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

BANGLADESH WATER DEVELOPMENT BOARD

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

DETAILED DESIGN OF FIVE POLDERS

Volume III: Environmental Impact Assessment

Part B: Polder No 33

Joint Venture of

CONSULTING ENGINEERING SERVICES (INDIA) PVT. LTD., INDIA
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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF WATER RESOURCES

BANGLADESH WATER DEVELOPMENT BOARD (BWDB)

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VOLUME III: ENVIRONMENTAL IMPACT ASSESSMENT

PART- B: POLDER NO. 33

Reviewed and Revised by

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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
GO	Government Organization
GTPE	Ganges Tidal Plain East
GTPW	Ganges Tidal Plain West
ha	hactare
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 Feasibility 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

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.
Baor	Baor dead arm of a river in the Moribund Delta as in the case of the Ganges; also called oxbow lake. It appears as a saucer shaped depression. The term baor is synonymous to beel, familiar in the southwestern part of Bangladesh.
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.
Charland	The chars, otherwise know as charlands, are riverine lands located in the active river basins of the main rivers of Bangladesh. They are located on the banks of the river and islands in the mid-steam of the main channel that are created by the continual shifting of these rivers and emerge from the deposition of sand and silt from upstream
Faria	Local trader/agent/intermediary.
Golda	Prawn *(Macrobrachium rosenbergii*), non-saline/fresh water species
Gher	Farmlands 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.
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

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 33, which is one of these five polders.

Background

The coastal zone in southern Bangladesh adjoining the Bay of Bengal is characterized by a delicately balanced natural morphology of an evolving flat delta subject to very high tides and frequent cyclones from the Bay of Bengal encountering very large sediment inflows from upstream. The coastal zone, in its natural state, used to face inundation by high tides, salinity intrusion, cyclonic storms and associated tidal surges. In 1960s, polderization was started in the coastal zone of the country to convert this area into permanent agricultural lands. The polders in this area are enclosed on all their 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 were designed to keep the land safe from regular tides and allow agriculture activities. These polders are equipped with in- and outlet sluice gates to control the water inside the embanked area.

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

The above reasons led the Government to re-focus its strategy on the coastal area from one that only protects against high tides to one that would provide 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.

Location and Synopsis of Rehabilitation Work

The location of polder 33 is in Dacope Upazila under Khulna District of southern Bangladesh The Polder covers a gross area of 8,600 hectare (ha) of which net cultivable area is 7,600 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 to be carried out in Polder 33 under CEIP-I are : re-sectioning of embankment (48km); construction of retired embankment

(1.50km); construction of 13 drainage sluices (replacement); construction of 12 flushing inlets; repairing of 5 flushing inlets; two flushing inlets to be demolished; re-excavation of drainage channels (63.21 km); bank protection works (1.45 km); slope protection of embankment (6.00 km) and afforestation (72 ha). Other components of the CEIP-I will include implementation of social action plan and environmental management plan; supervision, monitoring and evaluation of Project impacts; project management, technical assistance, trainings, and technical studies; and contingent emergency response.

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

Regulatory and Policy Framework

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

Under the Environmental Conservation Rules (1997) a classification system has been established for development projects and industries on the basis of the project objective. These categories include Green, Orange A, Orange B, and Red. The construction, reconstruction, expansion of polders and flood control embankment is categorized as Red in accordance with the DoE's classification. For 'Red' category projects, it is mandatory to carry out an Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and develop a Resettlement Action Plan as and where necessary for getting environmental clearance from DoE. According to the World Bank safeguard policies, the project has been classified as Category A, in view of high risk associated with widely involved major civil works in the project and also considering the high ecological sensitivity and vulnerability of the coastal area.

Analysis of Project Alternatives

Several alternatives were considered during the design phase of the project. These included 'no-project' alternative and technical alternatives.

The present situation of the polder is extremely vulnerable to cyclones, storm surges, wave action, and climate change effects, and the Polder is not in a state to provide required services particularly protection against tidal inundation, efficient drainage, and minimizing the impact of cyclonic surges. About 30 to 40 percent of the Polder area is vulnerable to salinity intrusion and water logging. Due to high salinity and scarcity of ground water during the periods of low rainfall, the area under irrigation is limited to merely about 2 to 3 percent of the total Polder area. The silted up water channels are resulting in limited navigation in their waterways, declining fisheries, and increasing environmental pollution. The proposed interventions under CEIP-I have been designed to address the above mentioned problems of the Polder. If proposed interventions are notimplemented, the present poor state of the Polder will continue and may further deteriorate; therefore the 'no-project' alternative is not a recommended option.

Several technical alternatives were considered to address each of the problems being faced in the Polder. These included alternatives for embankment strengthening, river bank protection works, protection of embankment slopes, replacement of drainage sluices, rehabilitation of flushing sluices, addressing water logging and drainage congestion.

Baseline Condition

The Polder 33 is located in the southwest region of Bangladesh near Sundarban. Topographically, this area is flat and developed by sedimentation process by the three mighty rivers of the country. The polder area is crisscrossed by a large number of creeks. The total area is basically flat with the central part a bit higher than the surrounding land. Administratively, the Polder 33 covers part Dacope upazila under Khulna district. The Polder area falls in five unions namely Laudubi, Dacope, Banishanta, Bajua and Kailasganj under Dacop upazila of Khulna District.

As a part of land resources appraisal of Bangladesh for agricultural development, the country has been subdivided into 30 agro-ecological regions and 88 sub-regions. The key parameters on the basis of which this classification has been carried out include physiography, soil properties, soil salinity, and depth and duration of flooding. These parameters are relevant for land use and the assessment of present and future agricultural potential. The Polder 33 lies in agro-ecological zone of the Ganges Tidal Floodplain. The elevation of the settlement and agriculture land is in between 1.50 m to 2.15m and 0.90 m to 1.05 m respectively.

The soil texture varies from clay to clay loam in the Polder 33. Non-calcareous grey floodplain soil is the major soil type in the Polder. Acid sulfate soils also occupy 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.

Total cropped area is about 8,600 of which 5,710 ha is covered with rice. The cropping intensity is about 135%. The rice cropped area is about 82.7% of the total cropped area and the rest 17.3% is occupied by non-rice crops. Among the rice, T Aman (HYV), T Aman (Local), T Aus(HYV), T Aus (Local) , B. Aus, and Boro (HYV) are being grown on 3,570 ha, 550 ha, 620 ha, 240 ha, 420 ha, and 310 ha respectively. Non-rice crops include Sugarcane, Orchard, Potato, Water melon , Spices, Chilli, S. Vegetables, W. Vegetables, Pulses and Oilseeds grown on 8, 15, 228, 200, 67, 35, 240, 150, 200, and 45 ha respectively.

Sedimentation is a common problem in the project area. The rate of sedimentation in the Chunkuri-Passur stream is more during dry season due to shortage of upstream pressure of river flow. On an average, roughly 1.5 to 2 feet sedimentation takes place in most of the main channels in the study area each year. Presently, approximately 2580 ha polder area is facing water logging problems during post monsoon season due to drainage congestion of the internal khals.

Climate of the project area is typical monsoon considering three seasons: Summer (pre-monsoon) – March to May; Rainy season (monsoon) – June to October; and winter season – November to February. Historical trend analysis shows that the average climatic parameters of temperature, humidity, rainfall for polder 33 is increasing by approximately 0.001 °C, 0.073 and 12.30 mm percent each year respectively.

Air pollution is not of much significance in the coastal area of Bangladesh. From field visits, it was observed that overall air quality in the study area is good. The measured air quality parameters (SPM, SOx, NOx) are within the range of standard values for Bangladesh.

The capture fish habitats occupy 533 ha (44% of total habitat). Among the culture habitats, Golda gher comprises over 47% followed by Bagda and fish pond. Moreover, there are some commercial fish farms in the polder area which are producing Bagda PL as well as producing Bagda under semi-intensive culture practice. Estimated total fish production of the study area is 584 ton. Culture fisheries produce bulk of the total production which accounts for 70% of total fish production (407).

The name of Bio-ecological Zones of polder 33 is Saline Tidal Floodplain where three ecosystems exist consisting of Terrestrial ecosystem, Aquatic ecosystem and the Mangrove ecosystem. A total of

59 terrestrial fauna species were observed within the project area. Of these, 42 species were birds and 7 species were mammals, 7 reptiles and 3 amphibians. A total of 23 aquatic fauna species were observed in the project area. Of these, 18 species were totally dependent on wetland (beels, river, ponds), and 5 species were partially dependent on wetland. The polder area shows scattered mangrove vegetation at foreshore, internal canal banks or even at the homesteads near wetlands. Species composition vegetation is Kewra *(Sonneratia apetalla)*, Gewa *(Excoecharia agallocha)*, Bain *(Avecenia alba)* and Hargoza *(Acanthus illicifolious)*.

The population in the Polder 33 is 50,883. This includes 25,350 males and 25,533 females. A total of11,896 households exist in the polder with average size of 4.28 persons per household. The density of population is about 1051 persons per square kilometer. Around 67 percent households report agriculture as their main occupation. About 26 percent population is engaged in service sector and only 7 percent is engaged in industrial sector. overall housing condition is not satisfactory. On an average, only three percent houses are pucka (made of bricks and mortar) whereas 88 percent are kutcha (made of wood/bamboo, and other local materials). Most of the people can collect drinking water from other sources such as ponds, PSF, rain water etc. salinity is the main problems in the polder area. It shows that about 60 percent households have hygienic sanitation facility (water-sealed), 23 percent have not water-sealed sanitation facility, 08 percent have non-sanitary sanitation facility and 09 percent have no sanitation facility.

Consultation and Disclosure

During the study period, public consultation meetings were organized with the participation of local people, representatives of local government and BWDB and other stakeholders. Local people showed interest in the rehabilitation of the project for their existence. They had no objection from their side to implement the project, rather were found ready to help the implementing agency spontaneously. Five Public consultation and two Public disclosure and eight focus group discussion meeting were held to collect stakeholder perception on the proposed interventions considering EMP measures. Regional and National Public Disclosure Meeting under the CEIP project has been held on 13 January and 28 February 2013 with impact and EMP findings. Representatives Department of Environment, other Government Institutions, local and national Non Government Organizations were presented in the national level workshop. The EIA is then updated incorporating findings of National level workshop.

Potential Impacts and Mitigation

The major environmental factors to be impacted of the polder are classified as High, Moderate and Low. The high impacted environmental factors are: 20 ha of land would be acquired resulting in displacement of about 1,302 households. In addition, *Gher* field (in between km 14.2 to km 17.5) will also be affected as a result of land acquisition. About 14 ha of single cropped land out of 20 ha is likely to be affected as a result of embankment retirement from Chainage km 3.2 to km 3.7 , from Chainage km 14.2 to km 17.5. Erosion of river and *khal* banks may increase the risk of damage to nearby settlements and infrastructure. The vulnerable erosion prone area are at Ch 0.00 to Ch 0.2, Ch 1.25 to Ch 1.75, and Ch20.25 to Ch 21.00km. According to initial estimate, about 310 ha of land are under *boro* (rice) cultivation. According to the initial estimates, about 1.50 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 670 ha. Specifically, Boro cultivation will be expanded in the medium high land and medium low land areas. Irrigation is vitally important for the agricultural activities in the Pachim Bajua, Porikata, Chandpara and Purbo Bajua 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.

About 13 existing drainage sluices will be replaced by new ones as part of the Project. All of these sluices are connected with the internal *khals* of the Polder. The fish species including Paisa, Betki, Horina Chingri, Khorsula, and Chatka Chingri are reported to move between the internal *khals* and *beel* during breeding season. The perennial khals namely Bajua khal, Taltola khal, Khutakhali khal, Laudubi khal, Khajuria khal, Banishanta khal, Amtola khal, Chaura khla, Basoa khal, etc are functioning as breeding, nursing and feeding grounds in the polder area. During the construction activities, the fish migration between the outside rivers and internal *khals* is likely to be affected. Similarly, fish migration within the Polder between *khals* and *low lying areas* can also be affected by the construction activities particularly the *khal* re-excavation.

The potential impacts during the construction phase include air pollution, noise pollution, degradation of landscape, soil erosion, water contamination, increased siltation in water bodies, loss of agriculture, damage to fish and other aquatic fauna, traffic congestion, and safety hazards. The key construction activities that are likely to cause these environmental and social impacts include construction camp establishment and operation, equipment and material transportation, material borrowing, excavation, embankment raising, dismantling, repair and construction of regulators, re-excavation of water channels, and waste disposal. The construction activities particularly near banks of rivers and other water bodies can potentially cause soil erosion. Similarly, material borrowing can also potentially cause soil erosion. Soil erosion can increase the sediment load and turbidity in the water bodies thus decreasing the amount of sunlight penetrating in the water. Erosion of river and *khal* banks may increase the risk of damage to nearby settlements and infrastructure. The vulnerable erosion prone area are at Ch 0.00 to Ch 0.2, Ch 1.25 to Ch 1.75, and Ch 20.25 to Ch 21.00km may increase the risk of damage to nearby settlements and infrastructure.

Borrowing material from the river banks may potentially cause increased sediments in the rivers. Similarly, excavation of water channels 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.

Construction activities including re-excavation of 11 *khals*, dredging of Passur and Bhadra rivers and discharge of solid wastes and waste effluents can potentially impact the benthic communities of the water bodies. It is estimated that more than 127 trees of different species and varying sizes exist along the embankments of the Polder 33. During the construction works, a large proportion of these trees will need to be felled 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 potential impacts during operation phase include soil and water contamination associated with increased usage of fertilizers and hindrance in fish migration. Rain cuts and public cuts are the major causes of embankment breaching of the Polder 33. Lack of regular maintenance has creates 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. Mal-operation and leakage of regulators will result in salinity intrusion during the low flow season, causing severe damage to the soil, water resources, and crops in the Polder. Construction of new water control structures on water channels which are currently directly connected with the outer rivers will potentially result in reduction in fish migration.

Sundarbans exist in the south part of polder 33. In the south from Chainage 1250 to Chainage 20500, Dangamari river is in between Sundarbans and Polder 33. The main impact of the polder on the Sundarban ecosystem situated across the river is the intrusion of more water on the forest floor of Sundarban. This may enhance the height of the tidal inundation of the forest. This enhanced tidal inundation, may imbalance the natural tide inundation features of the given ecosystem. It is commonly observed that in areas that have higher tide inundations, the species composition is different than that is found in the areas that have lower tide inundations. It has been observed that the species such as Sundri (*Heritiera fomes*), Passur (*Xylocarpus moluccensis*), Kakra (*Bruguiera gymnorhiza*), etc. prefer lower tide inundation. As against this, species such as Jhana (*Rhizophora mucronata*), Goran (*Ceriops decandra*), etc. prefers higher inundation. Thus with the enhanced inundation the species composition may gradually change. Secondary information obtained from interviewing local forestry officer reveals that the proportion of Goran on the patch of forest north of “Dabrir Bhorani” across the Shoronkhola Range has increased tremendously and population of crabs have reduced significantly.

Again if the quantity of water entering the Sundarbans increases, consequently the speed at which the water enters the forest floor also increases, which in turn may cause two things, namely

- brings in more of coarser soil particles on the forest floor as it enters and majority of these get deposited on the river banks or nearby
- drains off more of the heavier detritus from the forest floor as it recede s, which otherwise would have got retained by the given ecosystem.This may ultimately cause the loss of soil fertility.

