59	29	ID	Batiaghata, Dumuria	8218	49	2	3	13	5	-	0	LRZ	5	1233	1	MV	15	102	10		0	39	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
60	16	ID	Paikgacha, Tala	10445	45	1	2	25	9	-	0	LRZ	5	1567	1	MDV	10	108	5		0	33	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
61	68	SD, ID	Teknaf	3500	27	0	0	5	2	-	0	MRZ	10	0	0	MDV	10	95	10		0	32	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
62	64/1A	SD, ID	Bashkhali	5750	58	1	0.796	2	0.750	-	0	HRZ	15	0	0	MV	15	137	5		0	37	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
63	43/1A	ID, MD	Amtali	2675	27	0	1	-	0	2	1	MRZ	10	0	0	MDV	10	51	15		0	37	Breach caused by the cyclonic surge (SIDR) and wave action. Breach closed by constructing ring bundh
64	43/2C	SD, ID, MD	Galachipa	2753	26	1	1	-	0	1	1	LRZ	5	0	0	MV	15	54	15		0	36	Breach caused by the cyclonic surge (SIDR) and wave action
65	34/3	ID	Bagerhat	3656	17	-	0	17	6	-	0	LRZ	5	0	0	MDV	10	55	15		0	36	The embankment section is partly damaged due to erosion
66	43/2A	ID, MD	Patuakhali	5182	39	2.00	0	-	0	2	1	LRZ	5	0	0	MV	15	73	10		0	31	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
67	73/1 (A & B)	SD, ID, MD	Hatiya	21377	80	4	6	28	11	-	0	HRZ	15	0	0	MV	15	219	-10		0	36	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
68	17/2	ID	Dumuria	3400	11	-	0	-	0	-	0	LRZ	5	510	0	MV	15	28	15		0	35	-
69	43/1	SD, ID, MD	Amtali	10600	65	1.50	0	1	0	-	0	MRZ	10	0	0	MV	15	128	5		0	30	Breach caused by the cyclonic surge(SIDR & AILA) and wave action The embankment section is partly damaged due to erosion
70	28/2	ID	Batiaghata	2590	20	-	0	-	0	-	0	LRZ	5	389	0	MV	15	48	15		0	35	-
71	32	SD, ID	Sharankhola	13058	63	2	2	21	8	-	0	HRZ	15	0	0	MV	15	126	5		0	45	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion

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72	61/2	SD	Mirsharai	19855	10	0	0	-	0	-	0	MRZ	10	0	0	MDV	10	54	15		0	35	Breach caused by the cyclonic surge and wave action
73	73/2	SD, MD	Hatiya	11134	48	-	0	0	0	-	0	HRZ	15	0	0	MDV	10	214	-10		0	15	The embankment section is partly damaged due to erosion
74	39/1A	SD, MD	Pathargatha	11740	58	-	0	-	0	-	0	MRZ	10	0	0	MV	15	123	5		0	30	-
75	39/2C	SD, MD	Matbaria	10748	55	-	0	-	0	-	0	LRZ	5	0	0	MV	15	122	15		0	35	-
76	41/4	SD, ID, MD	Barguna Sadar	1741	19	-	0	-	0	-	0	LRZ	5	0	0	MV	15	46	15		0	35	-
77	44	SD, ID	Amta!i, Kalapara	17530	82	-	0	-	0	-	0	HRZ	15	0	0	MV	15	174	5		0	35	-
78	47/3	ID, MD	Kalapara	2025	20	-	0	-	0	-	0	HRZ	15	0	0	LV	5	42	15		0	35	-
79	52/53A	SD, ID, MD	Galachipa	3663	25	-	0	-	0	-	0	LRZ	5	0	0	MV	15	76	10		0	30	-
80	60	ID	Sonagazi	9150	38	-	0	-	0	-	0	MRZ	10	0	0	MDV	10	63	15		0	35	-
81	64/2A	ID, MD	Chakoria	3750	34	-	0	-	0	-	0	HRZ	15	0	0	LV	5	34	15		0	35	-
82	31	MD	Dacope	7288	47	-	0	4	2	4	2	LRZ	5	1093	1	MV	15	126	5		0	29	The embankment section is partly damaged due to erosion
83	13-14/2	ID	Koyara	17854	93	0	0	17	6	-	0	LRZ	5	2678	2	MV	15	156	5		0	34	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
84	31/Part	MD	Batiaghata	4848	29	-	0	9	3	-	0	LRZ	5	727	1	MDV	10	86	10		0	29	The embankment section is partly damaged due to erosion
85	22	MD	Paikgacha	1630	20	-	0	10	4	-	0	LRZ	5	245	0	MDV	10	50	15		0	34	The embankment section is partly damaged due to erosion
86	06-08 (Ext)	ID	Satkhira, Kalarua	8330	9	-	0	8	3	-	0	LRZ	5	1250	1	MDV	10	26	15		0	34	The embankment section is partly damaged due to erosion
87	18-19	ID	Paikgacha	3380	32	-	0	9	3	-	0	LRZ	5	507	0	MDV	10	76	10		0	29	The embankment section is partly damaged due to erosion
88	43/2E	ID, MD	Patuakhali	1650	20	-	0	-	0	6	4	LRZ	5	0	0	MDV	10	89	10		0	29	-
89	34/1	ID	Bagerhat	2212	10	-	0	8	3	-	0	LRZ	5	332	0	MDV	10	28	15		0	33	The embankment section is partly damaged due to erosion
90	9	ID	Paikgacha.	1255	8	-	0	6	2	-	0	LRZ	5	188	0	MDV	10	28	15		0	32	The embankment section is partly damaged due to erosion
91	39/2A	ID, MD	Bamna	5080	32	-	0	-	0	4	2	LRZ	5	0	0	MDV	10	88	10		0	27	-
92	55/4	SD	Galachipa	5142	33	-	0	-	0	4	2	LRZ	5	0	0	MDV	10	136	5		0	22	-
93	21	MD	Paikgacha	1417	17	-	0	5	2	-	0	LRZ	5	213	0	MDV	10	37	15		0	32	The embankment section is partly damaged due to erosion
94	20, 20/1	MD	Paikgacha	1600	23	-	0	5	2	-	0	LRZ	10	240	0	MDV	20	59	30		0	93	The embankment section is partly damaged due to erosion
95	4	ID	Assasuni	10500	80	2	2	21	8	-	0	LRZ	5	1575	1	MDV	10	153	5		0	32	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
96	1	ID	Assasuni, Debhata & Satkhira	28381	96	1	1	1	0	3	2	LRZ	5	4257	3	MV	15	171	5		0	31	Lowest Pocket Silted Up. Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
97	Kumiriya to Sonaichari Flood Control Project	SD	Sitakunda	1610	5	0	0.557	-	0	-	0	HRZ	15	0	0	MV	15	8	15		0	46	Breach caused by the cyclonic surge(SIDR & AILA) and wave action
98	41/2	SD, ID, MD	Barguna Sadar	3644	39	-	0	-	0	1	0	LRZ	5	0	0	MDV	10	118	5		0	20	-
99	43/2F	ID, MD	Amtali	4453	32	-	0	-	0	-	0	MRZ	10	0	0	LV	5	53	15		0	30	-
100	7/2	ID	Assasuni.	10486	60	1	2	18	7	-	0	LRZ	5	1573	1	MDV	10	116	5		0	30	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
101	24	ID	Abhaynagar, Dumuria, Keshobpur, Manarampur	28340	26	-	0	-	0	-	0	LRZ	5	4251	3	LV	5	61	15		0	28	-
102	06-08	ID	Assasuni, Satkhira, Tala	18450	53	1	2	10	4	-	0	LRZ	5	2768	2	MDV	10	128	5		0	28	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
103	55/2C	ID, MD	Galachipa	6275	48	-	0	-	0	3	2	LRZ	5	0	0	MDV	10	73	10		0	27	-
104	26	ID	Dumuria	2696	29	-	0	2	1	-	0	LRZ	5	404	0	LV	5	66	15		0	26	The embankment section is partly damaged due to erosion
105	28/1	ID	Dumuria	5600	23	-	0	-	0	-	0	LRZ	5	840	1	LV	5	65	15		0	26	-
106	2	ID	Assasuni, Satkhira	11296	64	0	1	10	4	-	0	LRZ	5	1694	1	MDV	10	129	5		0	26	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
107	10-12	ID	Koyara, Paikgacha	16315	67	2	2	3	1	-	0	LRZ	5	2447	2	MDV	10	119	5		0	25	Breach caused by the cyclonic surge and wave action. The embankment section is partly damaged due to erosion
108	27/1, 27/2	ID	Dumuria	4260	45	-	0	-	0	-	0	LRZ	5	713	1	LV	10	109	30		0	86	-
109	41/3	ID, MD	Barguna Sadar	1053	20	-	0	-	0	-	0	LRZ	5	0	0	LV	5	43	15		0	25	-
110	41/6A	SD, MD	Barguna Sadar	3850	33	-	0	-	0	-	0	LRZ	5	0	0	LV	5	49	15		0	25	-
111	41/7A	ID, MD	Betagi	6220	39	-	0	-	0	-	0	LRZ	5	0	0	LV	5	51	15		0	25	-
112	43/2B	ID, MD	Galachipa, Amtai, Patuakhali	5460	42	-	0	-	0	-	0	MRZ	10	0	0	LV		49	15		0	25	-
113	43/2D	ID, MD	Patuakhali	6500	43	-	0	-	0	-	0	LRZ	5	0	0	LV	5	50	15		0	25	-
114	52/53B	SD, ID, MD	Galachipa	4064	34	-	0	-	0	-	0	LRZ	5	0	0	LV	5	96	10		0	20	-
115	55/2A	ID, MD	Patuakhali, Galachipa, Amtoli	7166	43	-	0	-	0	-	0	LRZ	5	0	0	LV	5	80	10		0	20	-
116	59/1A	ID	Companiganj,	15506	36	-	0	-	0	-	0	LRZ	5	0	0	LV	5	98	10		0	20	-
117	5	ID, MD	Kaliganj, Shymnagar	55061	192	2	3	12	5	-	0	LRZ	5	8259	7	MV	15	272	-10		0	24	Lowest Pocket Silted Up Breach caused by the cyclonic surge and wave action. The embankment section is partly

	Polder No	Type of Dyke	Location of the Polder	Gross Area of the Polder (HA)	Embankment Length (Km)	Breach of Embankment (Km)	Mark Obtained	Erosion (Km)	Mark Obtained	Requirement of BPW (Km)	Mark Obtained	Location in the Risk Zone	Mark Obtained	Drainage Congestion (HA)	Mark Obtained	Opinion of Stakeholder	Marks (MV=15, MDV=10, LV=5)	Rehabilitation Cost (Crore BDT)	Mark Obtained	Special Criterion	Mark Obtained	Total Marks	Remarks
																							damaged due to erosion
118	25	ID	Dumuria Fultala	17400	46	-	0	-	0	-	0	LRZ	5	2610	2	LV	5	83	10		0	22	-
119	30	MD	Batiaghata	6396	40	-	0	-	0	-	0	LRZ	5	959	1	LV	5	110	5		0	16	-
120	59/1B	ID	Sudharam, Laxipur	18218	40	-	0	-	0	-	0	LRZ	5	0	0	LV	5	156	5		0	15	-
121	59/3B	SD, ID, MD	Shudharam	31376	63	-	0	-	0	-	0	MRZ	10	0	0	LV	5	182	5		0	20	-
122	39/1B		Matbaria	13100	63	-	1	-				LRZ	5		0			138	5		0	11	-
123	41/7B		Betagi	6150		-		-				LRZ	5		0			58	15		2	22	-
124	Bibichini		Betagi	4600		-		-				LRZ	5		0			33	15		3	23	-
125	43/1B		Kalapara	3000		-		-				HRZ	15		0			63	15		4	34	-
126	CDSP-II		Sonagazi	1981		-		-				HRZ	15		0			35	15		5	35	-
127	Dumki Laukathi		Patukhali	18550		-		-				LRZ	5		0			61	15		6	26	-
128	Itbaria Labukhali		Patukhali	9650		-		-				LRZ	5		0			53	15		7	27	-
129	Mirzagonj Rampura		Mirzagonj, Patuakhali	16500		-		-				LRZ	5		0			69	15		8	28	-
130	50/51		Galachipa	6935		-		-				HRZ	15		0			138	5		9	29	-
131	54		Kalapara, Amtoli, Galachipa	13954		-		-				HRZ	15		0			174	5		10	30	-
132	Satla Bagda-1		Agailjhara, Wazirpur			-		-				LRZ	5		0			59	15		11	31	-
133	Satla Bagda-2		Uzirpur, Agailjhara			-		-				LRZ	5		0			196	5		12	22	-
134	Satla Bagda-3		Uzirpur, Agailjhara			-		-				LRZ	5		0			25	15		13	33	-
135	59/2 Ext.		Ramgati	4000		-		-				HRZ	15		0			52	15		14	44	-
136	Boychar		Hatiya			-		-				HRZ	15		0			159	5		15	35	-
137	Char Bagardona-1		Subornachar	1350		-		-				HRZ	15		0			24	15		16	46	-
138	Char Bagardona-2		Subornachar	1200		-		-				HRZ	15		0			21	15		16	46	-
139	Char Mojid		Subornachar	850		-		-				HRZ	15		0			15	15		16	46	-

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 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.

5.3 Technical Alternatives

Once the problems being faced by the Polder and its inhabitants had been identified, several technical alternatives were considered to address these issues. These alternatives pertained to strengthening the Polder embankment, protection of river banks, protection of embankment slope, improving the sluices and their performance, and reducing drainage congestion and water logging. These technical alternatives are discussed in **Table 5.3** below.

Table 5.3: Technical Alternatives for Polder 39/2C

Proposed Interventions	Alternative Options	Consequence
Strengthening of the 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 would 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. NO protection against storm surges and sea water rise.
	Backing/minor inward shifting of embankment with slope protection	Same as above.
	Constructing new embankments **(selected option)**	New embankments will safeguard the Polder against storm surges, floods, and higher tides due to global warming. Hence, reduction in loss of lives and assets caused by the natural disasters.
	Re-sectioning of existing embankment with new design heights (**selected option**).	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, reduction in 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 in Polder area; and continued erosion of the river bank.

Proposed Interventions	Alternative Options	Consequence
	Bank Revetment (**selected option**)	Bank revetment will provide enhanced protection against erosion by wave action, storm surges and currents, and will result into preservation of Polder and its land/agriculture resources.
Protection of embankment slope (against wave action)	No change in the existing embankment	Continued weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land resources would continue to be damaged/ lost (similar to the 'no project' scenario discussed in earlier).
	Slope protection **(selected option)**	Slope protection works will strengthen the embankments and protect them against subsidence, wave action, and wear and tear.
	Foreshore plantation **(selected option)**	Effects of cyclone surge, wave action and wind could be mitigated to some extent, reducing loss of lives and assets.
Replacement of drainage sluices	No change in the existing structures	Continued use of the existing drainage sluices for both flushing and drainage would cause further damage to these structures. As a result, water logging and drainage congestion would be increased 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 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 dry season rice cropping practice will be possible 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 advantages, the structures will facilitate fish migration and navigation across 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. Shrimp culture during January to

Proposed Interventions	**Alternative Options**	**Consequence**
		May, as sweet water cannot be used in the periods of low rainfall (similar to the 'no project' scenario discussed in earlier).
	Repair of the existing structures	For sluices which are beyond repair, this option would be similar to the 'no project' scenario described above.
	Replacement of the existing Flushing Sluices **(selected option)**	Replaced flushing sluices will facilitate better agriculture practices, increased dry season rice cropping, and reduced 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 increased availability of surface water, better control on irrigation during periods of low rainfall and increased agricultural production.
	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.

Technical, Financial, Economic, Environmental, and Social Considerations of Selected Options

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 **Table 5.4** below.

Table 5.4: Technical, Economic, Environmental and Social Considerations

<table>
<tr><th rowspan="2">Intervention</th><th colspan="4">Considerations</th></tr>
<tr><th>Technical</th><th>Financial/Economic</th><th>Environmental</th><th>Social</th></tr>
<tr><td rowspan="4">Re-sectioning, Retirement/ Relocation of existing embankment with new design heights</td><td>Better protection against cyclone surges and water level rise</td><td>Financial savings from reduced damages caused by the floods</td><td>Improved surface water quality; improved natural vegetation</td><td>Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.</td></tr>
<tr><td>Protection to river bank erosion</td><td>Financial savings as the embankments will provide good road transportation routes.</td><td rowspan="3">Reduced traffic congestion inside the polder because of improved embankments, which will facilitate vehicular traffic</td><td>Reduction of loss of assets which would bring poverty reduction</td></tr>
<tr><td rowspan="2">Prevention of salinity intrusion in the polder</td><td>Improved earning of local people during construction</td><td rowspan="2">Improved cropping particularly for small farmers thus alleviating poverty.</td></tr>
<tr><td>Improved cropping pattern and boosting the local economy</td></tr>
<tr><td>Bank revetment, slope protection</td><td>Enhanced embankment protection against tidal wave action of rivers, provide erosion protection</td><td>Financial savings from reduced damages caused by the floods; increased 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.</td><td>Improved embankment stability; reduced soil erosion; and provide good means of transportation</td><td>Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.</td></tr>
<tr><td>Foreshore plantation</td><td>Enhanced embankment protection against tidal wave action</td><td>Financial savings from reduced damages caused by the floods and</td><td>Improved embankment stability; reduced soil erosion;</td><td>Reduced loss of lives and assets which would bring poverty reduction;</td></tr>
</table>

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
	of rivers, provide erosion protection	storms; increased 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.	enhanced soil quality; improved air quality; enhanced aesthetic value of the area.	increased employment opportunities for local people; 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; achieving 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 would improve the drainage characteristics Water logging, drainage congestion would be reduced.	Better agriculture practice could be achieved which would improve cropping pattern, enhance local earnings, and reduce poverty.
Channel re-excavation	Reduce water logging and drainage congestion	Enhanced agriculture output; the dredged soil can later be used in construction works and will save construction cost	Increase navigability of water ways and fish habitats would improve, the ecosystem will be enhanced	Increase in cultivable area, increased availability of irrigation water thus increased farm income for local community; increased farm labor opportunities.

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
Closure Dam	Better control against entry of silt free water. Restricts the entry of saline water as well. Increases the elevation head of water in the channel to ensure good flow	Better agricultural prospects (dry season boro cropping would be possible)	Environmentally compatible. Surface water quality inside the polder would be enhanced.	Better agriculture practice could be achieved which would improve cropping pattern, enhance local earnings, and reduce poverty.

5.4 Alternatives during Construction

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 discussed below.

5.4.1 Material Storage

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.

The storage site selected at this stage is located in the Play ground near Bhandaria Upazilla Health Complex, which is situated within the Polder. The required materials would be collected and transported from their respective sources to the Polder and then would be stored in the stock yard to be used during construction phase.

5.4.2 Material Sources

The sources from which the construction materials will be brought have been discussed below.

Soil for Embankments

For retirement, re-sectioning, and forwarding of embankments, about 19.55 million cubic meters of soil will be required. The following options are available for sourcing this material:

- Ample quantity of soil can be obtained from borrow pits along the river bank just outside the embankments, provided the soil quality is appropriate for this purpose. This will be one the better options since it will minimize soil transportation needs, minimizing any additional traffic related to material transportation, having minimal negative impacts in the borrow areas since these areas will be silted-up within a few seasons, and having minimum environmental and social impacts related to excavation and transportation.

- Part of the required material can be obtained 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 land owners will have to be obtained and mutually agreed compensation will have to be paid 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 soil from the riverside just outside the Polder embankment is not suitable, the material may be obtained from the river beds having required material quality. This option will entail higher cost of material transportation and other related environmental and social problems such as traffic congestion, air and water pollution.

At this stage, the final decision regarding the material source has not been finalized. This decision is likely to be taken during the construction phase.

Sand

Sand would be needed for embankment improvement works, concreting works, and for manufacturing concrete blocks for slope protection works. Two broad options are available to source this material as discussed below.

- Sand could be procured from markets. This would entail consistent quality and assured supply; however it would also entail increased transportation cost and associated environmental and social impacts including traffic congestion and air pollution.
- The send option is to obtain sand from the river beds. This would reduce the transportation needs along with the associated costs and environmental as well as social impacts. However quality of this sand may not be consistent and this sand may need to be washed before its use.

At this stage, the final decision regarding the source this material has also not been finalized. This decision is likely to be taken during the construction phase.

5.4.3 <u>Alternatives for Workforce Procurement</u>

Two broad options are available for sourcing the manpower for the construction works. These are discussed below.

- Employing 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 bulk of the manpower from within the Polder and only bringing more skilled and technical manpower from outside. This option will entail reduced labor camp sizes, and decreased transportation needs and associated environmental and social problem. This option will also offer employment opportunities for the local community thus increasing their economic condition and also increasing the local ownership of the project. In view of these advantages, this is the preferred option for manpower sourcing.

5.4.4 Alternatives for Mode of Transportation

All the construction materials are to be transported to the main stock yard by road with Trucks. The materials will be carried from the main stock yard to the worksite mainly by river and also by road. The road way conditions inside the polder are not suitable for transportation of larger vehicles i.e. dump truck, trolley, excavator etc. Therefore carrying of earth and other construction materials should be done by small carts, non motorized vehicles, manual labor etc. while using road ways; and small boats, trollers in the waterways.

Waterways

Polder 39/2C is located along the right bank of Kacha river. The Kacha river (North and West), is a large river considering its depth and width. The river remains navigable throughout the year and can be used for transportation purposes during construction. The other parts of the polder (East and South) are surrounded by Ponadon river, which is shallow and narrow and unsuitable for transportation of larger vehicles. Large Cargos, Burge, Trollers can move along the Kacha River whereas small boats are recommended for transportation using the Ponadon river.

Roadways

The materials stored in the stock yard can be transported to the construction sites using different types of roads (i.e. district road, upazilla road, and rural road) inside the Polder. While transporting materials to the stock yard from Khulna or other suitable locations, road ways are recommended. The district road named Charkhali-Matbaria road is recommended to be used for its good quality. This road is diverged from the Bagerhat-Khulna highway into Polder 39/2C and includes one ferry crossing the Kacha river near Nudmulla union. For the better quality of this road, it is to be used for transporting materials into Polder 39/2C.

6. Environmental and Social Baseline

This Chapter describes the existing environmental and social conditions in respect of water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic aspects of the Project area.

6.1 Physical Environment

6.1.1 Climate and Meteorology

The projected area is located in a typical monsoon climate area. It has three main seasons: Summer/pre-monsoon – March to May; Rainy season/monsoon – June to October; and winter season – November to February. The rainy season is hot and humid having about 80 percent of the annual rainfall. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall. Meteorological information specifically rainfall of the projected area has been taken from Khulna station of BWDB and temperature, humidity and evaporation from BMD and is presented in **Figure 6.1** to **Figure 6.6.**

Temperature

The meteorological data of the area measured at Mongla station shows that the monthly maximum temperature varies from 28ºC to 34ºC. Maximum temperature occurs in the month of April and is around 34ºC and average temperature during monsoon is about 26º C. Monthly minimum temperature ranges from 9ºC to 23ºC and the minimum temperature (December to February) is around 9ºC to 11ºC. **Figure 6.1** shows the monthly maximum, mean and minimum temperature at Mongla station.

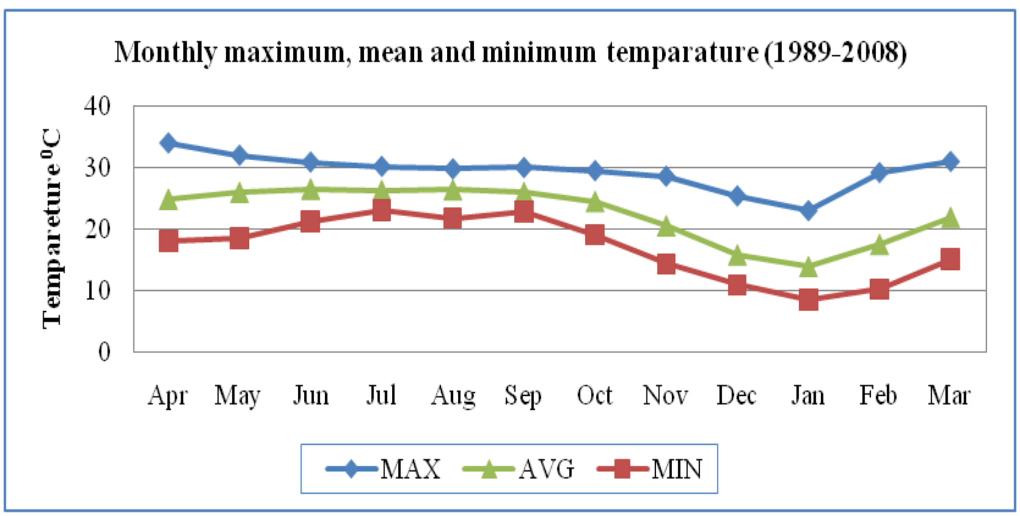

Figure 6.1: Temperature Data for Project Area

Yearly data of average temperature have also been analyzed for the same station (from 1989-2011). The trend analysis shows that the average temperature for polder 35/1 is increasing by approximately 0.027 °C each year (see **Figure 6.2**).

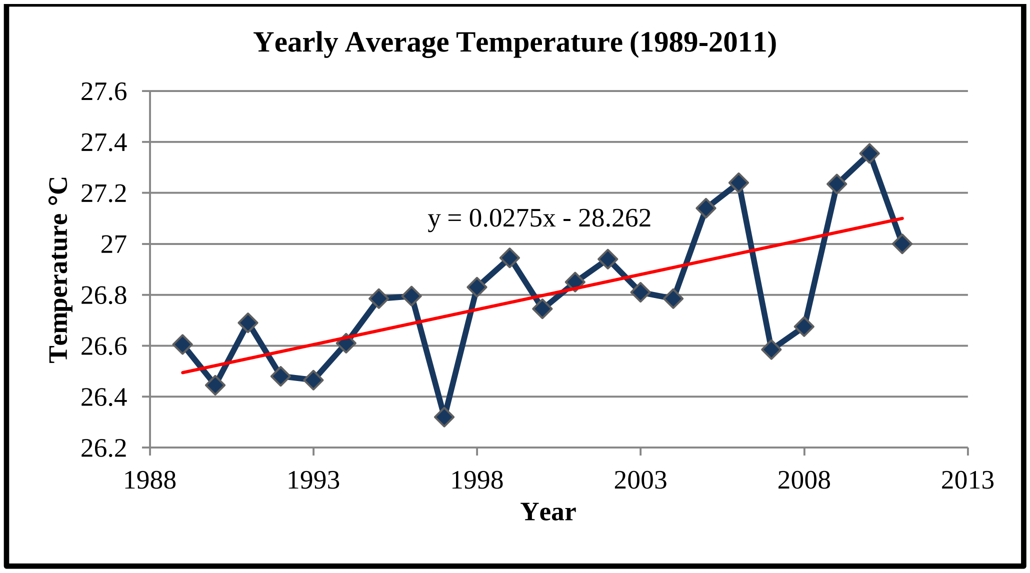

Figure 6.2: Yearly Average Temperature in Project Area

Humidity

The monthly average relative humidity measured at Mongla stations varies from 74 percent to 89 percent during a year. Even in the winter season the humidity is above 75 percent. **Figure 6.3** shows humidity data for the Project area.

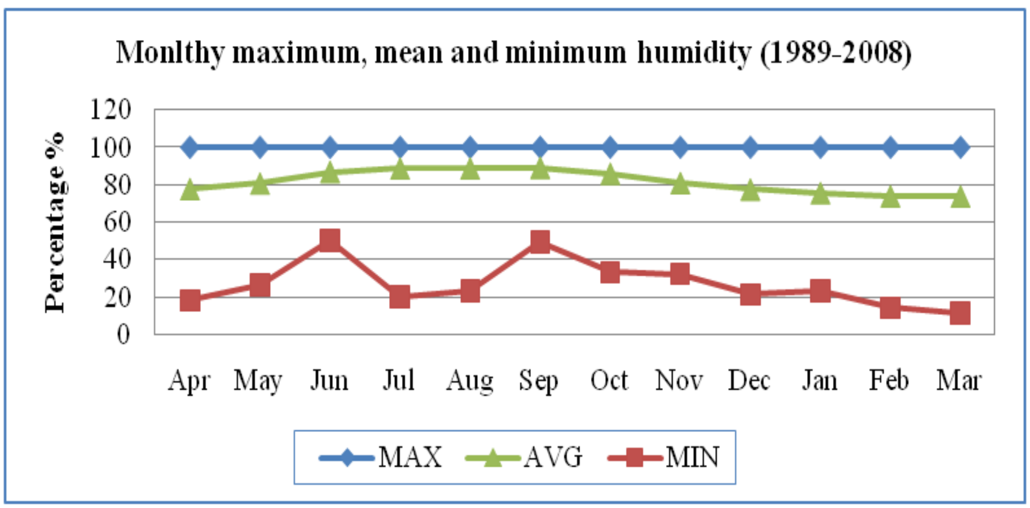

Figure 6.3: Humidity Data for Polder Project Area

Data of yearly average relative humidity have also been collected from the BMD station at Mongla. The trend analysis for the relative humidity values of polder 35/1 shows that the humidity increases by approximately 0.021 percent each year (see **Figure 6.4**).

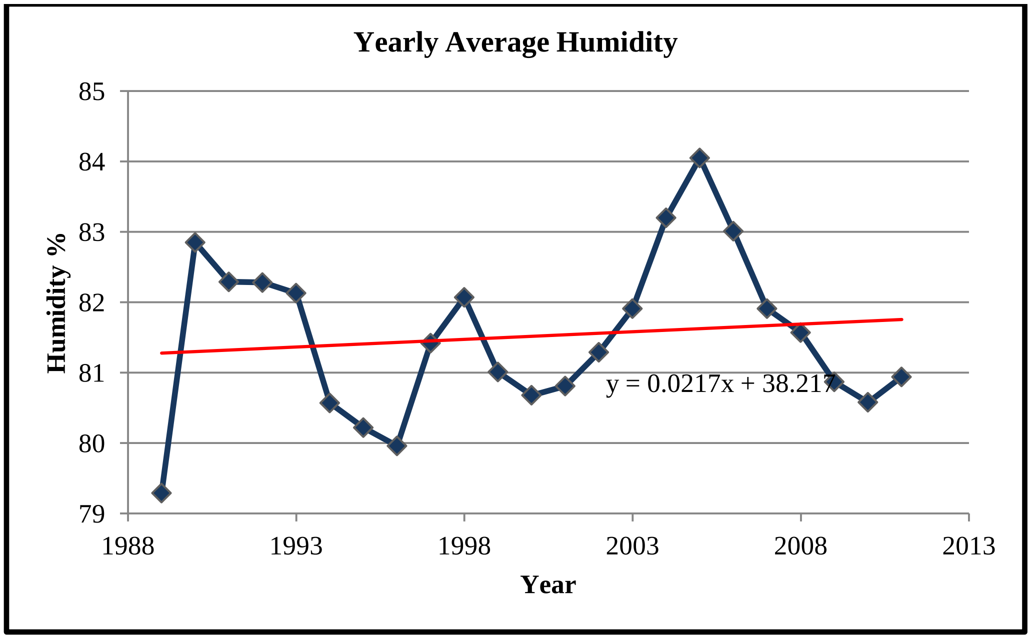

Figure 6.4: Average Yearly Humidity in Project Area

Rainfall

The annual average rainfall in the Project area is 1,946 mm. Monthly maximum rainfall was recorded as 983 mm in the month of June 2002. The average rainfall during monsoon is about 1,390 mm in the Project area. The mean monthly cumulative rainfall measured at Mongla is shown below in **Figure 6.5**.

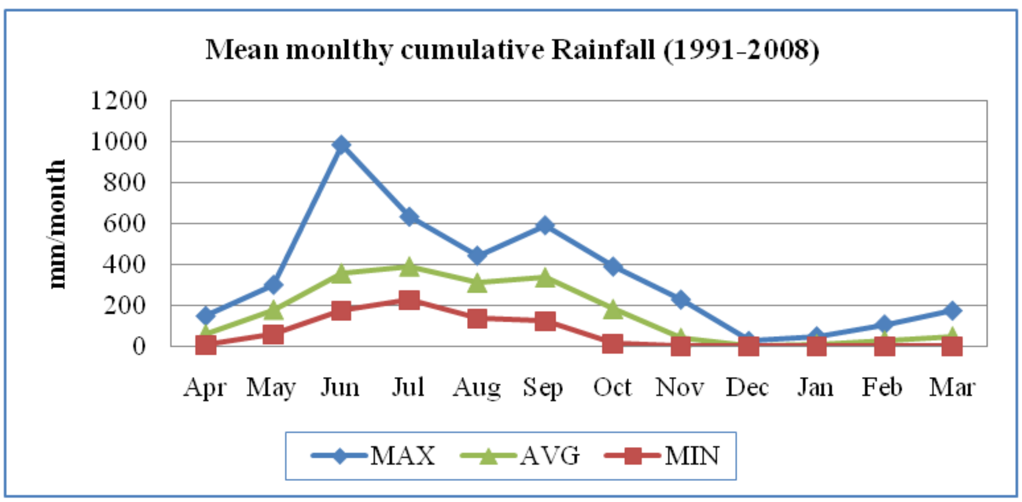

Figure 6.5: Rainfall Data for Project Area

A trend analysis has also been carried out collecting the yearly rainfall data from the BMD station at Mongla. The trend reflects that each year, the rainfall in the Project area has been increasing by approximately 15.74 mm (see **Figure 6.6**).

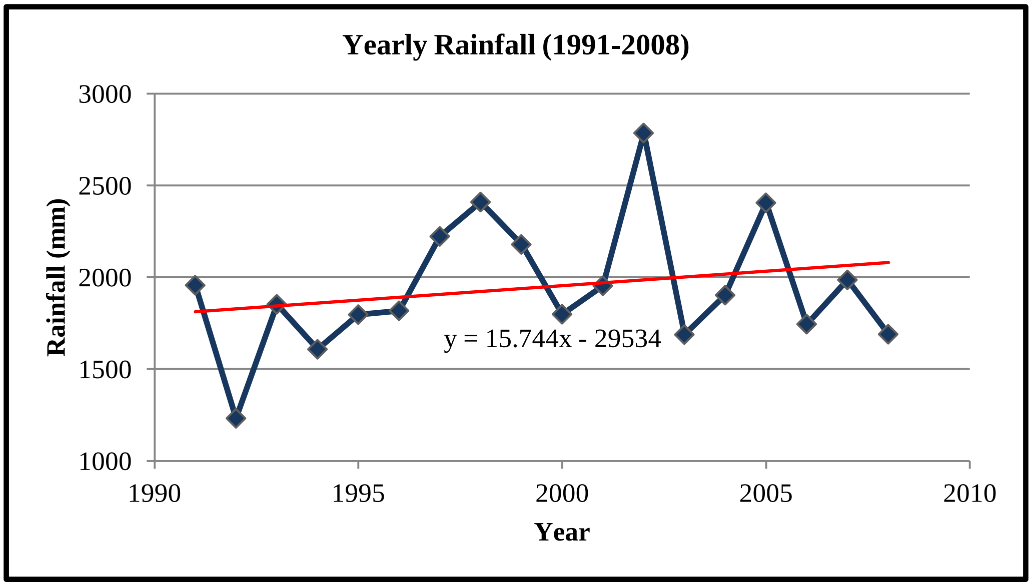

Figure 6.6: Rainfall Trent in Project Area

Evaporation

The monthly average evaporation in the Project area varies from 3 to 5 mm per day in a year. The monthly maximum average evaporation (16 mm/ day) occurs in the month of July.

6.1.2 Air Quality

From field visits, it was observed that overall air quality in the study area is good. The standards of ambient air quality should be maintained at the project site. The standards of air quality are given in **Table 6.1**.

Table 6.1: Standards of ambient air quality

Areas	Concentration of micrograms per meter cube		
	SPM (µg/m3)	SO_2 (µg/m3)	NO_x (µg/m3)
Industry	500	120	100
Commercial	400	100	100
Residential and rural area	200	80	80
Sensitive	100	30	30

Source: Environment Conservation Rules, 1997

Table 6.2 shows the air quality data measured at different locations of the polder, under Pirojpur district. The values suggest that the concentrations of the measured air quality parameters (SPM, SOx, NOx) lie within the range of standard values for Bangladesh (See **Table 6.1**).

Table 6.2: Values of ambient air quality parameters in the project area

Sample Location	**Air Quality Parameters**		
	SPM (µg/m3)	**SOx(µg/m3)**	**NOx(µg/m3)**
Bus stand mor, Mothbaria, Pirojpur	180	<25	18

Sample Location	Air Quality Parameters		
	SPM (μg/m3)	SOx(μg/m3)	NOx(μg/m3)
In front of Dhanishafa, UP office, Pirojpur	165	<25	16
Thana mor, Pirojpur	155	<25	14

Source: CEGIS field survey, December 2012

6.1.3 Noise

The noise level for both the normal situation and situation with traffic has been analyzed in the field. The values of noise level are shown in Table 6.3:

Table 6.3: Daytime noise levels of the study area

Sl. no	Location	Noise level (dB)		GPS
		Normal	With vehicle	
1	Telikhali bazar	51.86	79.3	N 22°18'47.0" E 89°50'54.4"
2	Ikri Bus Stand	62.7	82.4	N 22°24'48.7" E 89°59'14.7"

Source: CEGIS field survey, December 2012

Table 6.4 shows the standard values for noise in Bangladesh. Noise levels exceeding 80dB (with traffic situation) is usually considered as Noise pollution in our country. However the permissible limits for the country are less (Table 6.4). The study area can be regarded as a mixed area, and most of the noise level values observed in the study area have been found to be exceeding the permissible limits of mixed zones for daytime.

Table 6.4: Standards of Noise levels for different zones of Bangladesh

Zone Class	Limits in dB	
	Daytime (6 am – 9 pm)	Nighttime (9 pm-6 am)
Silent zone	45	35
Residential zone	50	40
Mixed	60	50
Commercial zone	70	60
Industrial zone	75	70

Source: Bangladesh Gadget, 2006

6.1.4 Topography

Polder 39/2C is located in the coastal area which consists of extremely low and flat land. This area experiences tidal flooding. The elevation of the land varies within the range from 0.54 m to 4.08 m. Average land level is 2.28 meters above the mean sea level (MSL). Land level along Balewsar River is comparatively high. Middle to southeast part of the polder area is gently slopes down (see **Figure 6.7**).

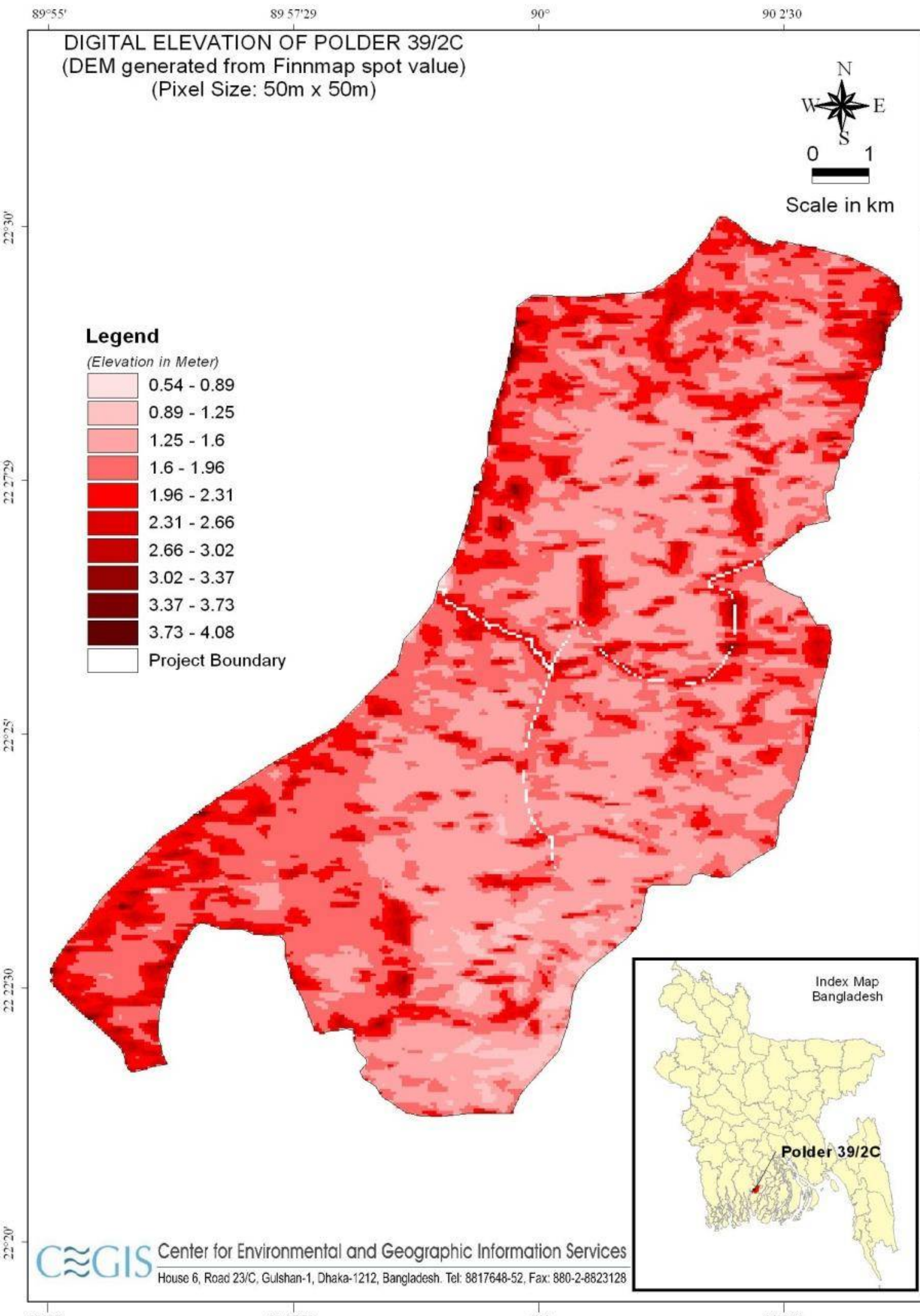

Figure 6.7: Land elevation map of Polder 39/2C

6.2 Water Resources

6.2.1 River System

The proposed Polder 39/2C is located under the southern hydrological zone of Pirojpur and partly in Jhalakathi district of Bangladesh. The polder is hydrologicaly linked with Baleswar river *(Kacha)* to the west, Bahar Khal to the east, Pona River to the north and Mirukhali – Amua Bharani and Pona Don to the south. The main river of the polder is Baleswar *(Kacha)* with tidal influence and flows north to south. There are numerous khals in the polder namely *Bhuter khal, Bamuner khal, Hetalia khal, Nadmulla khal, Singkhali khal, Podder khal* and others. These surrounding rivers and internal khals are the main hydrological and drainage features of the polder. These drainage khals also provide irrigation facilitities in the monsoon period.

Figure 6.8: Bahar Khal inside the proposed Polder area

Figure 6.9: Peripheral river Baleswar

6.2.2 Navigation in Rivers and Khals

Polder 39/2C is located along the right bank of Kacha river. The Kacha river (North and West), is a large river considering its depth and width. The river remains navigable throughout the year and can be used for transportation purposes during construction phase of the project. The other parts of the polder (East and South) are surrounded by Ponadon River, which is shallow and narrow and unsuitable for transportation of larger vehicles. Large Cargos, Burge, Trollers can move along the Kacha River whereas small boats are recommended for transportation using the Ponadon River. The internal khals/lakes are narrow and not suitable for navigation of larger vehicles.

6.2.3 Drainage Congestion

In the coastal area, drainage congestion is a major problem during the period July and October when cultivation of transplanted Aman is affected if water depth is more than 30cm for 3 days duration. Drainage congestion of the polder occurs where polder structure does not allow the excess water to drain from the polders.

The proposed Polder 39/2C comprises of a number of khals and channels characterized by tidal influences. Most of these khals run from north to the south and perform drainage of the polder area. These khals are also interconnected by a lateral channel running from the east to the west and draining into the main rivers. There are numerous khals namely *Tentul baria khal, Shing khali khal, Gabtalar khal, Bamuner khal, Safa bazaar khal, Bahar varani khal* and other khals which are open, i.e no structures exists in those khals to control regular tidal flow which cause inundating of low-lying areas of the polder. Since there is no embankment in eastern side of the polder to protect the areas it creates drainage congestion severely. Around 12-15% area of the polder are facing drainage problem during monsoon. The spatial distribution of drainage congestion is shown in the Figure 6.10.

6.2.4 Tropical Cyclones and Tidal Flooding

Cyclones are extreme meteorological events in the coastal region of Bangladesh. They occur mainly in the pre-monsoon (April-May) and post-monsoon (October-November) periods when the weather unstable and develops tropical cyclones in the Bay of Bengal. Devastating cyclones cross the Bangladesh coast almost every year.

Tropical cyclones are major threat to the coastal polder areas. The most devastating cyclones hit the polder on Sidr (2007) and Aila (2009). The cyclone Sidr was most disastrous for the polder area than the Aila. The surge water entered the polder area by overtopping and breaches in the protection embankment of Baleswar River *(Kacha)*. People reported that during cyclone (Sidr) surges *Telikhali*, *Nadmulla*, *Daowa* and *Ikri* unions were affected most in the polder area and many people lost their lives.

Tidal activity dominates during pre-monsoon and post monsoon period. In the absence of embankment in the eastern side along the Pona river, tidal water frequently enters the polder areas and damages crops. At present, the existing embankment along the Baleswar river is in vulnerable condition; about 40% of the polder area is under risk of high tide or any tropical cyclone.

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. So, in the last 52 years, the number of cyclones hitting coastal areas of Bangladesh has increased 5 times compared to the previous 57 years. (BMD)

In a frequency study carried out by Hennon, P. et al. (2010), Bay of Bengal has been found to be the second most frequently visited place in the world by cyclones with about 20 cyclones per decade.

6.2.5 Land Erosion and Sedimentation

Erosion due to wave action is a common problem in the coastal area. There is only 28 km of embankment in the western side of the polder along the Baleswar river *(Kacha)* which is damaged during cyclone Sidr and subsequently in Aila. Some segments of the embankment are susceptible to wave action and river erosion.

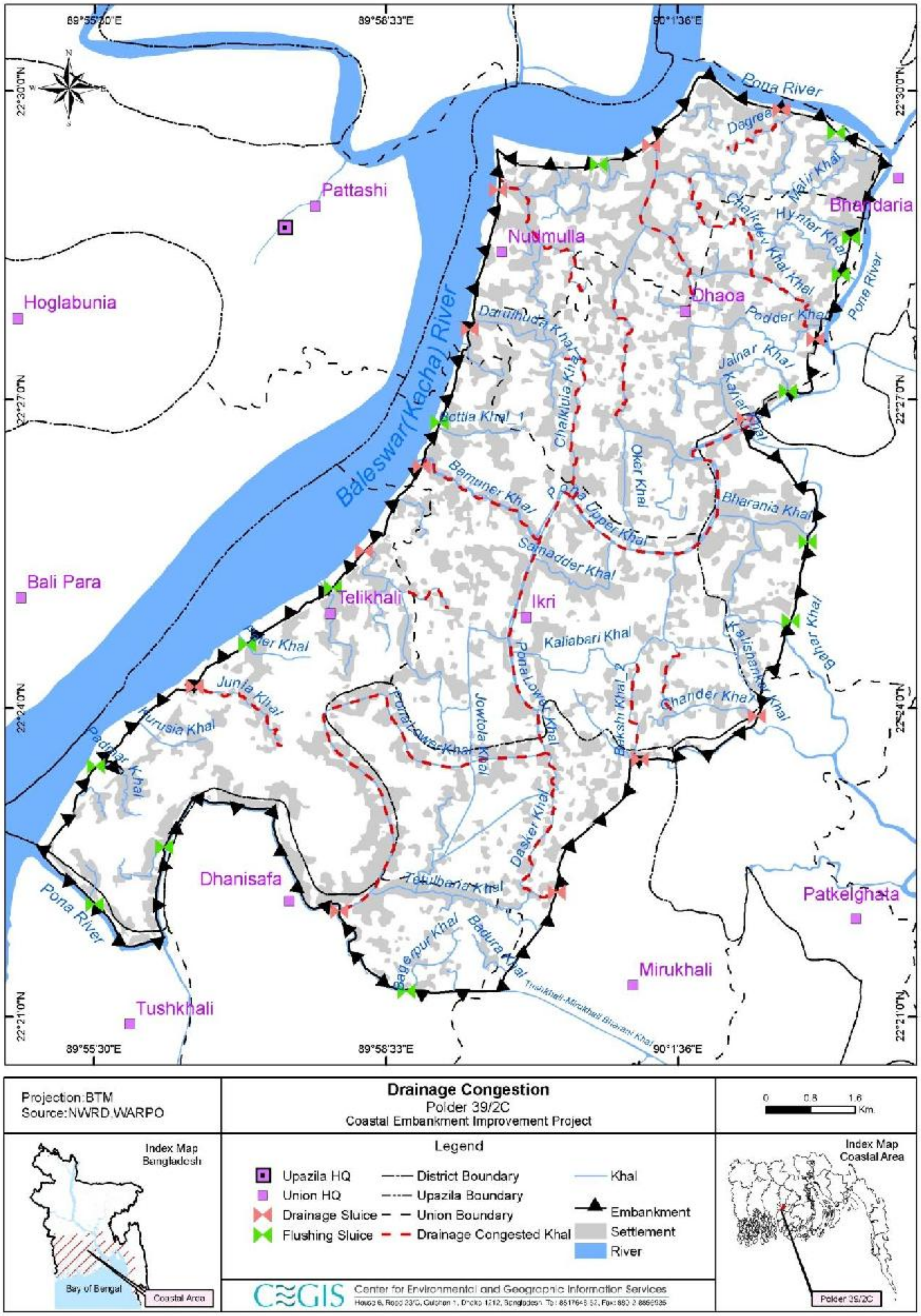

Figure 6.10: Drainage Congestion in Polder 39/2C

Sedimentation is also a problem in the polder areas. Sediment characteristics are different in the tidal rivers and khals. 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 is no water control structures along the khals, sedimentation took place in internal khals of the polder. On an average, there is roughly 5 inch to 7 inches of sedimentation in the main rivers and khals each year.