It is however very difficult to isolate what part or what quantum of these above said impacts are because of the polders alone. It needs to be mentioned herein that the quantum of these impacts will be lower if the width of the river between the Sundarban & Polder is more. In future, the Dhangar khal may be silted up and the area of Polder 33 may be merged with the Sundarbans.

To address the involuntary resettlement issues arising from acquisition of 20 ha of land and loss of other private and or community structures, a resettlement action plan (RAP) has been prepared. The RAP defines the entitlement criteria and estimates the total compensation to be paid to the affected people. To address the impacts associated with material and equipment transportation and traffic congestion, the contractor will prepare and implement a traffic management plan, which will ensure that sensitive receptors such as schools and busy markets and bazaars are avoided during the peak hours. To address the air and water pollution, contractor will prepare and implement a pollution control plan. Similarly, to address the safety and public health concerns, the contractor will prepare and implement an occupational health and safety plan.

On the positive aspect, the construction work will generate a significant opportunity of employment over its construction period to local people and other associated professionals. People will also be involved to carry out operation and maintenance related jobs to operate the hydraulic structures. It is expected that the agriculture production will be increased; water logging will be decreased due to the project which will create jobs indirectly from agriculture, business and commercial services.

Environmental Management Plan

The environmental management plan (EMP) provides the implementation mechanism for the mitigation measures identified during the present EIA. A comprehensive EMP which focuses on managing construction phase-related impacts should suffice in managing the potential construction and operation phase impacts. The EMP will be attached with the Bidding Document. The environmental management parameter will be included in the BoQ. Since most of the contractors do not have clear understanding on the need of environmental management, some tend to quote very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, Fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The total cost of EMP implementation for Polder 33 has been estimated as BDT 29.8 million (without Training and Field trip costing).The contractor needs to submit an Environmental Action Plan (EAP) based on the EIA and EMF in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

Extensive monitoring of the environmental concerns of the Polder 33 will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans will be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive **database of the polder specific Environmental Impact and Monitoring information** will be created, which will help to evaluate the impacts easily.

Furthermore, EMP identifies capacity building needs with respect to environmental management of the Project, in addition to defining reporting and record keeping protocol.

Impacts on Near by Area

Polder 30, 31, 34/2 are located on the north direction of Polder 33. Polder 34/2 also covers the eastern part of the polder. Polder 32 is located in the western periphery of the polder. Among these polders, Polder 32 is under CEIP-I whereas Polder 34/2 has been planned but not yet implemented.

The other polders located adjacent to Polder 33 under CEIP, i.e. Polder 23, 34/3 are not considered for detailed design in the first phase of the project. The locations of these polders are located far from Polder 33, and the effects that would be generated by these polders into Polder 33 due to implementation of CEIP are unforeseeable.

The other polders under CEIP-I (Polder 35/1, 35/3 and 39/2C) are located far from Polder 33 and generate very negligible cumulative impacts (if any). Therefore, from the context of Polder 33, discussions on such negligible cumulative impacts (if any) are avoided.

Polder 31, 32, 34/2 are adjacent to Polder 33 and located along the Passur river. The crest level of Polder 33 should be raised up to 4.5 m. If Polder 33 is raised as per the proposed design, the adjacent polders (31, 32, and 34/2) might be overtopped in the extreme cyclonic events or tidal flooding. Tidal water would not be able to enter polder 33 during monsoon, as a result water will be diverted towards the nearby polders.

Institutional Responsibility and Report Requirement

The **contractor** is responsible for implementation of EMP during construction works and Project Supervision Consultant 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, and external monitoring and evaluation. DoE will be consulted if any complicated issues arise during construction and operation stages. BWDB will apply for annual site clearance from DoE. WMOs will be trained up to ensure environmental management during project operation. Environmental Management Unit of BWDB, strengthened through this project, will ensure and oversee the environmental management during project operation.

BWDB will prepare the **Half Yearly Progress Report** on environmental management and will share with World Bank for review. Contributing development partners (if any) may join the field visit to understand the environmental compliance of the project. In addition, the effectiveness of screening, monitoring and implementation of EMP will be carried out by the third party monitoring firm along with the project component activity monitoring annually. The **Annual Environmental Audit Report** prepared by the third party monitoring firm will be shared with the safeguards secretariat.

The Environment, Social and Communication Unit (ESC) to be established to implement and manage the EMP will be structured to provide co-ordination, technical support and services during the environmental screening and preparation of EA, and implementation of the environmental mitigation measures. At least one of the two environmental specialists must be on board before effectiveness of the project. The specialists will prepare subproject specific environment screening/assessment report with EMP, supervise the implementation of EMP and support capacity building of the field level staff of BWDB and contractor. ESC will ensure quality of the environmental screening/assessment with EMP.

1. Introduction

1.1 Background

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 the Polder 33, which is one of these five polders. The remaining four EIA reports are presented under separate reports.

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 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 the daily tide to allow for agriculture activities. Without embankments the coastal communities would be exposed to diurnal tidal fluctuations. These polders are equipped with in- and outlet sluice gates to control the water inside the embanked area.

1.2 Need of the Project

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 of the embankment due to cyclones, siltation of peripheral rivers surrounding the embankment caused the coastal polders to suffer from water logging**,** which lead 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. As a result, in some areas soil fertility and good agriculture production are declining because of water logging and salinity increase inside the polders.

The above reasons have led the Government to re-focus its strategy on the coastal area from one that only protects against high tides to one that would provide 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.

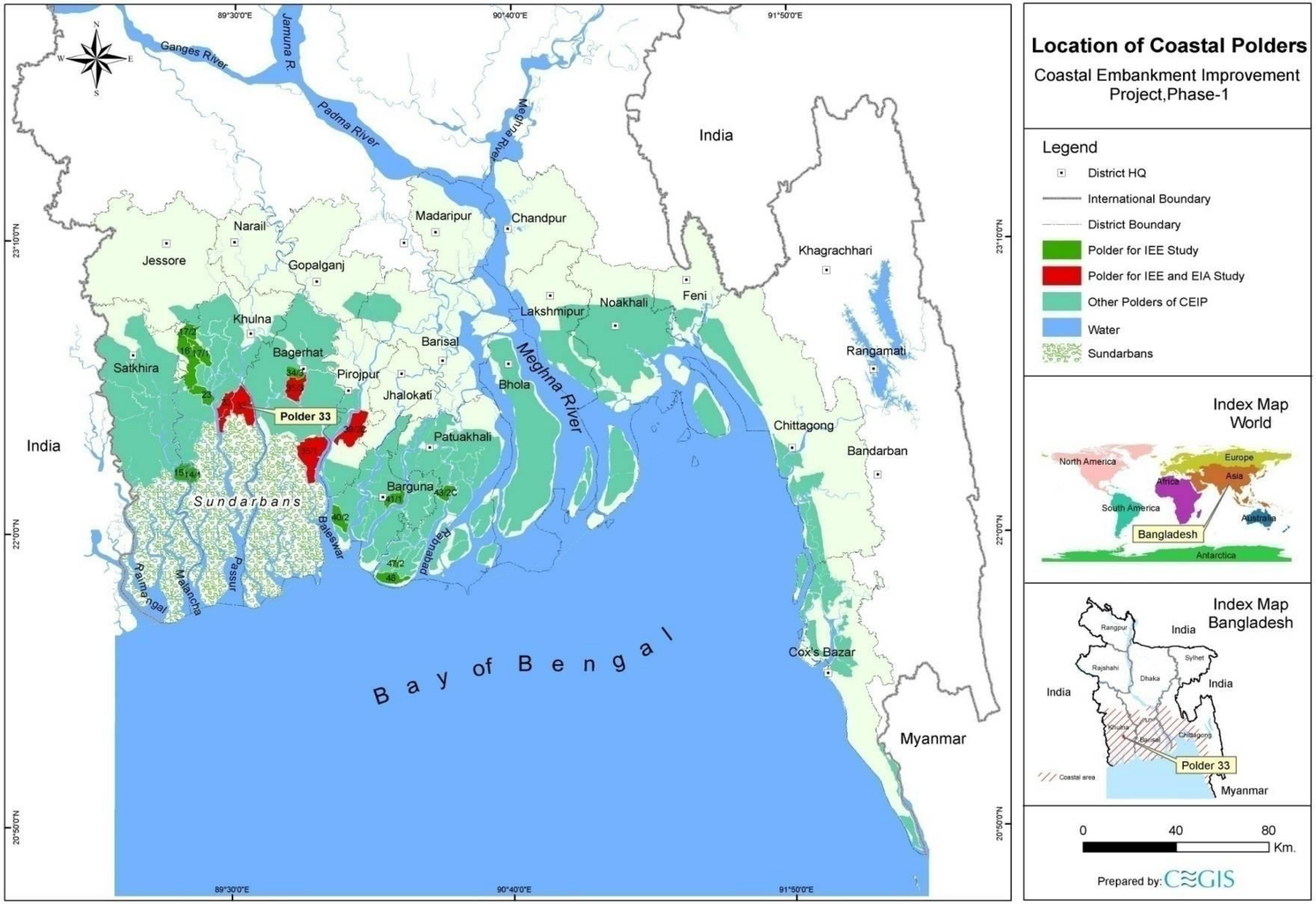

Figure 1.1: Coastal Polders

1.3 Polder 33 Location and Synopsis of Rehabilitation Work

The location of polder 33 is in Dacope Upazila under Khulna District of southern Bangladesh (see **Figure 1.2**). The Polder covers a gross area of 8,600 hectare (ha) of which net cultivable area is 7,600 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 (Table 1.1) will be carried out in Polder 33 under CEIP-I:

Table 1.1: List of proposed interventions under the re-habilitation works of Polder 33

	Components	Quantity
1	Re-sectioning of embankment	48.00km
2	Construction of retired embankment (*Proposed crest level 4.50*)	1.50km
3	Construction of drainage sluices (replacement)	13 nos.
4	Construction of flushing inlets	12
5	Repairing of flushing inlets	5
6	Flushing inlets to be demolished	2
7	Re-excavation of drainage channels	63.21 km
8	Bank protection works	1.45 km
9	Slope protection of embankment	6.00 km
10	Afforestation	22.7 hac.

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

The name of implementing agency for this project is the Bangladesh Water Development Board (BWDB).

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

1.4 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.

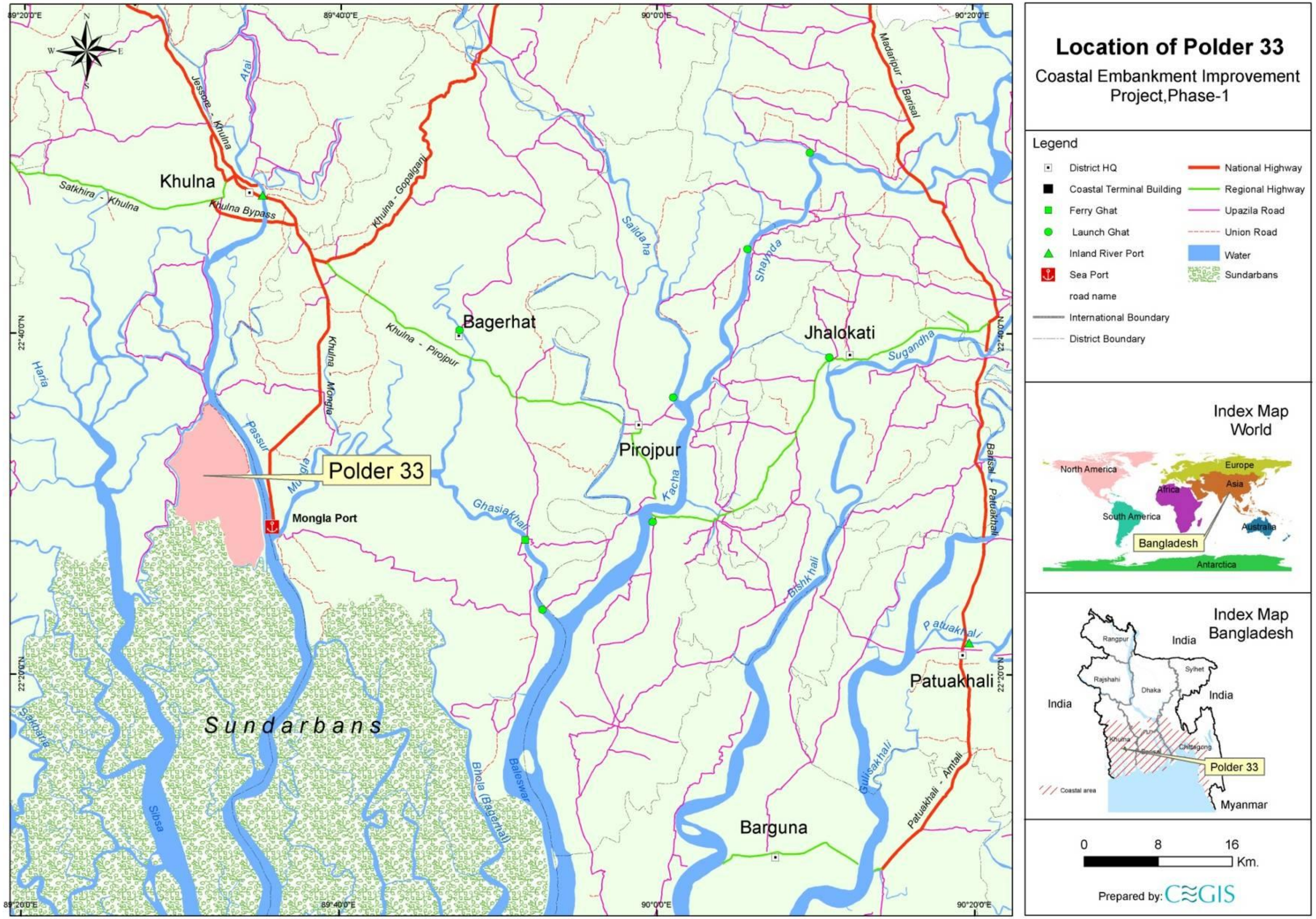

Figure 1.2: Location of Polders 33

1.5 Objectives of the Study

The overall objective of the EIA study of Polder 33 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).

1.6 Structure of the Report

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

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

Chapter 3 (***Policy, Legal and Administrative Framework***) reviews the national legislative, regulatory and policy framework relevant to the EIA study. Also given in the Chapter is a discussion on the WB safeguard policies and their applicability for the Project.

Chapter 4 (***Description of Proposed Interventions***) provides the 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 framework for consultations to be carried out during construction phase. Also included in the chapter are the disclosure requirements for the EIA.

Chapter 9 (***Assessment of Environmental and Social Impacts***) assesses the potential impacts of 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 surrounding areas of upstream and downstream considering spatial and temporal induced impact.

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, enhancement plan, 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. Data sources, methodology of data collection, processing and impact assessment are also described here.

2.1 Overall Approach

The EIA study for the rehabilitation of Polder 33 has been carried out following the DoE guidelines, the Environmental Management Framework (EMF) for CEIP-I, and the WB guidelines. The overall approach of the study is shown in **Figure 2.1** below.

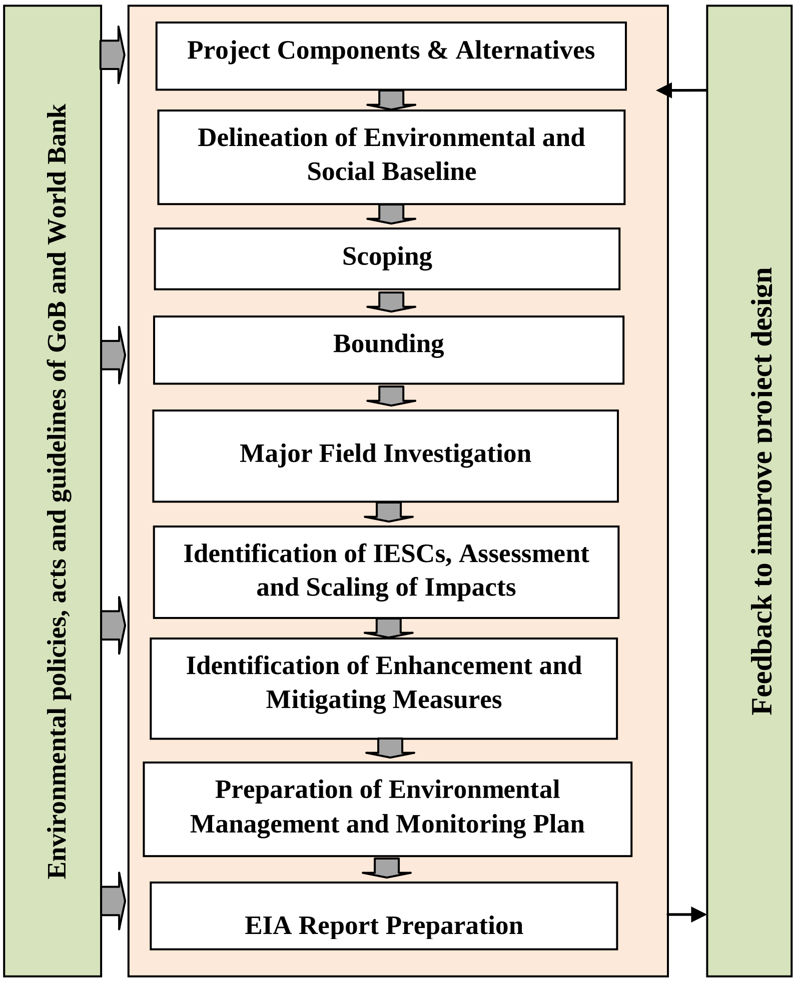

Figure 2.1: Overall approach of the EIA study

2.2 Methodology

The step-wise detail 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, 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 is 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 its functional objectives. Subsequently, 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 formulated 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 area.

Source and methodology of both primary and secondary 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 the secondary sources, 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 in 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 into the Project area and primary data on water resources components were collected. A checklist (**Annex A**) 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 that 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 were collected from Upazila[1] Land and Soil Resources Utilization Guide of Soils Resources Development Institute (SRDI). The secondary data of these parameters were 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.

Livestock Resources

Data on the present status of livestock (cow/bullock, buffalo, goat and sheep) and poultry (duck and chicken) in the polder area were 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

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

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 those were 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 were also reviewed;
- Reconnaissance field visit and discussions with BWDB officials and local stakeholders were made 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 identification of 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 the 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.

2.3 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.

2.3.1 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 2.1**.

Table 2.1: 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 (5 to 15 years)	Less than project lifespan	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond immediate project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to 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
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but breaches international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Occurs under worst case (negative impact) or best case (positive impact) operating conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to occur

2.3.2 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 2.2: 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

2.3.3 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 2.3**.

Table 2.3: Assessment of Potential Impact Significance

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

2.3.4 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 2.3** 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.

2.3.5 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

2.3.6 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.

2.3.7 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.

2.3.8 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 National Environmental Laws

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

3.1.1 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.

3.1.2 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.

3.1.3 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 ECA95. It empowers the Government to declare an area 'ECA', if it is satisfied that the ecosystem of the area has reached or is threatened to reach a critical state or condition due to environmental degradation. The Government is also empowered to specify which of the operations or processes shall not be carried out or shall not be initiated in the ecologically critical area. Under this mandate, MOEF has declared 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.

3.1.4 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.

3.1.5 Administrative framework of DOE for clearing and monitoring of projects

According to the Environment Conservation Act 1995 no industrial unit or project will be established or undertaken without obtaining, in the manner prescribed by the Environment Conservation Rules 1997, an Environmental Clearance Certificate from the Director General. Therefore, every development projects/industries which are specified under the Schedule – 1 of the Environmental Conservation Rules 1997 require obtaining site clearance and environmental clearance from the Department of Environment. According to the Rule 7 (1) of the Environmental Conservation Rules

1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). According to the categorization, all FC and FCD/I projects fall under the 'Red' category. For this category, it is mandatory to carry out Environmental Impact Assessment (EIA) including Environmental Management Plan (EMP) and where necessary develop a Resettlement Plan for getting environmental clearance from DOE. The application procedure for obtaining site clearance and environmental clearance for the sub-projects of CEIP is shown in Figure 3.1.

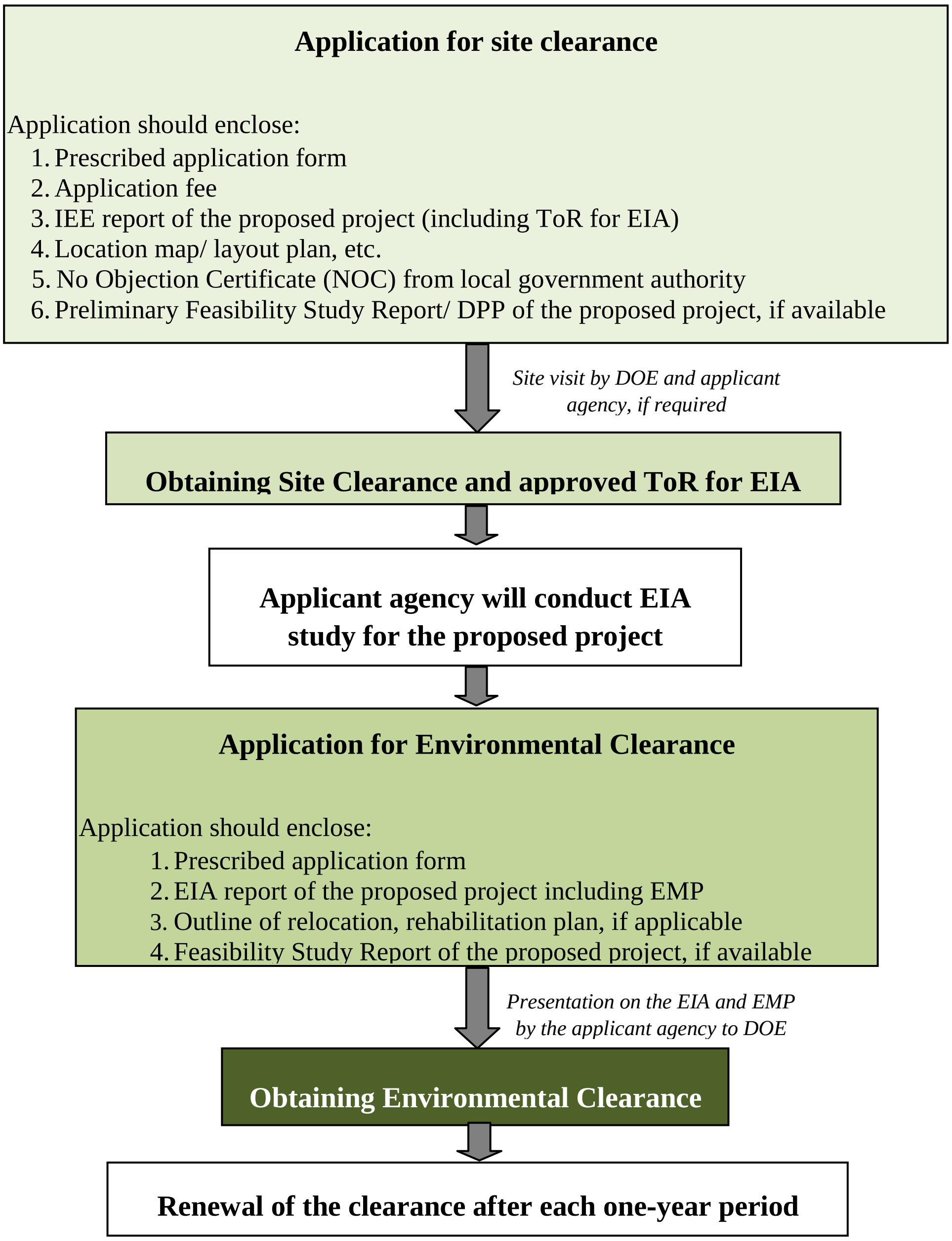

Figure 3.1: Process of obtaining Clearance certificate from DOE

3.2 Relevant National Policies, Strategies and Plans

3.2.1 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.

3.2.2 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.

3.2.3 NationalWater 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.

3.2.4 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.

3.2.5 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.

3.2.6 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.

3.2.7 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.

3.2.8 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.

3.2.9 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.

3.2.10 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 subsector 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.

3.2.11 The Forest Act, 1927 & Amendment Act 2000

The National Forestry Policy of 1994 is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy are to conserve the existing forest areas; bring about 20% of the country's land area under the afforestation program, and increase the reserve forest land by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

The need of amendments of the existing forestry sector related laws and adoption of new laws for sectoral activities have been recognized as important conditions for achieving the policy goals and objectives. The Forest Policy also recognizes the importance of fulfilling the responsibilities and commitments under international multilateral environmental agreements.

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

"26. Acts prohibited in such forests. -

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

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

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

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

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

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

3.2.12 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.

3.2.13 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.

3.2.14 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).

3.2.15 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).

3.2.16 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 (*nadisikosti*) 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.

3.2.17 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.

3.2.18 Ethnic Minority Rights in PRSP 2005

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

- Effective recognition of ethnic minority communities and their specific needs in all relevant government policies and programs towards improving the socio-economic conditions of these communities.
- Proper actions for protecting the rights of ethnic minority people, particularly their rights to land and forests.
- Transfer of land administration in CHT to the hill districts councils in accordance with the ‘Hill District Councils Acts of 1989’.
- Provide education to ethnic minority people with a curriculum that allows learning in their own language at the primary level.
- Strengthen their competence in job markets through affirmative actions at higher levels of education and skill training to promote their inclusion in mainstream economic life.
- Scale-up efforts to provide health care, clean water and sanitation facilities to ethnic minority areas in general and to the more disadvantaged groups among them in particular.
- Increase and utilize 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.

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[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.

3.2.19 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.

3.2.20 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
Rules for Removal of Wrecks and Obstructions in inland Navigable Water Ways (1973)	Rules for removal of wrecks and obstructions	IBWTA

[3]According to the law, the 'market price' is calculated by averaging the sales prices recorded in the previous one year, in terms of land characteristics by land administration units or mauzas. But it is a widely accepted fact that prices determined as such hardly reflect the true market value of the lands. As the sale/acquisition prices are grossly under-reported to evade on sale taxes, assessment of legal compensation almost always fall far 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
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	UpazilaParishad
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 offices 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	DO Arch
Acquisition and Requisition of Immovable Property Ordinance (1982)	Describes procedures and provides guidelines to acquisition and requisition of land	MOL
Bangladesh Labor Law (2006)	Deals with occupational rights and safety of factory workers; provision of comfortable work environment and reasonable working conditions	MOL

3.3 International Treaties Signed by GoB

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
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

Treaty	Year	Brief Description	Relevant Department
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

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

The CEIP project intervention Legislative bases for environmental assessment in Bangladesh are the Environmental Conservation Act 1995 (ECA'95) and the Environmental Conservation Rules 1997 (ECR'97). Department of Environment (DOE), under the Ministry of Environment and Forest (MOEF), is the regulatory body responsible for enforcing the ECA'95 and ECR'97. According to the Rule 7 (1) of the Environmental Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every industrial units or projects, in consideration of their site and impact on the environment, will be classified into the four categories and they are: Category I (green), Category II (Orange-A), Category III (Orange B) and Category IV (Red). According to the categorization, all construction/reconstruction/expansion of flood control embankment/polder/dykes etc falls under Red Category. Therefore Project intervention in polder 33 falls under the '**Red**' category.

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

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

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

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

The detail DoE clearance procedure is presented in the Environmental Management Framework.

3.5 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.

3.5.1 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.

3.5.2 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.

3.5.3 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.

3.5.4 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.
- 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.

3.5.5 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.

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

3.5.6 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.

3.5.7 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.

3.5.8 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.

3.5.9 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

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

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.
- 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.

3.5.10 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.

3.5.11 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.

3.5.12 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.

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

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

3.5.13 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.

3.6 Implications of the World Bank Policies on CEIP & Environmental Category

The project intervention for polder 33 falls under Category A project, due to the complexity of environmental issues associated with project activities involving major civil works by reconstruction and rehabilitation of the coastal embankment to protect against tidal flooding and storm surges. Since the coastal area is of high ecological sensitivity and vulnerability certain negative environmental impacts may occur during the implementation and operational phase on overall polder system. There may be localized impact on the natural habitats especially on the fish spawning site and protected areas, during the implementation of the civil works. Bhola River is in between the west of polder 33 and Sundarbans the largest Mangrove forest of South Asia. Rehabilitation and reconstruction of polders may have indirect impact on the water flow quality and pattern within the channels of Sundarbans.

The environment assessment (OP/BP 4.01), natural habitats (OP/BP 4.04) and forests (OP/BP 4.36) policy have been triggered for the proposed operation. Although no direct impacts on physical cultural resources are expected, screening mechanism incorporated into the EA process will identify subprojects with archeological, paleontological, historical, religious, or unique natural values, chance and find procedure will be followed to address physical cultural resources (OP/BP 4.11). The interventions under the proposed Project may result in an increased availability of irrigation water through cleaning and excavation of water courses in the Polder. This increased water availability can in turn potentially increase the usage of chemical fertilizers and pesticides. During regular environment monitoring during operational phase if the water and soil pollution is observed, the proponent will be responsible for preparing Pest Management Plan with prior approval from Bank. No Project activities are to be carried out in the rivers except some transportation.

4. Description of Proposed Intervention in Polder 33

The overall project activities are briefly described in this chapter. The description of construction methodology, construction schedule, and the institutional arrangements for implementation of the project are also described here.

4.1 Project Background

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

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

Coastal Embankment Project

The Coastal Embankment Project (CEP) was initiated in the 1960s to reclaim or protect areas in the coastal zone that lay below the highest tide levels for periodic inundation by saline water. These lands could now be used for agriculture by providing drainage structures capable of evacuating excess water during low tide. This system worked well for many years and 1.2 million hectares are now under the protection of the coastal embankment system bringing immense benefits. However, there have been unintended consequences of this project. The very act of preventing the high tides from spreading over the land and confining them within the river channels initially increased the tidal range by about 30 per cent which might have had an immediate beneficial impact on drainage. However, the reduction of upstream and overbank storage also decreased the tidal cubature (ie, the volume of water displaced during a tidal cycle). The reduction in cubature induced sedimentation or more correctly a reduction in cross sectional areas of the rivers of all types – the large rivers such as the Pussur which have sandy bottoms and clay/silt banks and the smaller rivers which have an excess of silt and clay. The consequent choking of smaller rivers resulted in drainage congestion within some internal polders, and navigation problems in some.

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

The CEIP Initiative

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

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

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

The Polder 33 is one of the polders to be rehabilitated under the CEIP-I.