6.2.6 Water Quality

As described earlier, there has been a decline in the effectiveness of the Polder because of the lack of repair and maintenance of embankments and water control structures as well as frequent attacks by minor to major cyclonic surges, and absence of functional community organizations. As a consequence, during the periods of low rainfall, the surface water of the entire area gets affected by salinity intrusion.

In order to provide a clear view of the existing condition of the water quality inside the Polder area, a number of water quality parameters – including salinity, dissolved oxygen (DO), temperature, electrical conductivity (EC), pH, total dissolved solids (TDS), chlorides (Cl), suspended solids (SS), and arsenic (As) - were selected by the study team for monitoring and evaluation. The surface water and ground water was analyzed during the field level survey conducted in two different periods of the year. The surface water quality was measured at six different locations in the month of December and the ground water quality was tested in the month of May. The results obtained in the two field surveys provided an understanding of the water quality in the Polder, discussed below.

Surface Water Quality

The surface water quality in Polder 39/2C is influenced by the hydrological connections of the internal water channels with the surrounding rivers of the polder. The rivers and lakes around the Polder provide tidal inflow into the Polder during the periods of high tide or low rainfall. The water bodies inside the Polder are mostly free flowing khals, and apart from salinity intrusion during January to April, the other water quality parameters remain within the acceptable range. **Table 6.5** presents the values of the water quality parameters measured in a number of selected locations of the Polder. The standard values of these indicators set by DoE, Bangladesh have also been shown for the comparison purposes.

Table 6.5: Water Quality in Polder 39/2C

Sample Location	Water Quality Parameters					
	Salinity (ppt)	Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO (mg/L)	pH
Nudmullar khal (nudmulla bazar, nudmulla union)	3	19.0°C	1128	2.35	5.4	7
Bamuner khal (madasshi bazar, poschim posaribuniya)	-	21.5°C	1067	2.21	5.9	7
Pona river (Bashbunia, motbaria thana)	3	18.8°C	270	0.37	2.4	7.1

Sample Location		Water Quality Parameters					
		Salinity (ppt)	**Temperature (°C)**	**TDS (ppm)**	**EC (mS/cm)**	**DO (mg/L)**	**pH**
Bakar khal (tofsir er ghat, banai bazar, moving inside crossing the banai primary school, kathailla thana)		1	21.3°C	1601	1.74	5.1	7
Standard Value (Bangladesh)	Irrigation	-	20-30	-	-	5.0	7.0-8.5
	Fishing	-	20-30	-	-	4.0-6.0	6.7-9.5

Source: CEGIS field survey, December 2012

Salinity. During monsoon the salinity levels are very low because of the increased amount of fresh water in the water bodies. The level of salinity starts increasing from January due to the reduction of upland discharge and reaches the peak in April and then starts decreasing again. Saline water intrudes the areas near the breached embankments causing damage to agricultural practices.

In the dry season, the overall salinity levels both in soil and surface water are high and roughly about 15-20 percent of the Polder area is affected. This happens because of the following reasons: (i) about 3-4 percent of the polder area is under golda (prawn) culture, (ii) saline water enters through breached embankments, and (iii) malfunctioning of sluices with/without gates. However in the month of December, the salinity value was low (0-3 parts per thousand) as shown in **Table 6.5** above, since rain water inside the Polder was still present and tidal flow from the ocean was yet to intrude. The embankments and water controlling structures have experienced significant deterioration over the years and as a result the salinity values inside the polder have increased. Especially after the occurrences of Aila and Sidr, the salinity intrusion in the polder during dry season has become a common phenomenon.

Dissolved Oxygen (DO). This is an essential parameter for the metabolic process that produces energy for growth and reproduction of fishes and other aerobic aquatic biota. Decrease in DO values below the critical level of 3 mg/l causes death of most fishes and other aerobic aquatic organisms. DO is relatively low in dry season than in wet season. The values of DO inside the Polder (measured in the month of December) ranged between 5 to 6 mg/l at most of the places, which complies with the DoE standards for irrigation as well as for fisheries and aquatic life. However, values found in Ponadon river was found lower than the range of standard values for irrigation and fisheries whereas the water of the Botolbunia khal has higher DO values.

pH. The hydrogen ion concentration of water is expressed by its pH value. A pH value of 7 indicates a neutral solution, neither alkaline nor acidic. In most of the water bodies of the Polder, the pH range is found well within the DoE standards**.**

Temperature. Temperature of water bodies affects the fish habitats and their oxygen holding capacity. The mean temperature of the water bodies inside the Polder area was around 18°C-22°C (**Table 6.5**), in December. This value lies within the DoE standards for both irrigation and fish habitats.

Total Dissolved Solids (TDS). The natural range of total dissolved solids concentration for most lakes occupying open basins is usually between 100 and 200 mg/l. However the values of TDS were found very high inside the Polder area (ranged between 1,000-1,600 mg/l (see

Table 6.5) because of the saline water intrusion. However at one location of the Pona river the value was found less (270 mg/l). Livestock and wildlife may be adversely affected by drinking this water containing excessive dissolved solids. Continuous use of such water may cause a general loss of condition, weakness, scouring, reduced production, bone degeneration and ultimately death. TDS may influence the toxicity of heavy metals and organic compounds for fish and other aquatic life. This takes place primarily because of the antagonistic effect of hardness on metals. The quantity and quality of dissolved solids often determines the variety and abundance of plants and animals in a given aquatic situation.

Electrical Conductivity (EC). EC is a useful water quality indicator for estimating the amount of minerals, assessing the effect of diverse ions on chemical equilibrium, physiological effects on plants or animals, and corrosion rates. It is an indirect measure of the TDS (TDS = 640 × EC), the effects of which have been discussed above. The values of EC inside the Polder ranged between 0.3 - 2.5 mS/cm. The higher values of EC indicate that the water bodies inside the Polder area are more affected by saline water rather than fresh water.

Ground Water (GW)

The ground water quality parameters, measured in the Polder during the month of May were found to comply with the drinking water quality standards (ECR'97). The values of the ground water quality parameters of the Polder area as well as the standard values of these parameters set in ECR'97 are presented in **Table 6.6**.

Table 6.6: Groundwater Quality at Bagerhat Sadar

Sample Location	Date	Parameters					
		Temp	pH	Chloride (mg/l)	Iron (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
Tube well water of Pirojpur upazila health complex, Pirojpur town, Pirojpur	02/05/12	25.3	7.25	421	0.8	4	0
Drinking water quality standard as per ECR'97			6.5 – 8.5	150 – 600	0.3 – 1.0	10	0.05

Source: CEGIS field survey, May 2012

6.3 Land Resources and Agriculture

6.3.1 Agro-ecological regions

According to the Land Resources Appraisal of Bangladesh for agricultural development, Bangladesh has been subdivided into 30 agro-ecological regions and 88 sub-regions. The major components of these regions and sub-regions are physiography, soil properties, soil salinity, depth and duration of flooding which are relevant for land use as well as for the assessment of present and future agricultural potential.

Polder 39/2C is included in the Ganges Tidal Floodplain (Figure 6.11) agro-ecological zone. The characteristics of this region are discussed briefly as follows.

Ganges Tidal Floodplain

This region occupies an extensive area of tidal floodplain land in the south-west of the country. The entire project area falls within this region. The Ganges Tidal Floodplain has low relief compared to the Ganges River Floodplain. The area is criss-crossed by innumerable tidal rivers and creeks whose banks are less than a meter above the adjoining basins. The entire zone is vulnerable to tropical cyclones. The main coastal rivers of Polder 39/2C are the external Baleswar and Kocha/Bishkhali River and internal ones are Pona river/Pona don etc.

This area is flooded at high tide, either throughout the year especially during the rainy season when rivers entering from the north with increased flows under natural conditions. In the southwest, the embankments have cut off this tidal flooding in places, but basin sites are flooded by rain water which accumulates in the monsoon season. The rivers are saline throughout the year in the west. In the east, they carry fresh water to the coast during rainy season, and only become saline in their lower courses during the dry season. Most of the eastern half of the unit is remain non-saline throughout the year, therefore; tidal and seasonal flooding are mainly shallow, but basin centres in the north are moderately deeply flooded in the monsoon season.

There is a pattern of grey, slightly calcareous, heavy soils on river banks and grey to dark grey, non-calcareous, heavy silty clays in the extensive basins. Non-calcareous Grey Floodplain soil is the major component of general soil types. Acid Sulphate soil also occupies significant part of the area where it is extensively acidic during dry season. In general, most of the top soils are acidic and sub-soils are neutral to mildly alkaline. The soils are formed from clay-loam, loam and clay sediments and seasonally flooded and are poorly drained except soils of high land areas.

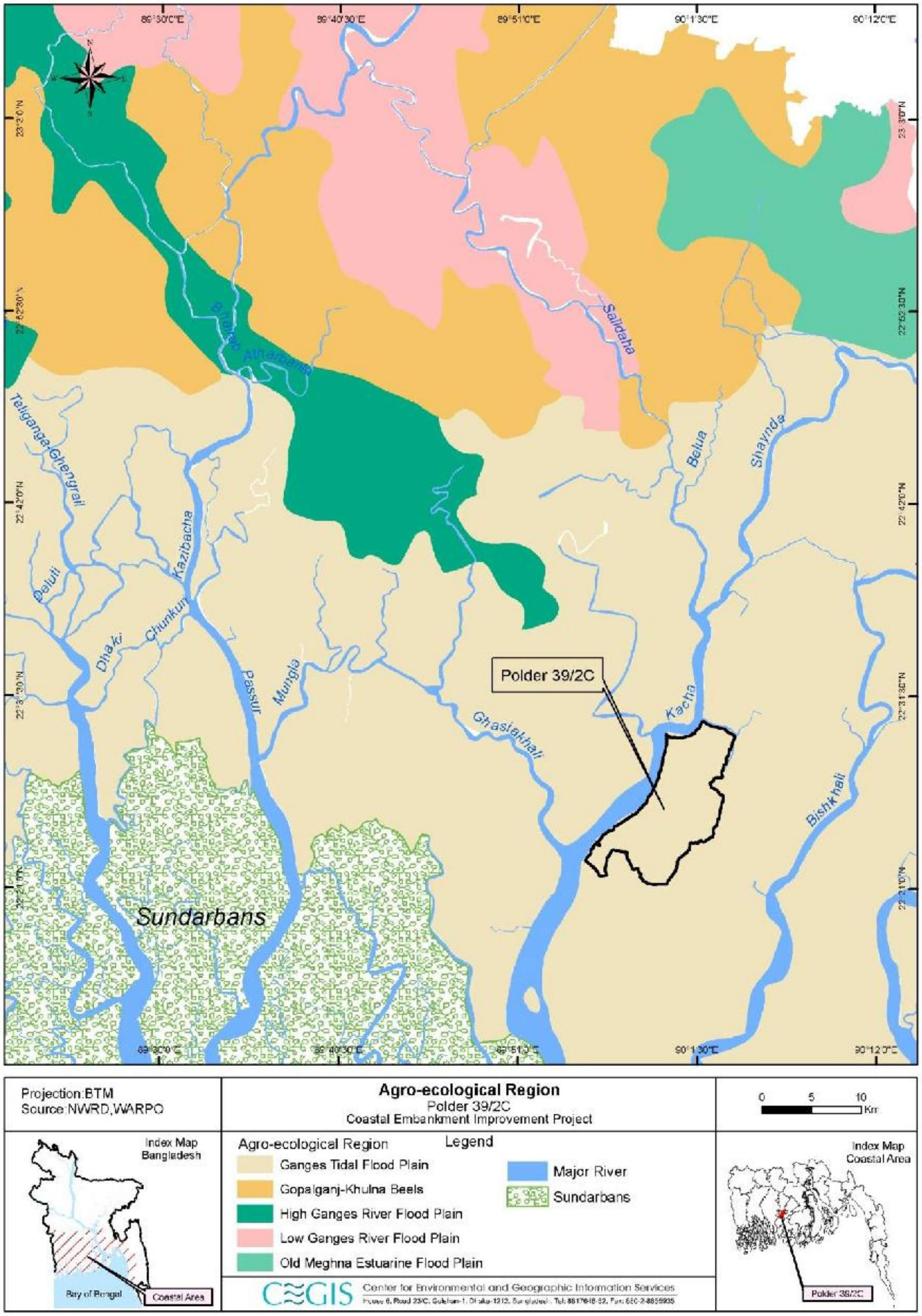

Figure 6.11: AEZ of the Polder area

6.3.2 Land use

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 about 79% of the gross area. Other 112.5 % and 8.5 % areas are covered by settlements, water bodies respectively.The single, double and triple cropped area are about 55.5%, 40.0% and 4.5% respectively. Detailed land use is presented in Table 6.7.

Table 6.7: Present land use of the project area

Land use	Area (ha)	%
Gross area	10,748	100
Agriculture land	8,500	79
Single crop	4,722	55.5
Double crop	3,403	40.0
Triple crop	375	4.5
Settlements	1708	16
Water bodies	540	5

Source: Feasibilty repor (agriculture), CEIP, 2012

6.3.3 Land type

Land type classifications are based on depth of inundation during monsoon season due to normal flooding on agriculture land. There are five land type classes: High land (HL: Flooding depth 0-30cm), Medium highland (MHL: Flooding depth 3-90 cm), Medium lowland (MLL: Flooding depth 90-180 cm), Low land (LL: Flooding depth 180-360 cm) and Very lowland (VLL: Flooding depth >360 cm). The land type is very important for utilization of lands for crop production.

About 25%, 68% and 7% of the net cultivable area (NCA) of the project area (Polder 39/2C) fall under high land, medium high land and medium low land respectively. The distribution of land types under polder 39/2C is shown in Table 6.8.

Table 6.8: Area under different land types

Land type/Flooding status	Area (ha)	% of NCA
Highland	2144	25
Medium Highland	5756	68
Medium Lowland	600	7
Lowland	-	-
Very Lowland	-	-
Total	**8500**	**100**

Source: Feasibilty report (agriculture), CEIP, 2012

6.3.4 Soil Texture

Soil texture is the relative proportions of sand, silt and clay. It is of great importance for agriculture crop production. It is observed that the soil texture in the project area varies from clay, clay loam to loam. The soil texture of polder 39/2C has been presented in Table 6.9.

Table 6.9: Soil texture of the scheme area

Soil texture with depth (cm)	% of NCA					
	Clay	Loam	Clay Loam	Sandy Loam	Sand	Total
Topsoil (0-15cm)	30	20	50	-	-	-

Sources: SRDI, 2012

6.3.5 Soil Salinity

Salinity is an inherited characteristic of coastal area. Coastal area is saline with tidal flow, capillary rise of saline groundwater and irrigation with saline water. Soil salinity is flushed out with rainwater in monsoon season and from upstream flow. There is also a relationship between river flow and salinity levels, the lower the flow the higher the level of salinity. The degree of salinity varies widely with area and season, depending on availability of freshwater, intensity of tidal flooding and nature of saline groundwater movement. The soil possess very low to very high saline condition in the dry season (2-24.4 ds/m) and soil pH ranges from 6.5-7.0 (Field Survey, 2009-2010). The fertility level is generally high with medium to high organic matter content.

The saline water of sea enters the polder areas through coastal rivers, channels, creeks twice every day during high tide. Inindation of land by saline tidal water causes salinization of the soils in the polder area. These lands are not favorable for most of the crop production. In Polder 39/2C, around 4595 ha area are very highly saline.

6.3.6 Farming practices

Farming practices within most of the Polder area have adjusted to agro-climatic conditions prevailing in Kharif (March-October) and Rabi (November-February) seasons. The crop year starts from the Kharif-I season which is characterized by high temperature, high evaporation, low humidity and low rainfall. Kharif-II season is characterized by high rainfalls, lower temperatures, high humidity, low solar radiation and high floods that recede towards the end of the season. The Rabi season is characterized by low temperatures, high solar radiation, low evaporation, insignificant rainfalls and low humidity. Kharif-II crops are harvested in the Rabi season and Rabi crops are harvested in Rabi season.

The farming practices in Polder 39/2C is complicated due to physical, biological, climatological and socioeconomic factors. The siltation of rivers and channels causes drainage congestion/ water logging during monsoon. Natural calamities like cyclone and surge cause devastating crop damage in the project area. Scarcity of fresh water for irrigation during dry season is also responsible for the non-expansion of the agriculture farming practices. On the other hand, saline surface water creates very favorable environment for brackish water fish culture. The environment of polder is also suitable for fish cum paddy cultivation. A limited variety of crops are grown due to unfavorable situation prevailing in the project area. Rice is the main crop grown because of its adaptability in diversified ecological conditions.

6.3.7 Present Cropping pattern and intensity

The present cropping pattern of the Polder area is Fallow - T Aman (Local) - Fallow, which is practiced in about 33% of the Net Cultivable Area (NCA). T. Aus (HYV) - T. Aman (Local) - Fallow is the next cropping pattern covering about 19% of the NCA. Fallow – T. Aman (HYV) - Fallow is the next cropping pattern 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 6.10.

Table 6.10: 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
Highland	Orchard	Orchard	Orchard	65	0.8
Highland	S. Vegetables	T. Aman (HYV)	Chilli	135	1.6
Highland	T. Aus (Local)	T. Aman (Local)	Potato	47	0.6
Highland	T. Aus (Local)	Fallow	W. Vegetables	228	2.7
Highland	T. Aus (HYV)	T. Aman (Local)	Oilseeds	100	1.2
Highland	T. Aus (HYV)	T. Aman (Local)	Fallow	1,060	12.0
Highland	T. Aus (HYV)	T. Aman (HYV)	Fallow	450	5.0
Highland	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
Medium Highland	T. Aus (HYV)	T. Aman (HYV)	Spices	93	1.09
Medium Highland	Fallow	T. Aman (HYV)	Fallow	1,267	15
Medium Highland	Fallow	T. Aman (Local)	Fallow	2,780	33
			Sub-total	**5,756**	**68**
Medium lowland	Fallow	Fallow	Boro (HYV)	123	1.4
Medium lowland	Fallow	Fallow	Oilseeds	150	2
Medium lowland	Fallow	Fallow	Pulses	327	4
			Sub-total	**600**	**7.4**
			Total	**8,500**	**100**

Source: Feasibilty report (agriculture), CEIP, 2012

6.3.8 Cropped Area and Production

Detailed cropped area, crop production, yield rate, damaged area and production loss are presented in Table 6.11.

Cropped Area

Total cropped area is about 12,653 ha of which rice occupied about 11,314 ha and the rest 1,339 ha is covered by non-rice crops. The rice cropped area is about 89% of the total cropped area.

Among the rice, T. Aman (HYV), T. Aman (Local), T. Aus (HYV), T. Aus (Local) and Boro (HYV) are commonly grown in the polder area.

Crop production

The total crop production has been calculated on the basis of damage-free area and damaged area. In the damaged free area, the normal yield of crops has been considered under the study. In the damaged area the damaged yield against the damaged area has been considered. This can be expressed as:

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

Total rice production is about 18,791 metric ton (Table 5.8), of which the contributions of T. Aman (HYV), and T. Aman (Local), T. Aus (HYV), T. Aus (Local) and Boro (HYV) are about 16.8%, 31.3%, 47.7%, 2.7% and 1.5% respectively. Total non-rice crop production is about 7,060 metric ton (Table 5.8)

6.3.9 Damaged area and production loss

Crop damage data for years 2007-2011 period (years) have been collected from the field in consultation with stakeholder/ farmers and officials of the DAE. The data from outside and inside embankments, drainage congested areas and salinity affected areas are considered for this purpose. Average annual crop damage along with damaged area have been evaluated. Crop production loss has been calculated using the formula:

Crop production loss = Total cropped area × damage free yield - (damaged area × damaged yield + damaged free area × damage free yield).

In the project area about 2,362 ha and 115 ha area of rice and non-rice crop fields were affected due to drainage congestion, drought, salinity, natural calamities, pest and diseases infestation etc. Total production loss of rice and non-rice crop has been estimated as 4,223 metric ton and 1,593 metric ton respectively (Table 6.11).

Table 6.11: Cropped area, production, damaged area and production loss in polder 39/2C

Crop name	Total cropped area (ha)	Damage free area		Damaged area		Total production (ton)	Production lost (ton)
		Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
T. Aus (LV)	324	324	1.57	-	-	509	-
T. Aus (HYV)	3,319	3,319	2.7	-	-	8,961	-
T. Aman (LV/LIV)	5,603	3,922	1.5	1681	1	5,883	2,521
T. Aman (HYV)	1,945	1,264	2.5	681	1.4	3,161	1,702
Boro (HYV)	123	123	2.25	-	-	277	-
Total rice	**11,314**	**8,952**		**2,362**		**18,791**	**4,223**
Sugarcane	10	10	30	-	-	300	-
Orchard	65	65	10.5	-	-	683	-
Chilli	135	135	1.25	-	-	169	-
Pulses	327	327	1.5	-	-	491	-
Potatoes	96	96	14	-	-	1,344	-
S. Vegetables	135	88	12	47	6	1,053	567

Crop name	Total cropped area (ha)	Damage free area		Damaged area		Total production (ton)	Production lost (ton)
		Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)		
W. Vegetables	228	160	15	68	10	2,394	1,026
Spices	93	93	3.25	-	-	302	-
Oilseeds	250	250	1.3	-	-	325	-
Total non-rice	**1,339**	**1,223**		**115**		**7,060**	**1,593**
Total	**12,653**	**10,176**		**2,477**		**25,851**	**5,816**

Source: Feasibilty report (agriculture), CEIP, 2012

6.3.10 Agriculture input use

Fertilizer and pesticides application

The rate of use of fertilizer per hectare varies considerably from farmer to farmer depending on soil fertility, cropping pattern and financial ability (Table 6.12). The major fertilizers used in this area are Urea, TSP and MP. The quantities of fertilizer are used 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 other chemical fertilizers. Generally farmers did not use manure or compost in their fields. Unbalanced use of chemical fertilizers would affect the soil health which would be ultimately reflected on crop yields.

Table 6.12: Fertilizer and pesticide use in the project area

Crop Name	Fertilizer (Kg/ha)						Pesticide (Tk/ha)
	Urea	TSP	MP	Gypsum	Zinc	Manure	
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: Feasibilty report (agriculture), CEIP, 2012

The use of pesticides depends on the degree of pest infestation. The majority of the farmers applied pesticides in T. Aus (Local/HYV), T. Aman (Local/HYV), Boro, Chilies, Potatoes, Vegetables and Spices crops. The major insects as reported by the farmers are Yellow Stem borer, rice hispa, Ear cutting caterpillar, Brinjal shoot and fruit borer, Fruit weevil and etc. Local farmer reported that they are using different types of pesticides such as Darsban, Melathion, Furadan (granular), Cup granular and powder etc. To prevent pest infestation in rice, vegetables and other croplands. Farmers of the polder area applied pesticides once or twice in a season.

Two oil samples were collected from different location of Polder 39/2C. The collected soil samples were sent to the Agrochemical & Environmental Research Division, Institute of Food and Radiation Biology of Atomic Energy Research Establishment, Savar, Dhaka for detect pesticide residues. As the desired pesticide residues were analyzed with a detection limit of 0.004 ppm using GC-MC (Thermo Electron & Pekin Elmer). The analyzed result shows that no pesticide (furadan) exists in the soil samples in the following table.

Sl No.	Location	Sample ID	Carbofuran (ppm)
1	Polder39/2C	1A(0-15cm)	ND
2	Polder39/2C	1B(15-30cm)	ND

Note: ND: Not detected, LOD = 0.004ppm, LOQ = 0.01ppm

Seeds

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 be considered for seed selection.

Most of the farmers in the project area used their own seeds in case of local variety, such as T. Aus and T. Aman. Medium and small farmers meet their requirement from neighboring farmers or local markets. Various improved crop seeds (HYV/Hybrid) are provided by BADC and private seed dealers. 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 also not aware of them. The seed rate for different crops is presented in Table 6.13.

Table 6.13: Cultivation cost in the polder area

Crop Name	Seed (Kg/ha)	Irrigation cost (Tk)	Equipments used for cultivation		Power tiller cost
			Power tiller (%)	Bullock	
T. Aus (Local)	35	-	85-90	15-10	3500-4500
T. Aus (HYV)	25	-	85-90	15-10	4000
T. Aman (Local)	30		85-90	15-10	3500
T. Aman (HYV)	25	-	90	10	4000
Boro (HYV)	25	5500	100	-	5000
S. Vegetables	2-3	200	85-90	15-10	3500
Chilli	2-3	300	85-95	15-10	3500
Pulses	30	-	-	-	-
Potatoes	2000 (Tuber)	2000	85-90	15-10	4000
W. Vegetables	2-3	300	80	20	3500
Spices	1-3	-	80	20	3000
Oil seeds	10	-	90	10	4000

Source: Feasibilty report (agriculture), CEIP, 2012

Irrigation

Irrigation is provided mainly in HYV Boro crops in the project area. Irrigation coverage of the study 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, Kocha, Bishkhali), internal river Pona river/Pona don and Khals (Kathaltali khal, Chander khal, Bamuner khal, Bothla khal,Telikhali, Podderer khal, Bhuter khal, Moller khal, Jalner 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. The salinity of the surface water gradually increases and reaches around EC>10.0 dS/m during April-May, which is far above tolerance, limit (EC< 2.0-4.0 dS/m). The surface water salinity comes down to around EC< 1.5 dS/m during monsoon season.

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 project area are grown under fully rain-fed condition. In some cases, HYV Aman is grown with supplementary irrigation.

Labor

In the polder area area, mostly manual labor is used for cultivation. Thereby, agricultural labor is considered as 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. The average labor used in the study area is presented in Table 6.14.

Table 6.14: Labor used in the study area

Crop name	Labor(No/ha)	Crop name	Labor(No/ha)
T. Aus (Local)	150	Chilli	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
Wheat	180		

Source: Feasibilty report (agriculture), CEIP, 2012

6.3.11 Livestock and Poultry

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.

Most of the households in the project 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 6.15.

Table 6.15: Status of Livestock and Poultry of the polder area

Livestock/Poultry	Number of Livestock
Cow/bullock	35,380
Buffalo	1,290
Goat	4,290
Sheep	1,090
Duck	37,500
Chicken	110,870
Total	**190,420**

Source: Feasibilty report (agriculture), CEIP, 2012

Figure 6.12: Few duck and and cattle of the polder area

6.3.12 Feeds and fodder

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.

In the fallow lands, brackish water shrimp culture is a common practice, which significantly reduces the grazing area of cattle. Shortage of grazing land throughout the year aggravates the feed problem for the animal population. Poultry population at family level survives by scavenging and generally no feed supplements are provided. However, at times kitchen waste becomes feed for the poultry.

6.3.13 Livestock and poultry disease

Production of livestock and poultry are mainly constrained due to diseases and death of the population. Outbreak of disease is causing a considerable economic loss in livestock farming. Every year livestock population is affected by different diseases like feet and mouth disease (FMD), Anthrax, Torka, Diarrhea, PPR etc. The got/cyst in head is common disease of goat. Major poultry diseases are Duck Plague, Paralysis, New Castle, Fowl pox, and Dysentery etc. The most vulnerable period is between July to October (rainy season) months for spreading diseases to livestock and poultry. The duck plague generally occurs in summer. However, some diseases are common throught the year.

During monsoon season, the soggy 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.

6.4 Fisheries Resources

6.4.1 Background

Based on the fish habitat, different varieties of fish are found in the polder area. Open water fish habitat of the proposed Polder includes surrounding rivers, such as *Kacha River and Pona River*, internal khals such as *Nadmulla khal, Hetalia khal, Fultola khal, Darulhuda khal, Bothla khal, Bamoner khal, Hainter khal, Poddarer khal, Mollar khal, Junia Khal, Napitkhalir Khal, Tentulbaria Khal, Gabtolar Khal, Rajpasha Khal, Degree Khal, etc* acting as major arteries of fish migration into the study area. These are playing vital role in maintaining fisheries productivity of internal open water. Bulk of the commercial fish production is coming from culture fish habitats while the main catch of capture habitats come from different seasonal and perennial canals. The proposed polder area is surrounded by two river system such as *Kacha river* (75% of rivers; perennial in nature), *Pona river* (25% of rivers; perennial in nature). As the rivers are peripheral and beyond the polder area fish production from them is not considered in the polder area as fish production estimation. Fish production trend is declining gradually from the open water sources. The numbers of fishermen is decreasing due to shrinkage of open water fish habitat; loss of fish biodiversity and corresponding decrease of fish catch. Aquaculture is developing in suitable ponds of congestion free highland area within the polder area.

Figure 6.13: Perennial open water fish habitats

The area is relatively moderate in fish biodiversity. But, the fish biodiversity shows a decreasing trend because of morphological changes, violating fisheries rule, use of harmful fishing gear, indiscriminate fishing etc. Aquatic environmental quality is satisfactory in the polder though some pollutants are released from crop fields and, are substantially causing some damage to fish. Fisheries sector is contributing in small scale to the local economy for improving the local livelihoods.

6.4.2 Fisheries problems and issues

Major fisheries problems and issues so far identified during baseline survey are as follows-

- siltation of internal khals are causing loss of year round river khal connectivity;
- indiscriminate fishing by using monofilament gill net, net jal, etc and overexploitation of fishes by using huge number of narrow meshed ESBN (Estuarine Set Bag Net) fishing;
- lack of quality fish seed and feed for the improved aquaculture practices;
- intrusion of salinie water and overtopping the culture fish pond;
- insufficient loan facilities for aquaculture practices.
- insufficient trained fish farmer, etc

6.4.3 Fish habitat description

6.4.3.1 Habitat classification

The polder mainly covers four unions viz Dhaoa (97%), Ikri (93%), Nadmulla (65%) and Telikhali (65%) of Bhandaria upazial. Total fish habitat of four unions is 2415 ha of which 919 ha falls in this polder area has been considered polder fish habitat. Fish habitat of the Polder area is primarily classified under two broad categories, for instance, capture fishery and culture fishery. Internal khals as well as floodplain are considered under capture fish habitat. The culture fish habitats are of two kinds such as Homestead fish pond and Commercial fish pond. Internal Khal fish habitat occupies over 27% of the total habitat of study area followed by floodplain, commercial fish pond and homestead fish pond. Commercial fish ponds occupy 25% of the water bodies of the Polderarea (Figure 6.14).

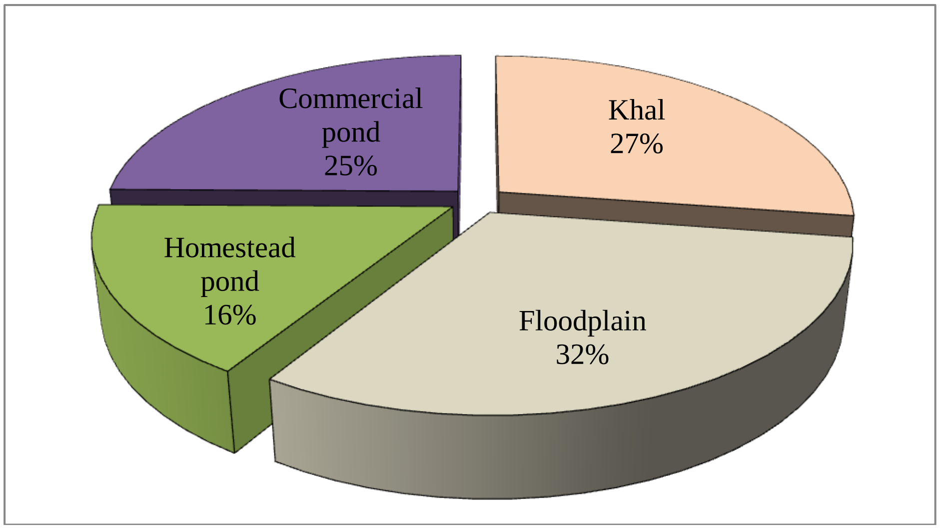

Figure 6.14: Fish habitat in the Polder area

6.4.3.2 Habitat distribution

The fish habitat of the polder area is mostly concentrated at Bhandaria Upazila comprises four unions. The area distribution of four unions of Bhandaria upazila is as shown in Figure 6.15.

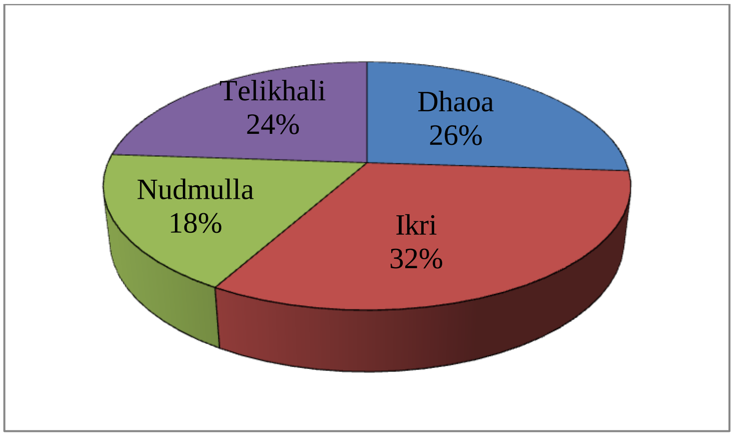

Figure 6.15: Distribution of fish habitat area within the Polder area

Capture fisheries

The estimated open water fish habitat of the polder area is 541 ha which is included in khal and floodplain as shown in the following Table 6.16.

Table 6.16: Fish habitat status of the study area

Sl. No.	Fisheries Category	Habitat Types	Area (Ha)	% of Habitat
1	Capture	Khal	251	27.3
2		Floodplain	290	31.6
		Sub-total	***541***	***59***
3	Culture	Homesteadpond	150	16.3
4		Commercial pond	228	28.8
		Sub-total	***378***	***41***
		Grand Total	**919**	**100**

Source: Data extracted from draft final of fishery report, Volume-II, CEIP

The polder area consists of a number of seasonal and perennial internal canals/khals, among those *Nadmulla khal*, *Bamoner khal*, *Hetalia khal*, etc are important.

It is rported that average depth of internal khals is 1.5-2.0 m which is sufficient for fish habitation. Depth of seasonal canals of the polder area is insufficient for sheltering fish juveniles. Local people reported that siltation rate in the internal fish habitats of the polderis 2-3 cm per year. Khal beds are silted up due to deposition of loose soil coming from agriculture field and tidal action carry lot of sediment.

Culture fisheries

Aquaculture practice is expanding slowly in the study area – constrained by overtopping of fish ponds 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. Exclusively poly-culture practice is adopted by the local people. Estimated area under culture pond is 378 ha (Table 6.16). About half of these ponds are non-commercial and traditional in nature.

Figure 6.16: Culture fish habitats inside the polder area

6.4.4 Fish production

Total fish production of the polder area is about 728 MT. A large volume of the inland fish production (73%) is coming from culture fisheries. the production from from different capture fisheries habitats is compareatively low (Table 6.17). Currently, fish production trend from capture fisheries is declining in the polder area due to silted up of internal khals and indiscriminate fishing activities. A major objective of this project is to protect saline water intrusion and flood water in agriculture land which continues to decrease the open water fish habitats.

Table 6.17: Fish production from different habitats of the polderarea

Sl. No.	Fisheries Category	Habitat Types	Total production (MT)
1	Capture	Khal	46
		Floodplain	81
		Sub-total	***127***
2	Culture	Homestead pond	111
3		Commercial pond	490
		Sub-total	***601***
		Grand Total	**728**

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

6.4.5 Fishing Effort

Fishers number

During the 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, 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 (80%) and rest (20%) from Hindu caste. They usually catch fish in the nearby tidal floodplain, rivers and khals. The main fisheries occupations of the polder area are mainly fishers, fish traders and fish farmers.

Fishing season

Monofilament Gill net (Current jal) fishing is the major fishery of the study area. Next to seine Chandi jal, Poma jal, Net jal, Jhaki jal, Chargora jal, Vesal jal fishing is prominent in the polder area fish habitats. Fishing in seasonal canals as well as in peripheral rivers starts in *May and continues up to March*. Rest of the time they are mainly engaged in other fishing. The traditional fishers catch fish in the rivers and perennial khals which are still open all the year round in most cases. The seasonality of major fishery is furnished in the Table 6.18.

Table 6.18: Fishing seasonality of the polderarea

Seasonality of fishing types

Fishing types	Boishakh	Jaishthya	Ashar	Sravon	Bhadra	Ashyin	Kartik	Agrahayan	Paush	Magh	Falgun	Chaitra
Seasonality	Apr–May	May–Jun	Jun–Jul	Jul–Aug	Aug–Sep	Sep–Oct	Oct–Nov	Nov–Dec	Dec–Jan	Jan–Feb	Feb–Mar	Mar–Apr
Kerrant jal	Low	Low	Medium	Medium	High	High	High	High	High	Medium	Low	Low
Chandi	High	High	High	High	Medium	Medium	No occurrence	No occurrence	No occurrence	No occurrence	High	High
Poma jal	Low	Low	Low	Medium	Medium	High	High	High	Medium	Medium	Low	Low
Net jal	No occurrence	No occurrence	No occurrence	No occurrence	Medium	High	High	Low	Low	No occurrence	No occurrence	No occurrence
Badha/Bendi jal	No occurrence	High	High	High	No occurrence	No occurrence	No occurrence	No occurrence	No occurrence	High	High	No occurrence
Jhaki jal	Medium	Medium	Medium	High	High	High	High	High	Medium	Medium	No occurrence	No occurrence
Chargora jal	Low	Medium	Medium	Medium	High	High	High	Medium	Medium	Low	Low	Low
Vesal jal	No occurrence	No occurrence	No occurrence	Low	Medium	Medium	Medium	High	High	High	Low	Low
	Low	Low	Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low

High | Medium | Low | No occurrence

Source: Field Survey, 2012

Fishing crafts and location

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

Fishing gears and target species

In the polder area, eight types of nets/gears are used for fishing: (a) Mono filament net, locally known as Current jal, used to catch poa, ghagla, chingri, tengra, gulsha, along with other estuarine fish as well; (b) Lift net, locally known as Vesal jal, used to catch punti, tengra, gulsha, bailla, guchi, bata, chingri, etc. (c) Cast net, locally known as Jhaki jal, used to catch rui, katla, puti, pua, bagda, golda, phasa, etc. (d) Drag net locally known as Net jal used to catch PL (post larvae) of shrimp and prawn; (e) Badha jal, is used to catch baila, chingri, punti, tengra, gulsha as well as other all type of small fishes; (g) Chandi jal, used to catch Ilish; (h) Poma jal, used to catch poa; (i) Chargora jal, 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 thepolder area are cast net (Jhaki jal), drag net (net jal), lining (Borshi), fishing traps (Aton), etc. (Figure 6.17).

Figure 6.17: Different types of fishing gears of the Polder area

6.4.6 Fish Migration

The main route of migration of natural fish and shrimp is the Koacha river and its connected different khals. Reportedly, feeding and spawning migration of riverine and polder area resident fish species occur through open and regulated khals at some extent during the period of late June to August. Perennial khals such as *Nadmulla khal, Hetalia khal, Bamoner khal* along with other seasonal internal khals are used as feeding and shelter ground of most of the open water fishes (Figure 6.18). Fish species like *Paisa, Betki, Horina Chingri, Khorsula, and Chatka* Chingri migrate horizontally to these water bodies as part of their life cycle. Peripheral rivers along with internal river and khals of the polder area are silted up naturally and due to structures on the khals cause the reduction of the length of successive migration routes.

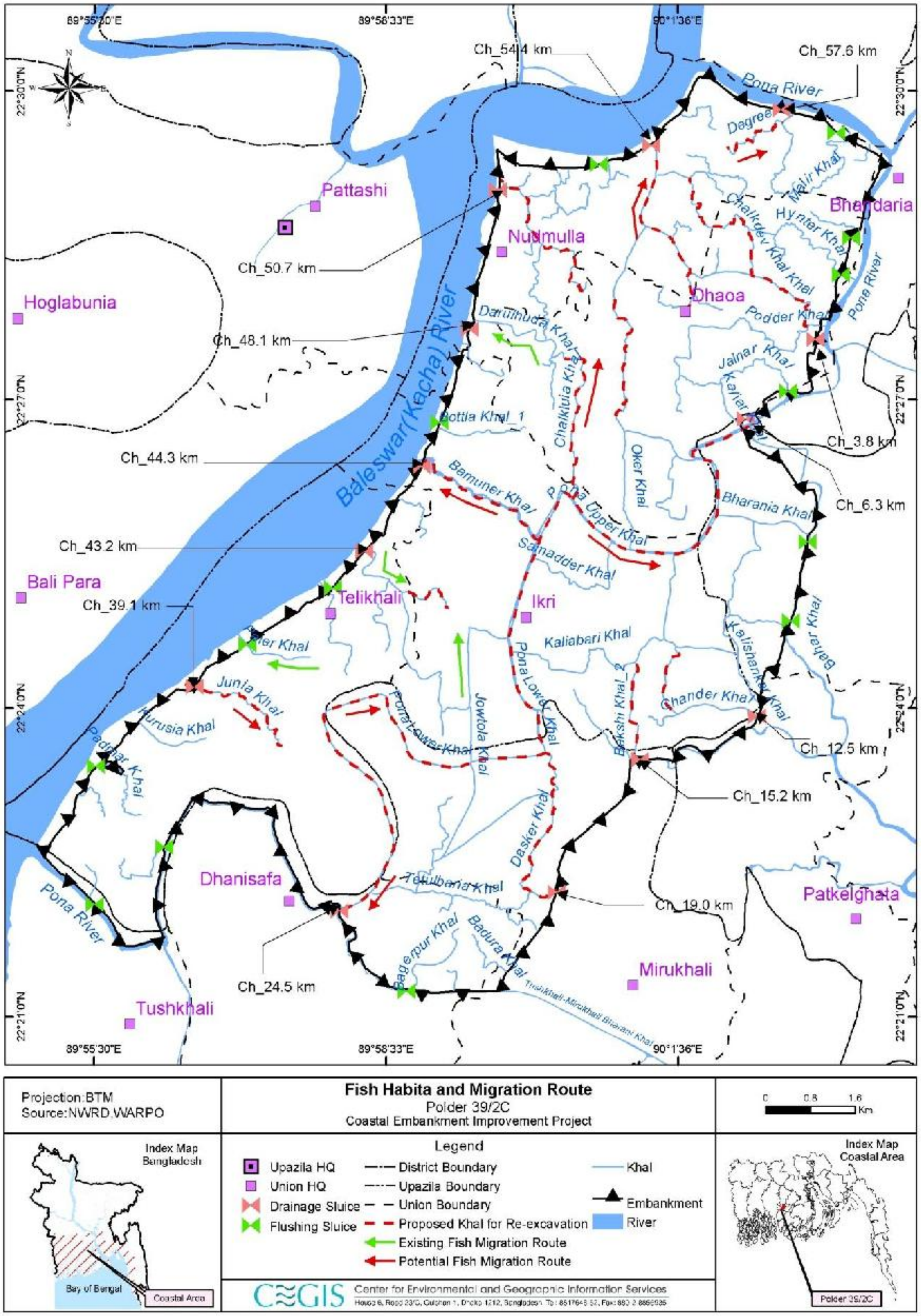

Figure 6.18: Fish migration route in the polder area

6.4.7 Fish Biodiversity

The fish biodiversity in the polder area is moderate while the biodiversity shows a declining trend over the years. The causes of gradual declining of fish abundance and biodiversity are pollutants (agrochemicals and pesticides) coming from ricefields, morphological changes of internal khals, siltation of fish habitats, squeezing of spawning and feeding grounds etc.. The Polderarea comprises an assemblage of both fresh and brackish water fish species (Figure 6.19).


Figure 6.19: Major fishes occupying the catch composition of polder area

Checklist of the fishes of different habitats reported by local fishers is analyzed to draw a tentative scenario of the local fish biodiversity of the study area. List of the fishes of different habitats of the study area is as follows.

Table 6.19: Indicative fish species diversity of different fish habitats in the Polderarea

Scientific Name	Local Name	Habitat Type		
		River	Khal	Fish pond
Brackish fish species				
Sperata aor	Ayre	P	A	A
Mystus vitatus	Tengra	P	P	A
Mystus cavasius	Gulsa	P	P	A
Macrobrachium rosenbergii	Golda	P	P	P
Macrobrachium rudi	Bagda	P	P	P
Metapenaeaus monocerus	Harina Chingri	P	P	P
Leander styliferus	Gura chingri	P	P	P
Acentrogobius cyanomos	Nuna Baila	P	P	A
Pama pama	Poa	P	P	A
Mugil corsula	Kholla/Bata	P	P	A
Latescal carifer	Vetki	P	A	A
Liza persia	Persa	P	A	A
Setipinna phasa	Phasa	P	A	A
Polynemus paradiseus	Taposhi	P	A	A
Fresh water fish species				
Glossogobius giuris	Baila	P	P	A

Scientific Name	Local Name	Habitat Type		
		River	Khal	Fish pond
Gudusia chapra	Chapila	P	P	A
Ompok pabda	Pabda	P	P	A
Aila puntata	Baspata	P	A	A
Channa straitus	Shol	A	P	A
Channa punctatus	Taki	A	P	P
Puntius titco	Tit punti	P	P	A
Anabas testudinius	Koi	A	P	A
Heterpnestis fossilis	Shing	A	P	A
Mastacembelus spp.	Boro baim	P	P	A
Mastacembelus pancalus	Chirka baim	P	P	A
Culture fish species				
Sarotheradon nilotica	Nilotica	A	A	P
Telapia mossambica	Telapia	A	A	P
Ctenopharyng odonidellus	Grass carp	A	A	P
Puntius sarana	China punti	A	A	P
Labeo rohita	Rui	P	A	P
Catla catla	Catla	P	A	P
Cirrhinus mrigala	Mrigal	P	A	P
Hyphthalmictric molitrix	Silver carp	A	A	P
Ctenopharyngodon idellus	Grass carp	A	A	P

Here, A=Absent and P=Present
Source: Feasibility report of CEIP and field survey, 2012

6.4.8 Species of conservation significance

There are some fish species which are locally unavailable for last 10 years or have become rare as reported by the local fishermen and concerned elderly people. The list of of fish species of conservation significance are given in the following table.

Table 6.20: List of species of conservation significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Notopterus chitola	Chital	√	
Nandus nandus	Veda/Mani	√	
Clarius batrachus	Magur	√	
Acanthopagrus latus	Datina		√
Heteropneustes fossilis	Shing		√
Channa marulius	Gojar		√

Source: Field Survey, 2012

6.4.9 Area of conservation significance

Nadmulla khal, Hetalia khal, Bamoner khal, etc and other peripheral water body is used as feeding and spawning ground of most of the open water fishes. There is limited scope for conservancy measures though with active participation of the community through establishing fish sanctuary in sections of the above internal khals and co-manageement with the community.

6.4.10 Fish marketing and post harvest facilities

In the polder area, local fishers sell bulk of their catch either directly to the local fish market (*Chinguria Bazar*, *Darulhuda Bazar*, *Nadmulla Bazar*, *Bothla Bazar*, *Banai Bazar*, *Telikhali Bazar*, *Ikri Bazar*, *Shafa Bazar*, etc.) or to fish traders or buyers (*Bapari*) coming from *Patuakhali*, *Bagerhat*, etc. Fish farmers sell their fishes to the fish traders coming from *Patuakhali*, *Bagerhat*, etc. Real fish arats are lacking in thispolder area. No structured fish landing centers are found in the area. Ice from ice plants is used for icing the harvested fish. No well fish storage facility is available. Transportation facility at root level is moderately developed. There is no private/ Govt. hatchery inside the polderarea. 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 at *Bagerhat*, *Khulna*, etc. Fish feeds are also collected from the fish feed mills at *Patuakhali*, *Bagerhat* etc. Quality of fish feeds are the immense threat for the fish farmers as the growth of fishes are retarded due to this phenomenon.