4.2 Polder Overview

The polder 33 is located in Dacope upazila of Khulna District (see Figures 1.2 and 4.1). The administrative and management of the water control structures in the Polder lies with Khulna Operation and Maintenance (O&M) Division of BWDB. The Polder covers five Union Parishad (UP) namely Banisanta, Laudobi, Kailashganj, Dacope and Bazua of Dacope upazila. The polder is surrounded by Bhadra and Chunkuri River to the West, Chunkuri and Pussur River to the North, Pussur River to the East and Dhangmari River to the South. The Polder covers a gross area of 8,600 ha of which net cultivable area are 7,600 ha.

Polder 33 was conceived in the year of 1960 under Coastal Embankment Project (CEP).The construction of the polder started in the year of 1966-67 and completed in the year of 1971-72. The original concept of construction of this Polder was only to protect the agricultural lands from salinity intrusion caused due to tidal inundation from the sea through the Pussur River. At present, the embankment of the Polder is under heavy threat of cyclone surge, wave attack, river erosion and increasing risks brought about by climate change.

Existing Water Management Infrastructure in Polder 33

The Polder is enclosed by embankment and includes various water controlling structures for draining and flushing purposes in the Polder area. Embankments were originally constructed to prevent salinity intrusion and tidal flooding. The summary of the existing infrastructure is given below.

Embankment	:	52.50 km
Regulators (drainage / flushing)	:	13
Flushing inlets	:	19
Internal *khals* (water channels)	:	100 km

4.3 Objectives of Improving Polder 33 under CEIP- I

The overall objective of the Project is to:

a) provide protection against tidal saline inundations for a favorable agro-production environment
b) minimize cyclonic damages to lives, properties, crops, livestock and other infrastructures through strengthened Polder system including a scheme of appropriate afforestation/plantation.

c) reducing the time of recovery after natural disasters such as cyclones and
d) improving the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.

4.4 Water Management Problems and Issues in Polder 33

Some segments of the embankment of the Polder were damaged mainly by overtopping during Sidr and Aila. The riverside slope and berm in many places are affected by river erosion and damaged by wave action. Almost the entire length of the embankment is under-sectioned and needs to be re-sectioned to meet the CEIP design. Many of the hydraulic structures are damaged, few are non-functioning due to missing gates and silted up diversion channels and a very few are already replaced such as DS-5. The other structures that are being functioning are not in good condition. The gates are corroded by saline water and concrete surfaces of the structures are in very poor condition. The loose apron on both C/S & R/S are either badly damaged or washed away. Most of the structures are not repairable which needs to be replaced. The internal drainage channels have become silted up and need to be re-excavated to water flow in the polder area.

The local people have been facing various water management problems. From the field survey, it is noted that currently about 25-30% of the polder area is facing problems of salinity and water logging. Irrigated agricultural land area is limited to about 310 ha only (out of total 7,600 ha because of high surface water salinity and unavailability of suitable ground water at shallow depth during April to May. The open water fisheries are being decreasing due to shrinking water areas, restricted movement for silted up internal khals (canal).

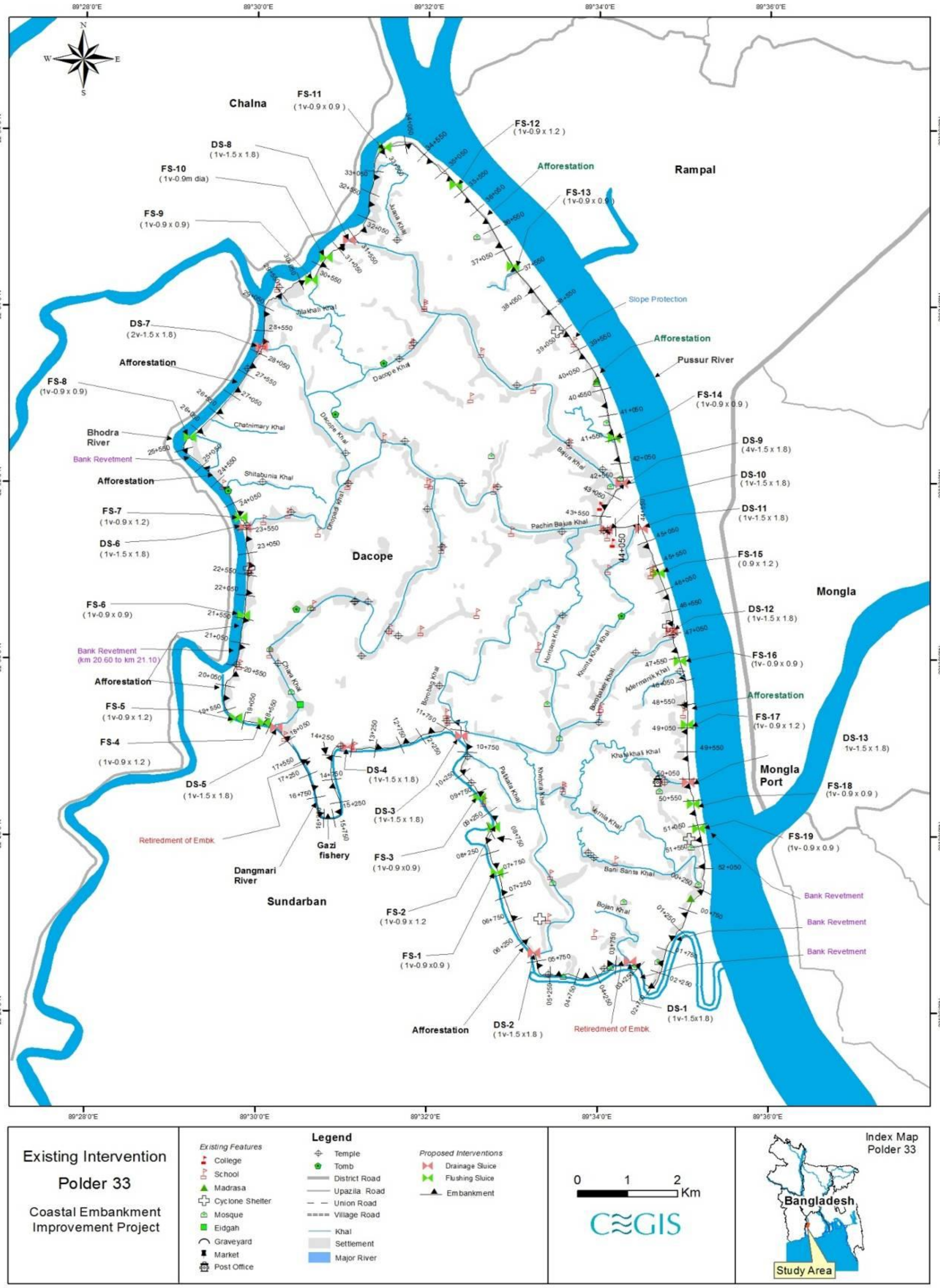

Figure 4.1: Alignment of the embankment and existing structures of the polder

4.5 Present Status of Water Management Infrastructures

4.5.1 Embankments

Present status of the embankments in Polder 33 and works required on them are:

- The portion of the embankment from Ch. 14.20 to Ch. 17.50 is being maintained by Gazi Fish Culture as they have their own activities there. That is why, BWDB constructed ring-dyke (Picture 4.2) for a length of about 1 Km by cross – connecting the embankment in between the Ch. 14.50 to Ch. 17.50) as retirement. This portion of embankment is required to be developed at proper section.
- The riverside slopes of some segments of embankment at Ch. 1.30 to Ch. 1.60, Ch. 2.95 to Ch. 3.20, and Ch. 20.60 to Ch. 21.10, Ch. 25.25 to Ch. 25.35 and Ch. 51.10to Ch. 51.40 have been fallen under the thrust of river erosion. These segments of the embankment are needed to be protected by bank protective works.
- The length and location of bank protection work will also be ascertained by the outcome of mathematical modeling study. Some segments of embankment in between Ch. 34.00 to Ch. 52.50 have fallen under the thrust of wave action of the mighty River Pussur and partially damaged.
- The slope protection of embankment at Ch. 32.50 to Ch. 33.60 and Ch. 51.10 to Ch. 52.00 has already been taken up for execution under Aila (GOB) funded program. The remaining segments of the embankment for a length of about 6.00 km in between Ch. 33.60 to Ch. 51.10 are needed to be protected by providing slope protection work with CC block as per CEIP design.
- The remaining length of embankment has to be re-sectioned up to the design level with mechanical compaction. There is brick soling on the top of embankment constructed by LGED, some portion of the embankment is being upgraded with bitumen carpeting on the top under JICA fund without following BWDB design and specification. The detailed of the embankment condition have been shown in **Figure 4.1.**

4.5.2 Water Control Structures

The Polder 33 has 13 drainage sluices,, and 19 flushing inlet structures. The present condition of the structures along with the required remedial actions is presented in **Table 4.1** below; some photographs of these structures are provided in **Figure**s **4.2** to **4.7**.

Table 4.1: Status of Structures and Recommendations for Improvement

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
1	Drainage Sluice 1 (DS-1) (1v-1.5m X 1.8m) (Bhojankhali Khal)	3.45 km	The structure has been fully damaged during SIDR.	The structure is required to be replaced with provision for flushing and drainage.
2	DS-2 (1v-1.5m x 1.8m) (Khajuriar Khal)	5.90 km	The structure is in a deplorable condition and is not repairable. Gates are corroded and loose apron at both C/S and R/S are partially damaged.	The structure is required to be replaced with provision for flushing and drainage.

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
			Diversion channel is silted up due to lack of maintenance.	
3	DS-3 (1v-1.5m x 1.8m) (Borobaker Khal)	11.10 km	Diversion channel is silted up. There is piping underneath the apron floor causing flanking and damages to the structure. Number of vent of the structure is insufficient.	A new structure with adequate vent (2v – 1.5m x 1.8m) is required to be constructed in place of existing one with provision for flushing and drainage.
4	DS-4 (1v-1.5m x 1.8m) (Bodlar Khal)	13.877 km	Diversion khal is silted up. The structure is in deplorable condition and is not repairable.	The structure is required to be replaced with provision for flushing and drainage.
5	DS-5 (1v-1.5 m x 1.8m) (Chaarar khal)	18.42 km	The structure is non-functioning.	A new structure (Iv-1.5m x 1.8m) is being constructed under AILA (GOB) fund.
6	DS-6 (1v-1.5m x 1.8m) (Dhopadi Khal)	22.831 km	The structure is leaking at the construction joint of the wing wall(C/S) and the structure is in deplorable condition.	The structure is proposed to be replaced with provision for drainage and flushing.
7	DS-7 (2v-1.5m x 1.8m) (Dacop Khal)	28.19 km	The structure is in deplorable condition and is not repairable.	The structure is required to be replaced with provision for flushing and drainage.
8	DS-8 (1v-1.5m x 1.8m) (Bajua Khal)	31.33 km	Loose apron at both sides of the structure is damaged and expansion joint displaced causing leakage of water. Minor repairing of the structure has been taken up under AILA (GoB) fund.	The structure is required to be replaced with provision for flushing and drainage.
9	DS-9 (4v-1.5m x 1.8m) (Basoa Khal)	42.70 km	Loose apron at both C/S and R/S is damaged and gates are missing.	The structure is required to be replaced with provision for flushing and drainage.
10.	DS-10 (1v-1.5m x 1.8m) (connected with Chara nadi)	43.85 km	Loose apron has been damaged.	The structure is required to be replaced with provision for flushing and drainage.
11	DS-11 (1v-1.5m x 1.8m) (Khutakhali Khal)	44.665 km	Loose apron has been damaged.	The structure is required to be replaced with provision for flushing and Drainage.
12	DS-12 (1v-1.5m x 1.8m) (Laudub Khal)	47.00 km	There is piping underneath the apron floor of the structure. The structure is under ventage which is required to be	The structure is required to be replaced with provision for flushing and drainage.

	Structure Description and Location	Chainage	Present Condition of the Structures	Action Required
			increased by providing additional vent.	
13	DS-13 (1v-1.5m x 1.8m) (Khatakhali Khal)	49.95 km	Loose apron at both sides of the structure is damaged.	The structure is required to be replaced with provision for flushing and drainage.
14	FS-8 (1v-0.9m x 0.9m) (Singzhara khal)	25.82 km	There is piping underneath the apron floor and the structure is not repairable.	The structure is required to be replaced.
15	Flushing Sluice 1 (FS-1) (1v-0.9mx0.9m) FS-3 (1v-0.9mx0.9m) FS-5 (1v-0.9mx1.2m) FS-6 (1v-0.9mx0.9m) FS-9 (1v-0.9mx0.9m) FS-10 (1v-0.9m dia) FS-11 (1v-0.9mx0.9m) FS-14 (1v-0.9mx0.9m) FS-15 (1v-0.9mx1.2m) FS-17 (1v-0.9mx1.2m) FS-19 (1v-0.9mx0.9m)	7.75 km 9.675 km 19.17 km 21.60 km 30.30 km 30.75 km 33.625 km 41.525 km 45.75 km 49.0 km 51.135 km	Condition of the structures is not good and is not repairable.	All the structures are required to be replaced.
16	FS-2 (1v-0.9mx1.2m) FS-12 (1v-0.9mx1.2m) FS-13 (1v-0.9mx0.9m) FS-16 (1v-0.9mx0.9m) FS-18 (1v-0.9mx0.9m)	8.86 km 35.35 km 37.43 km 47.625 km 50.635 km	There are minor damages to the structures which need to be repaired.	Repairing of structures are needed.
17	FS-4 (1v-0.9mx1.2m) FS-7 (1v-0.9mx0.9m)	18.65 km 23.85 km	The structures are badly damaged. There are drainage sluices adjacent to it which will serve the purpose of flushing of water.	Flushing-inlets are not needed at km 18.65 and km 23.85

Figure 4.2: Embankment cum Road

Figure 4.3: Temporary Embankment near Gazi fishery

Figure 4.4: Sluice 1 vent regulator

Figure 4.5: Sluice 4 vent regulator

Figure 4.6: Damaged regulator

Figure 4.7: Saline water intrusion inside the polder

4.6 Rehabilitation/Improvement Activities in Polder 33

The proposed interventions in Polder 33 under CEIP-I are listed in **Table 4.2** and shown in **Figure 4.9**.

Table 4.2: Proposed Interventions in Polder 33

	Proposed intervention	Quantity
1	Re-sectioning of embankment	48.20 km
2	Construction of retired embankment	3.8 km
3	Construction of drainage sluices	13
4	Construction of flushing inlets	12
5	Repairing of flushing inlets	5
6	Flushing inlets to be demolished	2
7	Re-excavation of drainage channels	63.21 km
8	Bank protection works	1.45 km
9	Slope protection of embankment	6.00 km
10	Afforestation on the foreshore areas	72.00 ha

Source: Feasibility Report of CEIP, 2012

4.6.1 Works on Embankments

Under the proposed interventions in the Polder, a total of 48.20 km of embankments will be re-sectioned and their height will be increased to 4.50 m and 3.8 km of embankments will be retired as shown in the **Table 4.3** below.

Table 4.3: Detail of Works on Embankments

	Description	Chainage (km)	Height m	Length (km)
1	Re-section of embankment (Increasing the height of embankments)	0.0 to 3.20	4.50	3.20
2		3.70 to 14.20	4.50	10.50
3		17.50 to 52.0	4.50	34.50
4	Retirement	3.20 to 3.70	4.50	0.50
5		14.20 to 17.50	4.50	3.30

Source: Feasibility Report of CEIP, 2012

Description of construction activities

Before starting of construction activities for embankment works, labor sheds should be constructed with proper sanitation and other required facilities. A suitable site shall be selected and prepared by cleaning bushes, weeds, trees etc. The tools required for construction of embankments will be procured in this period. During construction phase, alignment of embankments has to be fixed with adequate base width according to the design. Base stripping and removal of trees, weed etc will be made as per instruction of the Engineer in charge. After validating the final design, excavation of soil/carried earth will be carried and deposited in a selected area. Soil will be dumped in layers. At the same time, each layer (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. The slope of the embankment will be turfed. Watering and fertilizers will also be provided for proper growth of grass. During post-construction phase, embankment would need proper monitoring by BWDB and local committee. Moreover, if needed maintenance would be done.

4.6.2 Construction/Repairing of Drainage Sluices

Thirteen drainage sluices will be replaced under the proposed interventions of the rehabilitation works of the Polder 33. The detail description of these sluices has been given in **Table 4.1**.

Description of construction activities

During pre-construction phase for construction of drainage sluices, construction of labor shed, development of sanitation and other facilities etc. should be done. 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 for construction of the sluices. During construction period, ring bandh and diversion channel will have to be constructed before starting the construction of drainage sluices. After that the foundation treatment required for the structure will be carried out. The cement concrete (CC) and reinforced cement concrete (RCC)works along with cutting, bending and binding of reinforcements 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. During post-construction phase, a local committee would have to be formed and monitoring would be needed. Moreover, if needed maintenance would be done.

4.6.3 Construction/Repairing of Flushing Inlets

Twelve flushing inlets will be replaced under the proposed interventions for rehabilitation work of Polder 33. Besides, five flushing inlets will be repaired. The details description has been given in **Table 4.1**.

Description of construction activities

Before starting the construction activities of flushing inlets a labor shed will be constructed with proper sanitation and other facilities. The required construction materials (sand, cement, wood, shuttering materials etc.) will be procured simultaneously. A suitable site of the structure will then be selected. During construction phase, alternative diversion channels will be constructed before starting of the construction of flushing inlets. After that the foundation treatment required for flushing inlets will be carried out. Then the RCC works, pipe and machine pipe along with construction of 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 and downstream 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. During post-construction phase, a local committee would have to be formed and monitoring would be needed. Moreover, if needed maintenance would be done.

4.6.4 Re-excavation of Drainage Channels

Eleven channels will be re-excavated to decrease the drainage congestion. An estimated volume of 0.76 million cubic meters of soil/silt will be excavated from these channels. The excavated soil will be used for strengthening the *khal* banks, making them available to the farmers. The water channels to be re-excavated under the project are presented in **Table 4.4.**

Description of construction activities

For re-excavation of the drainage channels, at first the required tools will have to be procured. A schematic diagram showing centerline and layout plan will be made for the re-excavation noting the design depth and width of excavation to be made. 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 at the starting and final locations of the reach, and then soil from the channels will be removed up to the 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. These excavated soil or sludge should be used to strengthen the embankment. After finalizing excavation on one reach, the other reach in the downstream would be excavated by following structures procedure.

Table 4.4: Channels to be Re-excavated

	Name of Khal	Length (km)	Chainage (km)
1	Chara khal	10.0	18.65
2	Khejura Khal	5.5	5.9
3	Khunata Khal	4.5	44.665
4	Bajua khal	8.5	31.33
5	Bajuna khal	2.0	3.45
6	Borobag khal	7.5	43.85
7	Bolder khal	1.0	13.815
8	Dhopadi khal	4.0	23.85
9	Dacope khal	4.0	28.19
10	Borobaker khal	6.0	11.10
11	Kata khal	1.32	30.30
	Total	54.32	

Source: Feasibility Report of CEIP, 2012

4.6.5 Bank Protection and Slope Protection Works

The proposed intervention of the rehabilitation works of the project includes bank protection works. Bank protection works for length of only 1.45 km will carried out from Ch. 1.3 to Ch. 1.6; Ch. 2.95 to Ch. 3.2; Ch. 20.60 to Ch. 21.10; Ch. 25.25to Ch. 25.35 and Ch. 51.10 to Ch. 51.40 of the polder. In addition, about six km of slope protection in between Ch. 32.50 to Ch. 52.0 of embankment is to be carried out along the Pussur River.

Description of construction activities

The construction activities involved in the bank protection and slope protection are: the construction of labor shed, creation of sanitation facility and procurement of construction materials (sand, cement, wood, shuttering materials etc.), 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 construction 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 the toe of embankment in the river banks as per design. Finally, turfing will made on the slope of the embankments. Proper drainage provision will be kept to avoid formation of rain cuts for surface run off.

4.6.6 Afforestation

Plantation of mangrove forest is proposed for afforestation on the foreshore area. The areas selected for afforestation in the polder 33 are shown in **Figure 4.9 (a-d)**. Establishment of green belts in these areas can reduce the effect of toe and slope erosion due to wave action and river flow and promote land accretion. About 72 ha of foreshore area will be planted with mangroves in the Polder, whereas about 52 ha of land will be kept for timber saplings and 20 ha for Golpata. The saplings are to be planted at a spacing of 1.5m x 1.5m. **Figure 4.8** shows the typical cross-section of this plantation.

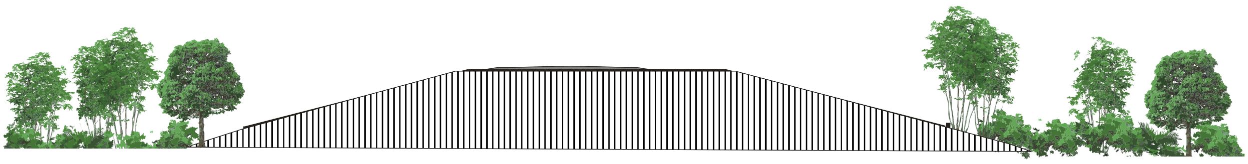

Figure 4.8: Typical Cross Section of afforestation works

The afforestation will be made at different locations on the foreshore of the polder area. Total length of afforestation will be 22.7 km. Detail information of afforestation with chainage is shown in Table 4.5 below:

Table 4.5: Possible BWDB foreshore lands available for afforestation

Chainage (km)	Length (km)
Golpata Plantation	12.8 Hectares.
Enrichment Plantation	5.7 Hectares.
Keora Baen Plantation	0.8 Hectares.
Mound Plantation	3.4 Hectares.
Total	22.7 Hectares.

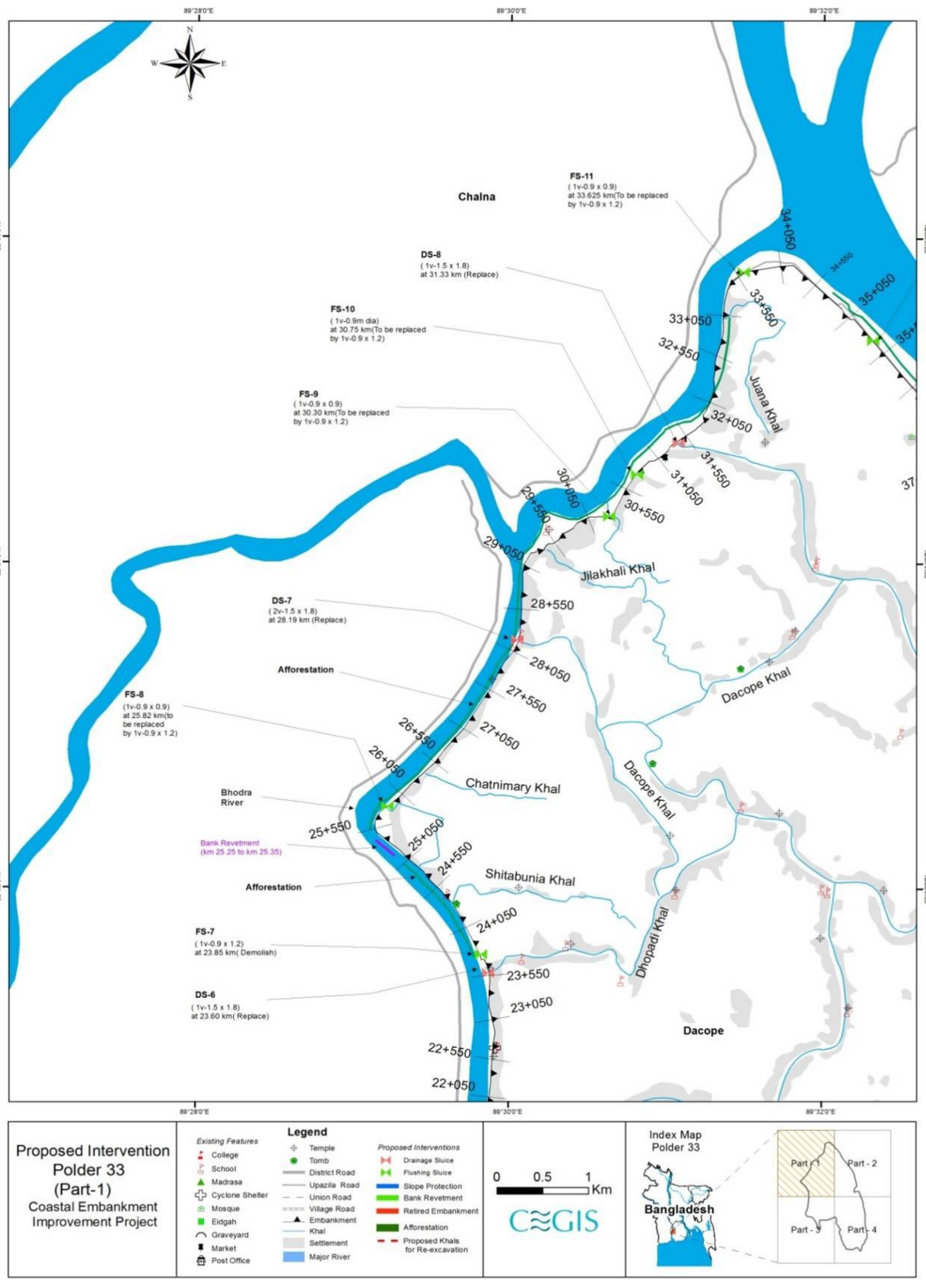

Figure 4.9 (a): Location of Proposed Interventions in Polder 33 (Part-1)

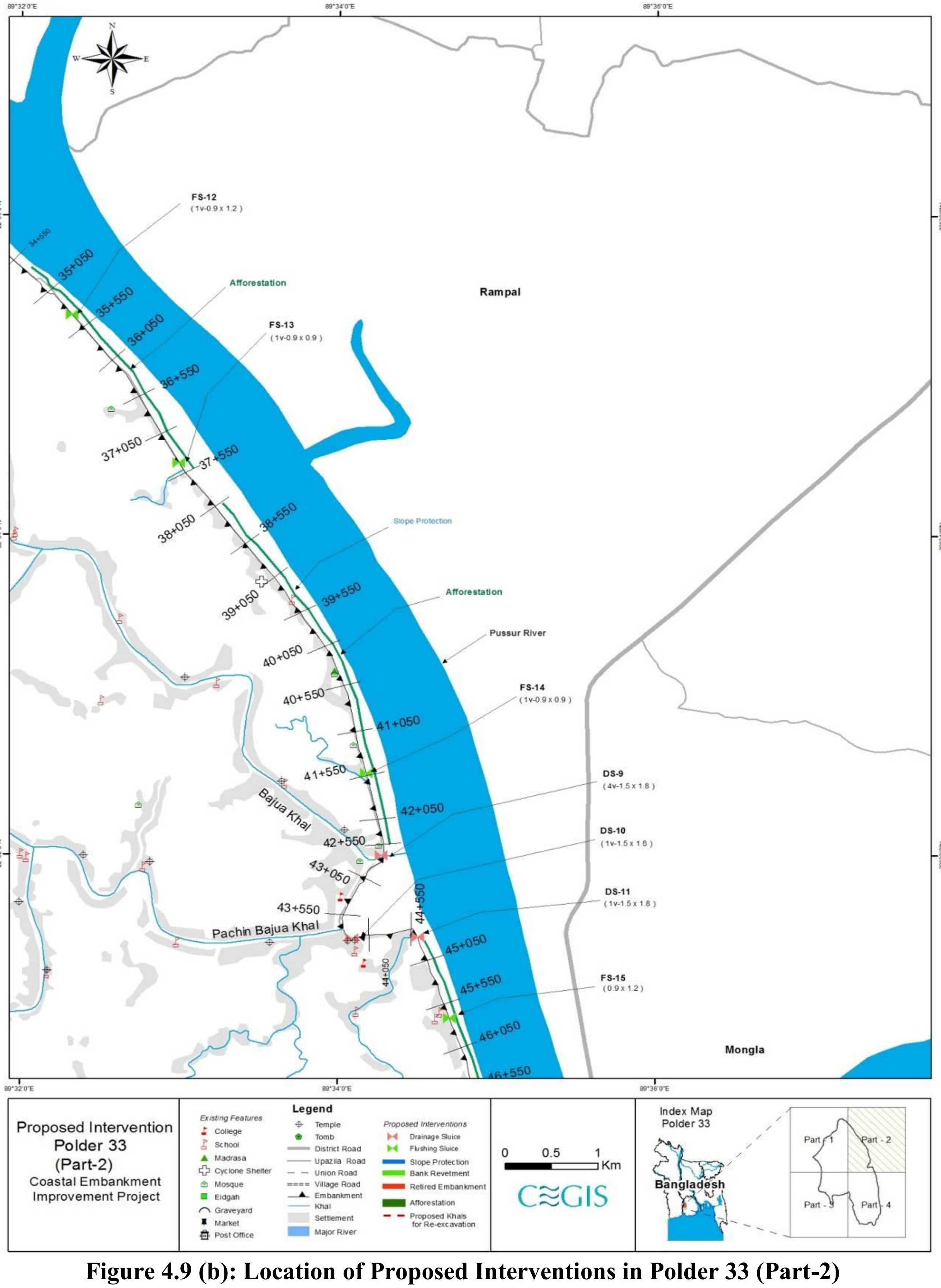

Figure 4.9 (b): Location of Proposed Interventions in Polder 33 (Part-2)