Tidal flood as well as riverine flood sometimes washes away the aquaculture ponds, damages the pond dykes, aggrades the pond beds and happen to cause lossfor the pond owner as fishes escape from the ponds. It occurs in every three to four years. The magnitude of fish loss from the aquaculture ponds ranges from 75% to 80%. Tidal flood also causes sand carpeting on the khals and thus created as less suitable for fish habitation. Inadequacy or lack of fish landing centers causes the wastage of fish.

6.4.11 Fishers lifestyle

The fisheris lifestyle in the polder is is moderate to poor. Average daily incomes of commercial fishermen, part time and subsistence level are Tk. 250-300, Tk.200-250 and Tk. 50-100 respectively while previous (10-15 years ago) daily income level was Tk- 300-350 Income level of traditional fishers is decreasing due to saline water intrusion in fresh water bodies, silted up internal khals, indiscriminate and over exploitation of fisheries resources, etc. Consequently, they are changing their occupation. They are also vulnerable to the musclemen who are responsible to convert open water fish habitats into culture fishery as well as natural degradation of fish habitats. A person involved in fish culture is mostly practicing both traditional and modern method.

6.4.12 Fisheries management

There is no community based fisherman association in the polder area. Fishing right on existing fish habitats is significant particularly on 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 they are very much limited to micro credit rather than extension services and aquaculture training. Enforcement of fisheries regulation is also weak.

6.5 Ecological Resources

The Proposed polder area is located in the southwestern part of the country which includes important ecosystems. The area is enriched by tidal river system and possesses numerous internal canals, mangroves, creeks, and homestead. The polder area and its surroundings are moderately covered with local vegetation as well as faunal species.

6.5.1 Bio-ecological Zone

According to the ecosystem features, species diversity, IUCN Bangladesh identified 25 Bio-ecological Zones in Bangladesh (Nishat *at el*, 2002). They are Himalayan Piedmont Plain, Barind Tract, Madhupur Sal Tract, Teesta floodplain, Ganges Flood plain, Brahmaputra-Jamuna floodplain, Surma-Kushiara floodplain, Meghna floodplain, Haor basin, Chalan Beel, Kaptai Lake, Gopalgonj-Khulna Peat Land, Sundarbans, Chakaria Sundarbans, The coastal plains, Offshore islands, Narikel Jinjira coral island, Narikel Jinjira coral island, Sandy beach/Sand dunes, Chittagong Hills and the CHT, Sylhet hills, The Lalmai-Tipperah hills, The saline tidal floodplain, Major Rivers, Coastal Marine Water.

The polder sites have the characteristics of one important bio-ecological zones of the country namely Ganges Flood plain, (Figure 6.20). Details of the zone within the Polder area are described below.

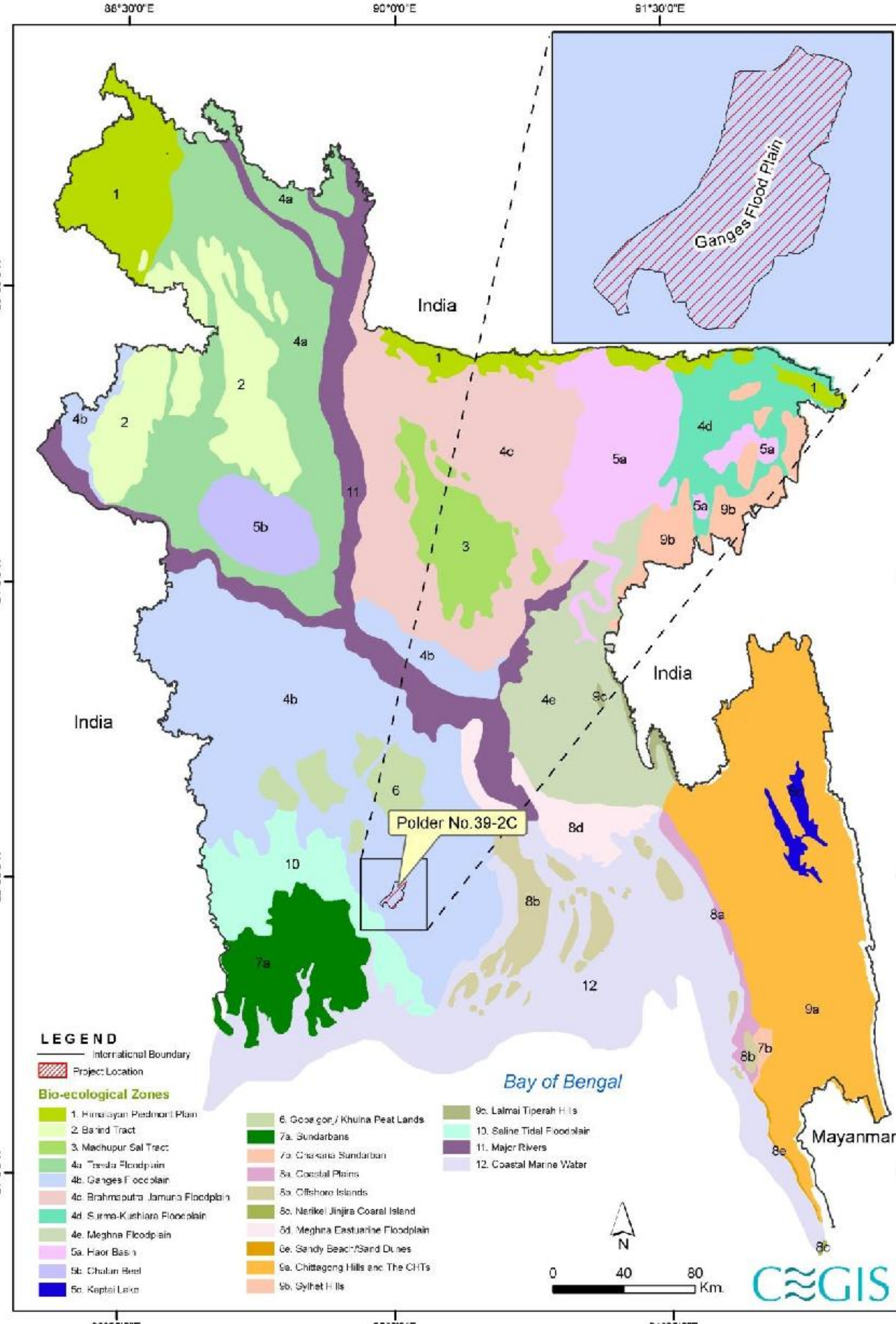

Figure 6.20: Location of bio-ecological features of the Polder 39/2C

The Ganges Floodplain

The Ganges Floodplain is the active meandering floodplain of the Ganges River. The floodplain mainly comprises of a smooth landscape of ridge, basins and old channels. The Ganges channel is constantly shifting within its active floodplain, and eroding as well as depositing large areas of charlands in each flooding season. Both plants and animals move and adapt with the pattern of flooding (Brahmer, 1996). The floodplain is characterized by mixed vegetation and support a habitat of rich bio-diversity to some extent due to the presence of a lot of stagnant water bodies and channels, rivers and tributaries. Beels and other water bodies support good amount of free floating aquatic vegetation. Homestead forests are prominent with both cultivated and wild plant species. In this zone, the dominant floral types are the Panimorich (*Polygonum orientale*), Jhanji (*Hydrilla verticillata*), Topapana (*Pistia strateotes*), Chechra (*Schenoplectus articulatus*), Sada Sapla (*Nymphaea nouchali*), Keshordam (*Ludwigia adscendens*), Kolmi (*Ipomoea* sp), Tamarind (*Tamarindus indica*), Panibaj (*Salix tetrasperma*) etc. Moreover, Grasses are abundant in Ganges floodplain and begin to grow as soon as the floodwater begins to recede. *Cyperus rotundus*, *C. deformis*, *Eleocharis* spp., *Hemarthria* sp. etc are the notable grass species. Major groups of oriental birds are present in this zone by one or more species. In addition, a large number of migratory birds are found here during the winter. Beside this, different species of freshwater tortoise and turtles are found in the rivers and ponds. Among the amphibian species, toads, frogs and tree frogs are well known. Foxes, Jackals, rats, mice, squirrels, bats etc are common mammals of this bio-ecological zone.

6.5.2 Ecosystems

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. ThePolder area is also near the Katcha River (Figure 6.21) where global and local shore bird was found. The project area supports two types of ecosystem with flora and fauna. They are-

- Terrestrial Ecosystem
- Aquatic Ecosystem

The biological brief of these ecosystem locations are presented below.

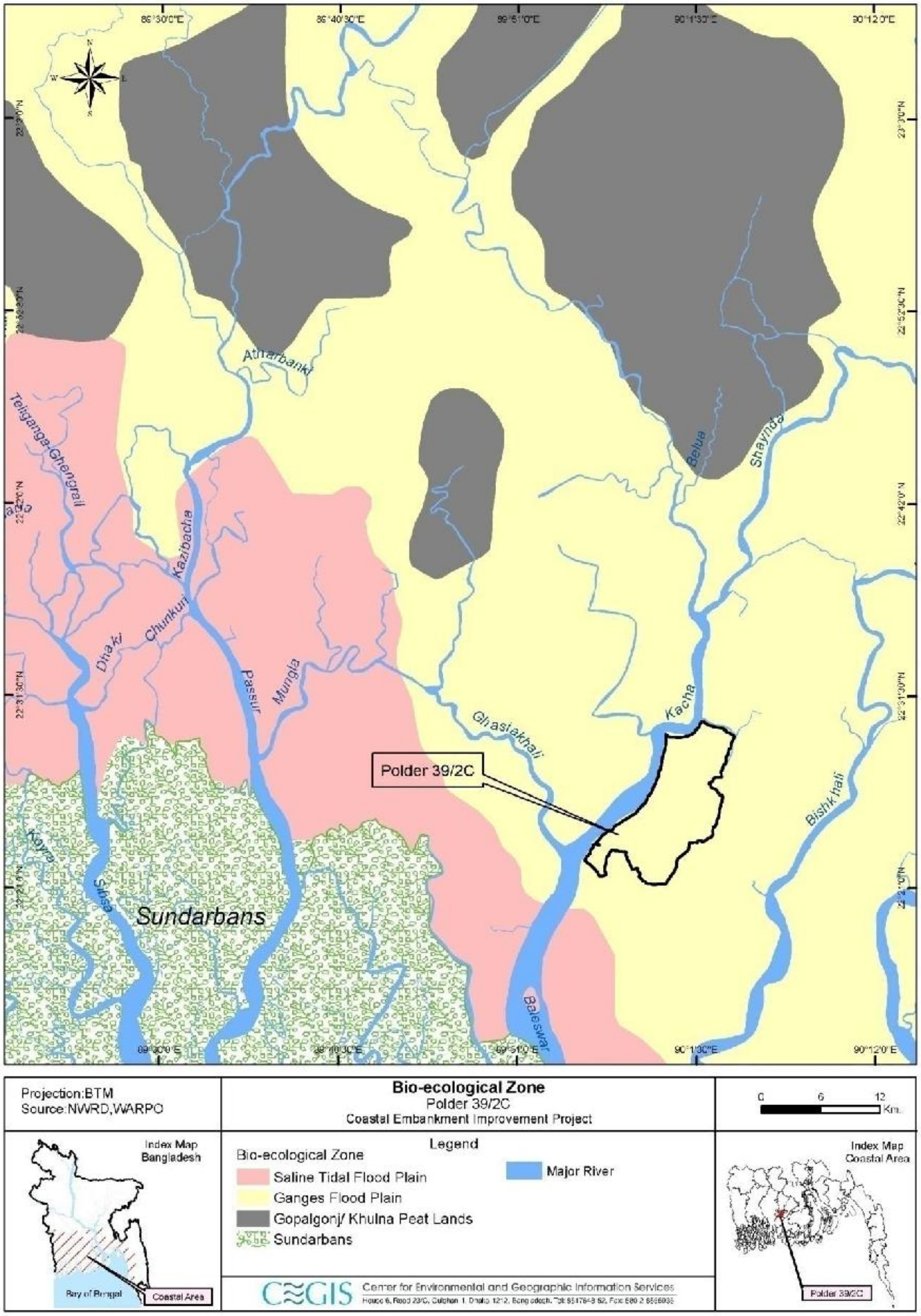

Figure 6.21: The base map of the Polder area

Terrestrial ecosystems

The major divisions found within the terrestrial ecosystems of the project area are i) Agricultural land, ii) Settlement/ homestead vegetation, iii) Embankment and roadside vegetation, and iv) Fallow lands. The terrestrial ecosystem can be divided into two categories: 1) Natural vegetation and 2) Human influenced vegetation. Natural vegetation includes wooded areas, 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. The composition of plant species in the homestead are: Narikel (*Cocos nucifera*), Supari (*Areca catechu*), Kafila (*Lanea coromandelica*), Neem (*Azadirachta indica*), Khejur (*Phoenix sylvestris*), Taal (*Borassus flabeliffer*), Kola (*Musa* Spp.), Kanthal (*Artocarpus heterophyllus*), Sisoo (*Dalbergia sisoo*), Rain tree (*Samanea saman*) and Bansh (*Bambusa* Spp.).

Figure 6.22: Road Side vegetation

Figure 6.23: Terrestrial habitat of the Polder

The agricultural lands are used for rice cultivation. Agricultural lands are fragmented around the homesteads and used for producing one or two rice crop and some vegetables. The crop field vegetation has low diversity of all types, but it is more important for searching food and shelter of wildlife. The major species (weed) growing with the crop in this area are *Alternanthera sessilis, Ageratum conyzoides, Heliotropium indicum, Cyperus cephalotes, Digitaria longiflora, Amaranthus spinosus, Polygonum sp, Oxalis corniculata and Cynodon dactylon*. Fallow lands are areas that are usually left out of crop production due to some physical constraints. These areas provide space for grazing and serve as habitats for several plant and wildlife species.

Roadside vegetation (Figure 6.22) of the polder area is dominated by Babla (*Accia nilotica*), Dhol Kalmi, Rendi koroi (*Albizia saman*), Sissoo (*Dalberzia sissoo*) etc. Embankment sides are exclusively dominated by Babla (*Acacia nilotica*) tree, Bhat (*Clerodendrum viscosum*), Dutura (*Datura metal*), Biskantali (*Polygonum* Sp.), Veranda (*Ricinus communis)* etc. Durba (*Cynodon dactylon*) is a common grass species which is exclusively dominant and cover top soil of the embankment. Details of the terrestrial and crop field's species diversity are mentioned on Table 1 under Annex 3.

Aquatic Ecosystems

Aquatic habitat in this area includes external rivers, internal channels and homestead ponds (Figure 6.24). 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 floras but also with many aquatic wildlife species including birds, fish amphibians and reptiles. Aquatic ecosystems of this polder may be classified into four major categories as follows:

- The surrounding rivers
- Internal canals
- Shrimp farms and
- Homestead's ponds and ditches.

The polder area is situated near Katcha River. The shrimp farms add some aquatic area to the main aquatic ecosystems to support different aquatic life-forms for their survival. Homestead's ponds are normally used for domestic purpose. Ditches exist between settlement and crop fields which bear comparatively high diversity of plant population. Internal canals possess some marginal vegetation. All major canals are connected with surrounding tidal rivers. The common floral species observed frequently within the project area are Shapla/Shaluk (*Nymphaea* Spp.) Kachuripana (*Eichhornia crassipes*), Dhol Kolmi (*Ipomoea fistulosa*), Khudipana (*Lemna* Sp.), Topapana (*Pistia strateotes*), Kutipana (*Azolla pinnata)* etc. Details of the aquatic species diversity are mentioned on Table 2 under Annex 3.

Figure 6.24: Aquatic habitat of the Polder 39/2C

5.8.3 Wildlife

Bangladesh is a part of the Indo-Burma biodiversity hotspot. The coastal zone contains several ecosystems that have potential conservation values. These ecosystems are not only biodiversity hotspot, but they also provide the ecological foundations for common property resources. The wildlife species within the project area are generally classified as amphibians, reptiles, birds and mammals.

The amphibian species are listed during field visit, amongst them Dicroglossidae was found highest in number. Among frog species the Indian Bullfrog (*Hoplobatrachus trigerinus*), Indian Pond Frog (*Euphlyctis hexadactylus*) is common. The members of this family usually prefer paddy fields, ponds, grasslands, gardens, arable lands, homestead forests, roadsides, drainage, ditches etc. Skipper Frog is available in water body like stream. Common Toad *(Duttaphrynus melanostictus)* is the only toad found within the site. Asian Brown Tree Frog *(Polypedates leucomystax)* is the tree dwelling frog belongs to the family Rhacophoridae, usually found in homestead forests, roadsides, around human habitation etc. It is arboreal whose niche preferences are branches of the trees, tree holes, from lower to mid canopy, bushy areas, nearby stagnant water bodies etc.

The reptiles species observed during the survey were House 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 tectum)* and Median Roofed Turtle *(Pangshura tentoria)* are common whereas Brown Roofed Turtle *(Pangshura smithii)* is very rare.

Common and uncommon bird species found in the project areas are India Pond Heron, Little Egret Cinnamon Bittern, Cotton Pigmy Goose, Little cormorant, White breasted Water Hen, Common Kingfisher, Lesser Whistling Duck, and Bronzed winged Jacana, Brhaminy Kite, and Pied Kingfisher etc. Common terrestrial bird species found within the project area is Common Myna, Pied Starling; Red vented Bulbul, Asian Magpie Robin, Green Bee-eater, Jungle Crow, House Crow, Common Tailor Bird, and House Sparrow.

The large mammals are in peril due to habitat destruction and hunting pressures. Mammal species are not very frequent within the site but few of them like Common Mongoose, Jungle Cat (*Felis chaus*), House Rat (*Rattus rattus*), Field Mouse (*Mus booduga*), Asian House Shrew (*Suncus murinus*), and Indian Flying Fox (*Pteropus gangeticus*) were found. Ganges River Dolphin (*Platanista gangetica*) roams in surrounding rivers. Existence of Fishing Cat has found within the area. Details of the wildlife species diversity mention on Table 3 under Annex 3.

6.6 Socio-economic Resources

6.6.1 Area and Location

The Polder 39/2C covers part of KanthaliaupazilaofJhalokati district as well as part of Bhandaria and Mathbariaupazilas of Pirojpur district. The Polder area falls in seven unions namely Chencuri Rampur, Dhaoa, Ikri, Nudmulla, Teikhali, Dhanisafa and Mirukhalias shown in **Table 6.21**.

Table 6.21: Unions and UpazilasinPolder39/2C

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, 2012

6.6.2 Demography

Based on the Census Report of Bangladesh Bureau of Statistics (BBS) for 2011, the population in the Polder 39/2C is 87,861. This includes 42,929 males and 44,932 females. A total of 20,525 households exist in the polderwithaverage size of 4.28 persons per household.The density of population is about 835 persons persquare kilometer. The key demographic data of the Polder is presented in **Table 6.22**.

Table 6.22: Demographic Data of Polder

Households	Population			Size of HouseHold
	Total	Male	Female	
20,525	87,861	42,929	44,932	4.28
		48.86%	51.14%	

Source: Population Census 2011, BBS

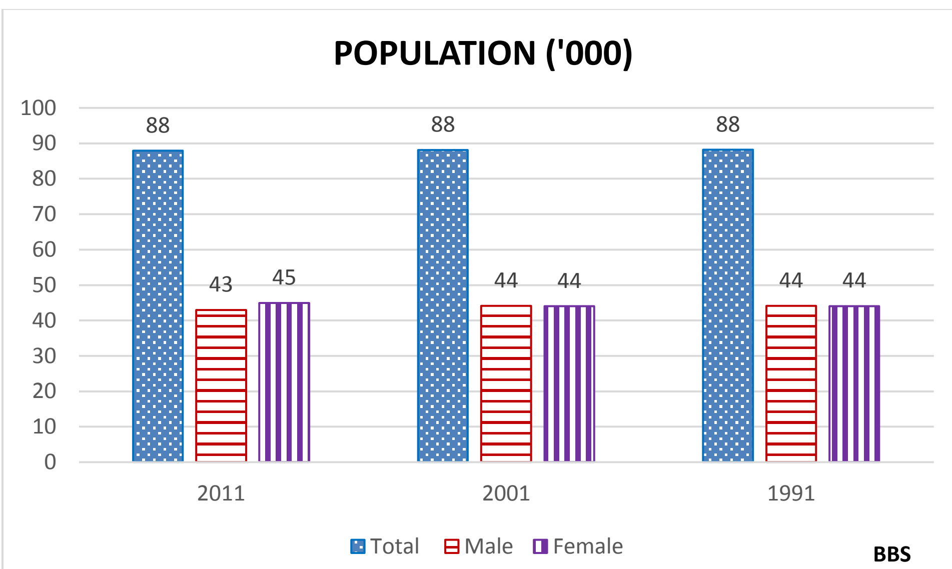

Figure 6.25 Trend of population in the study area.

Population trend is shown in thousands in the above figure (See **Figure 6.25**). It is found that total number of population remain same in 2011 as found in 2001 and 1991 (88 thousands). However, the number of male is decreased in comparison to the number of female in 2011.

Table 6.23 shows the age group composition of the people of the polder area. About 36 percent of the population is less than 15 years, 54 percent in between 15 to 59 years and 10 percentis over 60 years of age. The data shows that around 46 percent of the population depends on the 54 percent of the earning members of their households. Hence the dependency ratio is 85.

Table 6.23: Age Distribution in Polder

Age Range (Years)	0-4	5-9	10-14	15-19	20-24	25-29	30-49	50-59	60-64	65+
Percent of Population	10	13	13	8	7	8	24	7	4	6

Source: Population Census 2011, BBS

6.6.3 Livelihood

Occupation

According to the census report 2011, around 76 percent households report agriculture as their main occupation. About 16 percent population is engaged in service sector and only 8 percent is engaged in industrial sector. Most of the population is engaged in agriculture and service sector. (**Figure: 6.26** and **Table: 6.24**)

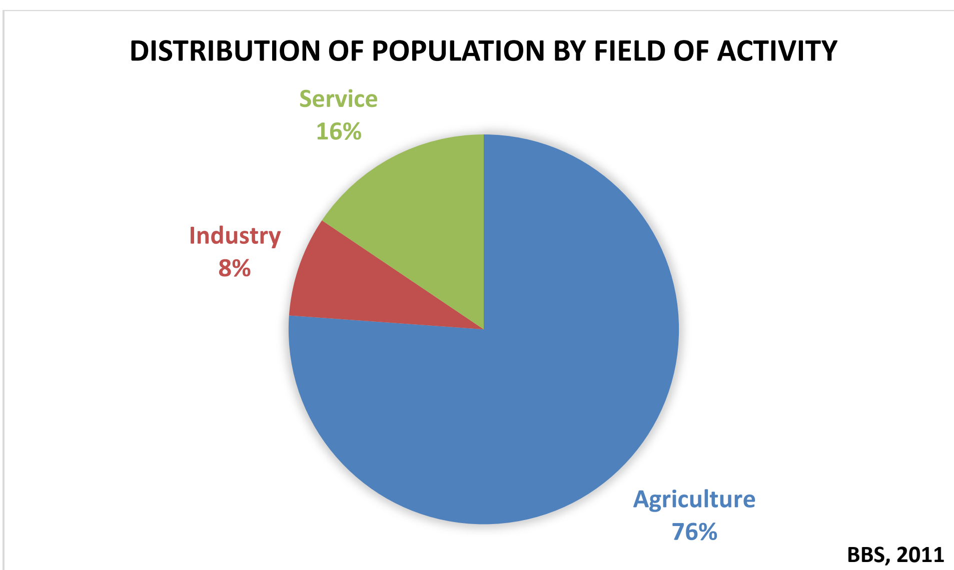

Figure 6.26: Distribution of population by field of activity

Table 6.24: Main Occupation in the Polder 39/2C

Union	Agriculture (%)		Industry (%)		Service (%)	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Chenchri Rampur	3.07	0.12	0.30	0.01	0.47	0.16
Dhaoa	10.53	0.28	1.31	0.05	1.68	0.23
Ikri	17.74	0.26	0.88	0.02	2.02	0.37
Nudmulla	10.54	0.19	0.90	0.05	4.86	0.31
Telikhali	22.19	0.80	3.91	0.38	0.78	0.13
Dhanisafa	2.94	0.02	0.29	0.02	1.97	0.26
Mirukhali	7.39	0.07	0.21	-	1.64	0.69

Source: Population Census 2011, BBS

Male and female are equally engaged in livelihood activities. However, participation of female member is nominal in comparison to male participation. In the polder area only four percent female members are working whereas 96 male members are engaged in income generating activities.

Employment

n the Polder, about 35 percent of total population is employed, 41 percentis engaged in household work, only one percent is looking for work andabout 23 percent of total population is not working (it includes children and physically challenged population). **Figure 6.27** shows the employment status of the people in the Polder area.

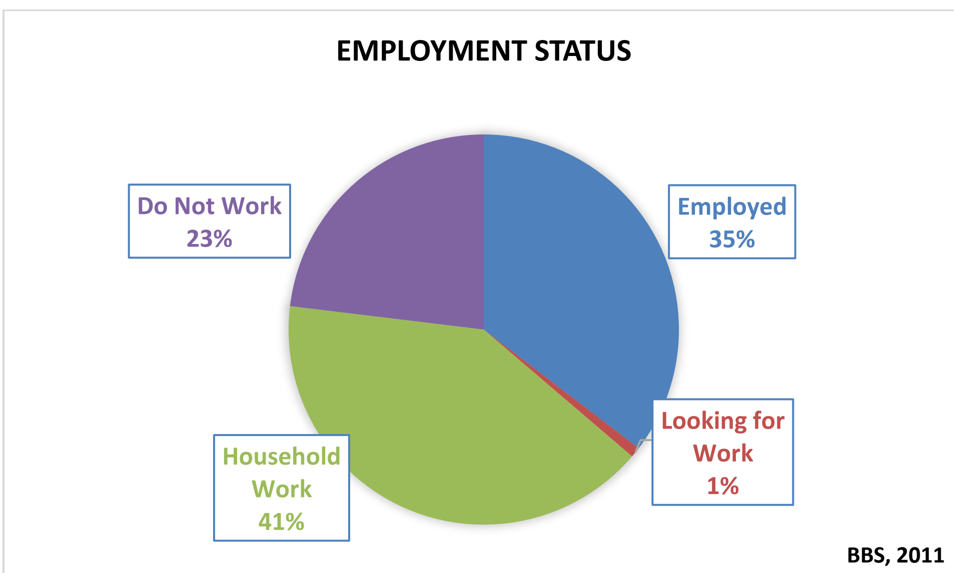

Figure 6.27: Employment status in the polder area.

The following table (**Table 6.25**) shows the distribution of employment status by male and female in the polder area. It is found that only four percent female members are employing whereas 34 percent male members are employing in the study area.

Table 6.25: Employment status in Polder

Union	Employed (%)		Looking for Work (%)		Household Work (%)		Do Not Work (%)	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Chenchri Rampur	1.36	0.10	0.01	0.01	0.17	1.81	0.42	0.63
Dhaoa	4.79	0.20	0.05	0.02	0.62	6.88	1.65	2.61
Ikri	7.31	0.23	0.19		0.40	8.52	2.24	2.53
Nudmulla	5.77	0.19	0.23	0.05	0.91	6.72	1.40	2.23
Telikhali	9.52	0.46	0.11	0.06	0.27	7.86	2.74	2.62
Dhanisafa	1.84	0.11	0.05	0.01	0.18	1.99	0.69	0.85
Mirukhali	3.27	0.27	0.07	0.01	0.45	3.88	1.07	1.40

Source: *Population Census 2011, BBS*

6.6.4 Quality of Life

Housing Condition

In the Project area, overall housing condition is not satisfactory. On an average, only three percent houses are pucka (made of bricks and mortar) whereas 89 percent are kutcha (made of wood/bamboo, and other local materials). **Figures 6.28 to 6.6** represent the photograph of housing types in the study area. Statistics shows that kutcha households are dominant in whole of the polder area.It can be concluded that the people living in the study area belong to extremely poor category in term of housing type[9].

Table 6.26: Housing condition in the study area

Union	Type of Structure (%)			
	Pucka	**Semi-pucka**	**Kutcha**	**Jhupri**
Chenchri Rampur	2.5	8.4	86.2	2.9
Dhaoa	3.7	8.6	86.7	0.9
Ikri	1.9	4.6	92	1.5
Nudmulla	4.4	10.3	84.3	1.1
Telikhali	2.3	3.8	93.3	0.6
Dhanisafa	3.7	9.3	84.7	2.3
Mirukhali	3.2	7.3	86.9	2.7

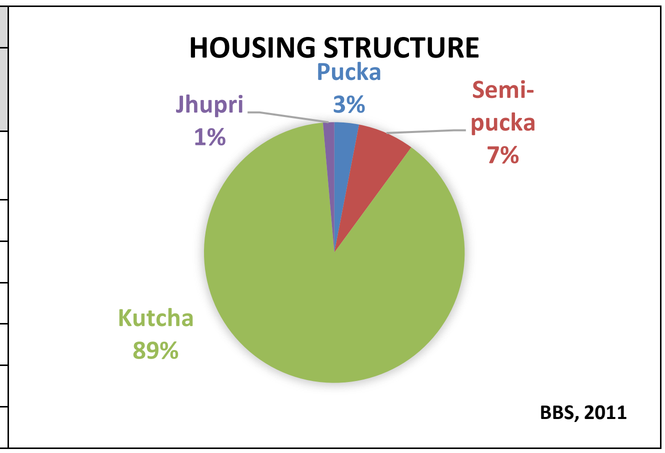

Figure 6.28: Housing Types in Polder Area

[9] 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 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.

Figure 6.29: *Jhupri* house

Figure 6.30: *Kutcha* house

Drinking Water

Overall status of drinking water in the area is not satisfactory. The coverage of tube-well is quite satisfactory in some unions such as Chenchuri Rampur, Dhaoa, Nudumulla and Telikhali. But in some unions people are to collect water from other sources such as pond, river and PSF (**Table: 6.27**). however, it is found that tube-well covers 55 percent of total households and 44 percent households are to collect water from other sources (**Figure:6.31**).

Table 6.27: Source of Drinking Water in Polder

Union	Sources of Drinking Water (%)		
	Tap	Tube-well	Other
Chenchri Rampur	1.6	64.5	33.9
Dhaoa	0.3	59.1	40.6
Ikri	0.3	33.9	65.8
Nudmulla	0.2	90.3	9.5
Telikhali	0.2	60	39.8
Dhanisafa	3.2	36	60.9
Mirukhali	1.5	32.1	66.3

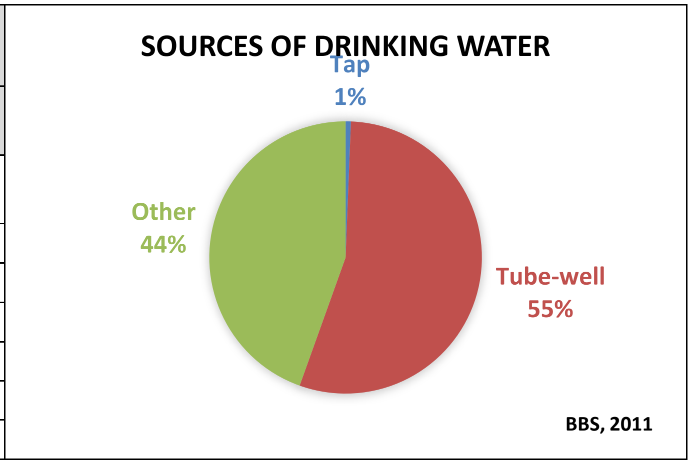

Figure 6.31: Coverage of drinking water by sources

Figure 6.32: Domestic level rain water harvesting

Figure 6.33: Community level tube-well

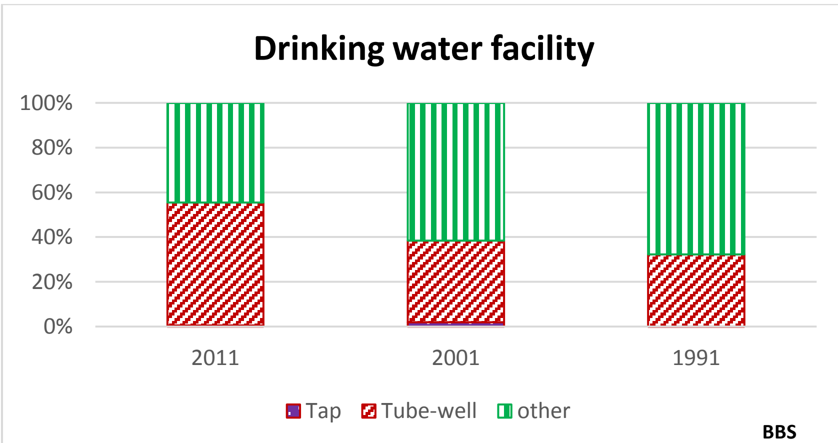

Figure 6.34: Drinking water sources in the polder area.

The above figure (**Figure: 6.34**) shows the sources of drinking water in various years. It is noticeable that the coverage of tube-well is increasing than the previous years. The water quality analysis result for drinking water i.e. arsenics or coliforms already has mentioned in baseline chapter of water resources.

Sanitation

The sanitation facilities[10] adopted by households of the Project area are presented in **Table 6.28 and Figure 6.35**. It shows that only18 percent households have hygienic sanitation facility (water-sealed), 58 percent have not water-sealed sanitation facility, 23 percent have non-sanitary sanitation facility and only one percent have no sanitation facility. Local people face the worst situation regarding the sanitation facility.

[10] 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.

Table 6.28: Sanitation Facilities in the Polder

Union	Type of Structure			
	Sanitary (water-sealed)	Sanitary (not water-sealed)	Non-sanitary	None
Chenchri Rampur	45.5	39.6	13.5	1.5
Dhaoa	23.7	54.6	21.6	0.1
Ikri	3.4	70.1	25.6	0.9
Nudmulla	52.6	38.3	8.8	0.3
Telikhali	4.8	75.6	18.9	0.7
Dhanisafa	1.6	70.6	26.3	1.6
Mirukhali	0.9	40.8	56.5	1.8

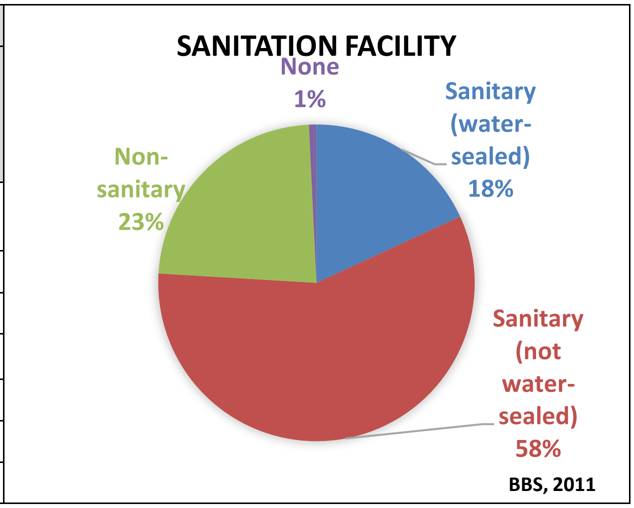

Figure 6.35: Sanitation facility in study area

Overall sanitation facility is not satisfactory in the polder area. Most of the households use sanitary not water-sealed latrines. Water-sealed sanitation facility covers the highest in Nudmulla union (53%).

Figure 6.36: Sanitation facility in the polder area.

Health Profile of Polder People

The health profile of the local people living in the Polder is presented in the **Table 6.29**. According to the ranking, the incidence of Gastric is the most prevalent ailment in the area. Diabetes,Influenza/Common fever and skin diseases are also common in the Polder area.

Table 6.29: Disease Profile in the Polder

Disease	Ranking by Incidence
Gastric	1
Diabetes	2
Influenza/Common fever	3
Skin diseases	4

Disease	Ranking by Incidence
Cough/cold	5
Chicken pox	6
Typhoid	7
Dysentery	8
Asthma	9
Hypertension	10

Source: CEGIS fieldwork, 2012

Health Services and Facilities

Field findings show that there are one upazila health complex, three Union Family Planning and Health Complex and eight community clinics in the polder area. (**Table: 6.30**). Additionally, there are peripheral health services institutions outside the polder area. As a result, local people can receive health service and facility from these hospital/institutions easily.

Table 6.30: 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)	-	MothbariaUPZ, Pirojpur
Dhanisafa	-	1	MothbariaUPZ, Pirojpur
Mirukhali	-	1	MothbariaUPZ, Pirojpur

Source: RRA, CEGIS, 2012

It is found that about 30 percent people tend to receive health service from quack and25 percent from paramedic/diploma physicians and 35 percent from trained physicians. But it is noteworthy that about 10 percent cannot receive treatment facility due to their impoverishment and communication problems (**Figure6: 37**).

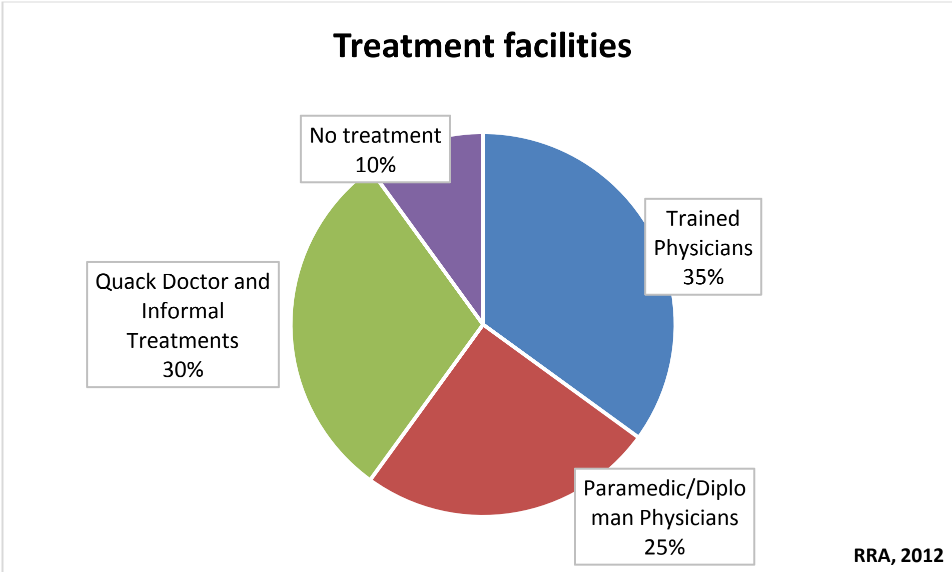

Figure 6.37: Health Service Providers in Polder

However, quality of health services and facilities is quite poor as reported by the local people. People responded that they are not satisfied in health services and facilities at all.

Education

In the study area literacy rate is quite satisfactory in terms of national average. The highest literacy rate comprises in Chenchri and Dhaoa unions (69%) (**Table 6.31**).However, the tendency to be educated is now growing among the local people. People shows their interest in education. They send their children to the institutions in due time and try to continue.

Table 6.31 Literacy Rate at Polder 39/2C Area

Union	Literacy Rate (%)		
	Total/Both	Male	Female
Chenchri Rampur	69	70.6	67.5
Dhaoa	69.2	70.9	67.6
Ikri	63.5	63.2	63.9
Nudmulla	63.2	62.6	63.7
Telikhali	56.7	53.5	59.9
Dhanisafa	62.4	63.6	61.1
Mirukhali	61.6	61.9	61.3

Source: Population Census 2011, BBS

The following figure (**Figure: 38**) shows the trend of literate rate. It shows that overall literacy rate is increasing gradually. The tendency of being educated is growing among men and women.

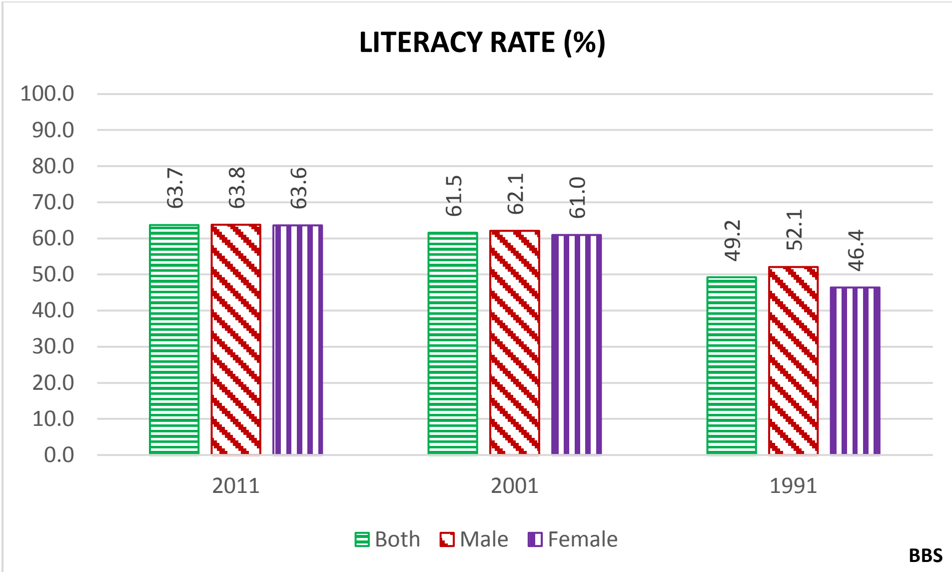

Figure 6.38: Trend of literacy rate in the polder 39/2C area

Figure 6.39: Schools in the polder area

Electricity

Electrification as reported in the Population Census is not satisfactory in the Project area. On an average, only 38 percent households are under electricity coverage. Very few households use solar electricity in the Project area. Figure 6.40 shows the percentage of electricity connection in different unions of the Polder areas. It shows that the electricity coverage is below the national average.

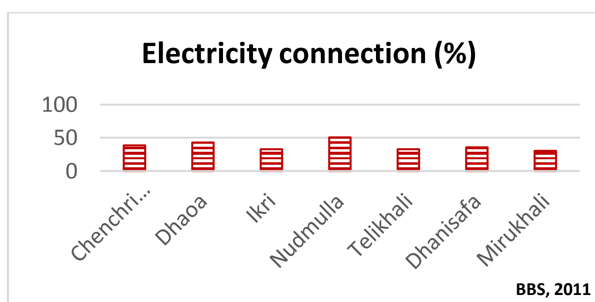

Figure 6.40: Coverage of electricity.

6.6.5 Poverty and Safety Nets

Landownership Pattern

Landownership pattern can be an indicator to understand the poverty incidence in a given area. Statistics shows that there are 86 percent smallholders, 12 percent medium and only 01 percent large landholders (**Table 6.32**).

Table6.32: Landownership Pattern in Polder

Land Ownership Classes	Households (%)
Small (0.05 to 2.49 acres)	86
Medium (2.5 to 7.49 acres)	12
Large (7.5 acres and above)	01

Source: BBS, Agriculture Census, 2008

The following figure (**Figure: 6.41**) shows the ownership pattern in the polder area in a comparative manner. It is found that smallholders are the dominant owner groups in the whole polder area. The second dominant group is the medium land holders.

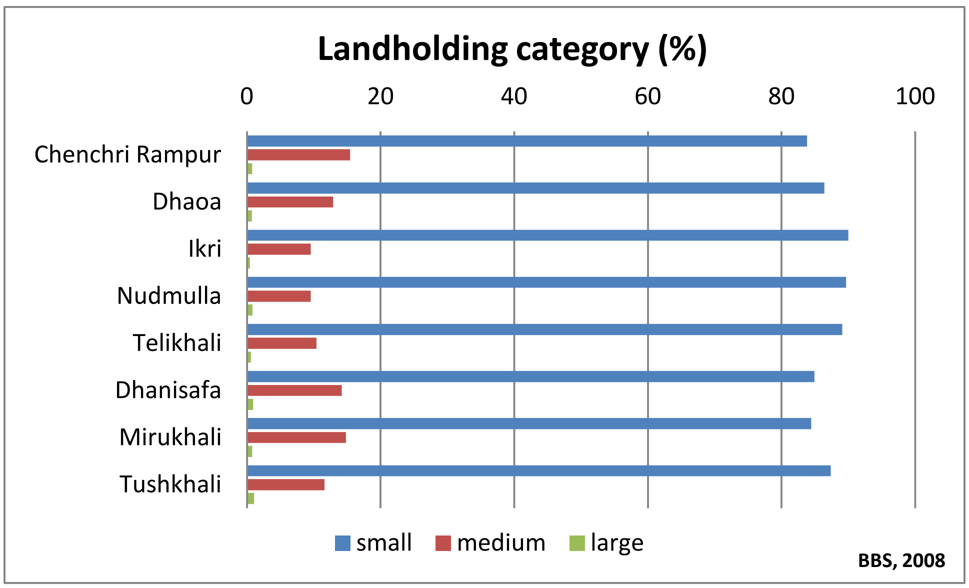

Figure 6.41: Land holding categories in project area
Source: BBS, Agriculture Census, 2008

Income Poverty

Income poverty profile has been prepared by the participants of the RRA themselves through a self-assessment exercise. The assessment is based on the year-round income along with the food consumption of the inhabitants within three different categories (**Figure 6.42**). It is observed that about 54 percent of the households in average belong to the 'balanced category. This group of people do not have savings but can run their families well. In some cases they are to borrow money temporarily. Additionally, the 'deficit' comprises almost 38 percent. These households have been identified in the RRA as the poor households of the Polder area. Considering the standard consumption of food (three meals in a day), the deficit group was usually taking two meals in a day in the lean period since they could not afford three full meals.

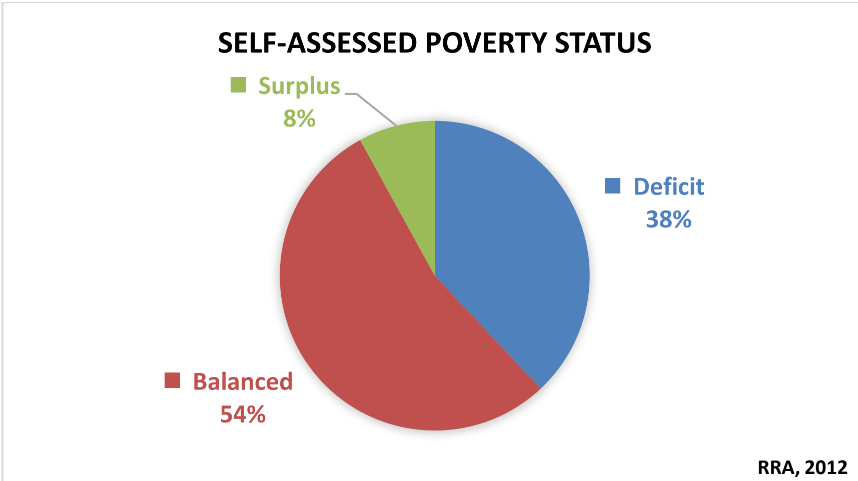

Figure 6.42: Self-Assessment of Poverty Status

Income and Expenditure

The income and expenditure at the household level in the Polder area is shown in **Table 6.33**. It is found that most of the people belong to 24,001 taka to 240,000 taka income and expenditure category annually. Their monthly income varies from 5,000 tk. to 20,000 tk. per month.

Table 6.33: Annual Income and Expenditure Level

Range in Taka	Percentage (%) of Households	
	Income	Expenditure
Up to 12,000	-	-
12,001 to 24,000	9	4
24,001 to 60,000	23	26
60,001 to 108,000	32	46
108,001 to 240,000	27	18
More than 240,000	9	6

Source: CEGIS fieldwork, 2012

Natural Disasters

The local inhabitants of Polder 39/2Chave identified tidal flooding, salinity intrusion and cyclones as the major hazards in the area. On 15 November 2007, the cyclone SIDR with wind velocity of about 220km/h hit this area causing damages to crops, houses, cattle, trees, properties and human lives because this area was on the alignment of the track of cyclone. It is reported that more than 100 people died in the polder area during this incidence. Thus, this area is also under threat of increasing risks brought about by climate change. Details about the disasters and their affects in the area are presented in **Table 6.34**.

Table 6.34: Effects of Recent Natural Disaster in Project Area

Disaster		Affected Area (%)	Affected House Holds (%)	Crop Damaged (%)	Major Damaged Crop
Tidal Flood	2007	80	50	90	Rice
Cyclone	2007 (Sidr), 2009 (Aila)	90	65	65	Rice

Source: CEGIS fieldwork, 2012

Social Safety Nets and Poverty Reduction Measures

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 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 6.35**).

Table 6.35: 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) of PIO	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, 2012

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), World Vision, Muslim Aid, CSS (Christian Mission), Proshika, Focus, Uddipan, Dak Deye Jai (**Table 6.36**). 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 households are found to benefit from the NGOs interventions. After disasters (Sidr and Aila) the JJS was appeared the most important NGO for the local people.