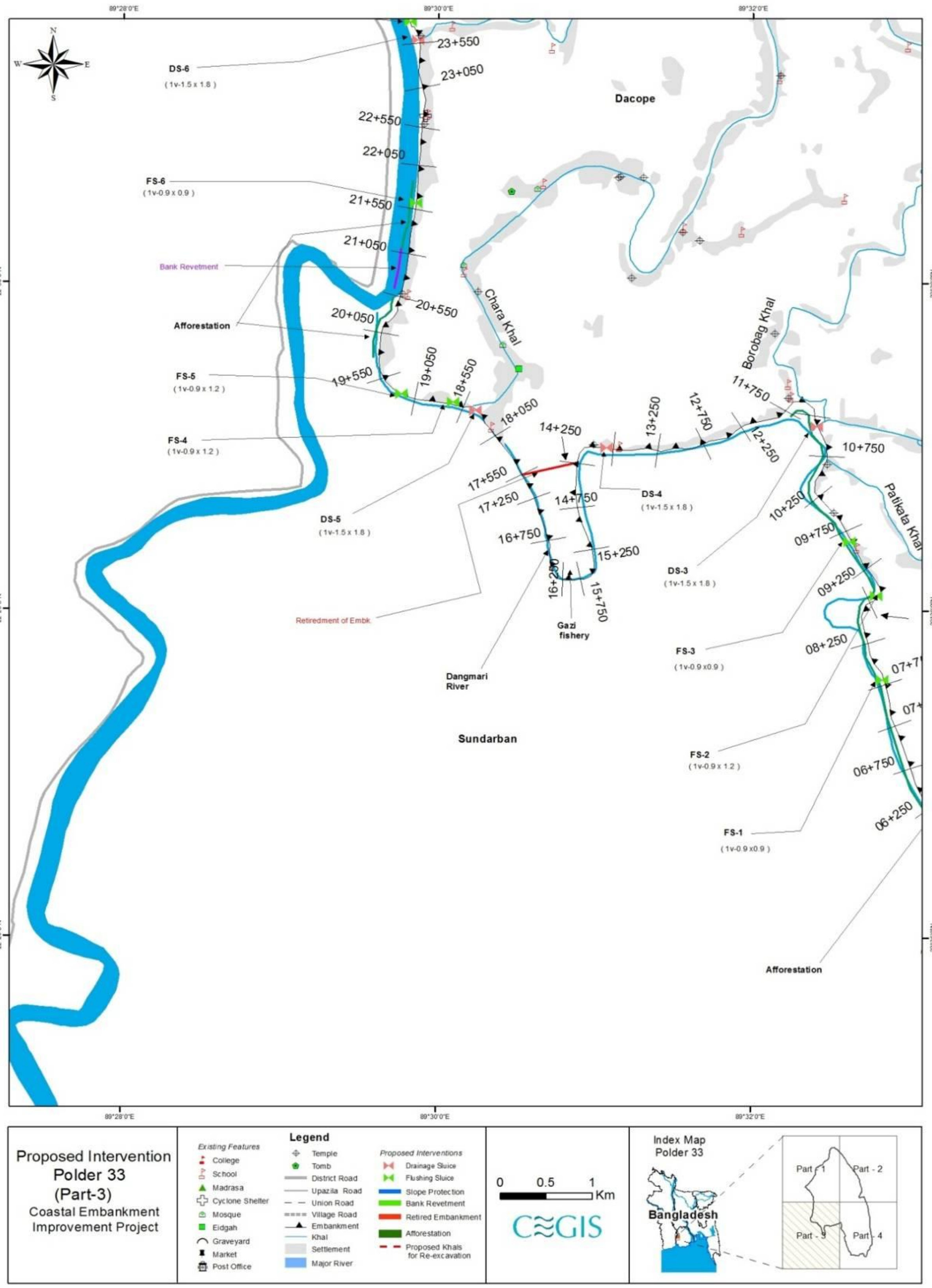

Figure 4.9 (c): Location of Proposed Interventions in Polder 33 (Part-3)

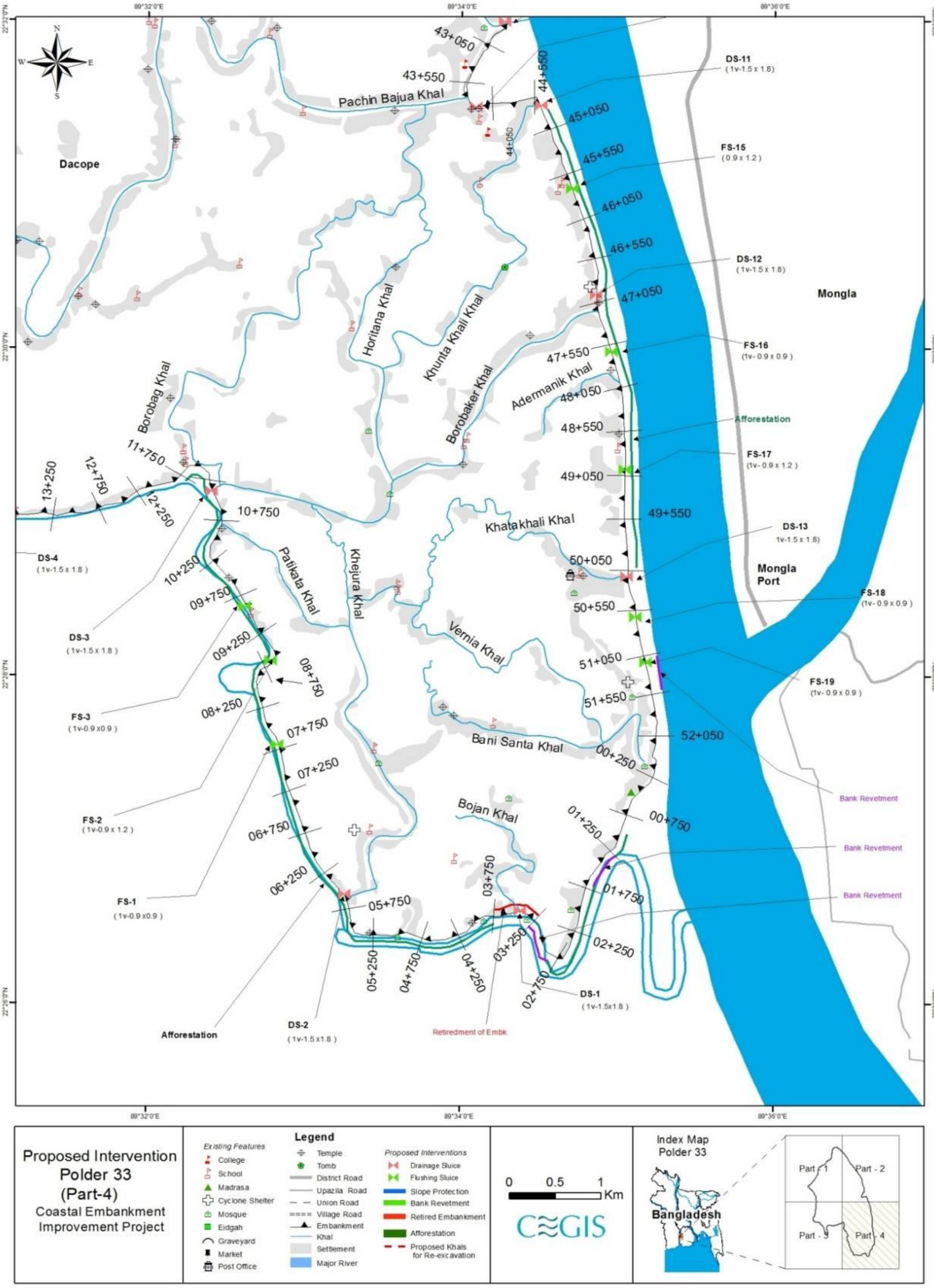

Figure 4.9 (d): Location of Proposed Interventions in Polder 33 (Part-4)

4.7 Construction Details

4.7.1 Construction Schedule

The works in Polder 33 under the CEIP-I are expected to be completed in four years. The construction schedule is present in **Table 4.6**.

Table 4.6: Construction Schedule

SL. No.	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*																
	Construction activities																
C	Procurement system of the project																
C1	Procurement of construction																

SL. No.	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																

SL. No.	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
	washout																
E2	Earth work by manual labor with clayey soil (minimum 30% clay, 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																

SL. No.	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
	regulator																
F1	construction and repairing of drainage sluices																
F2	construction and repairing of flushing inlets																
G	Bank revetment and slope protection works																
H	*Afforestation*																
H1	Land preparation																
H2	Fencing preparation and setting																
H3	Plantation of mangrove trees																

4.7.2 Construction Manpower Requirement

As it is a four-year project, a number of manpower will be needed of which there will be both technical and non-technical people. This will include engineers, technicians, supervisors, surveyors, mechanics, foremen, machine operators, drivers, and un-skilled labor. Around 60 to 70 percent of labor will be engaged from the local area and remaining will be from outside. The estimated manpower requirement is presented in **Table 4.7**.

Table 4.7: Required manpower for construction

	Required Manpower	Number
1	Engineer	5
2	Machinery Operators	60
3	Mechanics	3
4	Surveyor	6
5	Skilled labor	3835
6	Unskilled labor	328019

Source: Feasibility Report of CEIP, 2012

4.7.3 Construction Material

The construction materials required for re-sectioning and retired embankment, water regulatory sluices and flushing inlets, and bank protection work will include soil, cement, steel, and sand. Estimated quantities of these materials are presented in **Table 4.8**.

Table 4.8: Construction Materials

	Description	Quantity	Sources
Re-sectioning and retired embankment			
1	Earth work	9,85,900 m^3	Borrow pits, dredging spoils from re-excavation of drainage channels
Construction of sluices and flushing inlets			
2	Cement	2,01,484 bag	To be procured from local market
3	Sand	12020 m^3	To be procured from Khulna
4	Stone	27,045 m^3	To be procured from Khulna
5	Steel	727 Ton	To be procured from Khulna
Bank protection			
6	CC Blocks	81,194 nos	To be made at construction site during construction
7	Stones	27,000 m^3	To be collected from Khulna

The carried earth for embankment re-sectioning or retired embankment will be collected from the offshore area of the polder 33. The details of borrow pit area are attributed in the following Table 4.9:

Table 4.9: Availability of earth in the borrow pit area

	Quantity of Earth available from Borrow pit area			Quantity of Earth available from River bed		Details
	Location (chainage)	Pit Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	
1	1) 1.2 Km to 2.5 K.m	1.2 Km X15m X 1.5m	27,000 m^3	Passur	1) 0.0 Km to 2.5 Km	90% of earth is available at borrow pit area.
	2) 0.0 Km to 1.2 Km	500 m X 30m X 1.5m	22,500 m^3		2) 47 Km to 52.0 Km	
	3) 47.5 Km to 52 Km	3.5 Km X 10m X 1.5m	52,500 m^3			
	4) 47 Km to 47.5 Km	500m X 10m X 1.5m	7,500 m^3			
			1,09,500 m^3			
2	1) 33.8 Km to 40 Km	4.5 Km X 40m X 1.5m	2,70,000 m^3	Passur	1) 33.8 Km to 47 Km	Earth is available at borrow pit area.
	2) 40 Km to 42.7 Km	2.5 Km X 15m X 1.5m	56,250 m^3			
	3) 42.7 Km to 44.6 Km	2 Km X 15m X 1.5m	33,750 m^3			
	4) 44.6 Km to 47 Km	1 Km X 10m X 1.5m	15,000 m^3			
			3,75,000 m^3			
3	1) 29 Km to 29.7 Km	700m X 10m X 1.5m	10,500 m^3	Chunkuri	1) 29 Km to 33.8 Km	Earth is available at borrow pit area.
	2) 29.7 Km to 32.8 Km	2.2 Km X 30m X 1.5m	99,000 m^3			
	3) 32.8 Km to 33.8 Km	1 Km X 20m X 1.5m	30,000 m^3			
			1,39,000 m^3			
4	1) 21.1 Km to 23.7 Km	2 Km X 15m X 1.5m	45,000 m^3	Chunkuri	1) 21.1 Km to 29 Km	Earth is available

	Quantity of Earth available from Borrow pit area			**Quantity of Earth available from River bed**		**Details**
	Location (chainage)	Pit Size (Length x width x depth)	Quantity	Name of River	Location (Chainage)	
	2) 23.7 Km to 24.5 Km	300m X 10m X 1.5m	4,500 m^3			at borrow pit area.
	3) 24.5 Km to 26.8 Km	2.3 Km X 15m X 1.5m	51,750 m^3			
	4) 26.8 Km to 28 Km	700m X 15m X 1.5m	15,750 m^3			
	5) 28 Km to 29 Km	1 Km X 15m X 1.5m	22,500 m^3			
			1,39,500 m^3			
5	1) 13.5 Km to 4 Km	7.5 Km X 50m X 1.5m (A portion of Mangrove forestry along the foreshore area will be destroyed if earth is taken from the borrow pit area)	5,62,500 m^3	Dangmari	1) 2.5 Km to 21.1Km (Foreshore area is covered with mangrove forestry, therefore earth is to be collected from nearby Dangmari river)	60% of earth is to collected from river bed because foreshore area is covered with Mangrove forestry which cannot be destroyed.

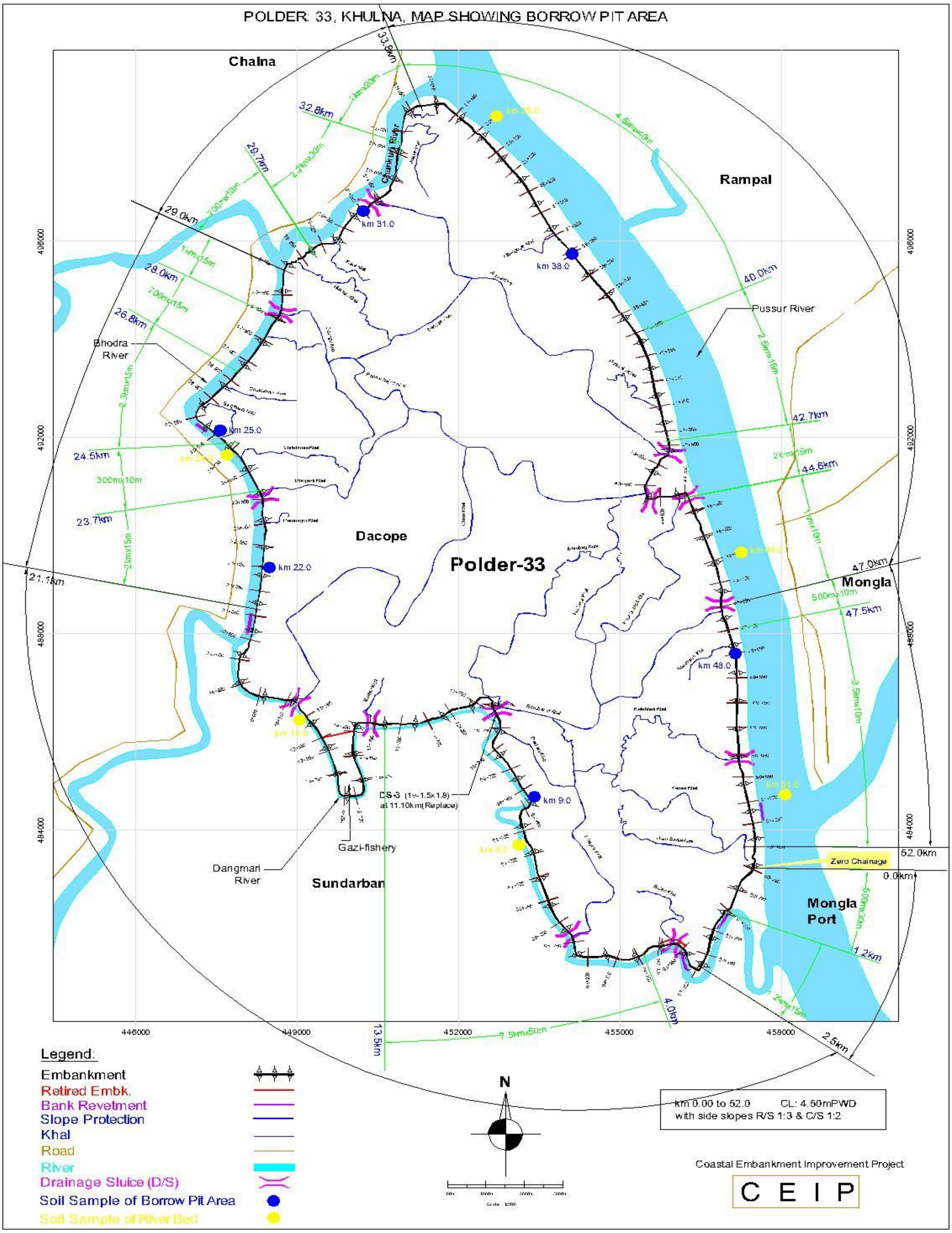

Figure 4.10: Potential Area for Borrow Material

4.7.4 Construction Machinery

A number of construction machinery and equipment would be needed for the construction activities in the Polder. A tentative list of these machinery and equipment is presented below:

Table 4.10: List of Construction Equipment and Machinery

Sl. No.	Description	Quantity (number)
1	Bulldozers	2
2	Dump- truck	12
3	Pay Loader	2
4	Excavator	2
5	Barge	2
6	Engine Boat	3
7	Vibrator	4
8	Compactor	4
9	Mixture Machine	40
10	Mixing plant	1
11	Truck	2
12	Tractor	2
13	Generator	13
14	Leveling Instrument	2
15	Total Station	1
16	De-watering System	12
17	Low lift pump	12

4.7.5 Construction Camps

A total of 52 camps for labor will be established during construction period. Out of the total camps, 20 camps for embankment works, 12 camps for sluice works, 13 camps for flushing inlet works, 6 camps for slope protection works, and one camp for bank protection 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

To ensure availability of safe drinking water for the camps and construction activities, a total number of 36 tube wells will be installed in the labor camps premises near the construction sites. Latrines will be constructed along with septic tanks for safe disposal of sewage for sanitation.