Table 6.36: NGOs and their Programs in Project Area

NGOs	Type of Programs						
	Credit	Education	Water and Sanitation	Health	Disaster	Gender	Food security

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

Source: CEGIS fieldwork, 2012

6.6.6 Social Capital

Roads

The communication facilities of roadways are moderate to good in the study area. Overall 516 km of road networks exist in seven unions where 106km roads are paved, 97km roads are brick soling and 313km roads are earthen (**Table: 6.37**).

Table 6.37: Road Network in Polder

Name of Union	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

Name of Union	Type of Road	Length (Km)
	Total	**516**

Source: CEGIS fieldwork, 2012

Figure 6.43: Muddy and soling roads in the Polder area.

Table 6.38: Traffic volume in the polder 35/3 area

Road name : Near Dema Bridge; Mollikerber-Kashimpur to Bagerhat, and Rampal -Khegraghat to Kashimpur																											
GPS location	**N**-22°37'19.0", **E**-89°45'52.4"										Survey period: 8 hours																
Type of Vehicles	**7:00 - 8:00**		**8:00-9:00**		**9:00-10:00**		**10:00-11:00**		**11:00-12:00**		**12:00-13:00**		**13:00-14:00**		**14:00-15:00**		**15:00-16:00**		**16:00-17:00**		**17:00-18:00**		**18:00-19:00**		**Total (T)**	**Factors (F)**	**T** x **F**
	Entry	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**	**Entry**	**Exit**			
Van	1	1	3	5	5	3	3	6	5	3	6	5	7	3	8	4	4	3	6	4	7	1	8	2	103	0.5	51.5
Motocycle	5	1	3	5	5	2	2	7	6	4	8	2	6	6	7	8	5	7	6	11	5	3	7	7	128	0.75	96
Rickshaw	3	2	5	3	4	5	5	3	4	5	6	3	4	5	7	6	5	8	3	4	5	5	8	3	111	0.5	55.5
BiCycle	5	3	3	5	7	6	6	3	10	7	4	3	5	6	4	8	5	2	6	4	6	3	11	6	128	0.5	64
Car	-	-	-	-	-	-	-	1	1	-	-	1	-	-	1	-	-	-	1	-	-	-	-	1	6	1	6
Jeep	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	1	-	-	1	-	4	1.75	7
Bus	6	5	4	4	5	8	7	4	6	7	4	6	5	6	3	6	2	5	5	7	6	7	8	7	133	3	399
Truck	-	-	-	-	1	1	2	3		1	3	2	2	-	1	2	3	-	1	2	2	4	5	5	40	3	120
Pickup/ Mini Truck	1	1	2	-	1	-	-	1	1	-	2	-	3	-	2	1	-	2	-	1	-	1	1	3	23	1.75	40.25
Auto Ricksaw	2	3	1	1	1	3	-	5	2	4	3	1	4	2	3	3	4	2	5	1	1	2	3	3	59	0.75	44.25
Tempo	1	3	2	2	5	5	2	4	3	4	4	2	2	4	3	2	5	3	3	4	2	4	3	3	75	1	75
																										Sum	958.5

Source: Baseline survey, CEGIS, 2012

The above table (**Table: 38**) shows the traffic volume in the study area. It is estimated following the standard PCU[11] (Passenger Car Unit) and found that traffic volume for 8 hours is 120 vehicles/ hour (958.5/8 = 120).

Waterways

Waterway is one of the most important mode of communication. There are three navigation path have been used by the local people as the main mode of communication. There are two main internal waterways:

1. Boleswar /Kocha route
2. Pona navigation route

Local people are to communicate through waterways due to poor road networks. As a mode of transportation people usetrawler, rocket and small boat to carry goods and commodities of peripheral area. The depth of river is varied in both dry and wet season on the basis of seasonal variation. It is found that in dry season, the depth of Boleswar/Kocha River continued within 45-50ft while in wet season it pointedly increased about 60-75ft in a year. Similarly, In Pona River depth have found as 15-20ft and 20-25ft both in dry and wet season respectively. Table 0.39 shows the major navigation routes and types of vehiclein the study area.

Table 6.39: 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, 2012

Educational Institutions

According to the field findings there are 103 primary schools, 26 secondary schools, 3 colleges and 63Madrashas in the study area (**Table: 6.40**). No college have not seen in Nodmullah, Telikhali, Dhanisafa and Mirukhali unions of the study area.

Table 6.40: Academic Institutions

Sl No	Union Name	Nos of Primary School	Nos of Madrasha	Nos of High School	Nos of Collage
1	NodmullahUP	13	13	08	-
2	DhaoaUP	32	36	07	01

[11] PCU (Passenger Car Unit) is a metric used in Transportation Engineering, to assess traffic-flow rate on a roadway. A Passenger Car Unit is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car.

Sl No	Union Name	Nos of Primary School	Nos of Madrasha	Nos of High School	Nos of Collage
3	Ikri UP	28	04	05	02
4	Telikhali UP	19	06	02	-
5	Dhanisafa UP	08	04	03	-
6	Mirukhali UP	03	03	01	-
	Total	**103**	**63**	**26**	**3**

Source: CEGIS field work, 2012

Markets

There are19 markets/bazaars in the study area, among them in Nomullah, Dhaoa and Ikri union carried highest proportion of bazaarwhere rest of the bazaars i.e. 5 (five) are situated in Telikhali, Dhanisafa and Mirukhali unions (**Table 6: 41**). These are serving better for the local people.

Table 6.41: Markets in Project Area

Sl No	Union Name	Name of Market	No of Market
1	NodmullahUP	NodmullahBazaar	04
2	Dhaoa UP	Dhaoa Bazaar	05
3	Ikri UP	Ikri Bazaar	05
4	Telikhali UP	Telikhali Bazaar	02
5	Dhanisafa UP	Dhanisafa Bazaar	02
6	Mirukhali UP	Mirukhali Bazaar	01
		Total	**19**

Source: CEGIS database, 2012

6.6.7 Gender and Women

Like other part of the country women in the polder area are also restricted to household works. Most of their decision making power goes to family maintenance. They have limited access to social sphere (**Figure: 6.44**). Women mobility in the area is mostly localized except when going for medical treatment, fetching water, farming activities, and visiting relatives.

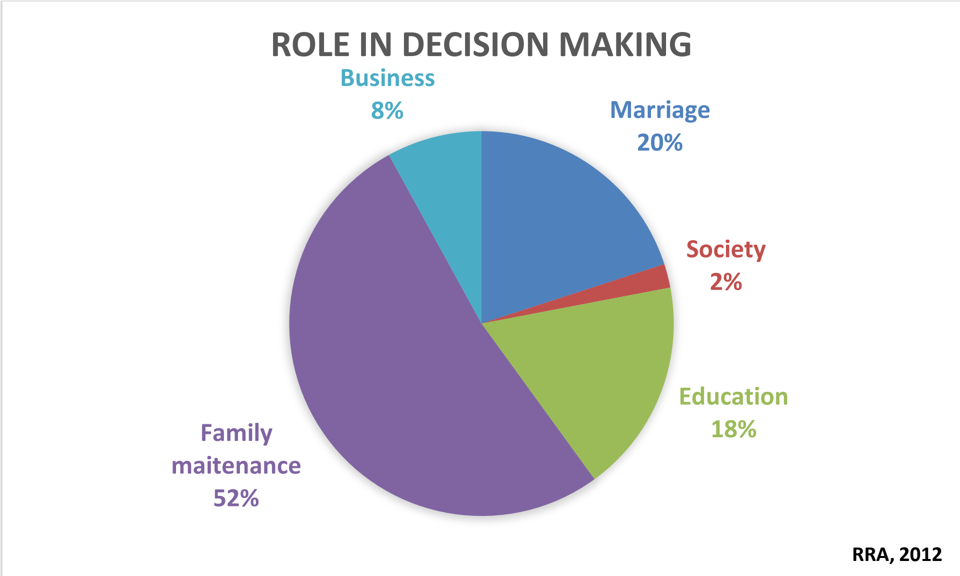

Figure 6.44: Scope of Decision Making by Women

In some cases women can play role in livelihood earning, education of their children. The traditional scenario is changing nowadays. Mortality rate of the pregnant mother during delivery period has reduced in the area. The growing consciousness among the local people as well as the health services provided by the public and other health centers including the programs of NGOs have contributed to the decrease of the mortality rate. About 30 percent women are living with good health condition and the rest are suffering from various diseases such as low blood pressure and premature delivery. About 15 percent women are getting proper nutrition and about 32 percent have access to the health centers, which are around 12 km away on average from their residence. Statistics shows the male literacy rate is higher than female. However, literacy rate of both male and female is ever increasing than the privous year (**Figure.6.45**).

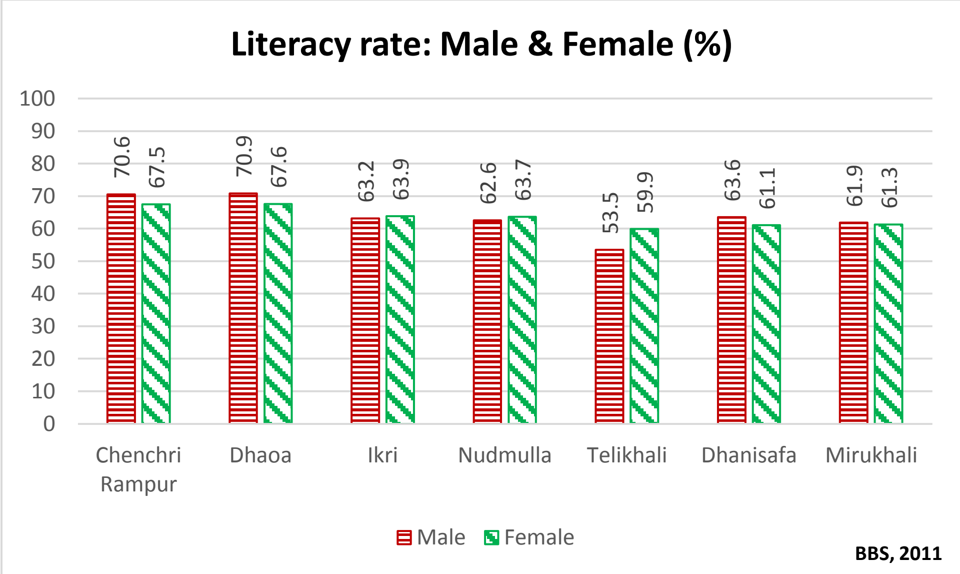

Figure 6.45: Literacy rate of both male and female

6.6.8 Vulnerable Communities

Fishers & farmers are the most vulnerable communities in the polder area. The polder on the other bank of Kocha river and Bishkhali River were completed long ago keeping the polder 39/2C unattended. During high tides, the embankment gets thrust from the other side of the completed polder and rush to the unprotected area of polder 39/2C inundation. People of the polder area have suffering a lot for this regular flooding from the river during high tide. It becomes disastrous during monsoon. In this situation, both categories of livelihood groups are too much vulnerable to climatic factors.

6.6.9 Common Property Resources

The common property places/resources of the area are different social amenities e.g. mosques, temples, cremation grounds, playgrounds and *Eidgahs* (place for offering Eid prayers). These are used frequently by the local people for the purposes of religious, social and cultural gathering.

There are 407 mosques, 52 temples and 9 crematoriums in the polder area. These common property resources are used by the local people. However, there is no known historical and archeological sites declared by government in the Polder area (**Table 6.42)**.

Table 6.42: Common Property Resources in Polder 39/2C

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

Source: CEGIS fieldwork, 2012

7. Climate Change

This Chapter briefly discusses the climate change aspects in global, regional and local perspectives and the likely impacts on the Project area and its surroundings.

7.1 Overview

Climate change refers to a change in the state of the climate parameters that can be identified by changes in the mean and the variability of it properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of anthropogenic activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (*Fourth Intergovernmental Panel on Climate Change - IPCC Synthesis Report, 2007*).

7.2 Global Context

Warming of the climate is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level. Various aspects of the climate change studied recently are discussed below.

7.2.1 IPCC Scientific Assessment on Climate Change Issues

This scientific judgment is based on the assessment carried out by the three Working Groups (WGs) of the IPCC. It provides an integrated view of climate change as the final part of the IPCC's Fourth Assessment Report (AR4). The following sections note many observed changes in the Earth's climate including atmospheric composition, global average temperatures, ocean conditions, and other climate changes.

Changes in Atmosphere

- Carbon dioxide, methane and nitrous oxide are all long-lived greenhouse gases. IPCC has assessed the followings:

- Carbon dioxide, methane, and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values.
- The amount of carbon dioxide in the atmosphere in 2005 (379 ppm) exceeds by far the natural range of the last 650,000 years (180 to 300 ppm).
- The amount of methane in the atmosphere in 2005 (1774 ppb) exceeds by far the natural range of the last 650,000 years (320 to 790 ppb).
- The primary source of the increase in carbon dioxide is fossil fuel use, but land-use changes also make a contribution.

- The primary source of the increase in methane is very likely to be a combination of human agricultural activities and fossil fuel use. How much each contributes is not well determined.
- Nitrous oxide concentrations have risen from a pre-industrial value of 270 ppb to a 2005 value of 319 ppb. More than a third of this rise is due to human activity, primarily agriculture. (*Fourth IPCC synthesis report, 2007*).

Warming of the planet

Cold days, cold nights, and frost events have become less frequent. Hot days, hot nights, and heat waves have become more frequent. Additionally following may happen:

- Eleven of the twelve years in the period (1995–2006) rank among the top 12 warmest years in the instrumental record (since 1880).
- Warming in the last 100 years has caused about a 0.74°C increase in global average temperature. This is up from the 0.6°C increase in the 100 years prior to the Third Assessment Report.
- Urban heat island effects were found to have negligible influence (less than 0.0006°C per decade over land and zero over oceans) on these measurements.(*Forth IPCC synthesis report, 2007*)
- Observations since 1961 show that the ocean has been absorbing more than 80% of the heat added to the climate system, and that ocean temperatures have increased to depths of at least 3000 m (9800 ft).
- Average Arctic temperatures increased at almost twice the global average rate in the past 100 years.
- It is likely that greenhouse gases would have caused more warming than we have observed if not for the cooling effects of volcanic and human-caused aerosols.
- Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1300 years (including both the Medieval Warm Period and the Little Ice age).(*Fourth IPCC synthesis report, 2007*)

Ice, Snow, Permafrost, Rain, and Oceans

The Summary for Policy Makers (SPM) documents increases in wind intensity, decline of permafrost coverage, and increases of both drought and heavy precipitation events. Additionally following also occurs:

- Mountain glaciers and snow cover have declined on average in both hemispheres.
- Losses from the land-based ice sheets of Greenland and Antarctica have very likely (>90%) contributed to sea level rise between 1993 and 2003.
- Ocean warming causes seawater to expand, which contributes to sea level rising.

- Sea level rose at an average rate of about 1.8 mm/year during the years 1961-2003. The rise in sea level during 1993-2003 was at an average rate of 3.1 mm/year. It is not clear whether this is a long-term trend or just variability.
- Antarctic sea ice shows no significant overall trend, consistent with a lack of warming in that region.(*Fourth IPCC synthesis report, 2007*)

Hurricanes

- There has been an increase in hurricane intensity in the North Atlantic since the 1970s, and that increase correlates with increases in sea surface temperature.
- The observed increase in hurricane intensity is larger than climate models prediction for the sea surface temperature changes we have experienced.
- There is no clear trend in the number of hurricanes.
- Other regions appear to have experienced increased hurricane intensity as well, but there are concerns about the quality of data in these other regions.
- It is more likely than not (>50%) that there has been some human contribution to the increases in hurricane intensity.
- It is likely (>66%) that we will see increases in hurricane intensity during the 21st century.(*Fourth IPCC synthesis report, 2007*)

7.2.2 Model-based Projections for the Future

Climate Change Model global projections are made based on an analysis of various computer climate models running under different scenarios that were established in 2000 in the Special Report on Emissions Scenarios (SRES). As a result, predictions for the 21st century are as shown below.

Surface air warming in the 21st century:

- Best estimate for a "low scenario" is 1.8°C with a likely range of 1.1 to 2.9°C (3.2°F with a likely range of 2.0 to 5.2°F)
- Best estimate for a "high scenario" is 4.0°C with a likely range of 2.4 to 6.4°C (7.2°F with a likely range of 4.3 to 11.5°F)
- A temperature rise of about 0.1°C per decade would be expected for the next two decades, even if greenhouse gas and aerosol concentrations were kept at year 2000 levels.
- A temperature rise of about 0.2°C per decade is projected for the next two decades for all SRES scenarios.
- Confidence in these near-term projections is strengthened because of the agreement between past model projections and actual observed temperature increases.
- Based on multiple models that all exclude ice sheet flow due to a lack of basis in published literature, it is estimated that sea level rise will be:
- in a low scenario 18 to 38 cm (7 to 15 inches)

- in a high scenario 26 to 59 cm (10 to 23 inches)
- It is *very likely* that there will be an increase in frequency of warm spells, heat waves and events of heavy rainfall.
- It is *likely* that there will be an increase in areas affected by droughts, intensity of tropical cyclones (which include hurricanes and typhoons) and the occurrence of extreme high tides.
- "Sea ice is projected to shrink in both the Arctic and Antarctic … In some projections, Arctic late-summer sea ice disappears almost entirely by the latter part of the 21st century."(*Fourth IPCC synthesis report, 2007*).

7.2.3 Temperature and Sea Level Rise in Various Scenarios

There are six families of SRES scenarios, and AR4 provides projected temperature and sea level rises (excluding future rapid dynamical changes in ice flow) for each scenario family.

Scenario	Assumptions
Scenario B1 The B1 scenarios are of a world more integrated, and more ecologically friendly. The B1 scenarios are characterized by: • Rapid economic growth as in A1, but with rapid changes towards a service and information economy. • Population rising to 9 billion in 2050 and then declining as in A1. • Reductions in material intensity and the introduction of clean and resource efficient technologies. • An emphasis on global solutions to economic, social and environmental stability.	Best estimate temperature rise of 1.8°C with a likely range of 1.1 to 2.9°C (3.2°F with a likely range of 2.0 to 5.2°F) Sea level rise likely range [18 to 38 cm] (7 to 15 inches)
Scenario A1T	Best estimate temperature rise of 2.4°C with a likely range of 1.4 to 3.8°C (4.3°F with a likely range of 2.5 to 6.8°F) Sea level rise likely range [20 to 45 cm] (8 to 18 inches)
Scenario B2 The B2 scenarios are of a world more divided, but more ecologically friendly. The B2 scenarios are characterized by: • Continuously increasing population,	Best estimate temperature rise of 2.4°C with a likely range of 1.4 to 3.8°C (4.3°F with a likely range of 2.5 to 6.8°F) Sea level rise likely range [20 to 43 cm] (8 to

Scenario	Assumptions
but at a slower rate than in A2. • Emphasis on local rather than global solutions to economic, social and environmental stability. • Intermediate levels of economic development. • Less rapid and more fragmented technological change than in A1 and B1.	17 inches)
Scenario A1B	Best estimate temperature rise of 2.8°C with a likely range of 1.7 to 4.4°C (5.0°F with a likely range of 3.1 to 7.9°F) Sea level rise likely range [21 to 48 cm] (8 to 19 inches)
Scenario A2 The A2 scenarios are of a more divided world. The A2 family of scenarios is characterized by: • A world of independently operating, self-reliant nations. • Continuously increasing population. • Regionally oriented economic development.	Best estimate temperature rise of 3.4°C with a likely range of 2.0 to 5.4°C (6.1°F with a likely range of 3.6 to 9.7°F) Sea level rise likely range [23 to 51 cm] (9 to 20 inches)
Scenario A1FI	Best estimate temperature rise of 4.0°C with a likely range of 2.4 to 6.4°C (7.2°F with a likely range of 4.3 to 11.5°F) Sea level rise likely range [26 to 59 cm] (10 to 23 inches)

Source: Fourth IPCC synthesis report, 2007

7.3 Regional Context

Asia is very likely to be warm during this century; the warming is likely to be well above the global mean in central Asia, the Tibetan Plateau and northern Asia, above the global mean in East and South Asia, and similar to the global mean in Southeast Asia. It is very likely that summer heat waves/hot spells in East Asia will be of longer duration, more intense, and more frequent. It is very likely that there will be fewer very cold days in East Asia and South Asia.

Boreal winter precipitation is very likely to increase in northern Asia and the Tibetan Plateau, and likely to increase in eastern Asia and the southern parts of Southeast Asia. Summer precipitation is likely to increase in northern Asia, East and South Asia and most of Southeast

Asia, but it is likely to decrease in central Asia. An increase in the frequency of intense precipitation events in parts of South Asia, and in East Asia, is very likely.

Extreme rainfall and winds associated with tropical cyclones are likely to increase in East, Southeast and South Asia. Monsoonal flows and the tropical large-scale circulation are likely to be weakened.

The above mentioned regional level climate change impacts were assessed in the second national communication report of Bangladesh.

7.4 Local Context

Bangladesh is vulnerable to sea level rise, as it is characterized by a densely populated coastal area with smooth relief comprising broad and narrow ridges and depressions (Brammer, et al., 1993). The Bay of Bengal is one of the hotspots for the generation of tropical cyclones. In this region, cyclones occur in the pre- and post-monsoon seasons. The coast is also vulnerable to cyclone-induced storm surges. Following are the likely implications due to climate change considered in this study for the coastal areas of Bangladesh:

7.4.1 Sea Level Rise and Coastal Inundation

Bangladesh is vulnerable to current coastal hazards and anticipated Sea Level Rise (SLR) because of its low elevation. Drainage congestion and water logging are already an alarming problem in Bangladesh specifically in polder area and likely to be exacerbated by SLR and increased river flooding. It is reported that inundated areas might increase up to 3 percent (2030s) and 6 percent (2050s) primarily in coastal low lying areas (0 – 30 cm, Khan et al., 2006, using upper estimates of SLR). Large uncertainties are associated with regional to district level estimates of inundation which is due to the compounding effects of the variable rates of uplift and sedimentation, river flooding and erosion. Siltation is gradually increasing in the project area due to SLR. As a result of reduced upstream flow, the silt flocculate/deposit in the riverbed which restricts removal of excess water from the countryside and causes drainage congestion.

7.4.2 Tidal Flooding

Tidal flood 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 this extent even gradually increased due to climate change impact (sea level rise).

A recent study entitled ‘Climate Change Impacts on Food Security in Bangladesh’ assessed future flooding scenarios for Bangladesh (Yu et al., 2010). In this study, MIKE 11 and MIKE BASIN models were used for generating river flow, discharge and finally flooding. In this study Bangladesh has been divided into 16 sub regions for incorporating the spatial and temporal variation in flooding in different parts of the country. In defining the sub regions the MPO/NWMP Plan Unit and district boundaries are considered to be whole. These sub regions are classified based on various climatic, agricultural and flooding characteristics. In the classification process of sub regions similar topography, flooding characteristics etc. have been considered with great importance. The results of the flooding analysis have been presented utilizing the MPO flood depth classification. This classification includes five flood phases/land type, based on a three-day maximum flood depth, theoretically with an exceedence return probability of 1 in 2 years (MPO, 1987). In this classification F0 is 0-30 cm; F1 is 30-90 cm; F2 is 90-180 cm; F3 is 180-300 cm and F4 is over 300 cm. **Figure 7.1** illustrates the percentage changes in flooded area in each sub region due to climate change in the 2030s and 2050s. The results show an increase in flooded area in the coastal region of Bangladesh.

7.4.3 Salinity Intrusion

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. In 2007, Institute of Water Modelling (IWM) and CEGIS jointly carried out a study on “Investigating the Impact of Relative Sea-Level Rise on Coastal Communities and their Livelihoods in Bangladesh” and assessed that in base condition about 10 percent of coastal area is under 1 part per thousand (ppt) salinity and 16 percent area is under 5 ppt salinity and this area will increase to 17.5 percent (1 ppt) and 24 percent (5 ppt) by 2050 considering 88 cm sea level rise. So, there will be an increase of around 8 percent in the area under 5 ppt salinity levels due to sea level rise. The area of influence of 5 ppt salinity line under different sea level rise scenarios are show in **Figure 7.2**. The intrusion of salinity will increase soil salinity and surface water salinity and might affect agriculture crop production.

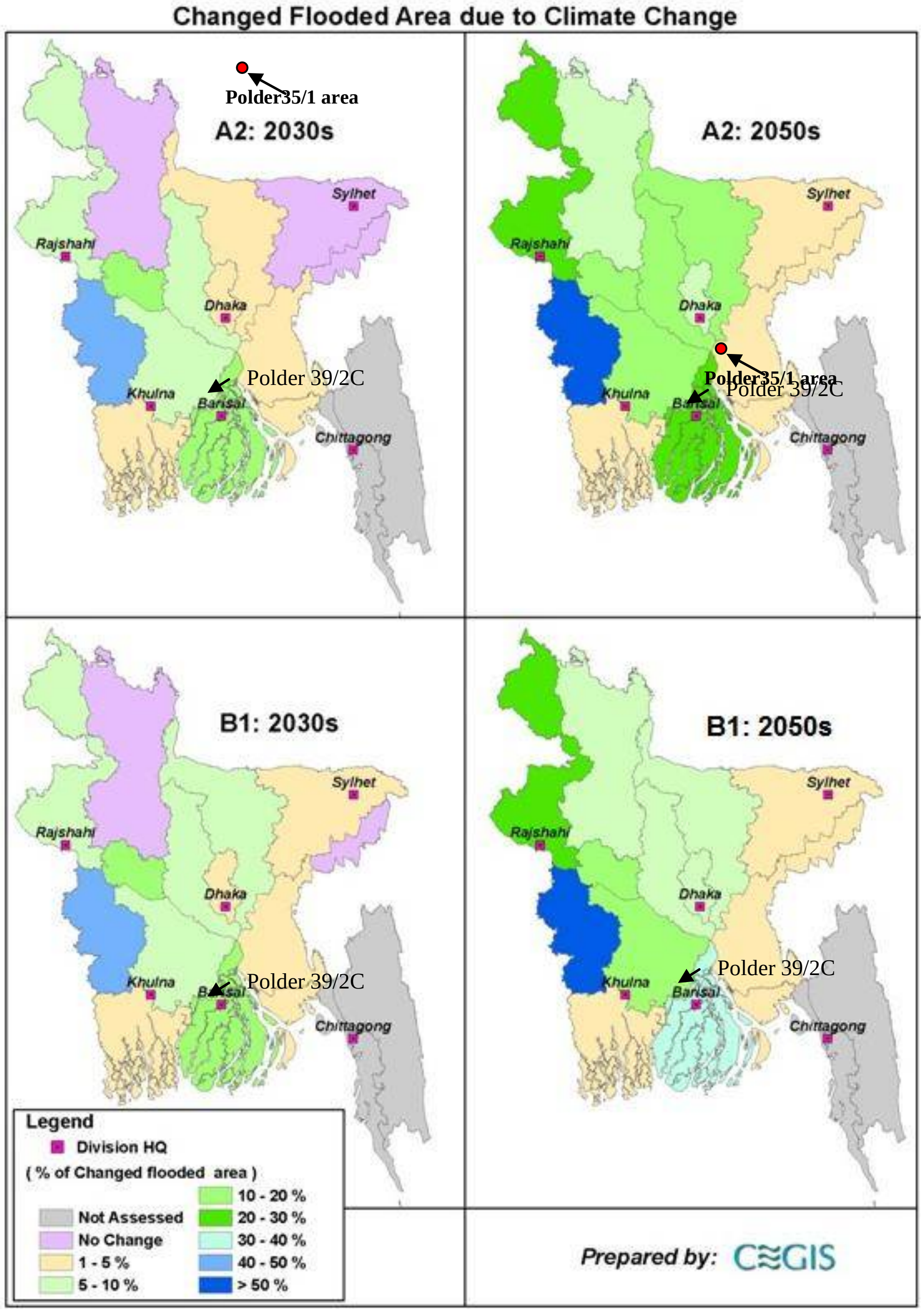

Figure 7.1: Changes in flooded area in Bangladesh in the 2030s and 2050s

(Source: Hassan et. al., 2010)

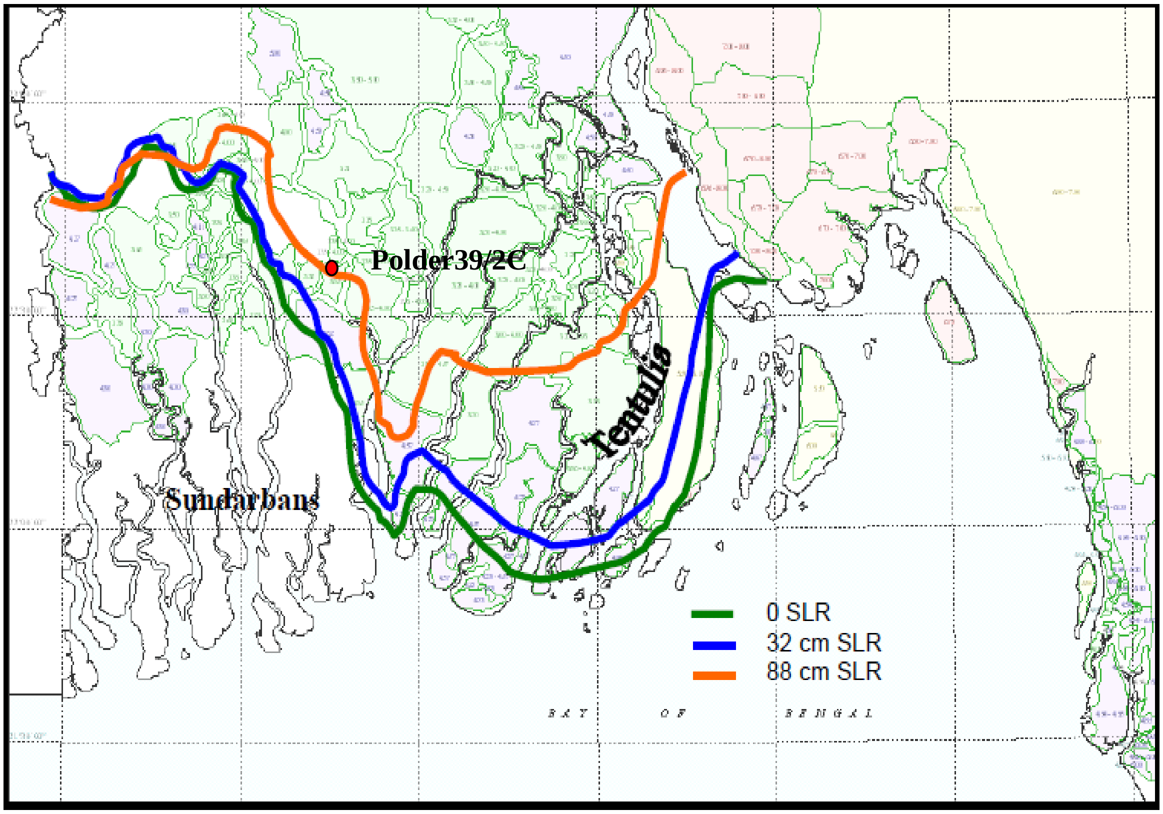

Figure 7.2: Five ppt isohaline line for different sea level rise in dry season (IWM and CEGIS, 2007)

7.4.4 Cyclones and Storm Surges

Tropical cyclones accompanied by storm surges are among the major disasters that occur in Bangladesh and severely damage lives and standing crops in the project area. Roughly, three to seven severe cyclones hit the coastal area each decade. There is some evidence that 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.

Tropical cyclones and surges are the major threats to the coastal areas, causing loss of human lives and livestock and severe damage to crops and properties. During last 125 years, more than 42 cyclones had hit the coastal areas (**Figure 7.3**) and 16 cyclones (**Table 7.1**) have occurred in the last 25 years. The following table represents the occurrence of cyclone is more frequent due to climate change (T. Islam, 2009). Last devastating cyclone (SIDR) hit the study area and project site on 2007. The project area (Polder33) is located in the wind risk zone of Bangladesh.

The area is vulnerable to cyclone and storm surge. During SIDR, surge water entered the polder area by overtopping the right bank of the Passur River. As per local community perception, the site has experienced the maximum surge height during cyclone SIDR. As per local perception, the area was inundated by the surge of 4.45 m.

Table 7.1: 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			

7.4.5 Rainfall, Drainage, and Water logging

The rainfall is likely to increase by about 26 percent in the month of March - May; and 13 percent in the month of June- August (4th IPCC). As a consequence, flooding inundation will change demanding efficient drainage for crops.

The drainage of coastal polders mainly depends on the tidal characteristics of the surrounding rivers and degree of siltation of these rivers. In 2008, Institute of Water Modeling (IWM) carried out a study on “Impact of Sea level rise in coastal river of Bangladesh” and assessed that present study mainly focused the change in the tidal characteristics of the surrounding rivers due to sea level rise and its impact on inundation area of the polder.

The result shows that high water level at the surrounding rivers of polders increases in the range of 30-80 cm for sea level rise of 32 cm and 88 cm respectively. 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 presented in **Figure 7.4**.

Sea level rise will deteriorate drainage conditions to a large extent. 17 polders (light green in **Figure 7.4**) out of 35 will be facing acute drainage congestion where present performance of this polder 39/2C is unsatisfactory.

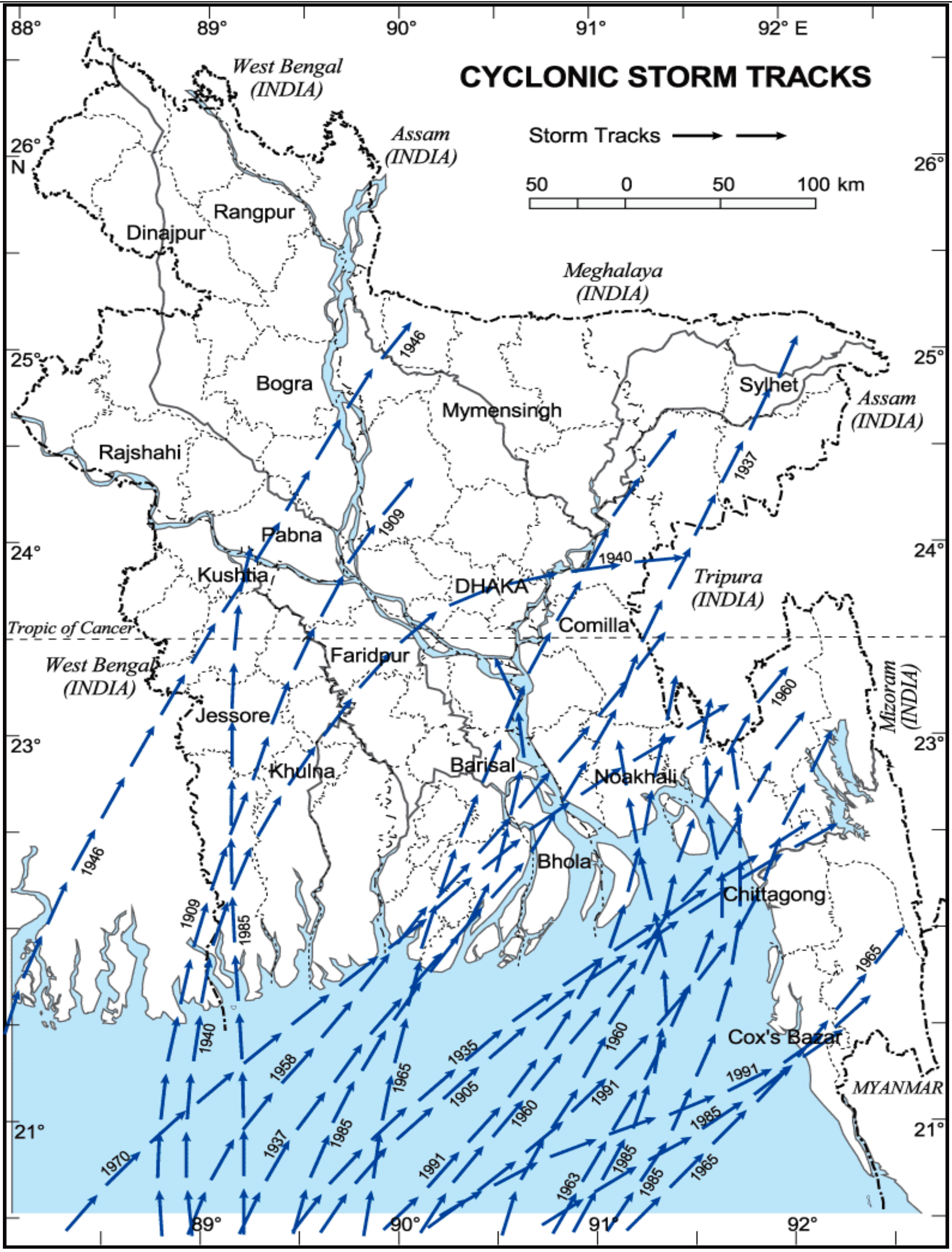

Figure 7.3: Previous Cyclonic Storm Tracks
(Source: MCSP, 1993)

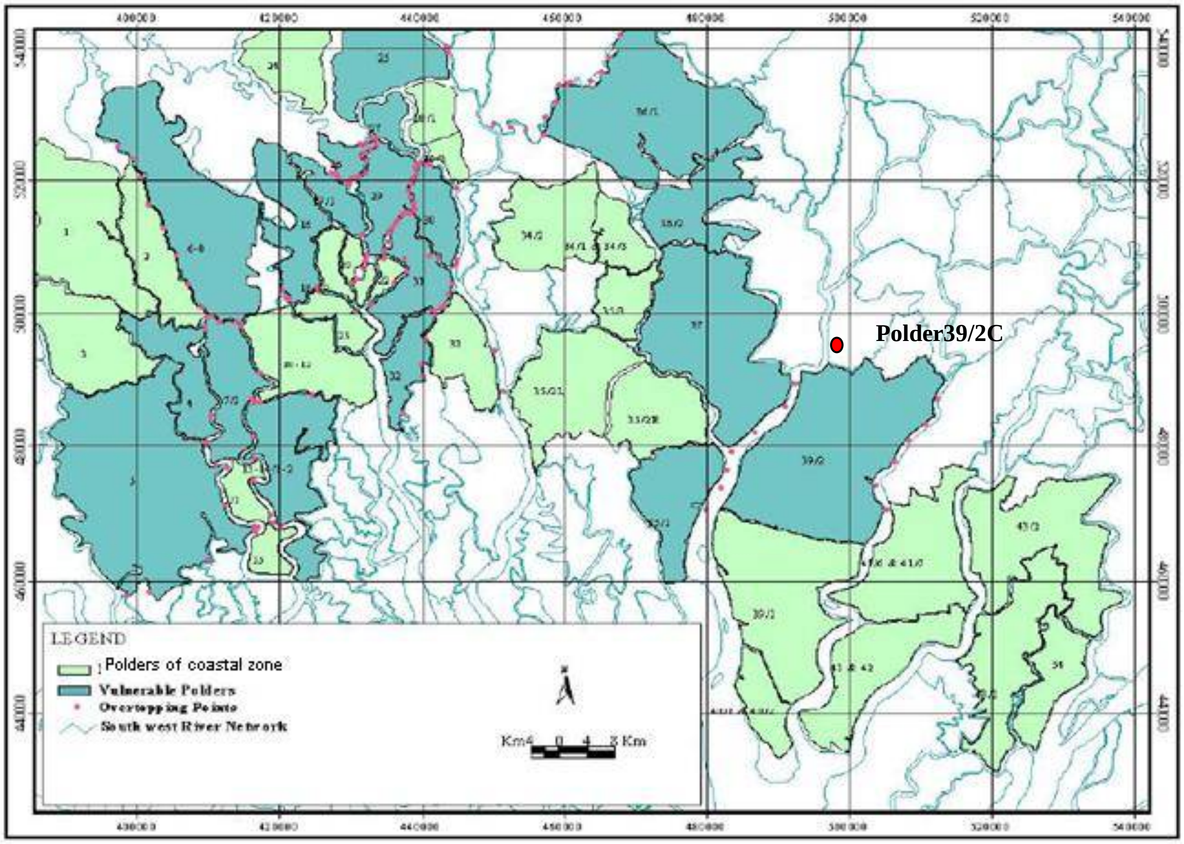

Figure 7.4: Drainage Congestion in Affected Polders due to Sea Level Rise

7.4.6 River Erosion and Accretion

Bangladesh is a riverine country and morphology of the rivers is highly dynamic. Disastrous riverbank erosion is mainly associated with the major river systems of the country. The main rivers are braided and form islands or chars between the braiding channels. These chars (many of which are inhabited) move with the flows and are extremely sensitive to bring changes in the river conditions (CEGIS, 2009). River erosion not only causes people's displacement but also leads to massive financial loss. River erosion is commonly observed in the entire coastal area specifically in Meghna estuary region.

The magnitude of erosion and accretion in the Meghna estuary (**Figure 7.5**) for the period of 2008-2010 is represented in the following figure. During this period the extent of accretion was 250 km^2 while that of erosion was 153 km^2 with a corresponding net accretion of 97 km^2. Extension of mainland of Noakhali towards the sea continued like the previous period with a net accretion rate of 4.3 km^2/yr. Significant amount of accretion occurred in Bhola Island with a net accretion rate of 27.6 km^2/yr. Both erosion and accretion process occurred along shoreline in Chittagong district with a net accretion rate of 8.5 km^2/yr. Erosion was observed in Patuakhali and Lakshmipur district with a net erosion rate of 3.2 and 2.8 km^2/yr respectively.

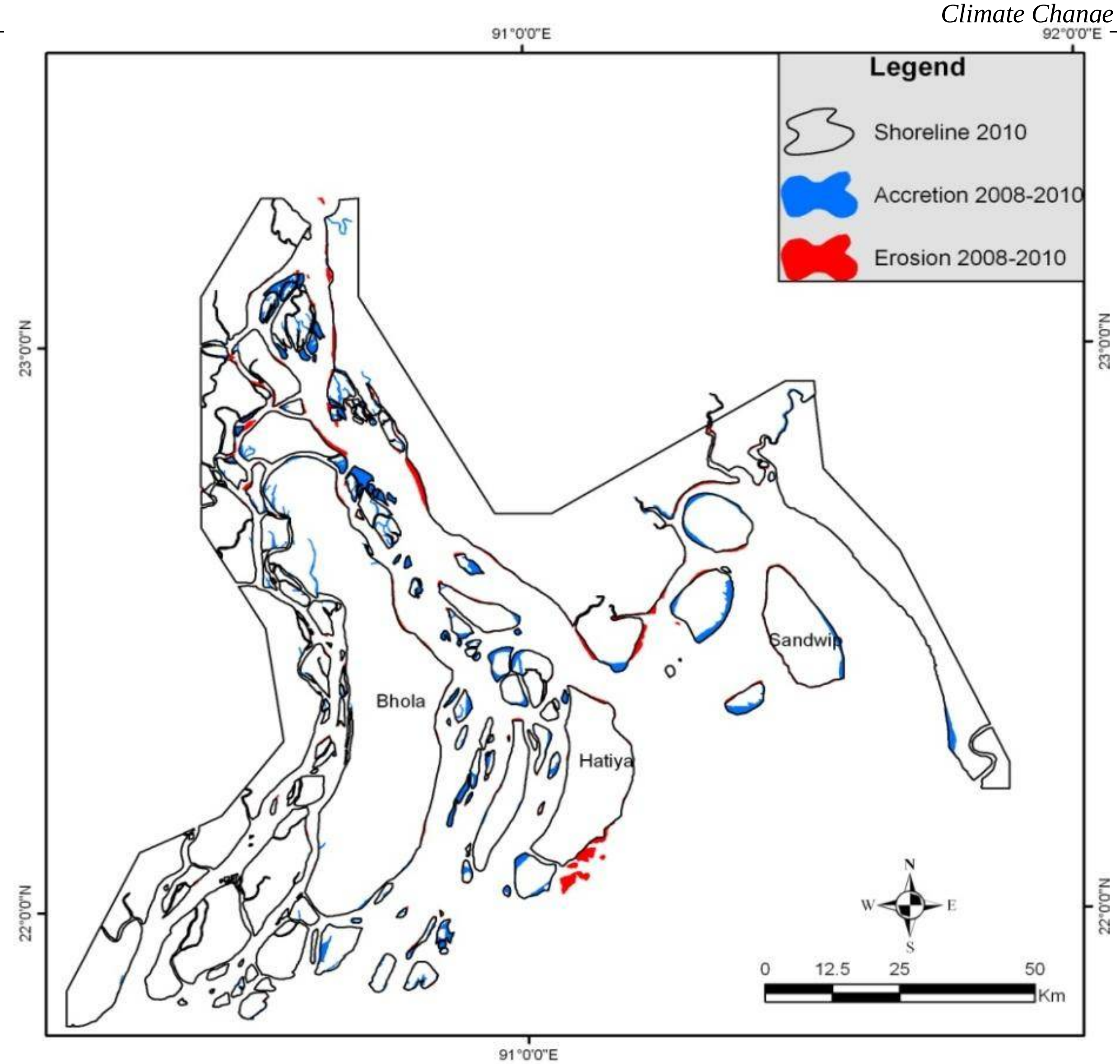

Figure 7.5: Erosion and Accretion of Land in the Meghna Estuary from 2008 to 2010

7.5 Adaptation Strategy for Climate Change Impacts in the Project Area

7.5.1 Adaption at Local level

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. 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 coastal belt of Bangladesh for adapting climatic hazards.

- People switching their livelihood from agriculture to shrimp culture.

- High yielding and salinity tolerance verities of paddy are being 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.
- Rain water harvesting system is being adopted to mitigate their drinking water problem during dry season.

7.5.2 Adaptation at Rehabilitation and Improvement Planning

The IPCC projections have been considered in the hydrologic and hydro-dynamic modeling of the feasibility study of the CEIP-I. The climate change projections have been considered to determine the design criteria and finally these outcomes have been 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.

These considerations have ultimately led to determine new height of the embankment is 4.50 for polder 39/2C and improved drainage system to cope with the impact of climate change.

8. Stakeholder Consultations and Disclosure

This Chapter provides details of the consultations held with the stakeholders at the Project site and framework for consultations to be carried out during construction phase. Also included in the Chapter are the disclosure requirements for the EIA.

8.1 Overview

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.

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 also mandated 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.

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.

8.2 Objectives of Stakeholder Consultations

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.

8.3 Identification of Stakeholders

Stakeholders include all those who affect and are being 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.

8.3.1 Primary Stakeholders

Primary stakeholders are people who would be directly benefited or impacted 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.

8.3.2 Secondary Stakeholders

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.

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 general public at large.

8.4 Approach and Methodology

Participatory approach was followed in conducting the public consultation meetings in the 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-I. 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 contacted over telephone and informed about the specific consultation meetings and requested them to be present in the meeting. In this way, the venue, date and time of the consultation meetings were fixed. Later, the consultant team organized the meetings at the local level. The participants provided their names, occupations and addresses in each meeting.

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-I, information on the 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.

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 were identified during discussions.

8.5 Public Consultation Meetings and FDGs

8.5.1 Consultation Process

A number of consultation meetings and FGDs were conducted at different locations of the Polder 39/2C. The details of these meetings and FDGs are presented in **Table 8.1** and some photographs of these meetings are given in **Figures 8.1**.

8.5.2 Consultation Details

Table 8.1: Meeting venue including time and date

Sl	District	Upazila	Union	Meeting venue	Type of consultation	Meeting date	Time
1	Pirojpur	Bhandaria	Nadmulla	Nadmulla UP	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 Bazar	"	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

Figure 8:1: Reflection of people's participation in PCM at Nadmula Union parishad

8.5.3 Consultation Participants

The main participants of the consultation meetings included public representative, farmer, trader and daily-wage laborers of the Polder 39/2C and nearby areas. A total of 158 participants attended these consultations. The participant details are provided in **Table 8.2** below:

Table 8.2: Participant Details

Sl	Meeting venue	Type of consultation	Type of Participants	No. of participants
1	Nadmulla UP	PCM	Primary and secondary stakeholders	54
2	Nadmulla Village	FGD	Primary stakeholders	08
3	Rajpasha	"	"	12
4	Nodmullah, 6 no word	"	"	10
5	Chorkhali	"	"	11
6	Chorkhali launch ghat	"	"	08
7	Darulhuda	"	"	07
8	Porchim Pasuribunia	"	"	07
9	Junia word- 4	"	"	08
10	Talekhali Bazar	"	"	12
11	Rajpasha (Pona Upper)	"	"	12
12	Gulbunia (Pona Lower)	"	"	09

Figure 8.2: FGD at Chorkhali and Talekhali bazar


Figure 8.3: FGD at Nodmullah, 6 no word and Gulbunia (Pona Lower)

8.6 Issues discussed in FGDs and Meetings

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 shared with the participants. Subsequently, the key environmental, social, and socioeconomic aspects listed below were discussed.

- 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.

8.7 Community Concerns and Suggested Solutions

The outcomes of the FGDs and consultation meetings in terms of concerns and the suggested solutions were noted and organized by themes are presented in the **Table 8.3** below.