4.7.6 Vehicular Traffic during Construction

The polder is surrounded by Pussur River (North and west), Chunkuri River (north), Bhodra River (east) and Dangmari River (south). There is no road communication between polder area and its surrounding. Navigation is only the way for communication. Embankment of polder is main road in this area. Some portions of this embankment are brick soled and the rest are earthen. No paved roads are found in this area. Motorcycle and non-motorized van can move in this way. Internal roads are narrow and earthen, which are not suitable to carry construction materials by small carts, non-motorized vans and other smaller vehicles. Therefore, the major quantity of earth may not be carried to the embankment by mechanical equipment like excavators, pay loaders, dump trucks, trolleys due to lack of road communication.

The equipment and construction materials including hard rock dumping materials and sluice gate equipment will be transported from Khulna on water vessels through Kazibacha River and Chunkuri River. The construction materials would be collected from the stock yard at BWBD colony (Dacope) and then would to be transported to the each construction sites using cargo and large engine boat.

4.7.7 Jetty Construction

As there is no communication route by road, construction materials would have to be carried through river. So a jetty is needed to load and unload the materials. However, polder 32 and polder 33 are adjacent to each other and a jetty would be constructed to polder 32. There is no need to make another jetty at polder 33.

4.7.8 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 the Ministry of Water Resources and will include the Secretaries of other Ministries like Finance, Agriculture, Environment, Public Health Engineering, and Forestry and Wildlife, the Chief Executive officer of selected NGO, and representatives of the local/district administration as 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 Member 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 be of 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 progress of the project, 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 staffs.

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 the activities compliance with the Environmental Management Plan and Social Action Program together with the engineering unit to 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 as provided in the project intervention and 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 interventions of the polders and supervise all construction works. For civil works, the Project Director will serve as the *Employer*, and the Project Supervision Consultant will serve as *Engineer* for construction supervision. At the site, a *Resident Engineer*, appointed by the consultant, with a team of specialists and inspectors will supervise the works of 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 panels are consisting 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.

4.8 Community Participation

4.8.1 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, in 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.

4.8.2 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 structures, 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.

4.8.3 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 must.

4.8.4 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 based on 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 federations functioning at the top level of the hierarchy. The office bearers of the WMF, the 5-member federating body will be selected from the MC members of WMAs. Important personalities of 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.

4.8.5 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 be included in the Water Management Groups (WMGs) as Functional Groups (FGs). The FGs have the scope of working in O&M of the polder under the purview of WMG.

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

Embankment Settler (ES)

ESs is the families selected from squatters and project affected persons who do not have any land or lost it for 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 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 daily basis and not based on 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 or CSs women participating in above-mentioned groups will be ensured.

4.9 Community Participation

4.9.1 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.

4.9.2 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 a 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.

4.9.3 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.

4.9.4 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 four) may come from the WMAs by virtue of their importance in controlling the numbers of WMGs.

4.9.5 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.

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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 Taka3 lacs (BDT 0.3 million) in a single contract. During formation of CBOs women participation in above mentioned groups will be ensured.

4.10 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 vital roles 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, maintenance of 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 the 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.

4.10.1 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 33.

Regulation of Gates

During pre-monsoon period, the vertical lifting 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 lifting 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 post monsoon season (*October to November*), the vertical lifting 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 with 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 (of embankment and structures) 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 most simple, cheaper 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 which 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.

4.10.2 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 in 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 33, the 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, cheaper 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 include:
  - 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 of 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 include:
  - 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.

Under CEIP, the total allocated maintenance cost including preventive and periodic have been estimated as Tk. 393 lacs.

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 closing 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 because of major calamities like cyclones or tidal surges. Other sources of funding viz. donor assisted emergency programs should also be explored.

4.11 Need of Resettlement Action Plan (RAP)

Any development project that requires land acquisition may entail some impacts on people or commercial units and may bring about the changes in the patterns of use of land or other natural resources. For this reason resettlement program addresses loss of affected people or commercial units for statutory compensation payment to the affected units. In this respect, Resettlement Plan must be prepared to ensure that the affected people or commercial units receive fair and adequate compensation and rehabilitation if needed. It is noted that the Resettlement Action Plan (RAP) study is conducted by another sub-consultant of CEIP-I for the Polder 33 project.

4.12 No Objection Certificate

The polder 33 is located in the southern hydrological zone in Dacope upazila of Khulna District. The name of the unions in the polder is: a) Banishanta, b) Basua, and c) Laudubi. There are no archeological sites or any cultural heritage in the polder area, which might affect the normal activities of the polder after rehabilitation. No Objection Certificates (NOC) from the Chairmen of the Union Parishads is attached herewith (**Annex B**), which are necessary for Environmental Clearance from DoE.

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. As a matter of fact, 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 20-30 percent of the Polder area is vulnerable to salinity intrusion and about 35 percent of the entire polder is subjected to drainage congestion problems during monsoon. The silted water channels are resulting into limited navigation in these waterways, declining fisheries, and increasing environmental pollution.

The interventions proposed in Polder 33 under CEIP-I are planned to neutralize the aforementioned problems of the polder. To point out 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
Re-sectioning of embankments (48.00 km)	At most locations, the embankments will further deteriorate and will drop below design level with time. 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 stronger, 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.

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	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 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.
Construction of Retired embankment (1.50 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 (1.45 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 (6.00 km)	Continued weakening of embankments; continuous subsidence of embankments due to traffic load and wave action; land	Slope protection works will strengthen the embankments and protect them against subsidence,

Proposed Works under CEIP-1	'No Project' Scenario	'With Project' Scenario
	resources would continue to be damaged/ lost.	wave action, and wear and tear.
Replacement of drainage sluices with drainage-cum-flushing sluices.	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.	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.
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 (22.7 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.
Re excavation of Drainage Channels (63.21 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

SL. No.	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 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

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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 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	10535												MV		123					
38	67/B	ID	Teknaf	900	8	-	0	7	3	-	0	MRZ	10	0	0	MDV	10	26	15	Naf River	5	43	The embankment section is partly damaged due to erosion
39	69/P1	SD	Moheshkhali	1800	13	1	1	5	2	-	0	HRZ	15	0	0	MDV	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	7.167	-	0	-	0	HRZ	15	0	0	MDV	10	144	5		0	37	Breach caused by the cyclonic surge(SIDR & AILA) and wave action.
41	61/1	SD	Sitakunda	8769	27	1	2.150	-	0	-	0	HRZ	15	0	0	MDV	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	MDV	10	48	15	Naf River	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	Moheshkhali	3025	32	-	0	5	2	-	0	HRZ	15	0	0	MDV	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	MDV	10	46	15	Naf River	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	MDV	10	26	15		0	41	Breach caused by the cyclonic surge and wave action
46	59/2	ID	Ramgati	21255	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	22267	64	1	1	1	0	2	1	LRZ	5	3340	3	MV	15	155	5	Issamoti River	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	40343	95	0	0	40	15	-	0	LRZ	5	6051	5	MDV	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	MDV	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	-
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,	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

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			Dumuria																				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
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,	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

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			Debhata & Satkhira																				and wave action. The embankment section is partly damaged due to erosion
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 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		Patukhali	9650		-		-				LRZ	5		0			53	15		7	27	-

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	Labukhali																						
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 are supposed to strengthen the Polder embankment, protect river banks, protectembankment slope, improve the sluices and their performance, and reduce drainage congestion and water logging. These technical alternatives and their consequences are discussed in detail in **Table 5.3** below.

Table 5.3: Technical Alternatives for Polder 33

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.
	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.
	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.

Proposed Interventions	Alternative Options	Consequence
	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 options 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 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 options 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 options 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.

Proposed Interventions	Alternative Options	Consequence
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 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

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
Re-sectioning, Retirement/ Relocation of existing embankment with new design heights	Better protection against cyclone surges and water level rise	Financial savings from reduced damages caused by flood	Improved surface water quality; improved natural vegetation	Reduced loss of lives and assets that would bring poverty reduction; increased employment opportunities for local people.
	Protection to river bank erosion	Financial savings as the embankments will provide good road transportation routes.	Reduced traffic congestion inside the polder because of improved embankments, which will facilitate vehicular traffic	Reduction of loss of assets which would bring poverty reduction
	Prevention of salinity intrusion in the polder	Improved earning of local people during construction		Improved cropping particularly for small farmers thus alleviating poverty.
		Improved cropping pattern and boosting the local economy		

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
Bank revetment, slope protection	Enhanced embankment protection against tidal wave action of rivers, provide erosion protection	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.	Improved embankment stability; reduced soil erosion; and provide good means of transportation	Reduced loss of lives and assets which would bring poverty reduction; increased employment opportunities for local people.
Foreshore plantation	Enhanced embankment protection against tidal wave action of rivers, provide erosion protection	Financial savings from reduced damages caused by the floods and 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.	Improved embankment stability; reduced soil erosion; enhanced soil quality; improved air quality; enhanced aesthetic value of the area.	Reduced loss of lives and assets which would bring poverty reduction; 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.

Intervention	Considerations			
	Technical	Financial/Economic	Environmental	Social
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.

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 33, 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 BWDB colony at Dakop, which is situated in Polder 32, the polder located in the western periphery of Polder 33. 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 9.86 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 0.76 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.

- About 0.99 million cubic meters of carried earth will be needed for construction works in Polder 33. This carried earth will be collected from other places, where land owner will be compensated by the contractor and there will be kept royalty between contactor and land owner.
- 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 Alternatives for Workforce Procurement

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 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 through the river by Cargo, Burge, Troller and Engine Boats. 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.

Waterways

Polder 33 is located along the right bank of Possur river. On the western periphery, the polder is bounded by Bhadra river and Chunkuri river.The Possur river (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 Chunkuri and Bhandra rivers are also navigable enough to be used for construction purposes on the west. In the southern direction construction can be carried out using the Dhangamari river. However this river is shallow and not feasible for transportation throughout the year.

Apart from the Possur and Chunkuri rivers, all the other surrounding rivers are relatively narrow and shallow and therefore small boats are recommended in these water bodies (Bhadra river, Dhangamari river). While large Cargos, Burge, Trollers can move along the Bigger rivers.

Roadways

While transporting materials to the stock yard from Khulna, the regional road through Chalna from Khulna city bypass high way can be used (Same as Polder 32). This route includes a Ferri crossing the Jhopjhopia river. There is another route available to enter Polder 33 through Bagerhat, and then Mongla. Passur river needs to be crossed using Ferri to enter Polder 33 from Mongla road. The roads inside the polder are deteriorated since the occurrences of cyclone Aila and Sidr.

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 Land Resources

6.1.1 Topography

Polder 33 is located near the Sundarbans under the southwest region of Bangladesh. Topographically, the sloping pattern of the polder area is mild from north to south and developed by the delta development process. Before construction of the polder, the low lying areas of the polder normally used to be inundated by tidal flooding and were vulnerable due to storm surge for its flat topography. The area of the polder is crisscrossed by many khals. The total area has moderate slope and north portion of land is higher than the south. However, the contour map shows that the high lands are situated on the banks of the river and khals. In the polder area, the elevation of the settlement and agriculture land is in between 1.50 m to 2.15m and 0.90 m to 1.05 m respectively. **Figure 6.1** below represent the land level of the polder in meter above the mean sea level (MSL).

6.1.2 Agro-ecological regions

As a part of 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 and for assessment of present and future agricultural potential. Polder 33 falls agro-ecological region of Ganges Tidal Floodplain (**Figure 6.2**).

Ganges Tidal Floodplain (AEZ-13)

This region occupies an extensive area of tidal floodplain land in the south-west part of the country. The entire Polder is covered by 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 generally stand less than a meter above the adjoining basins. This entire zone lies within the cyclone prone area.

There is a general 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 soils also occupy 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. Soils of the Sundarbans area are strongly alkaline. The fertility level is generally high with medium to high organic matter content. The Ganges Tidal Floodplain region occupies an extensive area of tidal floodplain land in the south-west of the country.