Table 8.3: 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 be taken up at the earliest with the active involvement of the local community.
Water Resources	1. 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. 2. 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.	1. 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; 2. New embankment is required to be constructed by developing village road; 3. The intrusion of saline water might be 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; 4. Scope of sweet water storage will be improved dramatically within

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	3. 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 (Kacha) which is 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. 4. 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 is no water control structures associated with the khals, sedimentation took place in internal khals of this polder. 5. Salinity is another problem in the polder areas. Salinity intrusion in the polder through surrounding channels of the Baleswar River (Kacha), Pona don, Pona *khal* and Mirukhali-Amua varani *khal*. Salinity contamination in the polder is very frequent through that channel due to lack of embankment as well as water control structures in the east and south eastern side. As a result surface water and soil has	internal khals and protective ponds due to proper functioning of associated water control structures; 5. 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; 6. Need awareness building among the communities about water management; 7. The Government should rehabilitate the affected farmers who are affected by salinity intrusion; 8. Salt tolerant varieties of rice need to be practiced and in this regard necessary extension works need to be organized by the respective departments;

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	become salininity prone. 6. The most devastating cyclones (Sidr, 2007 and Aila, 2009) hit the polder. The cyclone Sidr was most disastrous for the project area than the Aila. The surge water entered the polder area by overtopping and through breaches in the protection embankment in bank of Baleswar River (Kacha). People reported that during Sidr surges Telikhali, Nadmulla, Dhaoa and Ikri unions are affected most in the polder area and died so many people. 7. 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. 8. Scarcity of fresh water is another problem in the polder area during dry season. Due to malfunctioning of water control structures, lack of reserve sweet fresh water in khals for irrigation during dry season. Absence of embankment along the rivers also makes the surface water unavailable for the users. Saline water is trapped for long time in vast area and this is responsible for intrusion of salinity in the groundwater aquifers. 9. The labor out-migration is estimated 25% from the study	

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	area. At least 25% of the unemployed day laborers and farmers of the polder use to migrate out to the nearby city and towns for temporary employment. 10. 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. 11. The local inhabitants of the Polder 39/2C identified tidal flooding, salinity intrusion, cyclone, and riverbank erosion are major hazards those created disasters in the area. The tidal flooding and salinity intrusion is gradually becoming a severe problem in this study area.	

8.8 Consultations during RAP Preparation

A number of stakeholder consultations were conducted in the Project area while preparing the resettlement action plan (RAP) for the proposed Project in the Polder 39/2C. These are discussed below.

The local persons who could 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 was sought and considered in preparation of the RAP. A 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 is presented in Table 8.4; some photographs of these meetings are presented in **Figures 8.7** and **8.8**.

Table 8.4: Consultation Meetings Held in Polder 39/2C

Location, Date and Time	Category of Participants
Porchim Pasuribunia, Ikri UP December 20, 2012 at 13:00	UP Chairman, Ex-UP members, Service, Social Worker, farmers, fishermen and boatman.

Location, Date and Time	Category of Participants
Junia word- 4, Telikhali UP December 20, 2012 at 14:30	UP Chairman, UP members, and farmers.
Telikhali Bazar 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.

Figure 8.4: Meeting at Junia, word-4

Figure 8.5: Meeting at Rajpasha (Pona Upper)

During these meetings, the key features of the proposed interventions in Polder 39/2C under CEIP-I, 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 were disclosed to the communities to be affected. Views of the stakeholders were obtained on the Project and its potential impacts, encroaching government land, relocation requirements, compensation process, and alternative options. Consultations were also conducted with women and other vulnerable groups and their views obtained on their livelihood aspects, Projects impacts, and compensation options.

The communities including the persons to be affected by the Project expressed their views in favor 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.

8.9 EIA Disclosure

Once finalized, the EIA report and Bengali translation of its executive summary will be disclosed to the public and will also be available on the official website of the BWDB. EIA will also be sent to the WB InfoShop.

Consultation and Disclosure Workshop (to be written after the Workshop is held)

8.10 Framework for Consultations during Project Implementation

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 8.5** charts out the proposed participation framework during different project Phases.

Table 8.5: 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	Affected communities.	BWDB;

Project Stage	Proposed Tool	Stakeholders to be Consulted	Responsibility
	communities during Compliance Monitoring and Effects Monitoring (discussed later in the document).		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

9. Significant Environmental Impacts and Mitigations

This Chapter delineates the impacts on environment that may potentially be caused during different phases of the project and which are detrimental for societal system of the polder 39/2C. Appropriate mitigation measures have also been proposed to avoid, offset, reduces, or compensates these impacts.

9.1 Assessment Methodology

The assessment of effects and identification of residual impacts takes 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 and their sensitivity to the change. Potential impacts can be both negative and positive (beneficial), and the methodology defined below will be applied to define both beneficial and adverse potential impacts.

The criteria for determining significance are generally specific for each environmental and social aspect but generally the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining magnitude and sensitivity used for the Project are summarized below.

9.1.1 Magnitude

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.

The magnitude of potential impacts of the Project has generally been identified according to the categories outlined in **Table 9.1**.

Table 9.1: Parameters for Determining Magnitude

Parameter	Major	Moderate	Minor	Negligible/Nil
Duration of potential impact	Long term (more than 35 years)	Medium Term Lifespan of the project	Less than project lifespan	Temporary with no detectable potential impact

Parameter	Major	Moderate	Minor	Negligible/Nil
		(5 to 15 years)		
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 baseline	Baseline requires a year or so with some interventions to return to baseline	Baseline returns naturally or with limited intervention within a few months	Baseline remains constant
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
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

9.1.2 Sensitivity

The sensitivity of a receptor has been determined based on review of the population (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 9.2**.

Table 9.2: 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

9.1.3 Assigning Significance

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the potential impact significance matrix shown in **Table 9.3**.

Table 9.3: 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

9.1.4 Mitigation Measures

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 **Table 9.3** require appropriate avoidance/ mitigation/compensatory measures to reduce the significance. Impacts having low to negligible significance can be left alone not needing any mitigation measures.

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. Finally, if impact reduction is not possible, compensatory measures are proposed.

9.1.5 Assessment of Residual Impacts

The final step in the impact assessment process is determining the significance of the residual impacts, which essentially are the 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. For any residual impacts having moderate significance, monitoring mechanism is necessary to ensure that their significance does not increase. No residual impacts having major or critical significance are generally acceptable.

9.1.6 Impact Screening

As part of the environmental impact assessment process, a screening matrix was used tailored specifically to the proposed Project, focusing the potential environmental impacts during the design, construction and operation phases. 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 then each of these broad categories 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.

The matrix of polder 39/2C is provided in **Table 9.4**. The negative impacts predicted in this manner were the ‘unmitigated’ impacts. Appropriate mitigation measures were recommended as part of this EIA, thus reducing the occurrence possibility and severity of the potentially adverse impacts. The potentially negative impacts identified through this process are discussed in the subsequent sections.

Table 9.4: Environmental and Social Screening Matrix (Unmitigated)

	Physical					***Biological***		***Social and Socioeconomic***												
Project Phases and Activities	**Soil Erosion/ Contamination**	**Air Quality**	**Surface Water Quality**	**Groundwater Quality**	**Water Availability and Consumption**	**Natural Vegetation**	**Wildlife/Aquatic Fauna**	**Land Acquisition**	**Blocked Access Routes**	**Noise and Vibration**	**Impacts on Agriculture and grazing**	**Flooding**	**Vehicular Traffic**	**Safety Hazard**	**Damage to Infrastructure**	**Public Health**	**Aesthetic Value**	**Cultural Issues**	**Gender Issues**
Pre-construction Phase																			
Land Acquisition	N	0	N	N	0	0	0	0	0	0	N	N	0	0	N	N	N	N	N
Construction Camp Establishment	L	0	LN	N	LN	HN	HN	HN	LN	LN	LN	N	0	LN	LN	LN	LN	LN	LN
Construction Phase																			
Contractor Mobilization	LN	0	N	N	0	0	0	N	0	LN	0	0	LN	LN	LN	LN	0	LN	LN
Equipment / Material Transportation	0	0	LN	N	N	0	LN	N	0	LN	0	N	LN	LN	LN	0	0	0	0
Operation of Construction Camp	LN	0	LN	N	0	0	0	0	N	0	0	N	0	LN	N	0	0	LN	LN
Site Clearance	N	N	N	N	N	HN	HN	HN	0	0	0	N	0	LN	0	LN	LN	0	LN
Borrow and disposal area management	0	0	LN	N	0	0	0	N	0	0	LN	0	N	LN	N	LN	LN	0	0
Excavations of water channels	0	0	LN	N	0	LN	LN	0	N	0	0	0	N	LN	N	N	LN	0	LN
Re-sectioning of Embankments	LN	0	LN	N	0	0	0	N	0	0	N	N	0	LN	0	N	LN	0	LN
Retired of embankment	N	N	0	N	0	-1	-1	-1	N	0	0	N	0	-1	N	N	0	0	-1
Slope protection of embankment	0	N	N	N	N	0	0	0	0	0	0	N	0	LN	N	N	0	0	0
Installation/replacement/repair of Regulators	N	0	0	N	N	N	N	HN	LN	LN	LN	0	0	LN	0	LN	LN	0	LN
Bank protection works	0	N	LN	N	N	0	0	N	N	0	0	0	N	LN	N	0	0	LN	LN
Closure/Dam	0	N	LN	N	0	0	LN	LN	LN	LN	LN	LN	0	LN	N	N	0	0	0

Project Phases and Activities	***Physical***					***Biological***		***Social and Socioeconomic***												
	Soil Erosion/ Contamination	**Air Quality**	**Surface Water Quality**	**Groundwater Quality**	**Water Availability and Consumption**	**Natural Vegetation**	**Wildlife/Aquatic Fauna**	**Land Acquisition**	**Blocked Access Routes**	**Noise and Vibration**	**Impacts on Agriculture and grazing**	**Flooding**	**Vehicular Traffic**	**Safety Hazard**	**Damage to Infrastructure**	**Public Health**	**Aesthetic Value**	**Cultural Issues**	**Gender Issues**
Demobilization	N	0	N	N	N	0	0	0	0	0	N	N	LN	LN	N	0	0	LN	LN
Post-project/Operation Phase																			
Operation of Regulators	N	N	0	N	N	N	N	N	N	N	-1	-1	N	N	N	0	N	-1	0
Repair and Maintenance	N	0	0	N	N	N	N	N	0	0	N	0	0	0	N	0	N	0	0
Monitoring	N	N	N	N	N	N	N	N	N	0	N	N	0	0	N	N	N	0	0

Key: HN: High negative impact; LN: Low negative impact ; 0: insignificant/negligible impact; LP: Low positive impact ; HP: High positive impact (HP); N: No impact.

9.2 High Impacts

9.2.1 Impacts during Pre-construction Phase

9.2.1.1 Involuntary Resettlement

Land will need to be acquired to construct retirement of embankments (Ch. Km 14.2 to km 17.5) and water control structure. It is estimated that 97 ha of land would be acquired resulting in displacement of about 956 households (Pucca-18, Semi pucca-56, Tin shed – 502, Katcha-146 and Thatched – 234). The details of acquired land are 10.84 ha for household, 0.1 ha of single cropped, 0.19 ha of double cropped, 5.58 ha of multi cropped, 70.52 ha of orchard, 1.16 ha of pond, 0.07 ha of shrimp culture, 3 ha of canal or Beel and 5.81 ha others. The proposed polder 39/2C will be developed through construction of new embankment, retirements of embankment at a number of places, water regulatory structures. Presently, 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). About 97 hectares of land will be acquired for development work specifically for construction of new embankment, retired embankment regulators and excavation of bypass canal. In this case, the detail of the land acquisition plan, process and cost including the list of the PAPs are incorporated in the RAP report prepared by planning and design consultants (FS). During distribution of compensation, conflict may arise due to absence of proper legal document in connection with the land ownership.

The significance of this potential unmitigated impact has been assessed as Major on the basis of impact magnitude and receptor sensitivity (see table 9.5)

Mitigation

The following measures will be implemented to address the above concerns:

- A Resettlement Action Plan (RAP) will be prepared in accordance with the national laws and WB OP 4.12. Salient features of RAP would include: the affected households to be compensated for their loss of land, structures, trees, ponds and others; squatters and tenants 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 181 latrines and ten tube wells will be displaced during construction works; and community based drinking water facilities to be constructed.
- Compensation will be paid prior to construction in accordance with RAP
- Contractor will maintain liaison with communities.
- Grievance redress mechanism (GRM) will be established.

Residual Impacts

With the help of above mitigation measures, the impacts associated with the involuntary resettlement are likely to be mostly addressed and the significance of residual impact will be **Moderate**.

9.2.1.2 Preparation of Facilities for Contractor and Labour force

Establishing and constructing site facilities in the Polder may potentially cause air and water contamination, noise generation, hindrance to local communities, and other similar impacts. **Figure 9.1** shows the key locations in the Project area where this impact is likely to take place because of 19 schools are located near the embankment, where as all the labour force facilities will be implemented near the embankment.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will prepare site establishment plan and obtain approval from the Construction Supervision Consultants (CSC)
- Approval from CSC 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
- No untreated wastes will 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 where needed to suppress dust emissions
- Speed limits will be enforced for vehicles on earthen tracks
- Vehicles and machinery will have proper mufflers and silencers
- Liaison will be maintained with the communities.

Residual Impacts

With the help of above mitigation measures, the impacts associated with establishing the site facilities are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2 Impacts during Construction Phase

9.2.2.1 Soil and Water Contamination

Wastes particularly effluents from the work sites may contaminate the soil and water. Construction material, demolition debris, or fuel/oils may enter the river Pona, Nalbunia and Siakati or other water bodies causing contamination. The contractor's camps will generate domestic solid waste and waste water 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 waste 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. Borrowing material from the river banks 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 Annex 4** shows the key location where these impacts are likely to take place.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- 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/waste 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 river banks 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 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 be allowed to enter water bodies.

Residual Impacts

With the help of above mitigation measures, the impacts associated with soil and water contamination are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2.2 Drainage Congestion and Water Logging

The Project activities particularly on regulators and sluices and in water channels may block or clog water drainage channels, potentially causing water logging in the surrounding areas and negatively affecting the cultivation and 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 is likely to worsen the situation and exacerbate the water logging problem (see figure 6.10). In addition, excavation of eleven *khals* in the Polder (see **Table 4.3**) is likely to disturb the drainage which takes place through these channels.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will constructing bypass canal before replacement of regulators
- Sequence of work at the regulators and in the water channels will be carefully planned to avoid drainage congestion.
- Contractor will ensure that drainage channels are not obstructed or clogged by the construction activities
- Contractor will ensure that construction activities do not cause any water ponding near cultivation fields.

Residual Impacts

With the help of above mitigation measures, the impacts associated with water logging are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2.3 Loss of Agriculture

About 5.87 ha of land is likely to be acquired for construction of retired embankment along Baleswar (Kocha) river. This land includes singled, double and multiple crop areas (Ch 34.2-36.00 km; Ch 37.00 to 38.06 km; Ch.39.6 to 42.8 km; Ch.51.1 to 54.5 km; Ch.55.00 to 55.50km) is likely to be affected. This land includes cultivated areas (here, single cropped land 0.1 ha, double cropped area 0.19 and multi cropped area 5.58 ha) in addition to houses and other structures. The losses of production under the acquired land are given in Table 9.5. During collection of earth from the Borrow pit areas (see Figure 1 under Annex 4), no agriculture land will be impacted in the Project area as all spoil earth will be collected from offshore area through manual excavation and rivers of Bhaleswar (Kocha) and Bahar khal, Bhuter khal and Mirukhali and Baharani Khal through dredging.

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.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Table 9.5: Loss of Production under the acquired land

Name of Crops	Area(ha)	Yield(T/ha)	Production loss (m.ton)
Boro (HYV)	1.2	6.5	7.8
T. Aman(HYV)	1.97	2.75	5.4
T.Aman(Local)	1	2.2	2.2
Oilseeds	0.8	1.1	0.9
Pulses	0.9	2.2	2.0
Total			**18.3**

Mitigation

The following measures will be implemented to address the above concerns:

- Compensation will be paid for any crop damage
- Contractor will avoid cultivation fields during construction
- Contractor will avoid agricultural land for material borrowing, material stockpiling, and labor camps
- Contractor will ensure that no vehicular movements take place inside cultivation fields
- Contractor will ensure that no material is dumped inside cultivation fields
- Contractor will maintain liaison with communities.

Residual Impacts

With the help of above mitigation measures, the impacts associated with loss of agriculture are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2.4 Affects on Irrigation

Irrigation is vitally important for the agricultural activities in the Teulbaria, Dhanisafa, Bansbunia, Junia, Telikhali, Pasurbunia and Nudmulla of the Polder. Construction activities particularly on regulators and in water channels can potentially disrupt the crop irrigation during wet season 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.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will constructing bypass canal before construction of each regulator
- Sequence of work at the regulators and in the water channels will be carefully planned to avoid irrigation disruption.
- Contractor will ensure no negative impacts on crop irrigation
- Contractor will maintain liaison with communities.
- Contractor will work during dry season.

Residual Impacts

With the help of above mitigation measures, the impacts associated with disruption of irrigation are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2.5 Impacts on Fish Habitat and Migration

About 13 drainage sluices, 15 flushing sluices and 8 closures will be newly constructed as part of the Project. All of water control structures are connected with the internal *water channels* of the Polder. (see figure 4.4). During the construction activities, temporarily the fish migration between the outside rivers and internal *khals* is likely to be affected. Similarly, *khal* re-excavation and construction of closures would also affect fish migration within the Polder between *khals* and *low lying areas*. Fish migration through the internal water channels will be partially affected in the polder during construction of drainage and flushing sluices but for construction closures fish migration would be fully obstructed. . Fish species particularly the smaller ones take part in partial fish migration through bypass channels. These species are: Chingri, Baim, Baila, Tengra, Punti, Gulsa etc.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will constructing bypass canal before construction of each regulator
- Sequence of work at the regulators and in the water channels will be carefully planned to minimize impacts on fish and their migration.
- Contractor will maintain liaison with communities.

Residual Impacts

With the help of above mitigation measures, the impacts on fish habitat and migration are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.2.6 Safety and Public Health Hazards

The area is prone to cyclones and storm surges. Although the works will be carried out during the dry season, a certain level of safety hazards still exists for the construction staff.

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 camp sites may also pose safety hazards for the construction staff as well as for surrounding population.

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 for 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.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will 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 Health, Safety and Environment (HSE) Plan and obtain approval from the Construction Supervision Consultants. The Plan should also include awareness raising and prevention measures for particularly for communicable diseases such as hepatitis B and C, and HIV/AIDS.
- The WBG's EHS Guidelines will be included in the contract documents.
- Each contractor will prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be submitted to Construction Supervision Consultants for review and approval;
- 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 laborers working on site and living in the temporary accommodation facilities. The health screening would entail normal review of physical fitness and also include a review of appropriate vaccinations. Workers would be given vaccinations where required;
- 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 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 activity. 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;
- Ensuring acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work;
- Ensuring no workers are charged fees to gain employment on the Project;
- Ensuring 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;
- Develop a recruitment process community employees that involves local authorities in clearly understood procedures;
- 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;
- Report regularly on labor and working condition key performance indicators, for instance hours worked (regular and overtime) during period and cumulatively, hours lost, number and type of accidents, near misses, site audits and meetings; trainings, and use of labor grievance mechanism;
- 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 work 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 an ambulance available.
- Firefighting equipment will be made available at the camps and worksites.
- The camp staff will be provided safety including fire fighting training.
- 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

With the help of above mitigation measures, the impacts associated with safety and health hazards are likely to be mostly addressed and the significance of residual impact will be **Moderate**.

9.2.3 Impacts during Post-construction Phase

9.2.3.1 Water Contamination and Reduced Soil Fertility

At present, about 277 ha of land are under *boro* (rice) cultivation. According to the initial estimates, about 1.85 Mm^3 of water will be available from the internal canal system, after the completion of the proposed Project. This will allow expansion of area under irrigated cultivation of *boro* and *aus* varieties of rice to about 350 ha. Specifically, Boro cultivation will be expanded in the medium high land (see the figure 6.7). This expansion of irrigated cultivation is likely to result in decreased soil fertility and increased use of chemical inputs including fertilizers and pesticides. Runoff from such cultivation fields may potentially pollute the water bodies and even drinking water sources thus causing health hazards to the communities. This runoff may also lead to eutrophication of the water bodies. Such phenomenon would decrease the dissolved oxygen in the water and thus negatively affecting the aquatic fauna.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will 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.

- 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 while avoiding water contamination
- Farmers will be encouraged to cultivate leguminous crops to enhance the soil quality

Residual Impacts

With the help of above mitigation measures, the impacts associated with usage of increased level of chemical inputs are likely to be somewhat addressed and the significance of residual impact will be **Moderate**.

9.2.3.2 Risk of Embankment Failure

Rain cuts, wave action, tidal surge and public cuts are the major causes of embankment breaching of the coastal region. Lack of regular maintenance has created weak point at the sensitive locations of the embankment. Mal-maintenance and increasing intensity and magnitude of the cyclone and storm surge simultaneously have accelerated the risk of embankment failure. Counter clockwise circulation of the cyclone of the Bay of Bengal will make the western embankment (Ch 34.00 km to 35.9 km and Ch 48.00 km to 49.00 km to 51.00km, Ch 55.00 to 56.12 km) along the Baleswar (Kocha) river to more susceptible to breaches.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the western side of the Polder will be ensured. This monitoring will particularly be carried out before and after monsoon season.
- Available cyclone and flood shelter will be prepared as a contingency measure during emergency situation.
- WMG will develop a fund for this kind of emergency situation.
- Structural measures like geo bag and sand bag will be kept in the Upazila office for emergency.

Residual Impacts

With the help of above mitigation measures, the impacts associated with risk of embankment failure are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.3.3 Drainage Congestion and Increased Sedimentation in Water Channels and Rivers

There are numerous khals namely *Tentul baria khal, Shing khali khal, Gabtalar khal, Bamuner khal, Safa bazaar khal*, *Bahar varani khal* and other khals which are open, i.e no structures exists in those khals to control regular tidal flow which cause inundating of low-lying areas of the polder. Since there is no embankment in eastern side of the polder to protect the areas it creates drainage congestion severely.This polder is newly constructed under the CEIP. After implementation of the proposed intervention of the proposed new polder, the drainage system will improve. According to the proposed intervention, new construction of embankment and structures with adequate vents would remove drainage congestion and waterlogging problems in the polder area during monsoon and regular tide. Besides, drainage congestion will be significantly reduced due to re-excavation of internal khals of the polder area as per proposed plan. Other hand, sedimentation problem in the external rivers of Siakati, Nalbunia and Pona will be raised due to absence of silt management plan under feasibility study. Moreover, in future, the project will faced severe water logging due to drainage congestion, specifically south east corner of the project.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- An ongoing program of de-silting of water channels will be considered with full community involvement and participation.
- Proper land zoning plan will be prepared in the Polder for controlling unplanned development works. For this purpose further research should be taken by the SRDI or Agriculture Extension Office of Bangladesh.
- The local government (union parishad) will be authorized to monitor the development activities.
- Proper training program in connection with land zoning and monitoring system will be undertaken by the development authorities of Bangladesh.
- A research program will be carried out for polder-wise land zoning plan preparation in future.
- Prepare Bangla manual for sluice gate operation and provide training to WMOs; and
- Reduce conflicts between farmers and fishermen.
- Implement small scale tidal river management (TRM).

Residual Impacts

With the help of above mitigation measures, the impacts associated with drainage congestion are likely to be mostly addressed and the significance of residual impact will be **Moderate**.

9.2.3.4 Increase Salinity Intrusion Due to Leakage of Regulators

The proposed project has been designed to protect salinity intrusion through marginal dyke from the rivers Siakhali, Nalbunia and Pona Rivers. This interventions will expanded the cultivation of Boro crops during dry season. According to coastal polders experiences, mal-operation and leakage of regulators will result in salinity intrusion during dry season causing severe damage to the soil, water resources, and crops in the Polder. If the regulators will not be monitored and operated by the BWDB after project completion then salinity intrusion due to leakage of regulators will be initiated in future.

The significance of this potential mitigated impact has been assessed as **Low** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented 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 be translated in bangle as well.
- Capacity building of WMOs will be carried out.

Residual Impacts

With the help of above mitigation measures, the impacts associated with salinity intrusion are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.2.3.5 Reduce of fish habitat

Due to implementation of intervention like construction of closure dam, new water regulator structures, construction of new embankment, fish habitat quality of internal khals would deteriorate in dry season. On the other hand, excavation of internal khal would improve fish habitat quality of internal khals to some extent in the polder area. It is expected that khals on which closure dam will be built would go under culture fishery (about 80ha). It is observed from field study there are some fish farm practicing culture of white fish and prawn together. So it is expected that safeguarding of the area through constructing embankment, closure, sluice gate and associated structure from flooding inundation and salinity intrusion can be achieved. Therefore prawn culture practice may be promoted in this area.

The significance of this potential unmitigated impact has been assessed as **Minor** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

- Using of organic manure and IPM method for controlling contamination of water pollution.
- Re-enforcing fisheries laws and regulations in the field level for protecting indiscriminate fishing.

Residual Impact

Implementing the above mitigation measures, the impacts associated with fish habitat are likely to be alleviated and the significance of residual impact will be **Low**.

9.2.3.6 Obstruct Fish Migration

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 figure xxx under 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 (Ch 44.35 km) which are directly connected with external rivers.

A total of 28 water regulatory structure (15 drainage sluices and 13 flushing inlets), 8 closures on above mentioned khals would be constructed . This would directly hamper lateral fish migration of mild to moderate saline tolerant fish species. The fish species include Poa (*Pama pama*), Tulardandi (*Sillago domina*), Phasa (*Setipinna taty*), Chewa (*Taeniodes anguillaries*), Boal (Wallago attu) etc. Moreover, most of the brackish fish species, such as Bhetki (*Lates calcarifer*), Phasa (*Setipinna taty*), Harina Chingri (*Metapeneaus monocerus*) and freshwater fish (*Labeo rihita*, *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.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

- Fish friendly structures should be constructed at Pona (upper) khal, Pona (lower) khal and Nodmollar khal
- 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 of structures during fish breeding period
- Gate operation manual should be prepared and provide to WMOs. Manual should be translated into Bangeli and trained them up for properly handling of the structures.

Residual Impacts

Implementing the above mitigation measures, the impacts associated with fish migration are likely to be alleviated and the significance of residual impact will be **Low**.

9.2.3.7 Loss of fish Biodiversity

Consequences of obstruction to fish migration would decline fish species diversity may lead to high species dominance.

Mitigation

- Conserve fish species through construction of deep pool in the major khal like Nodmollar khal, Hetalia khal, Bamoner khal
- Introduce net pen culture in Darulhuda khal, Hainter khal, Poddarer khal, Mollar khal.

- Provide training on improved culture technology.
- Promote skill development training to the fish farmer for more fish production from Prawn gher and ponds.

Residual Impacts

Implementing the above mitigation measures, the impacts associated with loss of fish biodiversity are likely to be alleviated and the significance of residual impact will be **Low**.

9.2.3.8 Decline fish production

Due to construction of embankment, cross dam and water regulatory structure, it is expected that capture habitat fish yield would be reduced significantly. On the other hand, the area of culture pond in the polder area might be increased due to reducing of pond over topping chances. The people will adopt the modern technology for fish culture that will boost up the fish production. In addition, it is expected that, khals on which closure dam will be built would go under culture fishery. Therefore, estimated culture fish production might be improved compare to baseline conditions.

Mitigation

- Golda farming should 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 should 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.

Residual Impacts

Implementing the above mitigation measures, the impacts associated with fish production decline are likely to be alleviated and the significance of residual impact will be **Low**.

9.3 Moderate Impact

9.3.1 Impacts during pre-construction

9.3.1.1 Increased Vehicular Traffic during mobilization

Mobilization of contractor, 164 equipment and machinery, construction material and manpower will be transported to the Polder resulting additional traffic on roads and in water ways. This traffic may potentially cause traffic congestion particularly in Charkhali to Mathbaria road. Figure 9.1 shows the road of 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 Bazars are Bhaylebunia Bazar (Ch 10.31 km), Teltulbania Bazar (Ch 20.3 km) Dhanisafa Bazar (24.30 km) and Hetalia Bazar (Ch 49.93 km) will face traffic congestion during *Hat* time.

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor to prepare and implement mobilization plan considering water vessels and launch movement in the external rivers. And, avoid the launch movement time, which timing is mentioned in the baseline report under the section xxx.
- Vehicular traffic should be moved in the polder area and also on embankment during off peak time. No school time (10:00 Am to 13:00Pm) and day of marketing time (Hatbar) will be considered during vehicular traffic movement.
- Ensure minimal hindrance to local communities and commuters, specifically in the Charkhali ferry ghat(Figure 9.1).
- Liaise with local communities and concerned bazaar committee. Specifically union parishad members of the polder. The details of communication address of union parishad chairman and members have been 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 Bazar ,Teltulbania Bazar, Dhanisafa Bazar Hetalia Bazar. These four places is the common population gathering places in the polder area. This training must be needed because of safety of the local stakeholders.
- 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 Rayenda and Sonnasir Bazar. These two places is the common population gathering places in the polder area. This training must be needed because of safety of the local stakeholders.

Residual Impacts

With the help of above mitigation, the impacts associated with the increased traffic are likely to be adequately addressed and the significance of residual impact will be Low.

9.3.2 Impacts during construction

9.3.2.1 Air Quality Deterioration

Construction machinery and Project vehicles will release exhaust emissions, containing carbon monoxide (CO), sulfur 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 areas – see **Figure 4.1 under Annex 4**). Furthermore, construction activities such as excavation, leveling, filling and vehicular movement on unpaved tracks may also cause fugitive dust emissions. These emissions pose health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to air contamination caused by the Project activities (see **Figure 9.1**). Nineteen schools (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, Ch 56.6 km) are located near the embankment, which students is under threat for fugitive dust emissions. The spatial location of the schools is shown in figure 9.1 and their chainages are found in the project intervention map.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Exhaust emissions from vehicles and equipment will comply with standards.
- Proper tuning of vehicles, generators, and equipment will be carried out, to minimize exhaust emissions.
- Construction material (sand/soil) will be kept covered while transporting and stock piled.
- Water sprinkling will be carried out where needed, particularly on the earthen tracks near communities.
- Vehicle speed will be on low (15 km per hour) on earthen tracks particularly near communities and school.
- Vehicles and other machinery will be turned off when idle
- Good quality fuel will be used, minimizing exhaust emissions.
- 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

With the help of above mitigation measures, the impacts associated with air quality deterioration are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.2 Noise and Vibration

The construction activities particularly demolition of existing 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.

Increased noise levels may cause disturbance, nuisance and even health hazards for the nearby communities as well as for the construction workers. In particular, the settlements near the work areas will be exposed to noise and vibration generated by the Project activities; in addition sensitive receptors such as schools (see figure 9.1)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 (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, Ch 56.6 km). The students of these schools may be faced serious noise problem during school time.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Restricting/limiting construction activities during the day time.
- 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 at schools and other sensitive receptors, as needed.
- Provision of PPE (ear muffs and plugs) to 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 site.

Residual Impacts

With the help of above mitigation measures, the impacts associated with noise and vibration are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.3 Increased Inland and Waterway Traffic

Transportation of construction materials is a key concern during the Project as the Polder 39/2C is located in a remote area of Pirojpur. A couple of options are available for carrying construction materials to the Project stockyards in the Polder. The first option would involve water way transportation along Ghasiakhali-Baleswar River from the Khulna-Mongla port to inside the Polder. Water vessels would be used for carrying materials in this case. The second option would involve road transportation from Khulna to Charkhali Ferry ghat inside the Polder through truck.

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, travelers, and transporters. Increased amount of waterway traffic would also increase the noise level of the area.

The significance of these potential impacts has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see Table 9.5).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor to prepare and implement traffic management plan
- Contractor to establish new, temporary jetties where needed (eg, at Charkhali ferry ghat)
- River crossing for material transportation during night time where possible and appropriate.
- Liaison to be maintained with community and Charkhali ferry ghat Authority.

Residual Impacts

With the help of above mitigation measures, the impacts associated with additional traffic on roads and along water ways are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.4 Sedimentation

Borrowing material from the river banks 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 (see table xx under chapter 4) if carried out in water can potentially increase their sediment load. Excavated material from the channels if left along their banks may again enter the water thus increasing their sediment load. In addition, construction material, loose earth/soil, demolition debris, and other materials may enter 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.

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Small scale Tidal River Management (TRM) will be implemented where appropriate and needed
- Contractor will protect untreated embankment slopes
- Contractor will excavate channels after dewatering them.
- 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 river banks in a manner not to increase siltation in rivers, and will not leave loose soil after excavation.

Residual Impacts

With the help of above mitigation measures, the impacts associated with sedimentation are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.5 Impacts on Benthic Fauna

Benthic communities play important role in food chain not only for lentic (standing water) but also for lotic (flowing) water bodies. Construction activities including re-excavation of 11 *khals* (see table xx under chapter 4), dredging of Kacha and other external rivers of the polder and discharge of solid wastes and waste effluents can potentially impact the benthic communities of the water bodies.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- Contractor will not release untreated wastes on soil or in water.
- Contractor will carry out *khal* excavation in segment thus minimizing impacts on benthic fauna.

Residual Impacts

With the help of the above mitigation measures, the Project's impacts on benthic fauna will be somewhat reduced. After the construction phase, these resources are likely to fully recover gradually. The significance of the residual impacts has therefore been assessed as **Low**.

9.3.2.6 Damage / Disturbance to Faunal Resources

Significant faunal resources (like, mammals, birds, wild species etc) exist around the proposed marginal dyke (See Table 3 and 4 under Annex 3). The proposed marginal dyke will be constructed from Ch. 34.10 km to 51.190 km, which is important habitat of faunal species. Hence the Project activities are likely to have significant impact on the faunal resources of the Polder. Release of untreated waste effluents and contaminants in the rivers and water channels potentially affect the wildlife resources of the area.

Implementation of the proposed interventions in this polder would have temporary impacts on fauna. The fauna existing in the homestead and roadside vegetations might be relocated due to habitat disturbance or habitat destruction in the construction sites. Especially, the reptile's 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*) will be relocated temporary or may die during tree cutting and land clearance for construction works.

During re-sectioning works of embankment along the Baleswar (Kocha) river, some wildlife species like Pati Shial (*Canis aureus),* Beji (*Herpestes javanicus),* Bengal Monitor (*Varanus bengalensis), Mechho Bagh (Prionailurus viverrinus)* will be impacted.
The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.5**).

Mitigation

The following measures will be implemented to address the above concerns:

- Construction works would be carried out carefully
- Contractor will not release untreated wastes on soil or in water
- Labor will not indulge in hunting, trapping, or shooting wild animals.

Residual Impacts

With the help of above mitigation measures, the impacts on faunal resources are likely to be adequately addressed and the significance of residual impact will be **Low to negligible**.

9.3.2.7 Impacts on Floral Resources

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. During the construction works, a large proportion of these trees will need to be felled down to increase the width and height of the embankments. In addition, establishment of labor camps and other temporary facilities, material stockpiling, material borrowing, and waste disposal can potentially affect the natural vegetation and trees. The details of floral species are given in RAP report prepared by FS team.

The implementation of proposed activities in this polder might facilitate water control with positive impact in the entire area. On the other hand, the removal of mangrove vegetations from floodplains of canal and river sides due to pilling of spoils earth during re-excavation of khals and dredging spoils will cause negative impacts on floral community. During the construction and pre-construction activities, vegetation species will be impacted. Small herbs and shrubs would be impacted due to pre- construction materials dumping and construction of labour shed.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- 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 (eg, Geoa, Kewra and Babla) in the beginning of the Project.
- Contractor will avoid dumping of spoil earth in and material borrowing from vegetated areas;
- Construction camps and other facilities will be located so as to minimize vegetation loss and tree felling
- Contractor will enhance flora environment by planting fruit trees and mangrove plants;

Residual Impacts

With the help of above mitigation measures, the impacts on the floral resources are likely to be adequately addressed and the significance of residual impact will be **Low to negligible**.

9.3.2.8 Hindrance for Pedestrian and Vehicle Movement

Seven markets (Ch. 20.51 km, Ch 24.30 km, Ch 10.30 km, Ch 43.2, Ch 49.9 km, Ch 48.19 km, Ch 39.5 km) (see figure 9.1) 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 markets as these will be displaced during the construction of embankments. The construction activities along the embankments will also cause temporary disturbance in the movement of local people. The internal roadways are not sufficient enough 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.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- The works on embankment will be carefully scheduled to minimize impact on local markets and transportation routes.
- The embankment works will be carried out in segments and soil will be placed linearly on half of the embankment, leaving the other half to be used as track. When the works are completed on the first half, it will be opened for local traffic while works will be undertaken on the other half of the embankment.
- Work schedule will be finalized in coordination and consultation with local representatives and communities.
- Local routes will not be blocked as much as possible. If unavoidable, alternative routes will be identified in consultation with local community.
- GRM will be put in place.

Residual Impacts

With the help of above mitigation measures, the impacts on the floral resources are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.9 Impacts on Common Property Resources

A total of 32 different types of common property resources (CPRs) will be affected by the project interventions. The affected CPRs include mosque, school/pathshala, Mandir, Club and Samity house, Government office, Madrasha, Party office and Clinic. Number of CPRs is given in Table 9.6. Due to affecting of CPRs, religious, educational, and social services will be hampered for a short time.

Table 9.6: Polder wise number of affected CPRs

Sl. No.	Category of the CPR	Number
1	Mosque	17
2	Mandir	2
3	Club House	1
4	School/Pathshala	4
5	Government Office	1
6	Madrasha	5
7	Political Party office	1
8	Clinic	1
	Total	**32**

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity.

Mitigation

- Contractor will pay compensation to the affected organization/institutions
- Arrange alternative facilities during construction
- Contractor should discuss with respective authority/management committee

Residual Impacts

With the help of above mitigation measures, the impacts on the floral resources are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.10 Social unrest between Local worker and outside worker

Around 1 2,900 skilled and unskilled labour will be required for construction activities. Most of the labour will be need for re-sectioning of embankment and retired embankment. It is envisaged that about 60 percent construction workers will be recruited from within the Polder while the remaining will come from other areas. The presence of outside laborers 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 workers involvement and payment schedule.
- May create labour leadership problem.

Presence of a large number of outside labor can potentially cause encroachment in the privacy of local population particularly women and their mobility can be negatively affected.

The significance of this potential unmitigated impact has been assessed as **Moderate** on the basis of impact magnitude and receptor sensitivity (see **Table 9.4**).

Mitigation

The following measures will be implemented to address the above concerns:

- Proper awareness programs will be conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards 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 established to address the grievances of local as well as outside laborers.
- Careful use of local natural resources and project resources, fuel, 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.
- Avoiding construction activities during Prayer time.

Residual Impacts

With the help of above mitigation measures, the impacts associated with social unrest are likely to be adequately addressed and the significance of residual impact will be **Low**.

9.3.2.11 Seasonal Impacts (Natural Hazards)

Historically, this area is vulnerable to cyclone, storm and tidal surges. As per construction schedule, the development activities of proposed new polder will be conducted from October to May while most of the cyclone and storm surges are occurred in this area. According to previous record of occurred cyclone and storm surges, October to November and April to May is pick month of occurrence of cyclone and storm surges. It is suspected that the construction activities during this period may hamper as well as the workers may injure.

Mitigation

- Weather signals will be considered by the contractor during construction works.
- Radio and television will be kept in all the labour sheds for getting weather information through these media.
- Ensuring rigorous standards for occupational health and safety are in place;
- Having the Contractor establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.

Residual Impacts

With the help of above mitigation measures, the impacts associated with natural hazards are likely to be adequately addressed and the significance of residual impact will be **Moderate**.

9.4 Low Impact

9.4.1 Impacts during pre-construction phase

9.4.1.1 Changes in Land Use

The polder is partially embanked by the western dyke, which is located left bank of the Baleswar River. By the proposed marginal dyke will change the land use pattern of the area. Here, Land would be needed to establish temporary facilities including construction camp (labour shed) and borrow areas. It is estimated that about 70 labour sheds will be constructed to established temporary facilities for the rehabilitation works. All the labour sheds will be constructed in the requisite land. These camps would change the terrestrial land use pattern of the area where there are 4527 timber trees. These trees will be cut off during construction of 70 labour camps. Additionally 6 households will be displaced during the construction of labour sheds. The details environmental and societal features have been attributed in the Table 9.5 according to chainage.

The use of borrow pits area are majorly fallow during dry season. In wet season, these borrow pits area is used scattered for seedbed or grazing of livestock by the dwellers of the polder. Location of borrow pits area (See figure 1 under Annex 4) have been mentioned in the FS report.

The significance of this potential unmitigated impact has been assesses as Low on the basis of impact magnitude and receptor sensitivity (see table 9.4). All the borrow pits of the foreshore areas will be filled within one or two years due to tidal inundation.

Table 9.7: Number of features displaced during establishment of labour Shade

Chainage (Km)	Structural	Number of trees and Household					
		C/S			R/S		
		Homes	Shop/others	Trees	Homes	Shop/others	Trees
Ch. 2.13 km	F/S-3	2	-	52	1	1	70
Ch. 3.80 km	D/S-1	-	-	49	1	10	38
Ch. 5.04 km	F/S-4	-	-	58	-	-	66
Ch. 6.30 km	D/S-2	-	-	139	-	4	103
Ch. 9.0 km	F/S-5	-	2	22	-	1	123
Ch. 10.65 km	F/S-6	-	-	380	-	-	165
Ch. 12.55 km	D/S-3	-	-	540	-	-	70
Ch. 15.25 km	D/S-4	-	-	250	-	-	200
Ch. 19.0 km	D/S-5	-	-	160	-	-	34
Ch. 22.0 km	F/S-7	-	-	-	-	-	-
Ch. 29.55 km	F/S-8	-	-	-	-	-	-
Ch. 33.0 km	F/S-9	-	-		-	-	-
Ch. 36.0 km to 34.2 km	Retired embankment	-	-	-	-	-	-
Ch. 37.0 km	F/S-10			11		-	22

Chainage (Km)		Number of trees and Household					
	Structural	C/S			R/S		
		Homes	Shop/others	Trees	Homes	Shop/others	Trees
Ch. 37.9 km	F/S-11	4	1	29		1	15
Ch. 38.8 km to 37.0 km	Retired embankment	-	-	-	-	-	-
Ch. 39.1 km	D/S-7	-	-	15	-	-	-
Ch. 39.6 km to 42.8 km	Retired embankment	-	-		-	-	-
Ch. 40.5 km	F/S-12	-	-	16	-	-	8
Ch. 42.2 km	F/S-13	-	-	10	-	-	-
Ch. 43.25 km	D/S-8	-	-	45	-	-	-
Ch. 44.35 km	D/S-9	-	-	222	-	-	-
Ch.17.0-18.5 km	F/S-14	-	-	20	-	-	8
Ch. 46.0 km	D/S-10	-	-	515	-	-	25
Ch. 43.25 km	D/S-11			555			25
Ch. 51.5 km to 54.5 km	Retired embankment	-	-	-	-	-	-
Ch. 51.5 km to 54.5 km	Bank protection	-	-	-	-	-	-
Ch. 53.3 km	F/S-15	-	-	15	-	-	-
Ch. 54.45 km	D/S-12	-	-	367	-	-	-
Ch. 55.0 km to 55.5 km	Retired embankment	-	-	-	-	-	-
Ch. 57.6 km	D/S-13	-	-	10	-	-	-
Ch. 58.7 km	F/S-1	-	-	25	-	-	10
Ch. 01.3 km	F/S-2	-	-	25	-	-	15
	Total	**6**	**3**	**3530**	**2**	**17**	**997**

Mitigation

- Established all the construction camps within the area owned by BWDB.
- Pay compensation/rent if private property is acquired on temporary basis, which instructions should be specified in the tender document.
- Construct labour shed/camp at government khas land
- Avoid unnecessary tree cutting as much as possible.
- Consult local stakeholders in the polder area in presence of elected executive body of Union parishad.
- Avoid impacts on local stakeholders.

Residual Impacts

With the help of above mitigation, the impacts associated with changes in land use are likely to be adequately addressed and the significance of residual impact will be very Low.

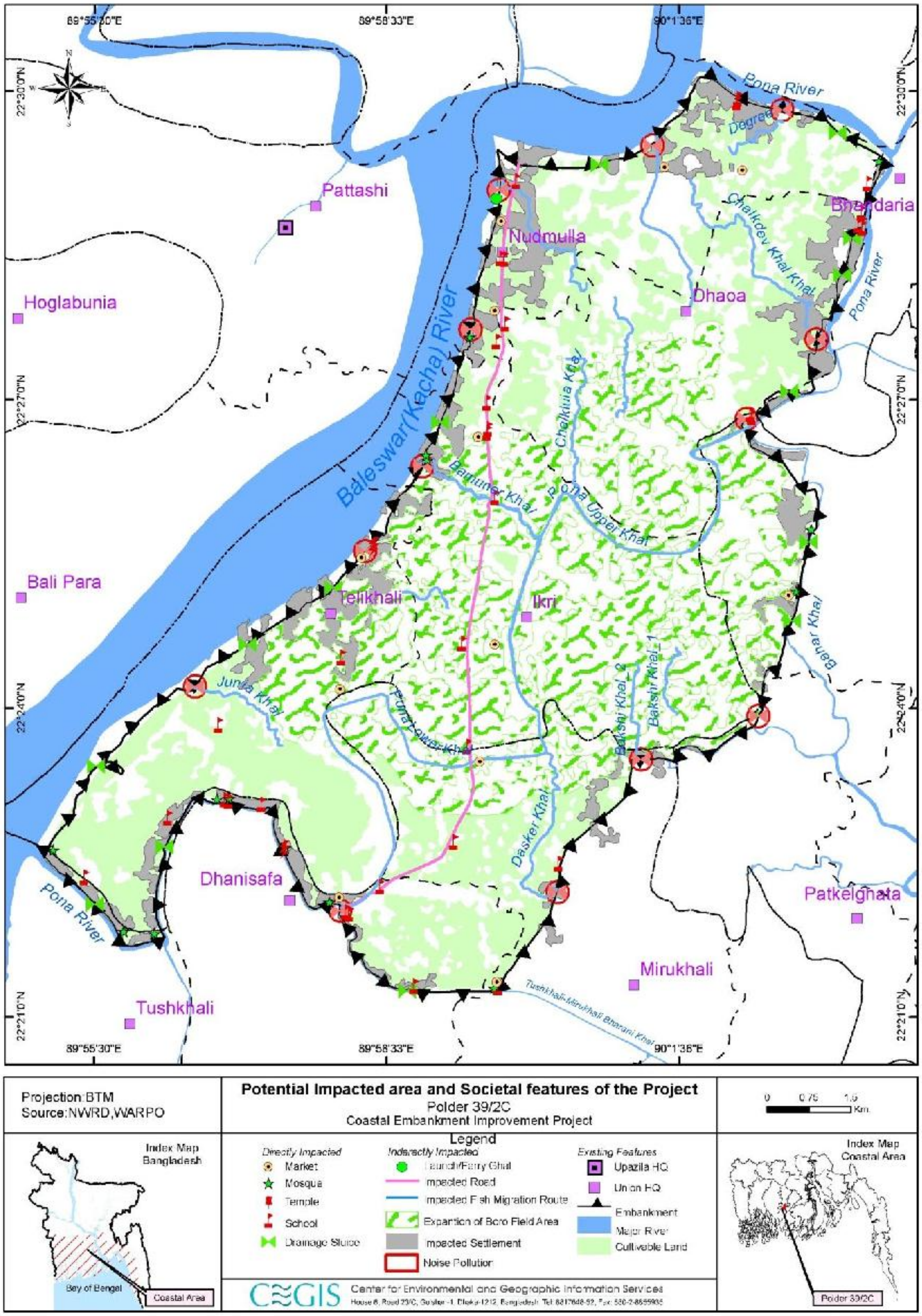

Figure 9.1: Potential impacted area and societal features of the project

9.5 Summary of Assessed Impacts

A summary of these impacts and their significance discussed in the sections above is presented in **Table 9.8**.

Table 9.8: Significance of Environmental Impacts

Potential Impacts	Temporal Aspects (See Table 9.1)	Spatial Aspects (See Table 9.1)	Reversibility (See Table 9.1)	Likelihood (See Table 9.1)	Sensitivity (Table 9.2)	Significance (Unmitigated) (Table 9.3)	Mitigation Measures	Residual Impact
A. Pre-construction Phase								
Changes in land use (preparation of construction facilities, borrow areas, others)	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• Establish all these facilities within the area owned by BWDB • Pay compensation/rent if private property is acquired on temporary basis • Consult communities • Avoid impacts on communities.	Low
Increased traffic for contractor mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• Contractor to prepare and implement mobilization plan. • Liaise with local communities and concerned authorities • Ensure minimal hindrance to local communities and commuters	Low
Impacts associated with construction of temporary facilities	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• Contractor will prepare site establishment plan • Approval from Construction Supervision Consultants 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							of the area • Site facilities will be established at a safe distance from communities • Contractor to prepare and implement pollution control and waste management plans • Do not release untreated wastes on ground or in water • Exhaust emissions from vehicles and equipment to comply with standards • Proper tuning of vehicles, generators, and equipment • Water sprinkling where needed • Speed limits for vehicles on earthen tracks • Vehicles and machinery to have proper mufflers and silencers • Consult communities	
Involuntary resettlement	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 redress mechanism (GRM) in place	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
B. Construction Phase							•	
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 comply with standards • Proper tuning of vehicles, generators, and equipment • Covering construction material (sand/soil) while transporting and stock piled. • Water sprinkling where needed • Speed limits for vehicles on earthen tracks • Turn off engine when idle • Use of good quality fuel • Locate camps at a safe distance from communities. • Liaison with the communities will be maintained and grievance redress mechanism will be established at the site.	Low
Noise generation	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Restricting/limiting timing of construction activities • 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							at schools and other sensitive receptors • Provision of PPE (ear muffs and plugs) to labor • Instruction for proper use of equipment • Liaison with community • Locate camps at a safe distance from communities.	
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 where needed • River crossing during nighttime where possible and appropriate • Material transportation through rivers during high tide where needed (eg, Dhangmari River) • Liaison with community and BIWTA.	Low
Soil and water contamination: large volume of construction wastes, leakage, spillage of oil from vessels and engine boat, camp wastes, disposal of demolition material, spoil,	Short term	Local	Reversible (after construction phase)	Certain	High	Major	• Contractor to prepare and implement pollution control plan • Oil separators/sumps for workshops • Avoid repairing vehicles and machinery in the field • Use plastic sheet or gravel in the workshop and equipment yard	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
and excavated silt							• 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 or release of fuel, oil or any other affluent/waste in the water • Locating camps away from communities and drinking water sources • Preparing and implementing camp waste management plan (septic tanks, proper solid waste disposal); • Do not release untreated wastes on ground or in water • Re-use spoil and excavated material where possible • Disposal of spoil at designated areas with community consent • Construction material and excavated soil/silt will not be allowed to enter 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							erosion control measures (eg, stone pitching) where needed • Re-contour borrow areas where needed • Protect untreated embankment slopes • Avoid works in rainy season.	
Sedimentation	Short term	May extend beyond Polder	Mostly Irreversible	Likely	High	Major	• Implement small scale Tidal River Management (TRM) plan • Protect untreated embankment slopes • Excavate channels after dewatering them. • Excavated earth and silt not to be placed on channel banks • Implement measures to protect channels from run-off from work areas and camps • Obtain borrow material from river banks in a manner not to increase siltation in rivers; do not leave loose soil after excavation.	Low
Water logging	Short term	Local	Reversible	Occasional	Medium to high	Major	• Constructing bypass canal during construction of all regulators • Ensuring that drainage channels are not obstructed or clogged • No water ponding near	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							cultivation fields	
Damage to agriculture	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 • No vehicular movements inside cultivation fields • No material dumping inside cultivation fields • Maintain liaison with communities.	Low
Affects on irrigation	Short term	Local	Reversible	Likely	High	Major	• Constructing bypass canal during construction of all regulators • Proper sequencing of works on regulators and sluices • Ensuring no negative impacts on crop irrigation • Maintain liaison with communities.	Low
Hindrance to fish migration	Short term	Local	Reversible	Likely	Medium to high	Major	• Constructing bypass canal during construction of all regulators • Proper sequencing of works on regulators and sluices; • During monsoon runoff will be diverted to adjacent depressions and from there to river after settling • Transferring fish from	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							rivers to Polder water channels where appropriate. • Maintain liaison with communities.	
Affects on benthic communities	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	• Do not release untreated wastes on soil or in water. • Carry out *khal* excavation in segment thus minimizing impacts on benthic fauna.	Low to medium
Damage / disturbance to faunal resources	Short term	Local	Reversible	Likely	Medium	Moderate	• No material to be borrowed from and no waste to be disposed in Sundarban. • Do not release untreated wastes on soil or in water • Labor not to indulge in hunting, trapping, or shooting wild animals.	Negligible
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 borrowed from and no waste to be disposed in Sundarban.	Negligible

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
Hindrance for Pedestrian and Vehicle Movement	Short term	Local	Reversible	Likely	Medium	Moderate	• The works on embankment will be carefully scheduled to minimize impact on local markets and transportation routes. • The embankment works will be carried out in segments and soil will be placed linearly on half of the embankment, leaving the other half to be used as track. When the works are completed on the first half, it will be opened for local traffic while works will be undertaken on the other half of the embankment. • Work schedule will be finalized in coordination and consultation with local representatives and communities. • Local routes will not be blocked as much as possible. If unavoidable, alternative routes will be identified in consultation with local community • GRM will be put in place.	Low
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	• All the construction work near Dhangmari River will be conducted in the presence of Forest Guards for safety of labor against the tiger attacks.	Moderate

Potential Impacts	Temporal Aspects (See Table 9.1)	Spatial Aspects	Reversibility	Likelihood	Sensitivity (Table 9.2)	Significance (Unmitigated) (Table 9.3)	Mitigation Measures	Residual Impact
							Construction workers' awareness raising will be carried out regarding the risks and their avoidance. Nighttime works will not be carried out in tiger-prone areas. Camps will be protected against tigers and periphery fencing and lighting will be carried out. Appropriate arrangements will be made to frighten the tigers to keep them away from the work areas. • 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. • Each contractor will establish a comprehensive Health and Safety Plan aimed at preventing accidents, injuries and work-related diseases. This plan will be submitted to BWDB and World Bank for review and approval; • Each contractor will	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							prepare an Emergency Response Plan defining procedures to be followed during any emergency. This plan will be submitted to BWDB and World Bank for review and approval; • 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; • 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 also include a review of appropriate vaccinations. Workers would be given vaccinations where required; • Hazards require staff training. All employees need to carry out induction health and safety training	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							prior to commencement of work. OHS issues would be part of the employee training plan. 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 activity. The construction contractor(s) would not hire people under the age of 18 on permanent contracts but	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							would include short training activities for youth to the extent possible; • Ensuring acceptable conditions of work including observing national statutory requirements related to minimum wages and hours of work; • Ensuring no workers are charged fees to gain employment on the Project; • Ensuring 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);	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							• 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; • Develop a recruitment process community employees that involves local authorities in clearly understood procedures; • 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,	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							including gender, and location source of workers; • Report regularly on labor and working condition key performance indicators, for instance hours worked (regular and overtime) during period and cumulatively, hours lost, number and type of accidents, near misses, site audits and meetings; trainings, and use of labor grievance mechanism; • 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 work environment taking into account the inherent risks for this type of project.	
Social Unrest	Short term	Local	Reversible	Likely	Medium	Moderate	• Proper awareness programs will be	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							conducted through public consultation measures such as village scoping sessions, meetings, and placement of bill boards with assistance from the Union Parishad Chairman, Upazila Nirbahi Officer (UNO) and BWDB local officers. • Cultural norms of the local community will be respected and honored. • GRM will be established address the grievances of local as well as outside laborers. • Careful use of local natural resources and project resources, fuel, 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. • Avoiding construction activities during Prayer time.	
C. Post Construction Phase								
Soil and water contamination (increased use of	Long term	Local	Reversible	Likely	High	Major	• Using IPM method for reducing pesticide use; • Awareness raising of	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
chemical inputs) and reduced soil fertility							communities	
Tidal flooding	Long term	Local	Reversible	Likely	High	Major	• Embankment should be monitored pre and post monsoon season to check the vulnerable situation of the polder.	Low
Risk of embankment failure	Long term	Local	Reversible	unlikely	High	Major	• Regular repair and maintenance of embankment and regulators.	Low
Drainage congestion and increased sedimentation in *khals* and rivers	Long term	Local	Reversible	Likely	High	Major	• Provide water shed management training to WMOs • Prepare Bangla manual for sluice gate operation and provide training to WMOs; and • Reduce conflicts between farmers and fishermen. • Program for on-going de-silting of water channels. • Implement small scale tidal river management (TRM)	Moderate
Increase salinity intrusion due to leakage of regulators	Long term	Local	Reversible	Likely	High	Major	• Regular repair and maintenance of regulators • Prepare Bangla manual for sluice gate operation • provide training to WMOs; • Proper standard operating procedures (SOPs).	Low
Reduced fish migration	Long term	Local	Reversible	Likely	Medium	Moderate	• Proper sluice gate operation allowing fish	High

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 9.1)				(Table 9.2)	(Table 9.3)		
							migration. • provide training to WMOs; • Transferring juvenile fish from rivers to Polder through artisanal fisher.	

10. Cumulative and Induced Impacts

This Chapter attempts to present analysis of cumulative impacts of the proposed Project and other projects in the area. In addition, induced impacts are also covered in the chapter.

10.1 Cumulative Impacts of all CEIP Interventions

As shown in Map 4.1, Polder 39/2C is surrounded by a number of rivers and lakes/ khals. There is Kacha River along the north-west directions. Pona Don River is another river that covers the north and south periphery by intersecting the polder from Rajapasha union. **Figure 10.1** shows the location of the Polder along with the surrounding polders.

The polder is surrounded by Polder 38 (north) and 37 (west). Polder 35/1 is among the five polders under CEIP-I, located in the downstream of Kacha River, and hydrologically connected with Polder 39/2C. The design crest level of Polder 35/1 is 6-6.5 m (above MSL) whereas the level of Polder 39/2C is 5 – 5.5 m. The implementation of CEIP-I in Polder 35/1 would divert the storm surge 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, diverted river water may actually generate increased hydraulic pressure on the embankments of Polder 39/2C. Also over the years, the Baleswar river and Kacha river may accumulate increased amount of silts and reduce in depth. This incident would hamper the aquatic balance and would also increase chances of flood into Polder 39/2C during monsoon and cyclonic events. There would be socio-economic impacts generated into Polder 39/2C, due to Polder 35/1. The overall developments of Polder 35/1 would lead to the increased labor attraction towards Polder 39/2C, the economic status of the people living in Polder 39/2C may improve.

Polder 35/3 is another polder located near Polder 39/2C (see **Figure 10.1**). This polder is also hydrologically connected with Polder 39/2C. The implementation of CEIP-I in Polder 35/3 would generate increased amount of waste in Katakhali khal, this may result in increased pollution in the Kacha River. Also the siltation caused in the Poylahara river and Passur river consequently would increase the inundation chances of Polder 39/2C.

The other polders under CEIP-I (Polder 32 and 33) are located far from Polder 39/2C and generate very negligible cumulative impacts (if any). Also the other 12 polders under CEIP that have not been considered in the first phase are not located adjacent to Polder 39/2C. Therefore there are no cumulative impacts at present from these 12 Polders into Polder 39/2C. , from the context of Polder 39/2C, discussions on such negligible cumulative impacts (if any) are avoided.

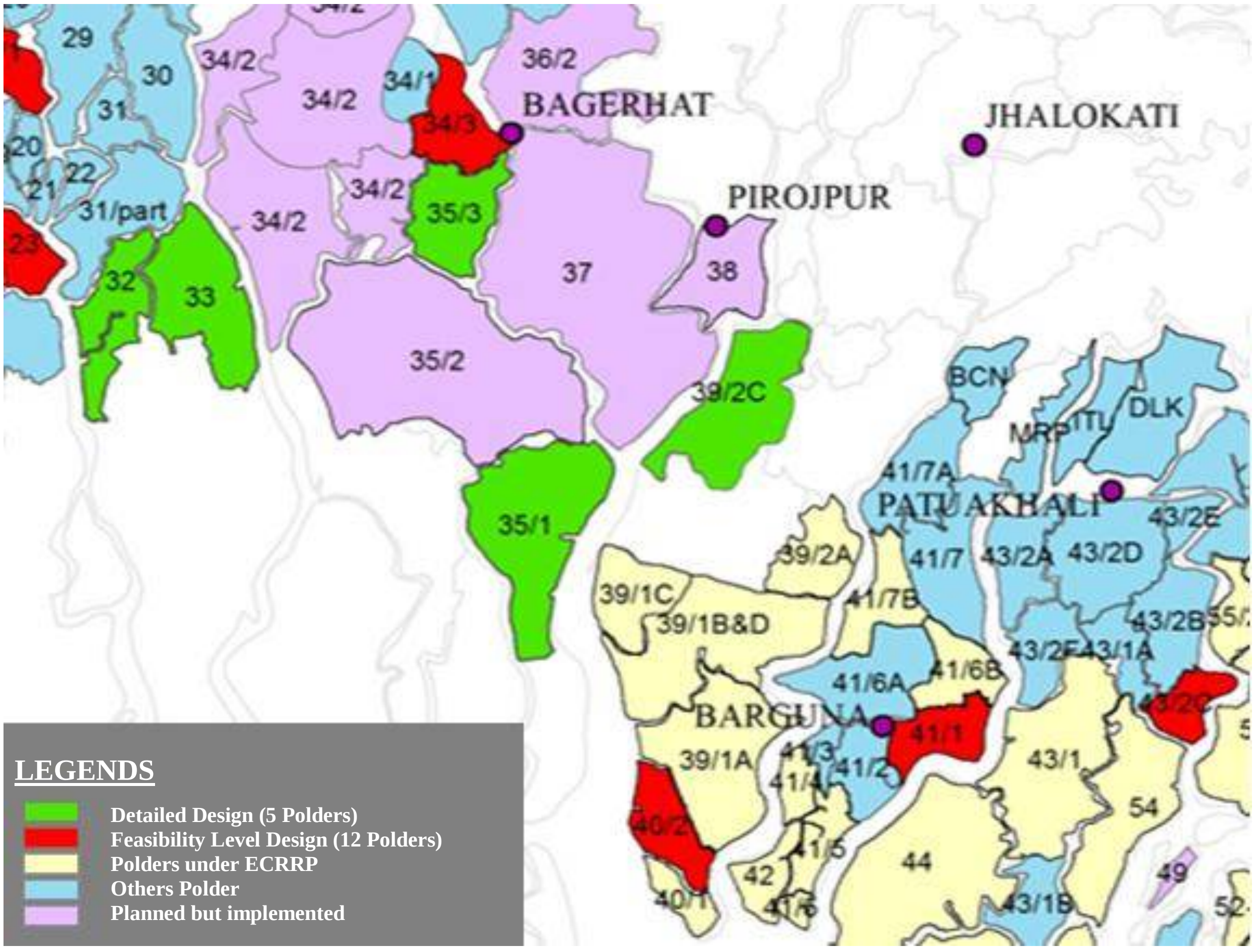

Figure 10.1: Locations of polders under CEIP-I

10.2 Other Projects around Polder 35/1

Apart from CEIP, there are some other development projects implemented by the Government of Bangladesh (GoB) and a number of Non Government Organizations (NGOs) at or near polder 39/2C. The activities of these projects may generate cumulative impacts on the polder. **Table 10.1** and **Table 10.2** show lists of various projects undertaken by the GoB and NGOs frequently in the districts of Khulna, Bagerhat, Pirojpur etc. where Polder 32 is situated.

Table 10.1: 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 Bazar
BEPZA	Mongla EPZ (Phase-1)	1998-2004	Khulna
KCC	Solid Waste Disposal and Environmental Improvement in Khulna City Corporation	1996-2004	Khulna

Table 10.2: 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

10.3 Cumulative Impacts of Other Projects in the Area

Some cumulative impacts are generated in Polder 39/2C, due to the implementation of various large or small scale projects. These impacts may be direct or indirect, major or minor in context of Polder 39/2C, but the consequences of such impacts need to be investigated. The cumulative impacts found in polder 39/2C for different projects are discussed below:

a) Emergency 2007 Cyclone Recovery and Restoration Project (ECRRP)

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.

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 35 polders considered for rehabilitation under the project, polder 39/1C is located in the downstream of Kacha river, at the opposite side of polder 35/1 (see **Figure 10.1**). The design height of embankments in polder 39/1 is 4m (from mean sea level) and this polder will tend to divert the flow of Baleswar river further upstream and downstream. Consequently, the small rivers in the periphery of polder 39/2C (Ponadon river) will be subjected to inflow of huge amount of silts and will be reduced in depth in future. Due to the reduced depth of Ponadon river, existence of mangrove flora may be expanded towards the polder in future.

Due to development of polder 39/1 under ECRRP, the Kacha river may undergo waste pollution, siltation, and the consequent shallow depth of this river will affect polder 39/2C in a number of aspects. The wave action of Kacha river may cause significant damage to polder 39/2C and river water may overtop the embankment of the polder due to rise in cyclonic surges beyond the design level.

ECRRP also covers reconstruction and improvement of multipurpose shelters in all upazillas of Pirojpur district. Material and labor procurement for the construction of such shelters may influence the implementation of proposed interventions under CEIP in polder 39/2C.

b) Other GoB projects

Apart from ECRRP and CEIP there are other projects undertaken by the GoB at or near the study area (see **Table 10.1**). The foreseeable impacts generated by the implementation of such projects are discussed below.

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 been 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.

In the year 1998, Department of Forest (DoF) extended the culture technology of marine shrimp on macro scale in Khulna, Bagerhat, Sathkhira & Cox's bazaar. The project continued upto 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 in regional level and in polder 39/2C shrimp culture has become a common practice during dry season. The culture of shrimp is not a labor intensive practice, thus shrimp culture in polder 39/2C created more unemployment among the people. During the dry season, a number of places in the embankment are cut down to facilitate the entry of saline water; this practice creates weak points in the embankment and reduces the strength of the embankment. One notable positive impact of shrimp culture in polder 39/2C is that it ensured 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.

The Mongla EPZ, Phase-1 project completed in 2004 and the cumulative impacts it presently generates are negligible. 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 as the way it used to do before. The quality and navigability of Ponadon river have further been improved due to the implementation of the project by KCC. Therefore, the environment of Polder 35/1 is being improved.

c) NGO projects

In recent times, there are few projects implemented in Khulna, Bagerhat, Pirojpur by several NGOs. Most of these projects are awareness building projects. 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 implemented as a measure of climate change adaptation (crab fatting, floating garden etc.). These non structural projects have mostly been able to spread awareness against climate change, biodiversity conservation etc. Now a days, 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 crisis situations.

10.4 Induced impacts caused by CEIP

In Polder 39/2C, implementation of interventions may cause some effects to a number of environmental and social components in a longer period. Impacts may also be found in different locations outside the Polder. The following sections provide detailed discussions on a number of spatially and temporally induced impacts of CEIP works in Polder 39/2C.

a) Sedimentation

The proposed interventions will guard the Polder against direct intrusion of tidal water during high tides or cyclonic hazards. The river water carrying huge amount of sediments will move further downstream or upstream and may cause siltation in the water bodies outside the Polder.

Sedimentation is assumed to be taking place in the Kacha and Ponadon rivers and new morphological changes may be established outside the polder (i.e. new lands may be formed inside the rivers through accretion). **Figure 10.2** shows the location of Polder 39/2C along with the accreted lands inside the Kacha rivers. There are some areas having no embankments protection near Polder 39/2C. These areas may suffer the consequences of sedimentation in Kacha river. Saula, Bhandaria, Amua etc. are some of the locations under Pirojpur district which are not under polder coverage (**Figure 10.2**). These areas are under the risk of being inundated during monsoon through the implementation of interventions in Polder 39/2C under CEIP-I.

The effects of project implementation in Polder 39/2C will be significant in the nearby areas. The Polders or areas located farther beyond the discussed areas will bear negligible bear negligible effects of the interventions in Polder 39/2C. **Figure 10.2** is a satellite image that shows the locations of the nearby areas along with Polder 39/2C.

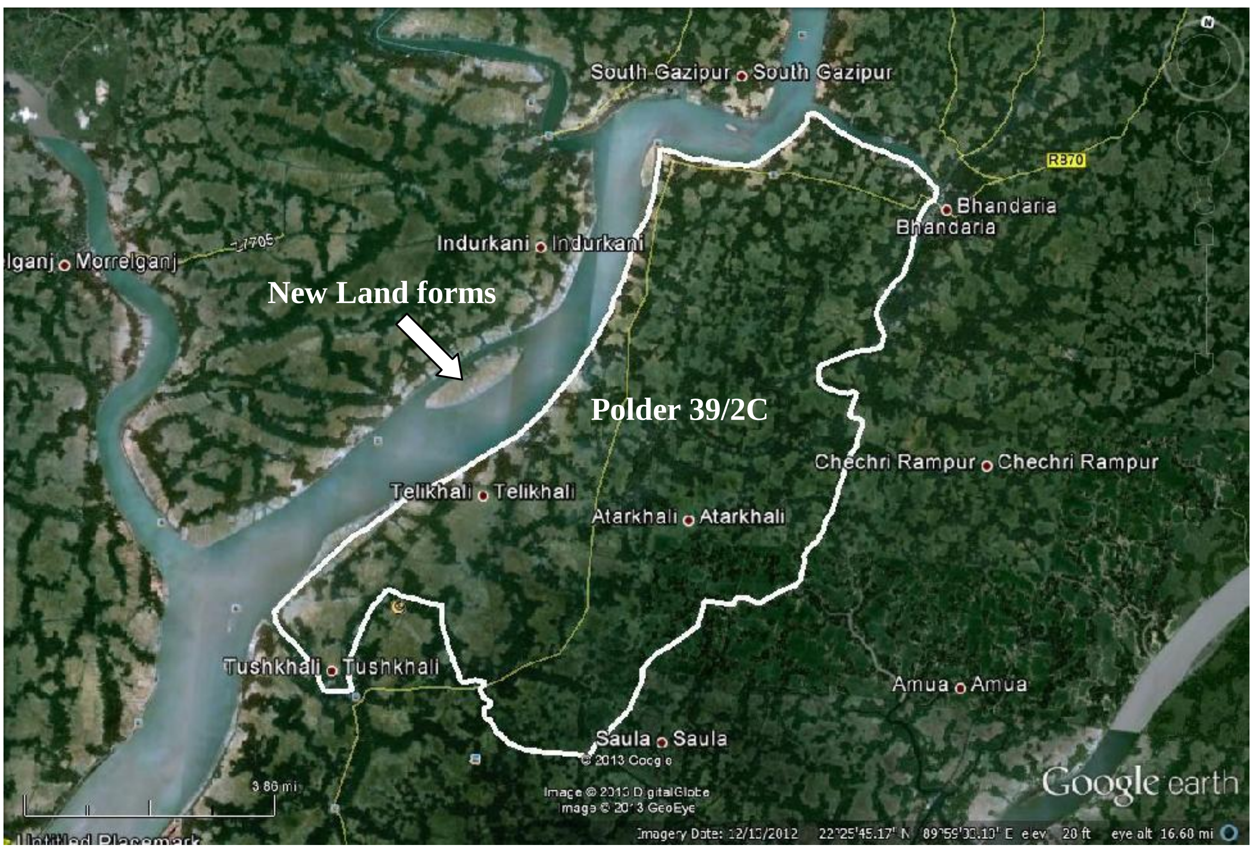

Figure 10.2: Satellite Image polder 35/1

b) Erosion

The blockage of tidal flow into the polder will result the flow of the peripheral rivers (Kacha and Ponadon) to be diverted further downstream and upstream. This may lead to erosion on the river banks of the unprotected areas (Parts of Pirjojpur district). Areas with no bank protection would be more vulnerable to tidal flow. In future, the effects on nearby areas (Saula, Chechri Rampur, Bhandaria etc.) due to erosion may be severe; a large number of people may lose their residences, the agricultural lands can be reduced.

c) Drainage congestion

Siltation in the rivers or water bodies outside the polder would cause drainage congestion on a more frequent basis. The smaller lakes and rivers i.e. Ponadon River would undergo frequent congestion. Especially during low tides, Ponadon River becomes shallower. In the next few years, there is possibility of Ponadon River to be filled up permanently due to accumulation of silts, lower velocity of flow etc. The effects of congestion in the surrounding rivers would directly affect the nearby areas (some places of Pirojpur district). The polders beyond these locations may undergo some congestion affects but these are negligible in the context of Polder 39/2C.

Due to the congestion in the rivers, the upstream areas would be subjected to greater surge heights. This may cause damage to embankments of the Polders located upstream of Kacha river (Polders 38 and 37). In the downstream of Kacha River, Polder 35/1 will be subjected to regular congestion problems due to the increased amount of drainage congestion in Kacha river.

d) Flooding

Tidal water would not be able to enter polder 39/2C during monsoon; as a result the nearby areas which are not protected will face higher risk of inundation. Loss of assets of the people living in Bhandaria, Saula unions, in Pirojpur district may take place due to flood. The nearby areas with no or insufficient polder protection will also be affected to cyclones and other hazards in future. The blockage of river water entry into Polder 39/2C will lead to increased flow of river towards Polder 35/1 (which is located downstream). However the design crest level of Polder 35/1 is relatively high (6 - 6.5m) and overtopping chances of river water into the polder is limited. The other two polders (Polder 37 and 38) on the north and west directions of Polder 39/2C would be subjected to tidal flooding on a more frequent basis.

Table 10.3 shows the design crest levels of embankments in polder 35/1, 39/1, 39/2C, 37 and 38. The crest level of 39/1 is low and therefore river water diverted from polder 39/2C towards Polder 39/1 (under ECRRP) may overtop the embankments during monsoon or cyclonic events.

Table 10.3: crest level of embankments of five polders

Polder Number	Crest level (mPWD)
39/2C	5.0 - 5.5 (design)
35/1	6.0 - 6.5 (design)
39/1	4.0 (existing)
37	On going
38	Not implemented

Source: Data collected by CEIP

e) Water quality

The implementation of interventions would lead to infrastructural developments, increased labor sheds, and hence population increase. This would generate increased amount of wastes. The disposal of wastes would deteriorate the quality of surface water in the nearby water bodies.

Pollution will also increase in the downstream of Kacha river. Due to increase in agricultural area, more agriculture practices and industrialisation are expected. Therefore, water pollution by chemical fertilizer, pesticides and industrial effluents may increase outside the polder as well.

The polders in the vicinity of polder 39/2C (polder 35/1, 39/1, 37 and 38) as well as the unprotected areas (Saula, Bhandaria etc. unions under Pirojpur district) will be more exposed to saline water intrusion. Saline water will enter into the nearby areas from January to April. Due to salinity intrusion for a longer period, water quality and soil quality may further deteriorate.

f) Land use

The implementation of proposed interventions may indirectly affect the land use of nearby areas. Due to increased surge created in Kacha river, Polder 37, 38, 39/1 and a few other unions of Pirojpur districts would undergo flooding on a more frequent basis. Agricultural areas may be reduced. However, the increased salinity of surface water during dry season might encourage local people to culture shrimps. In future, the local residences would be affected due to flood and other disasters. More erosion may take place in the river banks causing significant reduction of lands. The rivers in the periphery of Polder 39/2C would cause erosion in the adjacent areas, but for areas beyond the adjacent polders such affects would be negligible.

g) Cropping pattern

The implementation of the proposed interventions would increase water availability in the polder during dry season Boro cropping practice. Therefore, stakeholders will be able to sell their products to other nearby districts (Pirojpur, Barguna, Barisal etc.). Again, the salinity intrusion in other nearby areas that are not protected by embankments would prevent dry season boro cropping. Areas that would be subjected to the intrusion of saline water for a longer period will possess high soil salinity and therefore, such lands would not yield good production and be suitable for agricultural practice in future. There would be increased salinity intrusion on areas downstream of the Baleswar river. However in areas in the upstream of the river (Polders 37 and 38), salinity intrusion would be limited and boro cropping may still be practiced during dry seasons.

h) Habitat of flora-fauna

Depth of smaller water bodies outside the polder i.e. Ponadon river, Salkati khal would be reduced due to increased sedimentation, as well as other factors. Due to reduced depth of surrounding water bodies, the fish habitat as well as fish production may decrease in future. The terrestrial flora i.e. mangrove flora may be increased where as the aquatic flora and fauna may be decreased significantly.

For improvement of the polder, the risk of inundation would be transferred to nearby unprotected areas (particularly in the downstream of the peripheral rivers). Therefore tidal flood plain for capture fisheries may increase in that area where as overtopping chances for culture fisheries pond may be further aggravated.

i) Fish Migration and biodiversity

Due to protection of polder from flood water, increased amount of water will move towards the upstream and downstream of Kacha River during high tide. This increased volume of water will enhance fish migration in that water body. Consequently, fish migration of surrounding canals will be improved. In future, the salinity tolerant fish species will dominate while fresh water fish species may decrease. Biodiversity of aquatic life may decrease in the Kacha River.

j) Housing condition

The embankment giving protection around the polder area would prevent the intrusion of surface water during monsoon. As a result, the nearby unprotected areas may be subjected to flooding at regular intervals. This may eventually deteriorate the housing conditions of the people in nearby areas (Polder 37, 38, and parts of Pirojpur district)

k) Employment opportunities

The development of the polder would create better employment opportunities for local people. Employment will be properly distributed and in the nearby areas the employment opportunities would be enhanced as well. In few years time, due to the development of polder 39/2C, new employment opportunities would also be created. This will encourage people from outside the polder to visit the polder for work and improve their economic status.

l) Food security

The proposed interventions would drive economic development inside the polder. Thus, the polder area may provide food security to the surrounding areas. In future, polder 39/2C would not only be able to resist the damage of cyclonic hazards or flooding; but may also provide safety against food crisis for the probable damaged areas (polder 35/1, 39/1, 37, 38 and a few other parts of Pirojpur district).

10.5 Conclusion

Most of the cumulative and induced impacts discussed above are found to be marginal during the assessment made in the study. However, these impacts are important from the context of the project as implementation of the proposed interventions do not only depend on the scenario of the polder but also its surroundings. The changes that may be caused by the aforementioned induced and cumulative impacts need further assessments to be evaluated on a quantitative basis. A detailed study on such impacts would be needed to provide a more vivid perception.

The cumulative and induced impacts discussed in this chapter have covered the physical impacts causing infrastructural damage as well as those affecting the people and their property. Many of the impacts stated above have not been directly harming the interventions under different projects. But these impacts have caused significant changes either to the overall socio-economy or environment.

While assessing the cumulative impacts, the adjacent areas or Polders have been assessed. The minimal effects caused by the polders located beyond the adjacent ones could not be analyzed because of the constraints generated due to limited time frame, information unavailability etc. Therefore, further studies may be carried out in future on cumulative and induced impacts for the entire study area to quantify the cumulative and induced impacts if needed. Also for considering the polders outside the adjacent polders of 39/2C, more detailed studies are recommended.

11. Environmental Management Plan

This chapter depicts the Environmental Management Plan (EMP) for Polder 39/2C. The EMP has been prepared to ensure the implementation and monitoring of the proposed mitigation measures which have already been identified and discussed in **Significant Environmental Impacts and Mitigations Chapter.** EMP includes institutional arrangement for EMP, mitigation plan and monitoring plan. The EMP will be followed during pre-construction, construction and O&M stages for the assessed environmental impacts.

The main objective of the EMP is to minimize adverse impacts of the proposed intervention and enhance positive impacts where possible on the environment and people of the project area. The specific objectives of the EMP are to:

- **i.** Facilitate the implementation of the mitigation measures for identified impacts
- ii. Maximize potential project benefits and control negative impacts;
- iii. Delineate responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project; and
- **iv.** Define a monitoring mechanism and identify monitoring parameters

11.1 Institutional Arrangements for EMP

An institutional arrangement is required to ensure sustainable implementation of environment friendly project development and implementation of EMP, its operation and monitoring. It should be an effective and functional for implementation of EMP. The proposed institutional arrangement has been illustrated in Figure 11.1 which also includes organizational support, both implementation and stakeholders training needs with plan and management information system. This section discusses institutional arrangements required for implementation of EMP by concerned officials of BWDB, along with supervision consultant, and working contractors. An organizational structure has been developed at the corporate and field level to aid effective implementation of the EMP. The institutional structure starting from top, the Ministry of Water Resources, the BWDB headquarter to the bottoms the field office (Figure 11.1).

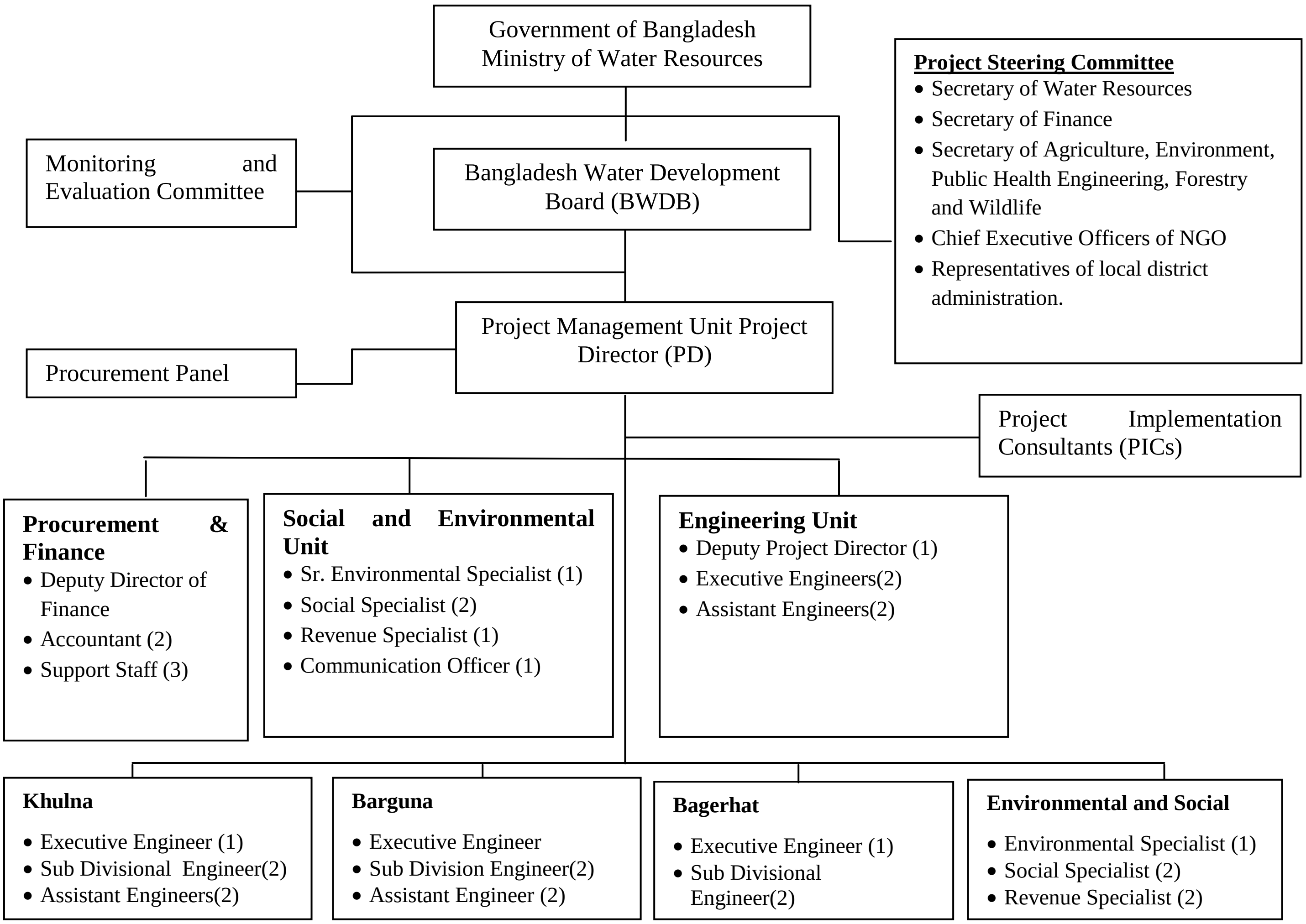

Figure 11.1: BWDB Institutional Arrangement for CEIP Implementation (Source, EMF Report, 2012)

The main environment issues related to the CEIP have been included in this institutional arrangement of BWDB is described in the following sections:

11.1.1 Project Implementation Consultant (PIC)

In the CEIP Division office, the construction and supervision (CS) consultants will be placed and will be responsible for overall supervision of project construction activities. The CS consultants will ensure quality and report to PD through the management consultant. The CS will also assist the ESC for ensuring environmental compliance and monitoring of progress including EMP and/or ECP implementation.

BWDB will ensure that proper environmental screening will be done by the design consultant. Design consultant (DS) will ensure Environmental Impact Assessment (EIA) of the rural road sub-projects. BWDB will carry out verification of some screening and assessment.

Implementation of EMP and to support capacity building of the field level staff of BWDB and contractor will be supervised by engagement of one or more (need based) Environment Specialist. The project will implement an environmental monitoring program (i) to monitor the contractor's work during project implementation in order to check contractual compliance with specified mitigation measures, and subsequently (ii) to assess the actual environmental impacts of the project over the years following completion of the various project components. The Senior Environment Specialist of ESCU will design the detailed monitoring plan of the project and prepare a routine monitoring report based on the monitoring results by BWDB. In addition, the environmental audit will be carried out before the mid-term evaluation and before project completion. The World Bank would also supervise the environmental compliance as part of regular implementation support missions.

11.1.2 Environment, Sociology and Communication Unit (ESCU)

An ESCU will be established in the defined institutional arrangement to ensure effective execution of the EMP implementation of EIA. Functions and the staffing responsibilities of ESCU are given below:

Function and role of Sr. Environment Specialist

A Senior Environment Specialist of ESCU will assist the PD in execution of the EMP during project implementation period. He will suggest to the PD or his representative to ensure compliance of the mitigation measures by the Contractors; incorporation of appropriate environmental specifications (on the basis of screening and ECP) into the respective bidding and contract documents; assist PIC consultant‘s and BWDB community organizer to carryout participatory consultation during planning, design and implementation of the sub-projects. He will assist PIC consultant‘s and BWDB community organizer and assist in development of training program for the key stakeholders BWDB, contractors, public representatives and local government institutions/ NGOs, in collaboration with the field level Junior Environmental Specialist. The Sr. Environment Specialist will keep liaison with the DOE on environmental and other regulatory matters. He will play a vital role to guide and assist the PD and the BWDB to strengthen the environmental management practices in polder rehabilitation, hydraulic structure construction and earth works. He will facilitate dialogue with the Project Affected Persons (PAPs) and ensure that the environmental concerns and suggestions are properly incorporated and implemented in the project. During rehabilitation works of the polder, he will also guide field level junior environment specialist to resolve any environment related matter and issue in the project. He shall be responsible for reporting to the PD on the environmental aspects pertaining to the project and be responsible to prepare periodic progress reports on implementation of the EMP for transmission to the World Bank throughout the project implementation period.

Function and role of Environment Specialist

An Environment Specialist who is a mid level official will assist the PMU in Environmental Assessments for the projects; Senior Environment Specialist and the Environmental Specialist of the PIC (Project implementation Consultant) and DS (Design and supervision) consultants in preparation of the training materials for conducting training. He will review the contractor's Implementation Plan for the environmental measures, as per EMP with assistance from the Environmental Specialist of the MS and DS consultant. He will keep liaison with the contractors and CSC Consultants for implementation of the EMP and will carry out consultations with the NGOs and Community groups to be involved in the project. He will establish dialogue with the affected communities and ensure that the environmental concerns and suggestions are incorporated and implemented in the project. He will be responsible to report to the Executive Engineer (Environment) / Project Director on the environmental aspects pertaining to the project and will also will assist in preparing the periodic reports for dissemination to the PMU, World Bank, etc.

Function and role of Field Level Junior professional

A field level junior professional will be appointed to execute the environmental issues directed by environmental specialist. Moreover, he will assist the DS Consultants and in Environmental screening process.

11.1.3 Contractor

The Contractor will be responsible for implementation of all environmental related activities along with all other construction activities under the project. In addition, the contractor shall be responsible for familiarizing themselves with Chance Finds Procedures in the IEE/EIA Report incase culturally valuable materials are uncovered during excavation or any project activities. Contractor will carry out more consultation with local people, Project Affected Persons (PAPs), local Chairmen and members before construction of the works.

11.1.4 Monitoring

Monitoring of the entire project activities and reporting to the Project Director (PD) will be carried out by the Environmental, Social and Communication Unit (ESCU). The ESCU will be dedicated to the department for monitoring the activities. Regular monitoring of different activities would be carried out by CEIP Division offices and supervision consultants at site and reviewed by the ESCU on monthly basis. The ESCU and Directors will also make regular review of ongoing project activities including environmental issues and corrective measures, if required at the implementation stage. For environmental components of a project, environmental monitoring plan has been developed, based on location specific baseline data and impacts predicted during the environmental assessment process. The concerned forest department staffs, as part of their duties would monitor impacts on ecological resources and activities of afforestation. The environmental monitoring plan for each project will be integrated with construction, operation and maintenance and shall be monitored by the ESCU on monthly basis. The higher management will be apprised through a monthly report. The ESCU will share a half yearly monitoring report with the World Bank.

11.2 Capacity Building and Training

Properly implementation of EMP of the sub-project (Polder 39/2C) of CEIP, the capacity building and training of BWDB officials and stakeholders concerned with the project is required. The effectiveness of the Environmental Impact Assessment and implementation depends considerably on the understanding and preparedness of their Engineers and in particular their Environmental Team (Consisting of Contractor Environmental specialist, and Consultant environmental specialist, ESCU of BWDB) is very essential for implementation of project activities. It is important for the project authority to take effort to sensitize the Engineers and an Environmental Team member on management of environmental issues, provide guidance, and encourages them to build requisite capacities. Capacity building of BWDB and stakeholders can be achieved by two point strategy are given below:

- Training program for existing management staff;
- Technical Assistance: knowledge sharing with consultants, having requisite expertise;

As per Component D, Project Management, Technical Assistance, Training and Strategic Studies will support institutional capacity building, technical assistance and training. The project will provide funding for essential technical assistance (TA), consulting services and advanced staff training. Under a TA consultancy service, a technical (EMS) training and capacity building expertise for the EMS requirements in BWDB units and Workshops for contractors, consultants and other external stakeholders will be undertaken. Capacity building training programs will be undertaken in the following area:

- Training of the management level officials of BWDB including ESCU 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, for the stakeholders on the environmental concerns;
- Special training program for the contractors and workers on EMP and their responsibilities to them who will actually be involved in the construction of the project interventions;
- Training program for the members of water management organizations(i.e. WMGs, WMAs and also WMF) and beneficiaries organizations; Following are the probable course outlines suggested for the beneficiary training;
- Training on structured format in reporting at all stages of implementation and those of relevant agencies who will be involved in EMP implementation.

The training programs should be arranged before implementation of the interventions in the polder area. Detail plan should be made by the proposed Environment Unit of BWDB. Table 11.1 provides a summary of various aspects of the environmental and social training.

Table 11.1: Environmental and Social Training

Contents	Participants	Responsibility	Schedule
Environmental and socioeconomic awareness; Environmental and social sensitivity of the polder area;	Design team, Selected BWDB management staff	ESCU along with external knowledgeable consultant	Prior to the commence of the project activities

Key findings of the EIA; Mitigation measures; EMP; Social and cultural values of the area.			
Environmental and socioeconomic awareness; Environmental and social sensitivity of the polder area; Key findings of the EIA; Mitigation measures; EMP; Social and cultural values of the area.	All field personnel	ESCU along with external knowledgeable consultant	Prior to the commencement of the project activities
EMP, Waste disposal	Construction team	Contractor with the help of consultant	Prior to the commencement of the project activities
Road safety, vehicle movement time, defensive driving, earth materials dumping, cultural values and social sensibility	Drivers	Contractor with the help of consultant	Before and during construction 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
Camp operation, waste disposal, health and safety, natural resource conservation	Camp staff/labour	Contractor with the help of consultant	Before and during construction activities

11.3 Mitigation Plan

The mitigation plan includes negative impacts of the proposed interventions which assessed at the environmental and social impact assessment stages. Measures to minimize and/ or avoid the negative impacts are suggested in the mitigation plan.

The Mitigation Plans for the Project are structured around the following components:

- Project activities – the stage of the Project;
- Impacts – identified in the environmental assessment (discusses in the earlier **chapter 10**)
- Actions - measures to mitigate and manage the impacts;
- Responsibility – the organization(s) responsible for executing the mitigation plan

Table 11.2: Environmental Mitigation and Monitoring Plan – Pre and Construction phase

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
A. Land acquisition, Site clearance and labour shed preparation	Changes in land use	All the construction camps to be established within the area owned by BWDB Khas land should be used as much as possible	Implementation Contractor	ESCU, BWDB, LGI, DoE
	Increased Vehicular Traffic during mobilization	Contractor to prepare and implement mobilization plan considering water vessels and launch movement in the external rivers. And, avoid the launch movement time, which timing is mentioned in the baseline report Ensure minimal hindrance to local communities and commuters, specifically in the Charkhali ferry	Implementation Contractor	ESCU, BWDB, LGI, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		ghat. Traffic management plan should be made and followed accordingly		
	Land loss due to land acquisition	RAP should be properly implemented Compensation should be paid to PAPs before construction activities Involvement of Local Government Authority such as Union Parishad Chairman and Upazila Nirbahi Officer (UNO) of the Upazila should be ensured	Implementation Contractor	ESCU, BWDB, LGI, DoE
	Preparation of facilities for Contractor(s) and Labor Force	Landscaping plan should be prepared before the construction activities Regular monitoring should be conducted by the Environmental and Social Monitoring Unit (ESMU).	Implementation Contractor	ESCU, BWDB
B. Labour shed preparation, Equipment transportation and carrying construction	Air quality determination (dust and emission of gases from vehicles)	Dust generation from construction sites will be restricted as much as possible and water sprinkling will be carried out as appropriate.	Implementation Contractor	ESCU, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
material		Spray water on soil; temporary fencing at construction sites should be made. Construction material (sand/soil) will be kept with covered while transporting and stock piled. Construction machinery and vehicles will be kept in good working condition and properly operated. Install fugitive particulate matter controlling system. Air quality should be monitored properly, especially near the thirteen settlement sites vehicles causing access gaseous pollutant should be banned from the project.		
	Noise and vibration	Workers in construction sites will wear ear protection mufflers Vehicles should have exhaust mufflers (silencers) to minimize noise generation. Vehicle movement at night should be	Implementation Contractor	ESCU, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		restricted near the communities. No horn will be used while passing through educational and religious institutions. Construction work near the schools along the periphery of embankment should be avoided during school hour. Noise levels from vehicles, equipment and machinery to comply with national and WB noise standards.		
	Soil and water contamination	Work smoothly and no spilling of diesel or any other fluids should not through into the river. Re-use spoil and excavated material as far as possible Select access road to avoid run-off to river.		
	Increased Inland and Waterway Traffic	Traffic management plan provided by Feasibility study team should be maintained. Avoid vessels or engine boat movement during	Implementation Contractor	ESCU, BWDB, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		fog and launch movement time. Temporary jetty should be constructed for unloading construction materials Vessels or large engine boat need to be moved during high tide through Pona River Liaison to be maintained with community and Ferry ghat authority		
	Solid and liquid waste from Labour shed and from construction sites	Sanitary latrine should be constructed in every labour shed Solid Waste Management Plan prepared during feasibility study should be followed properly	Implementation Contractor	ESCU, DoE
	Safety and Public Health Hazards due to natural hazard	Work schedule will be finalized in coordination and consultation with local representatives and communities. Provide with and use appropriate Personal Protective Equipment (PPE) during construction phase.	Implementation Contractor	ESCU, BWDB, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		First aid must be provided and there would be procedures in place to access appropriate emergency facilities. Contractor will establish a labor grievance mechanism and documenting its use for complaints about unfair treatment or unsafe living or working conditions without reprisal.		
C. Construction activities (Retired and re-sectioning of embankment)	Tree cutting during embankment re-sectioning and labor shade preparation	Contractor will prepare a tree cutting plan and re-plantation plan, and will also carry out compensatory tree plantation towards the end of construction phase. Avoid unnecessary loss of vegetation. A plant nursery should be established for this purpose with selected tree species (eg, Geoa, Kewra and Babla) in the beginning of the Project. Trees will be planted at the end of the construction	Implementation Contractor	ESCU, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		period during wet season		
	Hindrance for pedestrians and vehicles movement during re-sectioning of embankment	Work schedule will be finalized in coordination and consultation with local representatives and communities. Re-sectioning work should be done in each segment. Earth work for re-section of embankment during hat day can be shorted for essay movement of local people.	Implementation Contractor	ESCU, BWDB
	Disturbance of Fauna/wild life animal	Identified tress on the basis of feasibility report should be cleared during construction phase Avoid positioning spoil dumping areas used by fauna Provide corridors for animal movement Wildlife or local livestock will not be harassed, captured, hunted, fed or killed Noise level will be restricted during day time and levels will be properly monitored	Implementation Contractor	ESCU, DoE

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
D. Construction activities (replacement of drainage sluices, flushing, re-excavation of drainage channels, and dredging)	Effects on Irrigation	Contractor will constructing bypass canal before construction of each regulator Sequence of work at the regulators and in the water channels will be carefully planned to avoid irrigation disruption. Construction/re-excavation work should be implemented during dry season.	Implementation Contractor	ESCU, DAE, DoE
	Drainage congestion during replacement of drainage regulators	Construct alternative or bypass channels at each and every site of the regulator are to be needed to continue fish migration Avoid construction works during monsoon as far as possible	Implementation Contractor	ESCU, DoE
	Sedimentation	Contractor will not leave excavated earth and silt on channel banks	Implementation Contractor	ESCU, DoE
	Obstruction of fish migration	Alternative channel will be provided to continue the fish migration Try to avoid construction work	Implementation Contractor	ESCU, DoE, DoF

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
		during fish migration period e.g. Month of May-July and September-October Proper operation and maintenance of existing active sluices will be taken care during construction period		
	Impact on benthic communities	Contractor will carry out khal excavation in segment thus minimizing impacts on benthic fauna. Dredging activities will be implemented specifying the proposed dredging location in the Baleswar (Kacha) and Pona river Dredging activities in a number of locations of the same river will be conducted with interval of a number of days for revival of the benthic communities. Stop dispose or release untreated waste materials to surrounding rivers and canals	Implementation Contractor	ESCU, DoE, DoF
E. Bank/slope	Creating non-	Some generated	Implementation	ESCU,

Project Activities	Environmental impact/Issues	Action/Mitigation measure	Responsibility	
			Execution	Monitoring
protection activities	hazardous solid waste	waste like concrete wastes, sand, bricks, and cement during construction of CC Blocks would be collected and dumped on a pre-selected temporary dumping yard within polder area. No dumping of such waste nearby water bodies These wastes can be used to raise the level of the construction site or connecting roads.	Contractor	BWDB

Table 11.3: Environmental Mitigation and Monitoring Plan during post-construction phase

Environmental impact/Issues	Action/Mitigation measure	Responsibility	
		Execution	Monitoring
Water contamination and reduced soil fertility	Organic manure can be applied instead of chemical fertilizer as far as possible increase soil fertility Integrated Pest Management (IPM) and Integrated Crop Management (ICM) should be applied Solid waste will be dumped in waste pit Training for farmers on IPM and ICM should be provided in each Word of each union	Implementation Contractor	ESCU, BWDB, DoE
Tidal flooding	Mechanical compaction of soil should be conducted during re-sectioning of embankment Regular monitoring of embankment, regulators, and seepage of surface waters from Baleswar river and Pona river should be undertaken	Implementation Contractor, WMOs, LGI	ESCU, BWDB
Risk of embankment failure	Regular monitoring and proper maintenance of the embankment and existing water control structure especially near the Baleswar River. Water Management Group (WMG) will be formed before construction or re-sectioning work of embankment Fund for WMG will be allocated to tackle all emergency situation Structural measures such as geo bags, sand bags etc will be stored in local BWBD office to protect emergency hazard management.	Implementation Contractor	ESCU, BWDB
Drainage congestion and increased sedimentation in water	Internal canal should be re-excavated after few years interval. Encroachment of internal canal by the	Implementation Contractor	ESCU, BWDB

channels	local people will be restricted. Regulatory structures will be properly maintained properly. The local government (union parishad) will be authorized to monitor the development activities. Activities of CMG (Canal Management Group) will be strengthened and fund for CMG should be allocated		
Increase in salinity intrusion due to leakage of regulators	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 be translated in bangle as well. Capacity building of WMOs should be strengthened	Implementation Contractor	ESCU, BWDB
Fish diversity and production	Conserve fish species through construction of deep pool in the major khal like Nodmollar khal, Hetalia khal, Bamoner khal. Introduce net pen culture in Darulhuda khal, Hainter khal, Poddarer khal, Mollar khal. Provide training on improved culture technology. Promote skill development training to the fish farmer for more fish production from Prawn gher and ponds.	Implementation Contractor	ESCU, DoF, BWDB
Reduced fish migration	Fish pass/fish ladder should be constructed at Pona (upper) khal, Pona (lower) khal and Nodmollar khal Operation and Maintenance (O & M) of all water regulatory structures will be strengthened Gate of water regulatory structures should be opened during fish breeding period for a certain period Prepare gate operation manual and provide to WMOs. Manual should be translated into Bangeli.	Implementation Contractor	ESCU, DoF, BWDB

11.4 Chance-Find Procedures for Physical Cultural Property

The Contractor will be responsible for familiarizing themselves with the following ―Chance Find Procedures in case culturally valuable materials are uncovered during excavation or any project activities, this includes:

- Stop work immediately following the discovery of any materials with possible archeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artifacts as well as possible use of plastic covers, and implement measures to stabilize the area, if necessary, properly protect the artifacts;
- Prevent and penalize any unauthorized access to the artifacts; and
- Restart construction works only upon authorization of the relevant authorities.

11.5 Monitoring plan

A monitoring plan has been prepared to record the response of the project on the natural system and social system. Specific monitoring parameters will help to achieve the monitoring objective and ensure environmental quality to ascertain the optimal utilization of the natural resources and for the sustainability of the project. The monitoring programs will be carried out are as follows:

Table 11.4: Monitoring plan for general environmental effects

Monitoring Parameter	Monitoring locations	Frequency	Responsibility	Methodology/resources requirement	Documentation
Air quality (dust)	Construction sites	Daily	ESCU, BWDB, and DoE	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Record of sampling and analysis
Noise	Construction sites, nearby communities, and educational institutions	Weekly	ESCU, BWDB, and DoE	Noise meter	Complete record of noise measurement and location
Surface water quality	Both side of Closure dam on Pona (upper), Pona	Monthly	ESCU, BWDB, and DoE	Sampling bottles	Record of sampling and analysis

Monitoring Parameter	Monitoring locations	Frequency	Responsibility	Methodology/resources requirement	Documentation
	(lower), Junia, Telekhaki, Bumner, Darulhuda, Hetalia and Nodmullar khal Nalbunia and Siakati water bodies				
Solid waste and waste water	Construction sites, and labour shed premises	Daily	ESCU, BWDB, and DoE	Visual observation	Record of visual observations/ photographs
Soil and water salinity	Various location in the distributaries channels of the river of *Baleswar* and *Kocha/Bishkhali* River and internal *Pona river/Pona don* etc. as well as different khals such as *Kathaltali khal, Chander khal, Bamuner khal, Bothla khal, Telikhali, Podderer*	Fortnightly (15 days interval) during dry season (December-June) and monthly in the rest of the period.	ESCU, BWDB, DAE and DoE	Laboratory test/ field test	Complete record of analyzed result

Monitoring Parameter	Monitoring locations	Frequency	Responsibility	Methodology/resources requirement	Documentation
	khal, Bhuter khal, Moller khal, Jalner khal, Bahar khal, Banai khal, Nadmulla khal, Haintar khal, Hetalia khal, Fultola khal, Darulhuda khal, Saula khal, Bhitabunia khal				
Drainage congestion (Cross section of khal at tail and offtake point)	All construction sites (Sluice/flushing inlets)	Twice a year (Dry and wet season)	ESCU, WMOs	Field visit	Record of visual observations/
Crop production and damage.	Upazila wise within polder area.	Every crop season	ESCU, DAE	Field visit and consultation	Record of visual observations/
Soil fertility	Minimum three (3) locations, at least one site of each Union.	Once(1) a year	SRDI, DAE, BWDB and WMOs	Laboratory test	Complete record of analyzed result
Biodiversity richness	Two samples from each construction site	Twice during construction phase	ESCU, BWDB, and DoE	Field visit and public consultations	Record of visual observations/ photographs
Vegetation composition of terrestrial	Two samples in each	Twice during constructi	ESCU, BWDB, and DoE	Field visit and public consultations	Record of visual observations/

Monitoring Parameter	Monitoring locations	Frequency	Responsibility	Methodology/resources requirement	Documentation
and aquatic habitats	construction site	on phase			photographs
Mangrove vegetation coverage	Peripheral Coast side of entire polder	Once in pre-construction and once in post-construction phase	ESCU, BWDB, and DoE	Field visit and public consultations	Record of visual observations/ photographs
Fish migration	Internal khals (*Nadmulla khal, Hetalia khal, Fultola khal, Darulhuda khal, Bothla khal, Bamoner khal, Hainter khal, Poddarer khal, Mollar khal, Junia Khal, Napitkhalir Khal)* and Peripheral rivers (*Kacha River and Pona River)*	June-July, and September -October	ESCU, BWDB, and DoE, DoF,	Field visit and public consultation	Record of field data/ drawing migration route/ photographs
Fish biodiversity	*Kacha River and Pona River* Bazar, Internal khals, Dhaoa,Ikri, Nudmulla, Telikhali	Monthly	ESCU, DoE, DOF	Visual observation, Focus group discussions in each union, conducting surveys in the local markets.	Record of field data/ photographs

Monitoring Parameter	Monitoring locations	Frequency	Responsibility	Methodology/resources requirement	Documentation
Fish production	Local markets	Tri-monthly	ESCU, BWDB, and DoE, DoF	Focus group discussions, Field surveys.	Recording of field data

Note: DoE may conduct random and discrete monitoring

11.6 Compliance Monitoring

Contractor is responsible for implementation of EMP during construction period. Project Implementation Consultant (PIC) is primarily responsible for supervision of the implementation of the EMP. BWDB will conduct field inspections and surveys by the environment specialist (to be employed by BWDB on regular basis) at field. S/he will report to the Senior Environment Specialist at Head Quarter. The M&E consultant will be responsible for independent monitoring and implementation of EMP, external monitoring and evaluation.

DoE will be consulted if complicated issues arise during construction and operation stages. BWDB will apply for annual site clearance from DoE. BWDB will prepare the half yearly progress report on environmental management and submit to the World Bank for review. The World Bank will review the screening report, environmental management plan, monitoring reports on random basis and will carry out field visit for cross-checking. The contributing development partners may also join in the field visit to understand the environmental compliance of the project. 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. The data base will be incorporated with the mainstream of BWDB, MIS. Environment, Sociology, and Communication (ESC) unit will be responsible for updating the database for environmental information. In addition, the effectiveness of screening, monitoring and implementation of EMP will be carried out by the third party monitoring consultant along with the project component activity monitoring annually. The Annual Environmental Audit Report prepared by the third party monitoring consultant will be shared with the safeguards secretariat.

11.7 Documentation and Reporting

11.7.1 Internal Audits

During construction phase and after completing the construction activities, Environmental Audits of the project would be conducted. The objective of environmental management audits is to review the effectiveness of environmental management planning activities under implementation. Environmental auditing is generally done by an unbiased independent organization or a person having full command on the subject. The auditing team shall be consisting of Environmental Specialist, Technical Specialist, Socio-economist, Community

Specialist and Field Environmental Auditors. It is proposed that ESCU will carry out these audits on six-monthly basis during rehabilitation/improvement of the polder.

11.7.2 External Audits (Third Party Validation)

External audits through third party will be carried for four years of the construction and operation activities. The arrangement would be made for Water Resource and Environmental Management Specialists to carry out an independent audit of the existing practices against the requirements of the EMP, on annual basis. The Annual Environmental Audit Report prepared by the third party monitoring consultant will be shared with the safeguards secretariat.

The following aspects will be covered under the external audit:

- ESMP is being adequately and properly implemented,
- mitigation measures are being implemented with their effectiveness,
- compliance and effects monitoring are being conducted,
- environmental and social trainings are being conducted, and
- complete documentation is being maintained.

These audits would be used to re-examine the continued appropriateness of the EMP and advice on any up-dates required. BWDB would review the results of internal and external audits and provide commitment and resources to tackle the outstanding issues.

11.7.3 Monitoring Records

Quantitative Physical Monitoring

Monitoring records will be carried by the ESCU (Environment, social, communication unit) through quantitative physical monitoring. The objective of quantitative physical monitoring is to ensure the mitigation measures designed to prevent, reduce and where possible offset any significant adverse impacts on the environment are being implemented throughout the Project lifecycle. During this period, a database would be developed by ESCU, with involvement of PIC for storing the results of the quantitative monitoring. The facility would be capable of producing tabulated weekly and monthly reports which will provide the following information:

- Sampling points;
- Dates and times of sample collection and testing;
- Test results;
- Control limits;
- Action limits
- Any breaches of the control limits, including explanations if available.

11.7.4 Complaints Records

Complain received from the public or government organizations through various medium i.e. visits to the Polder area, telephone calls or correspondence would be recorded in a prepared standard tabular from.

The form would concisely list the following information:

- Date of complain;
- Name and contact address of the person who give complain;
- Brief description of the action taken by the Project Implementation Consultant (PIC) to investigate the cause of the complaint and bring about corrective action, if justified; and
- Date of reply to the complain, with a file reference to any correspondence.

11.7.5 Reporting

Monthly Internal Reports

The ESCU will prepare a monthly report and submit to the Project Management Unit /Project Director (PD) and Project Implementation Consultants. Project Director will forward the report to BWDB. These reports will normally be short to summarize the following:

- Progress on implementation of the EMP;
- Findings of the monitoring programs,
- Any emerging issues where information or data collected is substantially different from the baseline data reported in the Environmental Assessment;
- National Conservation Rules
- Summary of any complain by external bodies and actions taken / to be taken;

BWDB will prepare the **half yearly progress report** on environmental management and will submit to the World Bank for review.

11.8 Grievance Redress Mechanism

BWDB will establish a grievance redress mechanism (GRM) to ensure social accountability and to answer to the 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.

11.8.1 Grievance Redress Cell/Committee

A Grievance Redress Committee (GRC) at local level will be formed for each Union with union level representatives to ensure easy accessibility of 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 be forwarded 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 PMO, Dhaka. 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. For smoothly execution of compensation for PAPs, Grievance Redress Committee will be formed. Executive Engineer (BWDB Division Office) will be Convener of Committee. The form of the committee is given below:

1. 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

11.8.2 Grievance Resolution Process

All complaints will be received at the GRCs facilitated by the implementing agency. The aggrieved persons may select 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 of the complaints.

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 PMO for further review. The Project Director will assign the ESCU at PMO to 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 a decision at this level is again found unacceptable by the aggrieved person(s), BWDB can refer the case to the MoWR with the minutes of the hearings at local and headquarter levels. At the ministry level, decisions on unresolved cases, if any, will be made within 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.

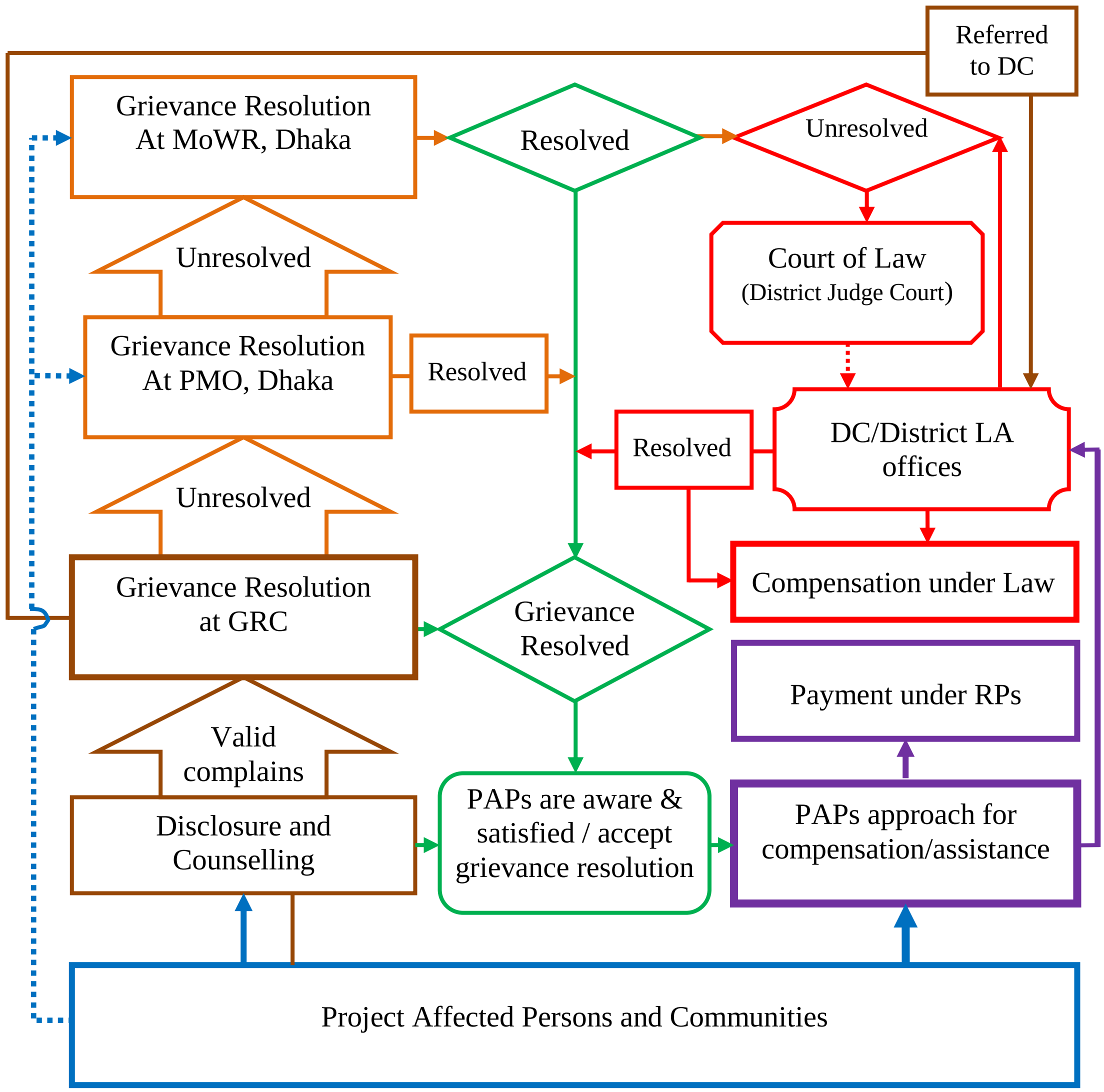

Figure 11.2: GRM Process Flow Chart (*Source: RAP report of CEIP, 2012*)

To ensure that grievance redress decisions made in formal hearings and in a transparent manner, the Convener will apply the following guidelines:

- Reject a grievance redress application with 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:
- To appoint a new member in consultation with the Project Director. If there is any removal of the GRC member.
- 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.

11.8.3 GRM Disclosure, Documentation and Monitoring

The affected persons and their communities will be informed about 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 affected persons. The PAPs will also be briefed on the scope of the GRC, the procedure for lodging grievance cases and the procedure of grievance resolution at the project level.

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’s or husband’s name, (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 media of communication, (6) Date of closing, (7) Confirmation of complainant’s satisfaction, and (8) Management actions to avoid recurrence.

Grievance resolution will be a continuous process in RP implementation. The PMO and SMOs 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 PMO will also prepare periodic reports on the grievance resolution process and publish them on the BWDB website.

11.9 Contractual clauses for EMP implementation

Contract will follow the directives and activities with specification as per Environmental Management Plan along with the good environmental construction guidelines to be incorporated in the bid documents work requirements. Penalty clauses should be incorporated in bid document for not complying with EMP requirements. Indicative penalty clauses proposed for the polder development in the CEIP are presented below (Addendum to Clause 17.2 Contractors Care of the Works of FIDIC).

- The contractors have to follow all traffic safety measures as defined in the technical specification. Damage shall be levied at the rate Tk. 3000/- per day per location for non – conformity of traffic safety measures as per decision of the Engineer.

- The contractors have 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 be levied 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 contractors have to ensure 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 decision of the Engineer.
- The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), will be provided to staff and labor all time as defined in the labor codes read along with the Environmental Management Plan (EMP). Damage shall be levied at the rate of Tk. 1000/- per day for non-conformity as per decision of the Engineer.

11.10 Cost Estimates for Environmental Management and Monitoring

Estimated cost of mitigation measures and monitoring are shown in Table 11.5. The cost of EMP implementation and monitoring will be carried out within four year period.

Table 11.5: Tentative Cost Estimates for Environmental Management and Monitoring

Sl. No	Description of EMP activities	Cost Million BDT	Cost Million US$
1	Crop compensation to the direct loser land owner/ share croppers of construction sites /damage to dredge spoils	5.0	0.061
2	Compensation for trees	Budget included in RAP report	
3	Construction of alternative or bypass channels at each construction sites	5.6	0.068
4	Installation of fugitive particulate matter system and Spraying water on embankment/road	Included in contractor budget	
5	Materials for net pen culture (at least 25 households in each	5.4	0.066

Sl. No	Description of EMP activities	Cost Million BDT	Cost Million US$
	Word/Council of a Union)		
6	Construction of five Fish Pass at five canals like Pona (upper), Pona (Lower) and Nodmollar Khal, Bamoner khal and Tetalia khal	60.25	0.735
7	Conservation and stocking of threatened fish species (at least 3 spots of *Nadmulla khal, Hetalia khal, Fultola khal, Darulhuda khal, Bothla khal, Bamoner khal, Hainter khal, Poddarer khal, Mollar khal, Junia Khal , Napitkhalir Khal, Pona (upper) khal, Pona (Lower) khal*	2.0	0.024
8	Aquatic mammal movement (Surfing, diving, migration, etc.)	0.5	0.006
9	Awareness program on plant and wild life conservation	0.40	0.005
10	Campaigning and providing training on improved culture practices as well as the rice-cum-golda farming	1.0	0.012
11	Social forestry program along both sides of the embankment and other khas areas	5.00	0.061
12	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	10.00	0.122
13	Monitoring cost to fish biodiversity, migration, fish production	1.5	0.018
14	Air and noise quality monitoring analysis cost	0.50	0.006
15	Water quality monitoring cost	0.40	0.005
13	Waste disposal plant construction cost	o.50	0.006
16	Soil and water salinity monitoring cost	o.50	0.006
17	Land acquisition and compensation cost	Budget included in RAP report	

Sl. No	**Description of EMP activities**	**Cost Million BDT**	**Cost Million US$**
18	Resettlement cost	Budget included in RAP report	
19	O &M cost during construction	Budget included in O & M report	
20	WMOs monitoring cost	1.00	0.012
21	Capacity building and training	4.00	0.049
22	Consultancy services cost for supervisions and monitoring	5.00	0.061
Total Cost of ESMP		**108.55**	**1.323**

Note: 1US$ = 82.00Taka (Dec 2012)

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Annex 1: Checklist

EIA of Coastal Polders under CEIP
Checklist for Water Resources Information Collection
Center for Environmental and Geographic Information Services (CEGIS)

A. Administrative Information

Name of Polder:	BWDB Zone:	Hydrological Zone:
BWDB Circle name:	BWDB O & M Division:	
District (s):	Upazila (s):	
Union (s):	Mouza (s):	

B. Project Description

General Information	
a. Type of project:	b. Area of polder (Ha):
c. Objectives of the scheme:	
d. New problems (if any) created by the project activities:	
e. Year of Starting:	f. Year of completion:
g. Name of surrounding polder	
h. Name of the projects hydro-morphologically dependent on the polder	
i. Cumulative hydraulic and morphological impacts as anticipated by local people	

Data Collected by:	Date:

Present Status/condition of Embankment	
Embankment length (……………….Km)	Embankment Type: Submergible / Full flood protection

Breaching: 1. Yes 2. No Breaching spot (If yes): (Please specify the spot names, length, GPS reading)

Location of Breaching Points (Name of Place)	Reasons of breach	Good		Moderately affected		Badly affected/ Vulnerable		Completely damaged	
		GPS ID	Length	GPS ID	Length	GPS ID	Length	GPS ID	Length

Public Cuts: 1. Yes 2. No Public Cuts (If yes): (Please specify the spot names, length, GPS reading)

Location of Public Cuts	Reasons	Moderately affected		Badly affected/ Vulnerable		Completely damaged	
		GPS ID	Length	GPS ID	Length	GPS ID	Length

Re-sectioning: 1. Yes 2. No Re-sectioning (If yes): (Please specify the spot names, length)

From	To	Length	Height	Actual reasons

Regulators

Location of Structure	GPS ID	Type	Vent Size	No of Vent	Service Condition (VG/G/M/B/VB)[12]	Present Condition (Partial/full damage/good)	Present Problems	Reasons for problem	Year of problem	Rehabilitable (Y/N)	Replaceable (Y/N)
Fish pass Structures											
Cross Drainage Structures (Syphon/Aqueduct)											
Barrage											
Pipe Sluices											
Irrigation Inlets											
Bridge/Culverts											
Others											
Drainage Channels											

12 VG – Very Good, G – Good, M – Moderate, B – Bad, VB – Very Bad

Name	Length	Flow Direction	Flow (%)	Present Service Condition \Problems	Reasons of Problem	Re-excavation Need (Y/N)	Proposed Re-excavation Mode (Manual/ Mechanical)	From – To (Approx. length)	GPS ID (Structure)

Irrigation Canals

Name	Length	Problems	Reasons	Re-sectioning (Y/N)	From – To (Approx. length)

Protective Works

Location Name	Type (Temporary/Permanent)	Length	Present Condition (G/ MD/ CD)13	Problems	Reasons	From – To (Approx. length)	GPS ID (Protection Work)

13 G – Good, MD – Moderately Damaged, CD – Completely Damaged

Do you think that local people/Stakeholders were involved or could be involved in future for the maintenance work of the above mentioned works? If 'Yes' mention the source of generating funds?	
Persons engaged in operating gates of the structures:	BWDB/Local people or Stakeholders/Beneficiaries
Problems facing in operating the gates of the structures:	
Your suggestions regarding the people to be engaged in operating these gates:	BWDB/Local people or Stakeholders/Beneficiaries

D. Water Resources

1.River system (inside and outside the polder)

Inside	Outside	Main river	Flow direction

2. Name of beels:

Union	Beels	Union	Beels

3. Topography:	4. Drainage pattern:
5. Drainage congestion extent (ha):	Causes: Natural / Man made/Through project activities
Problems:	Reasons:

6. Water logging (% of extent) in the month of February

Union	Area (%)	Causes

7. Flooding (depth, % of extent, onset, peak and recession)

Flood/Inundation Condition	Area (%)	Reasons of Flooding	
F0 (< 30 cm)			Onset:
F1 (30-90 cm)			Peak:
F2 (90 – 180 cm)			
F3 (180 – 360 cm)			Recession:
F4 (> 360 cm)			

E. River Erosion

River/Khal name	Area (ha)	Length (m)	Reasons

F. Accretion			
River/Khal name	Area (ha)		Reasons

G. Water Quality (Peoples perception)			
1. Ground water (Presence of pollutant)			
Arsenic (Yes/No)	Location:		
Iron (Yes/No)	Location:		
2. Surface water			
River/Khal name	Quality of water (Good/Bad/Avg.)	Type of Pollutant	Sources of pollutant

H. Historical severe flood:

Recent flood	Extent (Days)	Flood level (cm)	Damage of resources	
1988				
1994				
1998				
2004				
2007				
Last five years	Flood year			Flooding areas:
	Non flood year			

I. Participatory Social Mapping by stakeholders (Name of regulators, name of public cuts points, Name of breaching points, location of water logged area, identification of encroached canal with name and their location on map)

J. Peoples opinion of the project

Pre-project condition:
Period of project benefits:
Present condition and Present problems:

Causes of problems:
Probable Solution/Improvement:

EIA of Coastal Polders under CEIP
Checklist for Land Resources, Agriculture and Livesock Information Collection
Center for Environmental and Geographic Information Services (CEGIS)

Land Resources:

Land degradation

Factors	Year from starting LD	Result of LD
Soil erosion		
Sand carpeting		
Salinisation		
Acidification		
Nutrient deficiency		
Farming practices		
Water logging		
Others		

Agriculture Resources: (For small project information collection from filed. For large project both primary and secondary information collection from field and DAE office)

Cropping Pattern by land type

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-February)	% of area

Crop calendar

Crop name	Seedling		Transplanting/Sowing		Harvesting	
	Start	End	Start	End	Start	End

Crop yield

Crop Name	Damage free Yield (ton/ha)	Damage area (%)	Damage Yield (ton/ha)

*Damage area and yield loss calculation: Last 3 years average value

Crop damage

Name of hazard	Ranked	Timing	Causes
Flood			
Drought			
Pest infestation*			
Others:			
*List name of pest and pesticide by crop			

Fertilizer and pesticide application

Crop Name	Seed (Kg/ha)	Fertilizer (Kg/ha)				Pesticide		
		Urea	TSP	MP	Other	No of Appli.	Liq. (ml/ha)	Gran. (Kg/ha

Irrigation, Land preparation and Labour

Crop Name	Irrigation			Land preparation			Labour	
	Mode	% of Area	Charge (Tk/ha)	Power (%of Area)	Animal (% of Area)	Tk/ha	Nos./ha	Tk/ labour

Note: Support Services of the project areas

Livestock Resources: Primary and Secondary Information collection from field and DLS offices

Livestock and poultry production

Name of Livestock/poultry	% of HH having Livestock/Poultry	No. of Livestock/poultry per HH
Cow/Bullock		
Buffalo		
Goat		
Sheep		
Duck		
Chicken		

Feed and Fodder

Name of Livestock/poultry	Feed/Fodder Scarcity (Timing)	Causes	Remarks
Cow/Bullock			
Buffalo			
Goat			
Sheep			
Duck			
Chicken			

Diseases

Name of Livestock/poultry	Name of Disease	Disease (Timing)	Causes	Remarks
Cow/Bullock				
Buffalo				
Goat				
Sheep				
Duck				
Chicken				
Note: Support Services-				

Where, when, how much and causes of Crop Damage.

Fisheries Baseline Checklist
EIA of Coastal Polders under CEIP

Village: Mouza: Union: Upazila: District: BWDB Circle: BWDB Division:

Background Water bodies: Name: Alphabetic, Area: in Ha/% of area/Ana, Length: in km, Depth/Inundation depth: in Meter, Flood Duration: in Months, Production: metric ton

Problem/Issue	Fishing Effort	Habitat Type	Water Quality	Avg. Production	Production Trend (+/-) and Reason	List of Gears	% of gears	List of Habitat Name	Present					Past (15-20 yrs back)				
									Area	Length	Width	Depth	Duration	Area	Length	Width	Depth	Duration
Capture Fisheries:	a. Total No. of fisher HHs: b. %/No. of CFHHs:	River																
Culture Fisheries: Indiscriminate Fishing Activities:	c. %/No. of SFHHS: d. No. of Days spend annually in fishing by CFHHs: SFHHs:	Beel (Leased/non leased)																
	e. Hrs/Day spend in fishing by CFHHs:	Khal																
	SFHHs:	Floodplain																
		Swamp Forest																
		Fish pond																
		Baor																
		Other																

Fish Migration				Fish Biodiversity	
Previous Migration Status				Fish diversity status (Poor/Moderate/Rich)/%	
Present Obstacle to fish migration:	1. 2. 3.			Reasons of increase or decrease	1. 2. 3. 4. 5.
Important breeding, feeding and over wintering ground					
Horizontal Migration pattern	Species: 1. 2. 3. 4. 5.	Season (Months):	Routes:	Significant areas	1. 2. 3.
Vertical Migration Pattern	Species: 1. 2. 3. 4. 5.	Season (Months):	Habitats:	Species of Conservation Significance	Rare: Unavailable:

Species List					Species Composition				
River	Khal	Beel	Pond	Other	Group	River	Khal	Beel	Pond
					Major carp				
					Exotic carp				
					Other carp				
					Catfish				
					Snakehead				
					Live fish				
					Other fish				
					Prawn				
					Hilsa				
					Rui				
					Catla				
					Mrigel				
					Koi				
					Sarpunti				
					Large prawn				
					Small Pprawn				
					Silver carp				
					Carpu				
					Grass carp				
					Tengra				
					Chapila				
					Others				

Post Harvest Activities		Fishermen Lifestyle	
Fish edible quality:		Socio-economic Status of subsistence level fishermen:	

Source of pollution in each habitat:		Socio-economic Status of Commercial fishermen:	
Seasonal vulnerability:		Other conflict (with muscle men/ agriculture/ other sector/laws):	
Ice factory (Number, location and name):		Fishermen community structure (Traditional/Caste/Religion)	
Landing center, whole sale market, other district markets, etc.:		Traditional fishermen vulnerability (Occupation change/others):	
Storage facility (number, location and name):		Existing Fisheries Management	
Fish market (Number, location and name):		Fishermen Community Based Organizations (FCBOs):	
Marketing problems:		WMOs activity:	
Fish diseases (Name, Host species, Season, Syndrome, Reason, etc.):		Fishing right on existing fish habitats (Deprived/Ltd. access/Full access):	
Other backward and forward linkages (Number, location and name):		Leasing system:	
Transport facility (Mode of fish transportation, cost, other involvements)		Enforcement of fisheries regulation (Weak/strong):	
Dry fish industries (Number, location and name):		Department of Fisheries (DoF) activity:	
Others information:		NGOs activities:	

Note: 1. Major Carp - Rui, Catla, Mrigal, 2. Exotic Carp - Silver Carp, Common Carp, Mirror Carp, Grass Carp, 3. Other Carp - Ghania, Kalbasu, Kalia, 4. Cat Fish - Rita, Boal, Pangas, Silon, Aor, Bacha, 5. Snake Head - Shol, Gazar, Taki, 6. Live Fish - Koi, Singhi, Magur, 7. Other Fish - Includes all other fishes except those mentioned above.

Beels: Rui (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Kalbasu (Labeo calbasu), Gonia (Labeo gonius), Boal (Wallago attu), Air (Mystus aor / Mystus seenghala), Shol/Gazar (Channa spp.), Chital/Phali (Notopterus chitala / N. notopterus), Koi (Anabas testudineus), Singi/Magur (Heteropneustes fossilis /Clarias batrachus), Sarpunti (Puntius sarana), Large Shrimp (Macrobrachium rosenbergii /M. malcomsonii), Small Shrimp, Silver Carp (Hypophthalmichthys molitrix), Carpio (Cyprinus carpio), Grass Crap (Ctenopharyngodon idellus), Pabda (Ompok pabda), Punti (Puntius spp.), Tengra (Mystus spp.), Baim (Mastacembelus spp.), Chapila (Gudusia chapra), Others.
Pond: Rui (Labeo rohita), Catla (Catla catla), Mrigal (Cirrhinus mrigala), Kalbasu (Labeo calbasu), Mixed Carp, Silver Carp (Hypophthalmichthys molotrix), Grass Carp(Ctenopharyngodon idellus), Mirror Carp (Cyprinus carpio var. specularis), Tilapia (Oreochromis mossambicus / O. niloticus), Shrimp, Aor (Mystus aor / Mystus seenghala), Boal (Wallago attu), Shol/Gazar & Taki (Channa spp.), Chital/Phali (Notopterus chitala / N. notopterus), Koi (Anabas testudineus), Singi/Magur (Heteropneustes fossilis / Clarias batrachus), Sarpunti (Puntius sarana), Thai Sarpunti (Puntius gonionotus), Punti (Puntius spp.), Others.

EIA of Coastal Polders under CEIP
Checklist for Ecological Information Collection
Center for Environmental and Geographic Information Services (CEGIS)

Basic Information

Date		Prepared by	
Name of the Polder			
BWDB Circle Name			
District/s		Upazila/s	
Location of the FGD			

Habitat Information/Ecosystem Types (Please put tick where is applicable)

Agriculture land		Forest patches including social forestry	
Settlement/Homesteads		Canal and ponds	
Orchard		Grasslands	
Fallow		Reserve forest	
Ridges		Others	

Terrestrial Vegetation Checklist (List of Major Plant Species)

Species Name	Status	Utilization
Homestead Vegetation		
Mangrove Vegetation		
Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others		

Terrestrial Wildlife Check List

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			
Reptiles			
Birds			

Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest
Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare
Migration Status: 1= Local, 2= Local Migratory, 3= Migratory

Aquatic Wildlife Checklist

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			
Reptiles			
Birds			

Habitat: 1= Homestead forest, 2= Floodplains, 3= Wetlands, 4= River, 5= Pond, 6=Forest Status: 1= Very common, 2=Common, 3= Rare, 4= Very Rare Migration Status: 1= Local, 2= Local Migratory, 3= Migratory			

Foreshore vegetation/Mangrove vegetation

Name of the forest patches location (s)	Species Name	Abundance	Utilization
Abundance1= High,2=Moderate,3=Low Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others			

Major Wetland information

Name of wetland	Type of Wetland	Area in Acre	Connectivity		Impor tance
			Khal	River	
Type 1= Beels, 2= Rivers, 3= Open water wetlands, 4= Floodplains, 5= Closed water wetlands, 6= Ponds, 7= Baors (oxbow lake). 1 1=Fish; 2= migratory bird; 3= other wildlife; 4=aquatic flora					

Wetland vegetation Checklist

Species Name	Habit	Status	Utilization

Species Name	Habit	Status	Utilization
Habit 1=Submerged, 2=Free floating, 3=Rooted floating, 4=Sedges, 5=Marginal Status 1= High, 2= Moderate, 3= Low Utilization 1=food; 2=timber; 3=fuel; 4=medicinal; 5=fiber/thatching; 6=others			

Forest Information (Surrounding/nearer the polder)

Forest Name with Range/Beet office	Type	Location	Area in Acre	Major Plant Species
Type 1=Swamp Forest, 2=Reserve Forest, 3=Vested Forest, 4=Reed forest, 5=Other (specify)				

(9)Anticipated Impacts due to proposed interventions on particular Ecosystems
(Impact from changed land use, noise, human presence etc.)

Name of Intervention	Impacts
Embankment Re-sectioning	
Breach Closing	
Construction of Water control Structures	

(10) Comments (If any):

EIA of Coastal polders under CEIP
RRA/FGD Data Collection Format for Socio-economic Survey

Date of Survey:................................. Name of Polder:
1. Place of Interview:
Name of Mouza(s)...
Union(s)/Ward(s)..
Municipality(s).if any ....
Upazila(s)/Thana(s).. District(s)/.....................................

2. Characteristics of Population:

2.1 Total Households, Population (male, female, rural and urban) in Project area

Total Households	Population		
	Male	Female	Total

Source: BBS

2.2 Age distribution

Age range													
0-4 Years		5-9 Years		10-14 Years		15-17Years		18-34 Years		35-59 Years		60+Years	
M	F	M	F	M	F	M	F	M	F	M	F	M	F

Source: BBS
2.3 Literacy rate

% of Literacy (Over 7 years)		
Total	Male	Female

Source: BBS
2.4 Occupation and employment

Main occupation by population	% of population
Not working	
Looking for work	
Household work	
Agriculture	
Industry	
Water, Electricity & Gas	
Construction	
Transport	
Hotel & Restaurant	
Business	
Service	
Others…..	

Source: BBS

Main occupation by households:

Main occupation by households	% of households

Main occupation by households	% of households
Agriculture/Forestry/Livestock	
Fishery	
Agriculture Laborer	
Non-agriculture Laborer	
Handloom	
Industry	
Business	
Hawker	
Construction	
Transport	
Religious	
Service	
Rent	
Remittance	
Others…..	

Source: BBS

2.5 Labor availability and wage

a. Labor (Male) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:............Min: ....
b. Labor (M) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:............Min: ....
c. Labor (Female) for farming (High/Medium/Low), Av. Wage/Day (Tk.) Max:............Min: ....
d. Labor (F) for non-farming (High/ Medium/ Low), Av. Wage/Day (Tk.) Max:............Min: ....

2.6 Migration (seasonal/permanent)

a. Seasonal out migration from study area (% per year with location):

b. Seasonal in migration to study area (% per year with location):

c. Permanent out migration from study area (Number per 1/2 years with location):

d. Permanent in migration to study area (Number per 1/2 years with location):

2.7 Annual Expenditure and Income by range

a. Expenditure

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

b. Income

Expenditure group (in taka)	Percentage of households
<=12,000	
12,000-24,000	
24,000-60,000	
60,000-1,08,000	
1,08,000-2,40,000	
>=2,40,000	

Sources: RRA

Self assessed poverty for year round

Sl. No.	Poverty status	Percentage of households
1	Deficit	
2	Balance/Breakeven	
3	Surplus	

Sources: RRA

Housing (photographs)

Sl. No.	Housing status	% of hhs having
1	Jhupri	
2	Kutcha	
3	Semi Pucka	
4	Pucca	

Source: RRA

Drinking water (photographs)

Sl. No.	Drinking water sources	Percentage of households use
1	Tap	
2	Tube well	
3	Well	
4	Pond	
5	Other.........................	

Source: BBS

Sanitation (photographs)

Sl. No.	Toilet types	Percentage of households under each type
1	Water Sealed	
2	Ring Slub	
3	Kacha	
4	No facilities	

Source: RRA

2.12 Diseases in polder area

a. Diseases in area

Sl. No.	Disease	Ranking by incidence	Sl. No.	Disease	Ranking by incidence
1	Influenza/ Common fever		9	Chicken pox	

Sl. No.	Disease	Ranking by incidence	Sl. No.	Disease	Ranking by incidence
2	Cough/cold		10	Skin disease	
3	Diarrhoea		11	Diabetes	
4	Dysentery		12	Hypertension	
5	Hepatitis		13	Asthma	
6	Malaria		14	T B	
7	Dengue fever		15	Gastric	
8	Typhoid		16	Arsenicosis	

Sources: RRA

b. Health facilities in study area (photographs)

Sl. No.	Type of facility	Number of facilities with name
1	Number of District level Hospitals	
2	Number of Upazila Health Complex	
3	Union Health Center	
4	Private Health Clinic/ Hospitals	

Sources: RRA

b.1 Status of peripheral health facilities used by the study area people:

____
____
____
____
____
____

Source of treatment facilities in study area

Sl. No.	Source of treatment facilities	% of hhs received
1	Trained Physician	
2	Paramedic/ Diploma Physician	
3	Quack Doctor and Informal Treatments	
4	No treatment facilities at all	

Sources: RRA

2.13 Electricity

Percentage of household having electricity facility: ....BBS
Percentage of household having electricity facility: ....(During Survey)

3. Social overhead capital (photographs)

3.1 Existing road networks in study area and it's level of benefit

a. National Road (km.) ....(GIS) Beneficial: Highly /Moderately / Poorly
b. Regional Road (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly
c. Local Road Pucca (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly
d. Local Road Kancha (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.1.1 Status of peripheral road networks (with name) used by the study area people:

____
____
____
____
____
____
____
____
____.

3.2 Existing railway network in study area and it's level of benefit

a. Railway (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.2.1 Status of peripheral railway service used by the study area people:

____
____
____
____
____
____

3.3 Existing waterways in study area and it's level of benefit

a. National Route (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

b. Local Route (km.) .... (GIS) Beneficial: Highly /Moderately / Poorly

3.3.1 Status of peripheral water ways (with name) used by the study area people:

____
____
____

3.4 Status of the navigation route by season

a. National Route: Served Seasonally/Through out the year

b. Local Route: Served Seasonally/ Through out the year

3.5 Major waterways handicapped

a. by structures................................... location

b. by siltation................................ location

3.6 Nos. of major ghats/ports and name:

3.7 Academic Institution (school, colleges) (photographs)

Sl. No.	Type of facility	Nos. of Institution	Type of facility	Nos. of Institution
1	Primary School		Ebtedayee Madrasha	
2	High School		Dakhil Madrasha	
3	College		Alim/ Fazil Madrasha	

Sources: RRA

3.6.1 Status of peripheral academic institutions (with name) used by people of the study area:

____
____
____
____
____
____

3.8 Markets and GC (photographs)

Sl. No.	Type of facility	Nos. of markets	Comments with name
1	Major markets		
2	Minor markets		
3	Growth Centers		

Sources: RRA

3.8.1 Status of peripheral markets used by people of the study area:

____
____
____
____
____
____

4. Land holding categories

4.1 Percentage of HH who have owned agricultural land: ....(BBS)

Percentage of households with different land ownership category in the area:

Land ownership classes	Percentage of household
Land less/ No land (0 decimal)	
Land less (up to 49 decimal)	
Marginal (50-100 decimal)	
Small (101-249 decimal)	
Medium (250-749 decimal)	
Large (750 + decimal)	

Sources: RRA

5. Conflict between different land owner group and professional group

Reasons of Conflicts	Present status of problem	Solution they want with location

Reasons of Conflicts	Present status of problem	Solution they want with location
Water control infrastructures		
Land elevation		
Cross-interest		

6. Disaster related information: (photographs)

6.1 Type of major disaster and damage occurred in the area after completion of the Project

Sl. No.	Major Disaster	Severely affected year	% of area affected	% of hhs affected	% of crop damage	Major crop damaged
1	Flood					
2	Drought					
3	Tidal flood					
4	Storm					
5	Cyclone					

Sl. No.	Major Disaster	Severely affected year	% of area affected	% of hhs affected	% of crop damage	Major crop damaged
6	Hail storm					
7	Salinity intrusion					
8	Water logging					
9	Erosion					

Sources: RRA

7. Safety Nets and Poverty Reduction Measures in the area:

7.1 Name and activity of GO/ NGOs working in this area

Name	Activity (Credit, Education, Health, Forestry, Fishery, Livestock Rearing, Women Empowerment, Human Rights, VGF, Boyosko bhata, etc.)	% of HHs coverage

8. Information on Water Management Organizations (WMOs) (photographs of office building, committee members, resolution etc)

8.1 Do you know about the CEIP project? Y/N

8.2 Existence of WMOs: Yes/No

8.2.1 If WMO exists:

Sl	Issue/Question	Response/Suggestion
a)	Year of formation (date if possible)	
b)	Registered by whom?	

Sl	Issue/Question	Response/Suggestion		
c)	Number of members (male-female)	Male	Female	Comments
	Farmer			
	Trader			
	Labor			
	Landless			
	Fisher			
	Service holder			
	Others			
d)	No. of villages covered			
e)	Existence of fund			
f)	AGM			
g)	Election			
h)	EC meetings			
i)	Present water resources management activities			

8.2.2 Name of EC members with address/phone number:

Sl. No.	Name	Address	Phone Number
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Sl. No.	Name	Address	Phone Number
13			
14			
15			

If WMO does not exist, please state the reasons for

____
____
____
____
____
____

8.3 Are people willing to form WMO? Y/N
(If yes, give demonstrative proof of their capacity if any)

8.4 Is WMO willing to take up management responsibilities? Y/N

8.4.1 If yes, please give some idea about what to do on management

9. Some other Issues

9.1 Any land acquisition to be needed for the rehabilitation of the polder ? Yes/No

9.1.1 If yes, size of the area? __________________________________(acre)

9.1.2 If yes, are they willing to provide land for acquisition? Yes/No

9.2 Any replacement of people to be needed for the rehabilitation of the scheme? Yes/No

9.2.1 If yes, how many? _____________________________ (number of household)

9.3 Have any cultural heritage /archeological sites in the polder? Yes/No
Give some description

9.4 Have any vulnerable communities (e.g. landless, fishermen, boatmen, destitute women without food and/or shelter) in the scheme area? Yes/No

a. Give some description

9.5 Have any common property resources (e.g. irrigation systems, fishing grounds (wetlands), pastures, forests, graveyard, cremation ground, mosque, temple, etc.) in the scheme area? Yes/No

a. Give some description

10. Comments of Facilitator:

Name of the RRA/FGD Participants:

Name	Age	Occupation	Address/Phone No.

Annex 2: No Objection Certificates

গনপ্রজাতন্ত্রী বাংলাদেশ সরকার

২নং নদমূলা শিয়ালকাঠী ইউনিয়ন পরিষদ

ডাকঘর ও উপজেলা ঃ ভান্ডারিয়া, জেলাঃ পিরোজপুর।

স্মারক নং

তারিখঃ ২৭/০৫/২০১৭

অনাপত্তি পত্র

এইমর্মে প্রত্যায়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্বব্যাংক কর্তৃক গৃহিত উপকুলীয় বাধ উন্নয়ন কর্মসুচীর আওতায় (সিইআইপি) বাংলাদেশ পানি উন্নয়ন বোর্ডের অধীনে পোল্ডার ৩৯/২সি, ভান্ডারিয়া,মঠবাড়ীয়া,কাঠালিয়া উপজেলার অন্তর্গত প্রকল্পটির জরুরী ভিত্তিতে পূনর্বাসন ও উন্নয়নের কাজ করলে অত্র এলাকার জনগনের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগনের সক্রিয় অংশগ্রহনে পরিচালিত হবে। তাছাড়া ও বাংলাদেশ পানি উন্নয়ন বোর্ড এর নির্মান কাজ চলাকালীন সময় অত্র ইউনিয়নের জনগন সার্বিক ভাবে সহায়তা করবেন।

শফিকুল কবির বাবুল তালুকদার
চেয়ারম্যান
২নং নদমূলা শিয়ালকাঠী ইউনিয়ন পরিষদ
ভান্ডারিয়া,পিরোজপুর।

গনপ্রজাতন্ত্রী বাংলাদেশ সরকার

৩নং তেলীখালী ইউনিয়ন পরিষদ

উপজেলা ঃ ভান্ডারিয়া, জেলাঃ পিরোজপুর।

স্মারক নং

তারিখঃ ২৭/০৫/১২

অনাপত্তি পত্র

এইমর্মে প্রত্যায়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্বব্যাংক কর্তৃক গৃহিত উপকুলীয় বাঁধ উন্নয়ন কর্মসুচীর আওতায় (সিইআইপি) বাংলাদেশ পানি উন্নয়ন বোর্ডের অধীনে পোল্ডার ৩৯/২সি, ভান্ডারিয়া,মঠবাড়ীয়া,কাঠালিয়া উপজেলার অন্তর্গত প্রকল্পটির জরুরী ভিত্তিতে পূনর্বাসন ও উন্নয়নের কাজ করলে অত্র এলাকার জনগনের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগনের সক্রিয় অংশগ্রহনে পরিচালিত হবে। তাছাড়া ও বাংলাদেশ পানি উন্নয়ন বোর্ড এর নির্মান কাজ চলাকালীন সময় অত্র ইউনিয়নের জনগন সার্বিক ভাবে সহায়তা করবেন।

২৭/০৪/১২
মোঃ শাহাদাৎ হোসেন
প্যানেল চেয়ারম্যান-১
৩নং তেলিখালী ইউনিয়ন পরিষদ
ভান্ডারিয়া, পিরোজপুর

Annex 3: Tables

Table 1: Checklist of terrestrial plant species found within the Polderarea

Scientific Name	Family	Local Name	Habit
Acacia moniliformis	Mimosaceae	Akashmoni	Tree
Acalypha indica	Euphorbiaceae	Muktajhuri	Herb
Aegle marmelos	Rutaceae	Bel	Tree
Albizia lebbeck	Leguminosae	Sirish	Tree
Albizia procera	Leguminosae	Silkaroi	Tree
Albizia richrdiana	Leguminosae	Gogon Sirish	Tree
Alstonia scholaris	Apocynaceae	Chatim	Tree
Anthocephalus chinensis	Rubiaceae	Kadom	Tree
Areca catechu	Palmae	Supari	Tree
Artocarpus heterophyllus	Moraceae	Kathal	Tree
Averrhoa carambola	Averrhoaceae	Kamranga	Tree
Azadirachta indica	Meliaceae	Nim	Tree
Bambusa sp.	Gramineae	Bans	Tree
Barringtonia acutangula	Barringtoniaceae	Hijal	Shrub
Borassus flabelifer	Palmae	Tal	Tree
Calamus tenuis	Palmae	Bet	Shrub
Calotropis gigantea	Asclepiadaceae	Akand	*Shrub*
Carica papaya	Caricaceae	Papay	Shrub
Carissa carandas	Apocynaceae	Karamcha	*Shrub*
Cassia alata	Leguminosae	Dadmordon	Shrub
Cassia fistula	Leguminosae	Sonalu	Tree
Casuarina equisetifolia	Casurianaceae	Jahu	Shrub
Centella asitica	Umbelliferae	Thankuni	Herb
Cestrum nocturnum	Compositae	Hasnahena	Shrub
Citrus grandis	Rutaceae	Jambura	Tree
Cleorodendrum viscosum	Verbenaceae	Bhat	Shrub
Clerodendrum inerme	Verbenaceae	Bhant	*Herb*
Cocos nucifera	Palmae	Narikel	Tree
Cotula hemispherica	Compositae	Kancha ghash	*Herb*
Crotolaria retusa	Gramineae	Ban-san	*Herb*
Croton bonplandianum	Euphorbiaceae	Banjhal	*Herb*
Cuscuta australis	Convolvulaceae	Swarnalata	*Herb*
Cynodon dactylon	Gramineae	Durba	*Herb*
Cyperus diformis	Cyperaceae	-	*Herb*
Dalbergia sissoo	Fabaceae	Sisso	Tree
Datura suaveolens	Solanaceae	Dutura	Herb

Scientific Name	Family	Local Name	Habit
Dentella repens	Rubiaceae	Hachuti	*Herb*
Dillenia indica	Dilleniaceae	Chalta	Tree
Diospyros discolor	Ebanaceae	Bilatigab	Tree
Diospyros perigrina	Ebanaceae	Deshigab	Tree
Erythrina ovalifolia	Leguminosae	Talimandar	Tree
Euphorbia hirta	Euphorbiaceae	Dudhia	*Herb*
Ficus benghalensis	Moraceae	Bot	Tree
Ficus heterophylla	Moraceae	Bhui Dumur	Herb
Ficus hispida	Moraceae	Dumur	Shrub
Ficus religiosa	Moraceae	Assawath	Tree
Glycosmis pentaphylla	Rutaceae	Daton	Shrub
Lagerstromia speciosa	Lythraceae	Jarul	Tree
Leucauna laucocephalata	Mimisaceae	Ipil ipil	Tree
Litchi chinensis	Sapindaceae	Lichu	Tree
Mangifera indica	Anacardiaceae	Aum	Tree
Marsilea quadrifolia	Marciliaceae	Susnishak	*Herb*
Mikania scandens	Compositae	Assamlata	Herb
Moringa oleifera	Moringaceae	Sajna	Tree
Nicotiana plumbaginifolia	Solanaceae	Bantamak	*Herb*
Nyctanthes arbortristris	Solanaceae	Sefali	*Herb*
Ocimum americanum	Labiatae	Tulshi	Herb
Pandanus sp.	Pandanaceae	Keya	Herb
Phoneix sylvestris	Palmae	Khejur	Tree
Pongamia pinnata	Fabaceae	Karoch	Tree
Psidium guajava	Myrtaceae	Peyara	Shrub
Rhynchospora rufescens	Cyperaceae	Shimbhatraji	*Herb*
Ricinus communis	Euphorbiaceae	Reri	Shrub
Rorippa indica	Cruciferae	Bansarisha	*Herb*
Sacciolepis interrupta	Gramineae	Nardulla	*Herb*
Sesbania rostrata	Leguminosae	Dhaincha	*Herb*
Spondias dulcis	Anacardiaceae	Amra	Tree
Streblus asper	Urticaceae	Sheora	Shrub
Swietenia mahagoni	Meliaceae	Mahogoni	Tree
Syzygium cumini	Myrtaceae	Kalojam	Tree
Tamarindus indica	Leguminosae	Tetul	Tree
Tectona grandis	Verbenaceae	Segun	Tree
Terminalia arjuna	Combretaceae	Arjun	Tree
Terminalia catappa	Combretaceae	Katbadam	Tree
Trewia nudiflora	Euphorbiaceae	Pitali/Latim	Tree

Scientific Name	Family	Local Name	Habit
Zizyphus mauritiana	Rhamnaceae	Baroi	Tree

Source: Field survey, 2012

Table 2: Checklist of aquatic flora species found within the Polder area

Scientific Name	Family	Local Name	Habit
Alternanthera philoxiroides	Amaranthaceae	Helencha	Herb
Ceratophyllum desmersum	Cearatophyllaceae	Jhangi	Herb
Colocasia esculenta	Araceae	Kachu	Herb
Eclipta alba	Compositae	Kalokeshi	Herb
Eichhornia crassipes	Pontaderiaceae	Kochuripana	Herb
Enhydra fluctuans	Cyperaceae	Helencha	Herb
Hygroryza aristata	Gramineae	Putki	Herb
Ipomoea aquatica	Convolvulaceae	Kalmi sak	Herb
Lemna perpusilla	Lemnaceae	Khudipana	Herb
Ludwigia abscendens	Onagraceae	Keshordam	Herb
Ludwigia hyssopifolia	Onagraceae	Keshordam	Herb
Mersilea quadrifoliata	Mersileaceae	Susnisak	Herb
Monochoria hatata	Pontaderiaceae	Kechur	Herb
Nachamendra alternifolia	Hydrocharitaceae	Kaisa	Herb
Najas. sp	Najadaceae	Goisa	Herb
Nymphaea nouchali	Nymphaeaceae	Shapla	Herb
Nymphaea stellata	Nymphaeaceae	Nilshapla	Herb
Phragmites karka	Gramineae	Nol	Herb
Pistia stratiotes	Araceae	Topapana	Herb
Polygonum barbatum	Polygonaceae	Bishkatali	Herb
Polygonum glabrum	Polygonaceae	Bishkatali	Herb
Sagittaria sagittifolia	Alismataceae	Chhotokul	Herb
Scirpus juncoides	Cyperaceae	Chisra	Herb
Spirodela polyrhiza	Lemnaceae	Khudipana	Herb
Trapa natans	Trapaceae	Singra	Herb
Vallisnaria spiralis	Hydrocharitaceae	*Bicha*	Herb
Vetiveria zizanioides	Gramineae	*Binna*	Herb
Wolffia microscopica	Lemnaceae	*Guripana*	Herb

Source: Field survey, 2012

Table 3: Checklist of bird species found within the study area

Status
IUCN Status
VU- Vulnerable

EN-Endangered
CR- Critically Endangered
LC-Least Concern

Birdlife Global Status
Same as IUCN Status
Local Status
CR-Common Resident
UR-Uncommon Resident
CWV- Common Winter Visitor
UWV- Uncommon Winter Visitor
RR-Rare Resident
DD-Data Deficient
WV-Winter Vagrant
RWV-Rare winter visitor
Birdlife Status: LC= Leased Concerned; NT = Near Threatened; NRF = No Record Found

Scientific Name	English Name	Local Name	IUCN Status	Local Status	Birdlife Status
Acridotheres fuscus	Jungle Myna	Jhuti Shalik		CR	LC
Actitis hypoleucos	Common Sandpiper	Pati Batan		CWV	LC
Aegithina tiphia	Common Iora	Pati Fatikjal		CR	LC
Alcedo atthis	Common Kingfisher	Pati Machranga		CR	LC
Amaurornis phoenicurus	White-breasted Water hen	Dholabook Dahuk		UR	LC
Anastomus oscitans	Asian Open bill	Eshio Shamkhol		CR	LC
Anthus hodgsoni	Olive-backed Pipit	Jolpaipith Tulika		CWV	LC
Anthus richardi	Richard's Pipit	Richarder Tulika		CWV	LC
Anthus roseatus	Rosy Pipit	Golapi Tulika		CWV	LC
Anthus rufulus	Paddy field Pipit	Dhani Tulika		CR	LC
Ardeola grayii	Indian Pond Heron	Deshi Kanibok		CR	LC
Artamus fuscus	Ashy Wood swallow	Metey Bonababil		CR	LC
Athene brama	Spotted Owlet	Khuruley Kutipecha		CR	LC
Bubulcus ibis	Cattle Egret	Go Boga		CR	LC
Caprimulgus macrurus	Large-tailed Nightjar	Lenja Ratchora		CR	LC
Casmerodius albus	Great Egret	Boro Boga		CR	LC
Celeus brachyurus	Rufous Woodpecker	Khoira Khathkurali		CR	LC
Centropus sinensis	Greater Coucal	Boro Kubo		CR	LC
Charadrius dubius	Little Ringed Plover	Soto Nothjiria		CR/CWV	LC
Cisticola juncidis	Zitting Cisticola	Bhomra Soton		CR	LC
Columba livia	Common Pigeon	Gola Paira		CR	LC
Copsychus saularis	Oriental Magpie-Robin	Udoi Doel		CR	LC
Coracias benghalensis	Indian Roller	Bangla Nilkanto		CR	LC
Coracina macei	Large Cuckoo shrike	Boro Kabashi		CR	LC
Corvus macrorhynchos	Large-billed Crow	Dar Kak		CR	LC
Corvus splendens	House Crow	Pati Kak		CR	LC
Cuculus micropterus	Indian Cuckoo	Bokotakou Kokil		CR	LC
Cypsiurus balasiensis	Asian Palm Swift	Ashio Talbatashi		CR	LC
Dendrocitta vagabunda	Rufous Treepie	Khoira Harichacha		CR	LC
Dendrocopos macei	Fulvous-breasted Woodpecker	Batabi Kathkurali		CR	LC

Scientific Name	English Name	Local Name	IUCN Status	Local Status	Birdlife Status
Dendrocygna bicolor	Fulvous Whistling Duck	Raj Shorali		CWV	LC
Dendrocygna javanica	Lesser Whistling Duck	Pati Shorali		CR	LC
Dicrurus macrocercus	Black Drongo	Kala Fingey		CR	LC
Dinopium benghalense	Lesser Golden back	Bangla Kaththokra		CR	LC
Dinopium javanense	Common Golden back	Pati Kaththokra		CR	LC
Egretta garzetta	Little Egret	Choto Boga		CR	LC
Egretta intermedia	Yellow-billed Egret	Majhla Boga		CR	NR
Elanus caeruleus	Black-winged Kite	Katua Chil		UR	LC
Eudynamys scolopaceus	Asian Koel	Eshio Kalakokil		CR	LC
Falco tinnunculus	Common Kestrel	Pati Kestrel		CWV	LC
Gallicrex cinerea	Water cock	Deshi Kora		UR	LC
Gallinago gallinago	Common Snipe	Pati Chega		CWV	LC
Gallinago stenura	Pin-tailed Snipe	Lenja Chega		CWV	LC
Gallinula chloropus	Common Moorhen	Pati Panmurgi		CR	LC
Glareola lactea	Small Indian Pratincole	Soto Babubatan		CR	LC
Halcyon smyrnensis	White-throated Kingfisher	Dholagola Machranga		CR	LC
Haliastur Indus	Brahminy Kite	Shonkho Chil		CR	LC
Hierococcyx varius	Common Hawk-Cuckoo	Pati Chokhgelo		CR	LC
Hypothymis azurea	Black-naped Monarch	Kalaghar Rajon		CR	LC
Ixobrychus cinnamomeus	Cinnamon Bittern	Khoira Bogla		UR	LC
Ketupa zeylonensis	Brown Fish Owl	Khoira Mechopecha	VU	UR	LC
Lanius cristatus	Brown Shrike	Khoira Latora		CWV	LC
Lanius schach	Long-tailed Shrike	Lenja Latora		CR	LC
Larus ridibundus	Common Black-headed Gull	Kalamatha Gangchil		CWV	LC
LC *Acridotheres tristis*	Common Myna	Bhat Shalik		CR	LC
Leptocoma zeylonica	Purple-rumped Sunbird	Begunikomor Moutushi		CR	LC
Lonchura malabarica	Indian Silver bill	Deshi Chandithot		UR	LC
Lonchura malacca	Black-headed Munia	Kalamatha Munia		UR	LC
Lonchura punctulata	Scaly-breasted Munia	Butibook Munia		CR	LC
Malacocincla abbotti	Abbott's Babbler	Aboter Satarey		CR	LC
Megalaima asiatica	Blue-throated Barbet	Neelgola Boshonto		CR	LC
Megalaima haemacephala	Coppersmith Barbet	Shekra Boshonto		CR	LC
Megalaima lineata	Lineated Barbet	Dagi Boshonto		CR	LC
Megalurus palustris	Striated Grassbird	Dagi Ghashpakhi		CR	LC
Merops orientalis	Green Bee-eater	Shobuj Shuichora		CR	LC
Metopidius indicus	Bronze-winged Jacana	Dol Pipi		UR	LC
Milvus migrans	Black Kite	Bhubon Chil		CR	LC
Mirafra assamica	Bengal Bush Lark	Bangla Jharbhorot		CR	LC
Motacilla alba	White Wagtail	Dhola Khonjon		CWV	LC
Motacilla cinerea	Grey Wagtail	Metey Khonjon		UWV	LC
Motacilla citreola	Citrine Wagtail	Sitrin Khonjon		CWV	LC
Motacilla madaraspatensis	White-browed Wagtail	Dholavru Khonjon		UR	LC
Nettapas coromandelianus	Cotton Pygmy Goose	Dhola Balihash		UR	LC
Numenius arquata	Eurasian Curlew	Eureshio Gulinda		V	LC

Scientific Name	English Name	Local Name	IUCN Status	Local Status	Birdlife Status
Numenius glareola	Wood Sandpiper	Bon Batan		CWV	LC
Nycticorax nycticorax	Black-crowned Night Heron	Kalamatha Nishibok		CR	LC
Oriolus xanthornus	Black-hooded Oriole	Kalamatha Benebou		CR	LC
Orthotomus sutorius	Common Tailorbird	Pati Tuntuni		CR	LC
Parus inornata	Plain Prinia	Nirol Prina		CR	LC
Parus major	Great Tit	Boro Tit		CR	LC
Passer domesticus	House Sparrow	Pati Chorui		CR	LC
Pericrocotus cinnamomeus	Small Minivet	Choto Saheli		CR	LC
Phalacrocorax niger	Little Cormorant	Choto Pankouri		CR	LC
Picus xanthopygaeus	Streak-throated Woodpecker	Dagigola Kathkurali		UR	LC
Ploceus philippinus	Baya Weaver	Deshi babui		CR	LC
Pluvialis fulva	Pacific Golden Plover	Proshanto Shonajiria		CWV	LC
Psittacula krameri	Rose-ringed Parakeet	Modna Tia		CR	LC
Pycnonotus cafer	Red-vented Bulbul	Bangla Bulbul		CR	LC
Rhipidura albicollis	White-throated Fantail	Dholagola Chatighurani		CR	LC
Spilornis cheela	Crested Serpent Eagle	Tila Nag-eegol		CR	LC
Sterna acuticauda	Black-bellied Tern	Kalapet Panchil			LC
Sterna aurantia	River Tern	Nodia Panchil		UWV	LC
Sterna hirundo	Common Tern	Pati Panchil		UWV	LC
Streptopelia chinensis	Spotted Dove	Tila Ghughu		CR	LC
Streptopelia decaocta	Eurasian Collared Dove	Eurashio Konthighughu		CR	LC
Streptopelia tranquebarica	Red Turtle Dove	Lal Konthighughu		CR	LC
Sturnus contra	Pied Myna	Eshio Pakrashalik		CR	LC
Sturnus ginginianus	Bank Myna	Gaang Shalik		UR	LC
Sturnus malabaricus	Chestnut-tailed Starling	Khoiralej Telshalik		CR	LC
Tadorna ferruginea	Ruddy Shelduck	Khoira Chokachoki		CWV	LC
Terpsiphone paradisi	Asian Paradise-flycatcher	Eshio Shabulbuli		UR	LC
Treron phoenicopterus	Yellow-footed Green Pigeon	Holdepa Horial		CR	LC
Turdoides striatus	Jungle Babbler	Bon Satarey		CR	LC
Turdoides earlei	Striated Babbler	Dagi Satarey		UR	LC
Tyto alba	Barn Owl	Lokkhi Pecha (SA)		UR	LC
Upupa epops	Eurasian Hoopoe	Pati Hoodhood		UR	LC
Vanellus duvaucelii	River Lapwing	Nodi Titi	EN	UR	LC
Vanellus indicus	Red-wattled Lapwing	Hot Titi		UR	LC
Zoothera torquatus	Eurasian Stone Chat	Pati Shilafidda		CWV	LC
Zosterops palpebrosus	Oriental White-eye	Udoi Dholachokh		CR	LC

Source: Field survey, 2012

Table 4: Checklist of Mammals, Amphibians, and Reptiles with status found along the Polder alignment

Local Status code: CR – Common Resident, C – Common, UR – Uncommon Resident, RR – Rare Resident, V – Vagrant, WV – Winter Visitor; UWV – Uncommon Winter Visitor
IUCN Status code: CR – Critically Endangered, EN - Endangered, VU – Vulnerabal

Scientific Name	English Name	Local Name	IUCN Status (BD)	Local Status
Mammals				
Bandicota bengalensis	Lesser Bandicoot Rat	Indur	-	CR
Bandicota indica	Greater Bandicoot Rat	Dhari Indur	-	CR
Canis aureus	Asiatic Jackal	Pati Shial	VU	RR
Felis chaus	Jungle Cat	Ban Biral/Woab	EN	RR
Herpestes javanicus	Small Indian Mongoose	Beji	-	UR
Hipposideros galeritus	Cantor's Leaf-nosed Bat	Kantor Pata-nak Chamchika	NT	UR
Megaderma lyra	Indian False Vampire	Daini Chamchika	-	CR
Mus musculus	House Mouse	Nengti Indur	-	UR
Pipistrellus coromandra	Indian Pipistrelle	Chamchika	-	CR
Platanista gangetica	Ganges River Dolphin	Shishu/Shushuk/Houm	EN	UR
Prionailurus viverrinus	Fishing Cat	Mechho Bagh	EN	UR
Pteropus giganteus	Flying Fox	Badur		CR
Rattus rattus	Common House Rat	Ghorer Indur	-	CR
Rousettus leschenaulti	Fulvous Fruit Bat	Kola badur	LC	UR
Suncus murinus	Asian House Shrew	Chika	CR	CR
Viverricula indica	Small Indian Civet	Khatash	VU	RR
Amphibians				
Hoplobactrachus tigerinus	Indian Bull Frog	Sona bang	-	C
Microhyla ornata	Ornate Microhylid	Cheena Bang	VU	C
Hylarana tytleri	Leaping Frog	Pana Bang	-	U
Polypedates leucomystax	Asian Brown Tree Frog	Gecho Bang	-	CR
Polypedates maculatus	Indian Tree Frog	Gecho Bang	-	UR
Reptiles				
Pangshura tectum	Indian Roofed Turtle	Kori/Hali Kasim	-	C
Pangshura tentoria	Median Roofed Turtle	Kaitta	-	U
Aspideteres gangeticus	Ganges softshell Turtle	Khalua Kasim	EN	UR
Lissemys punctata	Spotted Flapshell Turtle	Patapori/ Shundi Kasim	VU	UR
Calotes versicolor	Common Garden Lizard	Roktochosha	-	CR
Gekko gecko	Tokay Gecko	Tokkhak/Kokkay	VU	CR
Hemidactylus brookii	Brooks House Gecko	Tiktiki	-	CR
Hemidactylus flaviviridis	Yellow-bellied House Gecko	Goda Tiktiki	-	CR
Hemidactylus frenatus	Common House Gecko	Tiktiki	-	CR
Mabuya carinata	Keeled Grass skink	Anzoni	-	C
Sphenomorphus	Spotted Litter skink	Anzoni	-	C

Scientific Name	**English Name**	**Local Name**	**IUCN Status (BD)**	**Local Status**
maculatus				
Varanus bengalensis	Bengal Monitor	Gui Shap	VU	CR
Varanus salvator	Water Monitor	Sona Gui	EN	RR
Typhlops jerdoni	Jerdon's Blind Snake	Sutanoli Shap	-	CR
Atretium schistosum	Olive Keelback	Matia Shap	-	CR
Amphiesma stolatum	Striped Keelback	Chilu Shap	-	CR
Enhydris enhydris	Common Smooth Water Snake	Painna Shap	-	CR
Lycodon aulicus	Common Wolf Snake	Gharginni Shap	-	CR
Ptyas mucosus	Indian Rat Snake	Daraj Shap	-	CR
Xenochropis piscator	Checkered Keelback	Dhora Shap	-	C
Bungarus caeruleus	Common Krait	Kal-keute Shap	EN	UR
Naja naja	Spectacled Cobra	Khoiya Gokhra Shap	EN	C
Naja kaouthia	Monocled Cobra	Gokhra Shap	VU	RR

Source: Field survey, 2012

Annex 4: Figures

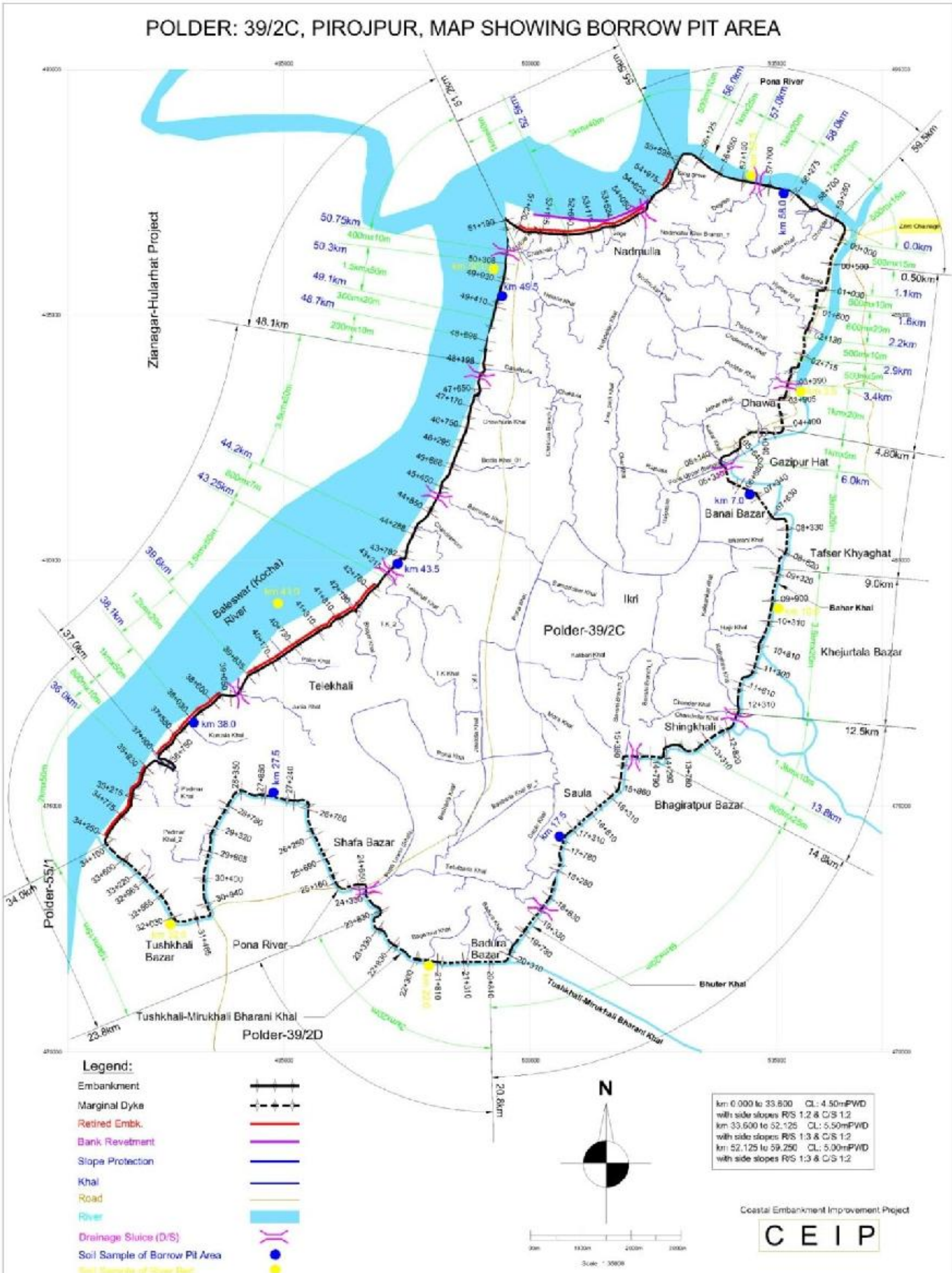

Figure 1: Showing the borrow pit area

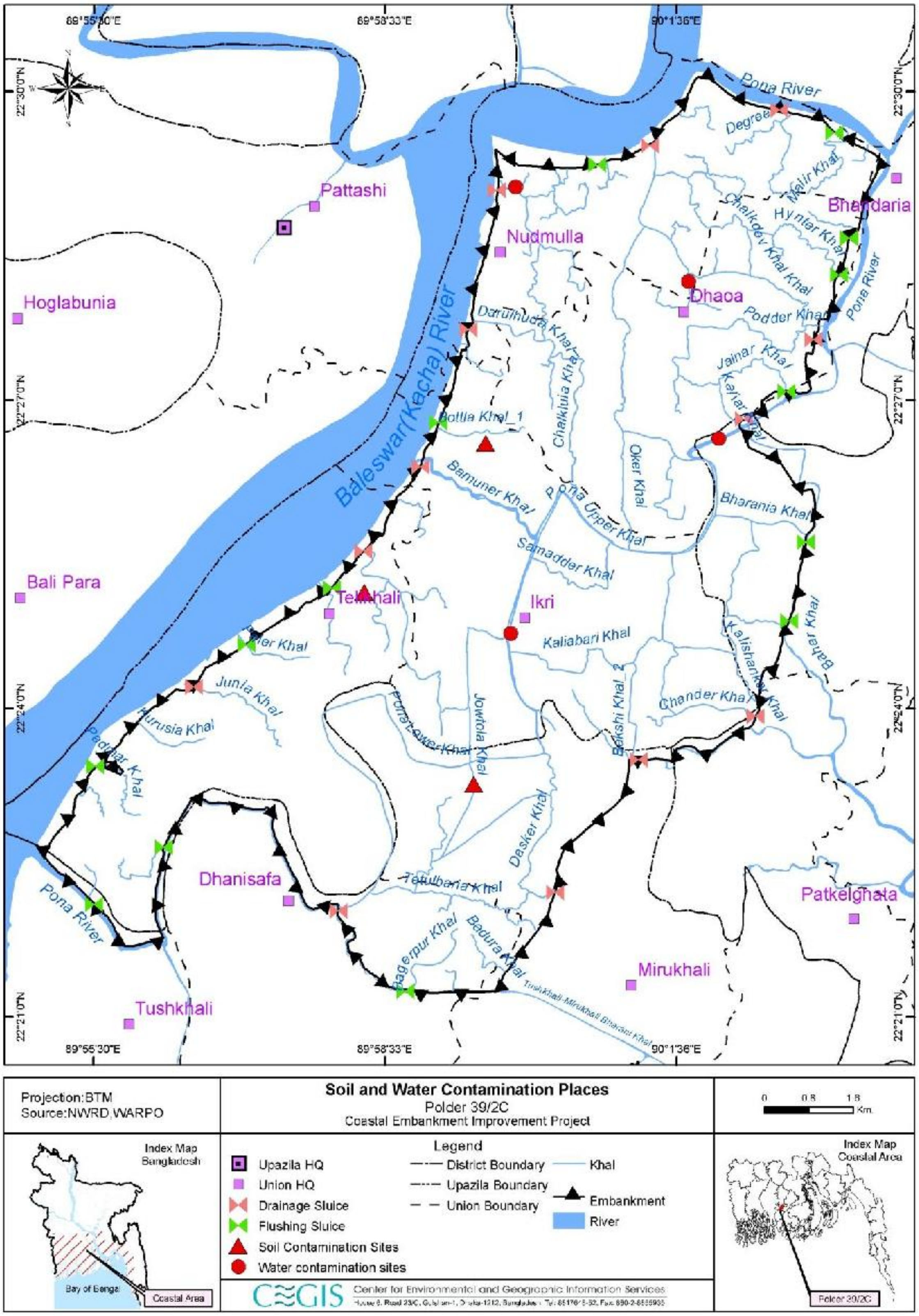

Figure 2: Soil and water contamination sites of polder 39/2C

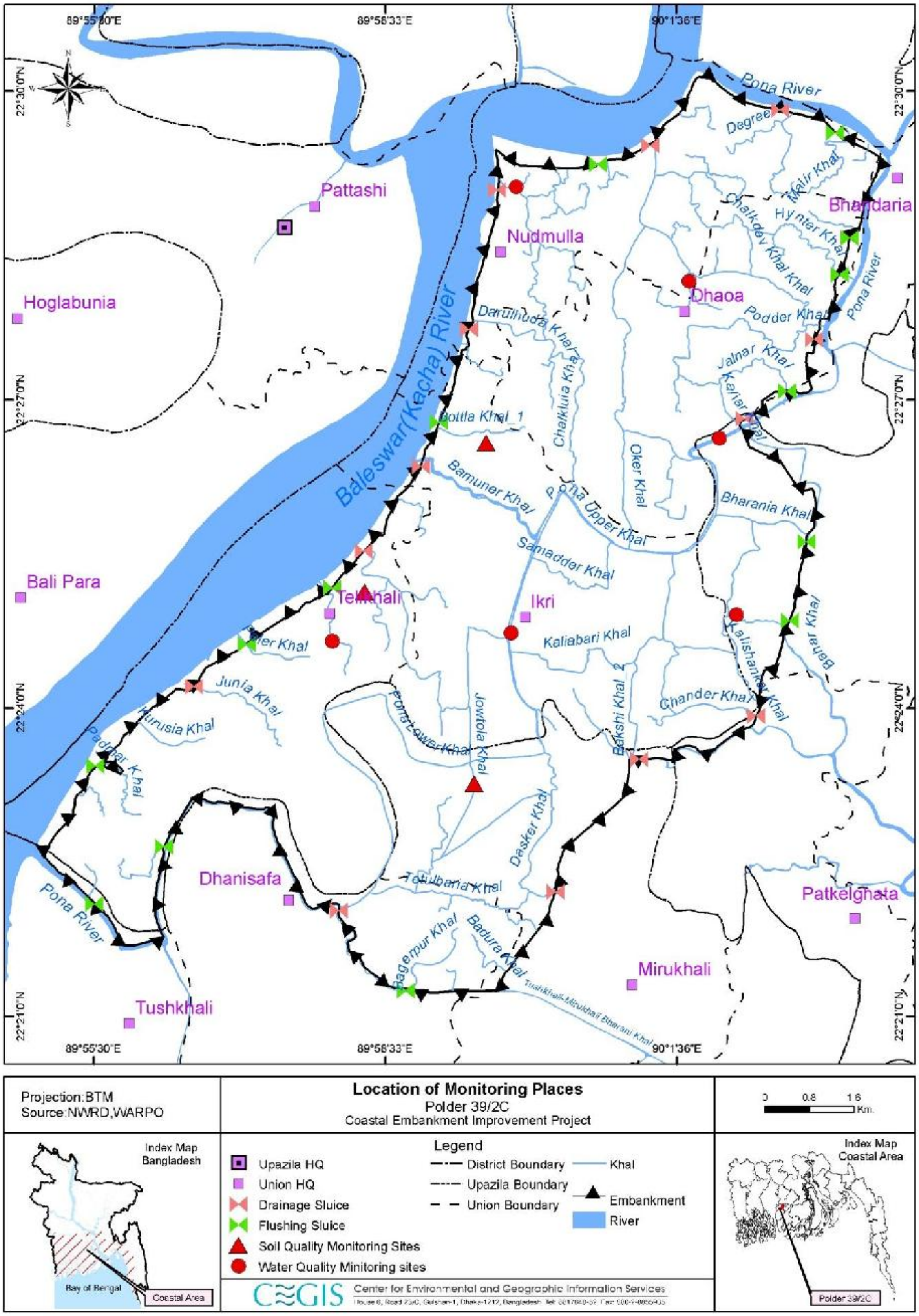
Location of Monitoring Places
Polder 39/2C
Coastal Embankment Improvement Project
Projection:BTM
Source:NWRD,WARPO
Legend
Upazila HQ
Union HQ
Drainage Sluice
Flushing Sluice
Soil Quality Monitoring Sites
Water Quality Minitoring sites
District Boundary
Upazila Boundary
Union Boundary
Khal
Embankment
River
Index Map Bangladesh
Bay of Bengal
Coastal Area
Index Map Coastal Area
Polder 39/2C
Center for Environmental and Geographic Information Services
Baleswar(Kacha) River
Pona River
Pattashi
Nudmulla
Hoglabunia
Bali Para
Dhaoa
Bhandaria
Ikri
Dhanisafa
Tushkhali
Mirukhali
Patkelghata
Degree
Malir Khal
Hynter Khal
Podder Khal
Jalnar Khal
Darulhuda Khal
Chalkkuia Khal
Oker Khal
Bamuner Khal
Pona Upper Khal
Samadder Khal
Bharania Khal
Kaliabari Khal
Junia Khal
Kurusia Khal
Jowtola Khal
Bakshi Khal 2
Chander Khal
Dasker Khal
Bagerpur Khal
Badura Khal
89°58'33"E
90°1'36"E
89°55'30"E
22°30'0"N
22°27'0"N
22°24'0"N
22°21'0"N

Figure 3: Monitoring sites of polder 39/2C

Annex 5: List of participants of PCM

Polder 39/2C

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থান: নদমূলা শিয়ালকাঠি ইউপি মিলনায়তন তারিখ: ২৭.০৫.২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১	সবিতা রানী	[illegible]	01743648481	[illegible]
২	[illegible] হোসেন	সদস্য, নদমূলা	01716150882	[illegible] 29.05.12
৩	মো: নুরুল আমিন	[illegible]	01735653773	[illegible] 29.05.12
৪	[illegible]	[illegible]	01728852191	[illegible]
৫	মো: [illegible]	[illegible]	01932064582	[illegible]
৬	মো: [illegible]	[illegible]	01716234369	[illegible]
৭	মো: [illegible]	[illegible]	[illegible]	[illegible]
৮	মো: [illegible] ইসলাম	ইউপি সদস্য নদমূলা ইউপি	01743-947490	[illegible] 29/05/12
৯	মো: [illegible]	[illegible]	01712188339	[illegible]
১০	[illegible]	[illegible]	01752091725	[illegible]
১১	মো: [illegible]	[illegible]	01716448819	[illegible] 29-05-12
১২	[illegible]	[illegible]	[illegible]	[illegible] 29/5/12
১৩	[illegible]	[illegible]	01770145776	[illegible]
১৪	মো: জলিল	[illegible]	[illegible]	জলিল
১৫	[illegible] মিয়া	৮ নং ওয়ার্ড [illegible]	[illegible]	[illegible]
১৬	[illegible]	[illegible]	[illegible]	[illegible]

Folder 39/20

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ নদমূলা শিয়ালকাঠী ইউ.পি. মিলনায়তন তারিখঃ ২৭.০৫.২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১৭	মজিবুল জলিল আকন্দ	কৃষক	০১৭২১৫৬৯২১৭	[illegible]
১৮	আবদুল মান্নান তাং	কৃষক	01727057727	আঃ মান্নান
১৯	মোঃ মতিউর রহমান	পেশা -	01719967346	[illegible]
২০	আঃ মান্নান মোল্লা	এ.ই.ডি.	01710068776	[illegible]
২১	মোসাঃ ইসমত আরা বেগম	ই.উ.পি.	01739177295	[illegible]
২২	তহমিনা বেগম	প্রাঃ শিঃ	01729549700	[illegible]
২৩	স্মৃতি রানী	প্রঃ শিঃ	01736165581	স্মৃতি
২৪	রিতা রানী	প্রাঃ শিঃ	01733833[illegible]76	রিতা রানী
২৫	মোসাঃ হাবিবা বেগম	প্রাঃ শিঃ	01738322285	
২৬	নিলীমা রানী বৈরাগী	প্রাঃ শিঃ	01748791790	নিলীমা
২৭	মাজমুন নাহার	S.J.K	01717938562	Nahar.
২৮	আলফানা	গৃহিনী	01735490877	আলফানা
২৯	কোহিনুর বেগম	ব্যবসা	01190473957	কোহিনুর
৩০	হেনা বেগম	গৃহিনী		হেনা
৩১	পারভীন নাহার	দঃ শিয়ালকাঠি (গৃহিনী)	01715888157	[illegible]
৩২	জুলেখা	গৃহিনী		জুলেখা

Polder 39/2

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থান: [illegible] ইউপি মিলনায়তন তারিখ: ২৭.০৫.২০১২

ক্রমিক নং	অংশগ্রহণকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৩৩	[illegible]	[illegible]	01713965357	[illegible]
৩৪	[illegible]	ব্যবসায়ী	—	[illegible]
৩৫	মো: রাকিব হোসেন		01725549608	রাকিব
৩৬	রোকেয়া বেগম	সদস্য ইউপি [illegible]	01716-207484	রোকেয়া
৩৭	[illegible]	[illegible]	—	[illegible]
৩৮	[illegible]	ব্যবসায়ী	—	[illegible]
৩৯	[illegible]	ইমাম	—	[illegible]
৪০	মো: আ: জলিল	ইউপি সচিব [illegible]	01761-888379	[illegible]
৪১	[illegible]	ইউপি (সদস্য)	01747645735	[illegible]
৪২	[illegible]	ইউপি সদস্য	[illegible]	[illegible]
৪৩	হাবিবা আক্তার	[illegible]	[illegible]	[illegible]
৪৪	মো: [illegible]	[illegible]	[illegible]	[illegible]
৪৫	মো: [illegible] ইসলাম	কৃষি	—	[illegible]
৪৬	মো: আ: রহিম	[illegible]	-	রহিম
৪৭	[illegible]	[illegible]	01818 770598	[illegible]
৪৮	ইয়াকুব আলী	ব্যবসায়ী	[illegible]	[illegible]

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা
নিরূপণ বিষয়ক মত বিনিময় সভা

স্থানঃ নদমূলা শিয়ালকাঠী ইউপি ভান্ডারিয়া 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	[illegible]
৫০	তারিক হোসেন মাতুব্বর	চেয়ারম্যান ইকড়ি ইউপি	01711-000684	[illegible]
৫১	[illegible]	চেয়ারম্যান [illegible]	01715821212	[illegible]
৫২	মো: আতিকুর রহমান	চেয়ারম্যান নদমূলা	01727932579	[illegible]
৫৩	মোসাম্মৎ শাহীনুর বেগম	ইউ পি সদস্য নদমূলা	01736427545	শাহীনুর বেগম
৫৪	মোঃ সরোয়ার হোসেন	এস.এ.ই, পানি উন্নয়ন বোর্ড	01762620529	[illegible] 27-05-012

Table: List of FGD participants

Table: Nodmullah, 6 no word, Nadmulla, Bhandaria, Pirojpur (FGD-3)

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-4)

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-5)

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-6)

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-7)

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-8)

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 Bazar, Telikhali UP, Bhandaria, Pirojpur (FGD-9)

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-10)

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-11)

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

Annex 6: ToR for Environmental Impact Assessment of Polder 39/2C

*Backg*round

Bangladesh Water Development Board (BWDB) requires to conduct Environmental Impact Assessment (EIA) study for Polder 35/3 under CEIP, as per the findings of IEE study as well as the guidelines of DOE and World Bank. The EIA reports will be submitted to DOE for obtaining environmental clearance. The EIA study should be conducted according to following scope of works.

Objective

The objective of the EIA study is assessment of environmental impacts and preparation of environmental management plan for implementing the sub-projects without harming the environment.

Scope of works

i) Carry out detail field investigation of required parameters of environmental and social baseline, especially on the critical

ii) Determine the potential impacts due to 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 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 be generated by the project. These would include, but not be limited to, changes in the coastal erosion and accretion due to alteration of tidal currents, changing fish migration routes, destruction of local habitats, and water logging, etc.

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

viii) Prepare (a) an estimate of economic costs of the 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; The damage/ cost and benefits should be estimated in monetary value where possible, otherwise describe in qualititative terms.

ix) Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives that would 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 be 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 and 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 pass should be provided to ensure free movement of fish or drainage facility should be provided to avoid water logging in the surrounding area.

xi) Prepare a detailed Environmental Management Plans along with the 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 in the plan an estimate of capital and operating costs 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

Structure of the EIA report

EIA report should be prepared as per following key contents, but not limited to:

1. Executive Summary
2. Introduction: *This section will include (i) purpose of the report and (ii) extent of the IEE study.*
3. Policy, Legal and Administrative Framework: *This section will describe relevant environmental policies, rules and administrative procedures that need to be followed for the proposed project.*
4. Methodology of EIA
5. Project Description: *This section will provide a brief but clear picture about (i) type of project; (ii) category of Project; (iii) need for project; (iv) location (use maps showing general location, specific location, and project site); (v) size or magnitude of operation;(vi) proposed schedule for implementation)*

6. Analysis of Alternatives: *This section will describe analysis of alternatives in terms of project location and technical designs and associated environmental impacts.*

7. Environmental and Social Baseline: *This section will provide sufficient information on the existing environmental and social baseline resources in the area affected by the project, including the following:*

   (i) Physical Resources: (e.g. atmosphere, topography, air quality etc.)

   (ii) Water Resources: (e.g. hydrology, surface water and groundwater system, sedimentation, tidal influence, etc.)

   (iii) Land and Agriculture resources: (e.g. land type, landuse, cropping pattern, crop production, etc.)

   (iv) Fisheries resources: (e.g. fisheries diversity, fish production, etc.)

   (v) Ecology: (e.g. ecosystems, wildlife, forests, rare or endangered species, protected areas, coastal resources, etc.)

   (vi) Socio-economic condition: (e.g. population and communities (e.g. numbers, locations, composition, employment), health facilities, education facilities, socio-economic conditions (e.g. community structure, family structure, social well being), physical or cultural heritage, current use of lands and resources for traditional purposes by Indigenous Peoples, structures or sites that are of historical, archaeological, paleontological, or architectural significance, economic development (e.g. industries, infrastructure facilities, transportation, power sources and transmission, mineral development, and tourism facilities, etc.)).

8. Climate Change: *Climate change aspects in global, regional and local perspectives and the likely impacts on the Project area and its surroundings should briefly discus in this section.*

9. Stakeholder Consultation and Disclosure: *This section will describe the process undertaken to involve the public in project design and recommended measures for continuing public participation; summarize major comments received from beneficiaries.*

10. Significant Environmental and Social Impacts: *Significant environmental and social impacts due to project location, and related to project design, construction, and operations phase should discus detail in this section.*

11. Cumulative and Induced Impacts: *Cumulative impacts of the proposed Project and other projects as well as induced impacts should provide in this section.*

12. Environmental Management Plan: *The environmental management plan (EMP) will include institutional arrangement for EM, mitigation and enhancement plan, compensation and contingency plan as well as monitoring plan. The EMP should also include tentative cost of implementation of the plan.*

13. List of References

14. Annexes:

    Checklist for Environmental and Social Survey
    Records of Consultations (list of participants and photographs)
    Data and Unpublished Reference Documents

Annex 7: Photo Album

Figure1: Proposed closure at Hetalia khal

Figure2: Proposed closure at khal

Figure 3: Local people closing the upper Pona khal at Rajpasha

Figure 4: Horinpala 2 vent Drainage Sluice on Padma khal

Figure 5: Proposed closer on Lower Pona khal

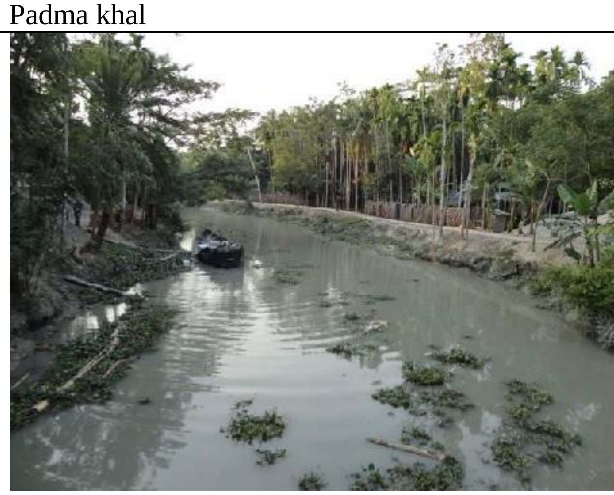

Figure 6: Proposed closure at Bamner khal


Figure 7: Proposed closure at Nadmulla khal


Figure 8: Proposed closure at Juniar Khal


Figure 9: Baleswar River bank erosion at Charkhali


Figure 10: Existing embankment inside the Polder


Figure 11: Water salinity test inside the Polder


Figure 12: Water salinity test inside the polder


Figure 13: Kutcha road inside the polder


Figure 14: Herringbone road near Charkhali launchghat


Figure 15: Pucca road inside the Polder area


Figure 16: Pucca road in the Polder area


Figure 17: Traditional Communication System


Figure 18:Wodden+Steel made bridge

 Figure 19: Charkhali ferry ghat	 Figure 20: Bhandaria launch ghat
 Figure 21: Navigation in Baleswar river	 Figure 22: Navigation at Pona river
 Figure 23: Internal navigation at Junior Khal	 Figure 24: Internal navigation at Pona River

Figure 25: Fishing by Lining (Borshi)

Figure 26: Fishing by chargora jal

Figure 27: Guchi machh

Figure 28: Bhetki machh

Figure 29: 50 Bed Upazila Health Complex

Figure 30: Dhawa Union Health Complex


Figure 31:Purbo Posheare Bonia primary School


Figure 32: Talekhali High School

Figure 33: Seailkati High School

Figure 34: B P M Dakhil Madrasha


Figure 35: Ikri Jam-e -Mosque


Figure 36: Dhawa Jam-e- Mosque

Figure 37: Source of Drinking Water

Figure 38: Source of Drinking Water

Figure 39: Pucca house in the Polder

Figure 40: Kuccha house in the Polder

Figure 41: Kutcha house in the Polder

Figure 42: Jhupri house in the Polder

Figure 43: Puuca toilet in the polder area

Figure 44: Ringslub toilet in the polder area

Figure 45: Kutcha toilet in the polder area

Figure 46: Kutcha toilet in the polder area

Figure 47: Nodmullah Cyclone Shelter cum Primary School

Figure 48: Nolbunia Cyclone Shelter cum Primary School


Figure 49: FDG at Nodmullah Union


Figure 50: FGD at Poshchim Pasuribunia


Figure 51: FGD at Rajpasha (Pona Upper)


Figure 52: FGD at Gulbunia (Pona Lower)


Figure 53: FGD at Chorkhali


Figure 54: Chorkhali launch ghat


Figure 55: FGD at Darulhuda


Figure 56: FGD at Talikhali Bazar


Figure 57: PCM at Nadmulla UP


Figure 58: PCM at Nadmulla UP


Figure 59: Discussion with local people


Figure 60: Discussion with local people


Figure 61: Discussion with local people


Figure 62: Discussion with local people


Figure 63: Discussion with local people


Figure 64: Discussion with local people


Figure 65: Discussion with local people


Figure 66: Discussion with local people