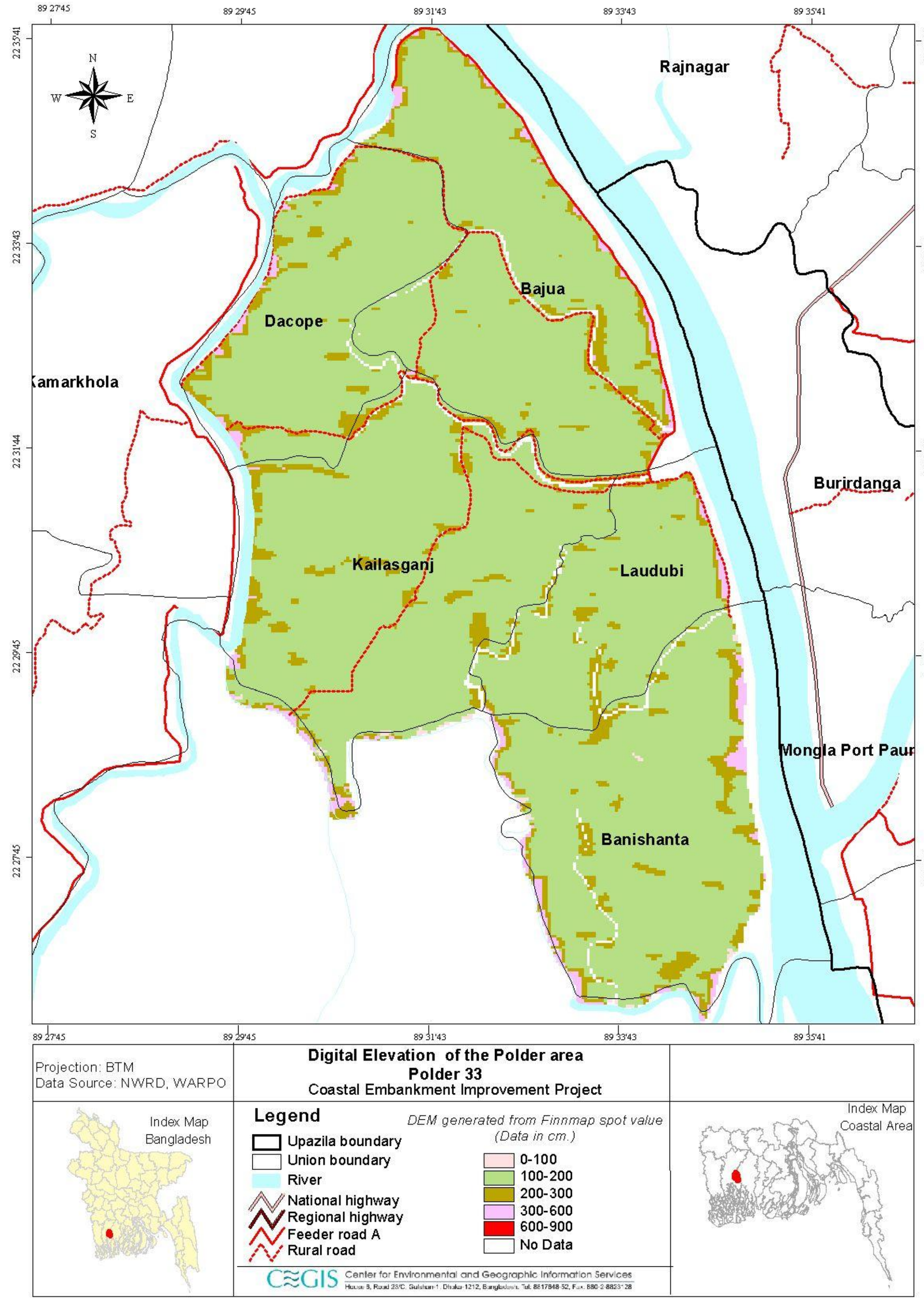

Figure 6.1: Land elevation of Polder 33

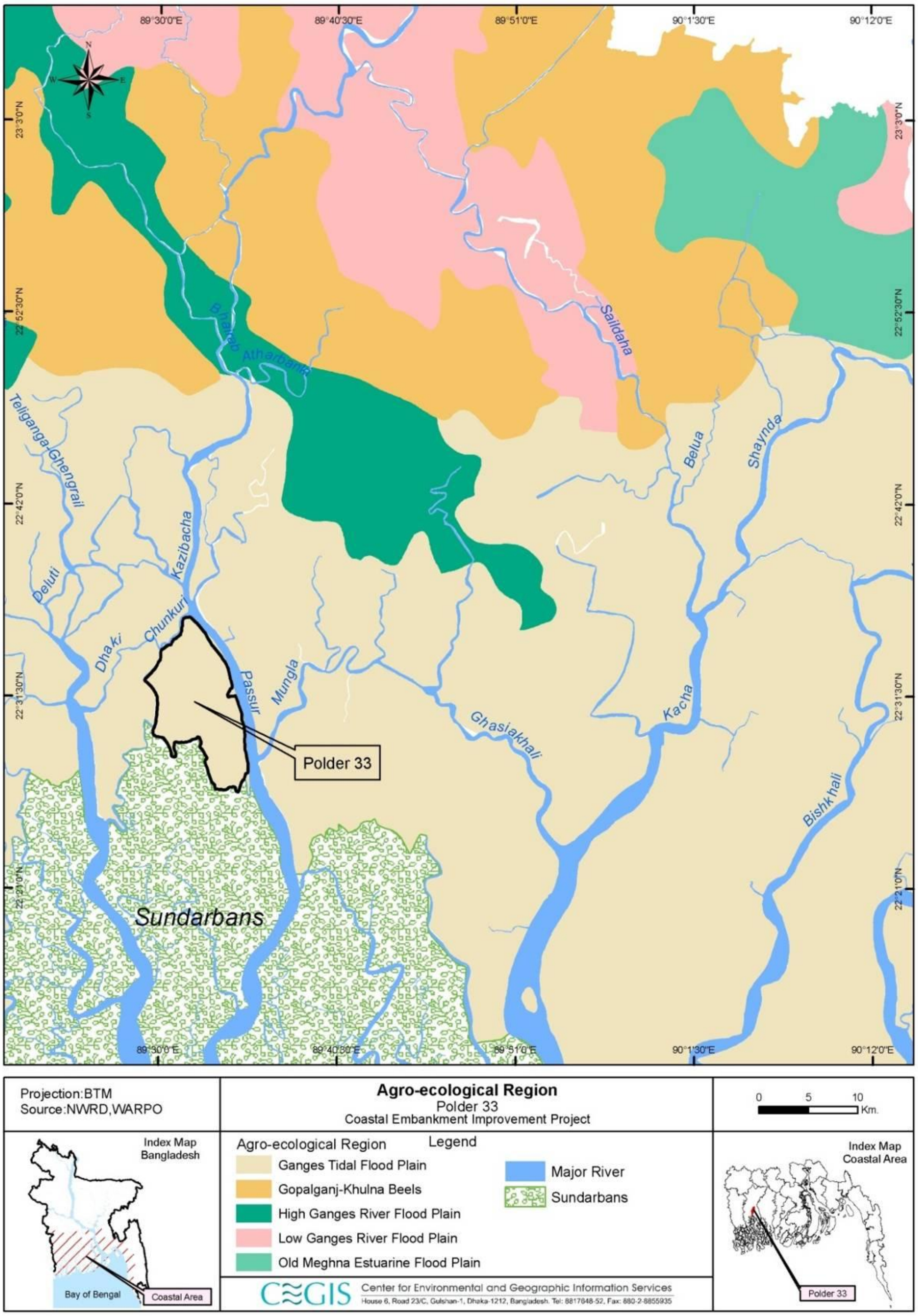

Figure 6.2: Agro-ecological Zone (AEZ) of the polder area

6.1.3 Soil

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 soil type. Acid sulfate soils also occupy 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, poorly drained except soils of high land areas.

Soil texture is the relative proportions of sand, silt and clay. It is very important for agriculture crop production. The texture of topsoil of the polder area is clay (68%), loam (30%) and clay loam (2%). Detailed soil texture is presented in **Table 6.1**.

Table 6.1: Soil texture of the polder area

Soil texture with depth (cm)	% of NCA		
	Clay	Loam	Clay Loam
Topsoil (0-15cm)	68	30	2

Sources: SRDI, 2012

6.1.4 Land type

Classifications of land type are based on depth of inundation level during monsoon season due to normal flooding on agriculture land. There are five land type classes: High land (Above flood level), Medium highland (Flooding depth 0-90 cm), Medium lowland (Flooding depth 90-180 cm), Low land (Flooding depth 90-270 cm) and Very lowland (Flooding depth >270 cm). The polder area is dominated by medium highland (58%). The highland and medium lowland area are about 32% and 10% respectively. Detailed land type is presented in **Table 6.2.**

Table 6.2: Area under different land types

Land type	Area (ha)	Percent
High land	1,653	32
Medium high land	2,950	58
Medium low land	517	10
Low land	0	0
Very low land	0	0
Total	5,120	100

Source: Estimation from main consultant and field information

6.1.5 Land use

The total polder area is about 8,600 ha of which about 5,120 ha is available for cultivation. The settlements and water bodies cover about 40% of the total area of the scheme. About 3,557 ha, 1,348 ha and 215 ha of NCA are being used for single, double and triple cropped area. The percentages of single, double and triple cropped area are about 70, 26 and 4.2 of the NCA respectively. Detailed land use of the scheme areas is presented in **Table 6.3**.

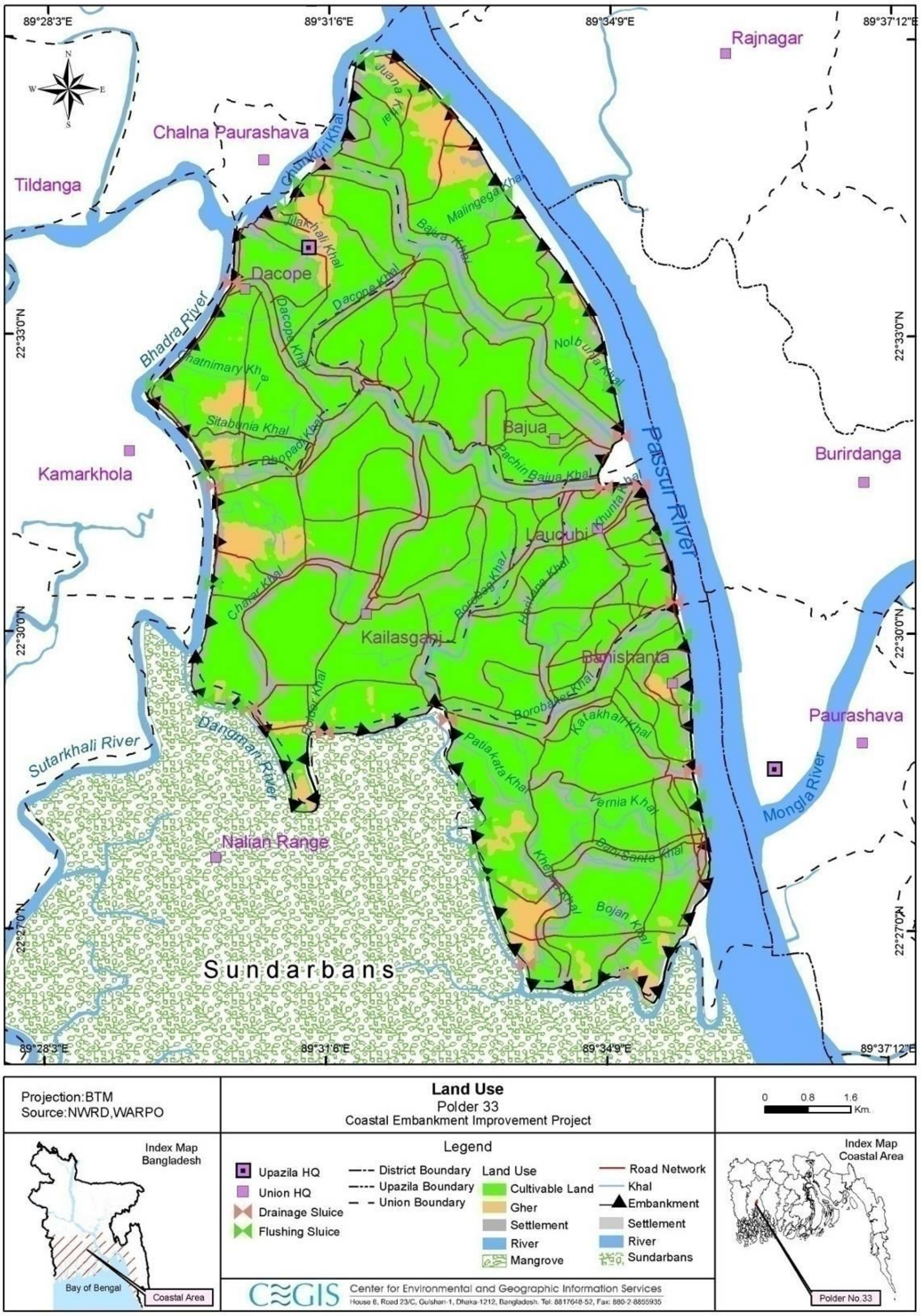

Figure 6.3: Land use Map

Table 6.3: Present land use of the polder 33

Land use	Area (ha)	%
Total area	8,600	100
Settlement	2,254	26
Water bodies	1,226	14
Agriculture land	5,120	60
Single crop	3,557	70
Double crop	1,348	26
Triple crop	215	4.2
Total cropped area	6,898	

Source: Estimation from main consultant and field information

6.1.6 Farming practices

Farming practices within most of the Polder area are influenced by the 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 33 are complicated due to physical, biological, climatological and socioeconomic factors. The siltation of rivers and channels cause drainage congestion during monsoon. Natural calamities like cyclone and surge cause devastating crop damage in the polder area. Scarcity of sweet 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 polder area. Rice is the main crop grown because of its adaptability in diversified ecological conditions.

6.1.7 Present Cropping pattern and intensity

Existing prominent cropping pattern is Fallow - T. Aman (HYV) - Fallow which is practiced in about 53.7% of the net cultivable area (HL 12.98% and MHL 40.72%). The cropping intensity is about 135%. Detailed cropping patterns by land type are presented in **Table 6.4**.

Table 6.4: Present Cropping Pattern in polder 33

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-Feb.)	Area (ha)	% of NCA
High land	Sugarcane	Sugarcane	Sugarcane	8	0.15
High land	Orchard	Orchard	Orchard	15	0.29
High land	Vegetables	Fallow	Potato	200	3.9
High land	B. Aus (Local)	T. Aman (HYV)	Fallow	420	8.2
High land	T. Aus (Local)	T. Aman (HYV)	Watermelon	200	3.9
High land	Chilli	T. Aman (Local)	Spice	15	0.29
High land	T. Aus (Local)	Fallow	Chilli	20	0.39

Land Type	Kharif-I (March-June)	Kharif-II (July-October)	Rabi (Nov-Feb.)	Area (ha)	% of NCA
High land	T. Aus (HYV)	Fallow	Vegetables (W)	110	2.14
High land	Fallow	Aman (HYV)	Fallow	665	12.98
Sub-total				1,653	32.28
Medium High land	T. Aus (HYV)	T. Aman (Local)	Fallow	400	7.8
Medium High land	Vegetable	Fallow	Vegetables	40	0.78
Medium High land	Fallow	T. Aman (Local)	Potato	28	0.5
Medium High land	T. Aus (HYV)	Fallow	Boro HYV	90	1.75
Medium High land	Fallow	T. Aman (Local)	Fallow	307	5.99
Medium High land	Fallow	T. Aman (HYV)	Fallow	2,085	40.72
Sub-Total				2,950	57.61
Medium Low Land	T. Aus (Local)	Fallow	Boro (HYV)	220	4.29
Medium Low Land	T. Aus (HYV)	Fallow	Pulses	20	0.39
Medium Low Land	T. Aus (Local)	Fallow	Pulses	180	3.51
Medium Low Land	Fallow	Fallow	Oilseeds	20	0.93
Medium Low Land	Fallow	Fallow	Spices	52	1.01
Medium Low Land	Fallow	Fallow	Oilseeds	25	0.48
Sub-Total				517	10.09
Grand Total				5,120	100

Sources: Main consultant and field information.

6.1.8 Cropped Area and Production

Detailed cropped area, crop production, yield rate, damaged area and production loss are presented in the following sections.

Total cropped area is about 6,898 of which 5,710 ha is covered with rice. The rice cropped area is about 82.7% of the total cropped area and the rest 17.3% is occupied by non-rice crops. Among the rice, T Aman (HYV), T Aman (Local), T Aus(HYV), T Aus (Local) , B. Aus, and Boro (HYV) are being grown on 3,570 ha, 550 ha, 620 ha, 240 ha, 420 ha, and 310 ha respectively. Non-rice crops include Sugarcane, Orchard, Potato, Water melon , Spices, Chilli, S Vegetables, W. Vegetables, Pulses and Oilseeds grown on 8, 15, 228, 200, 67, 35, 240, 150, 200, and 45 ha respectively (**Table 6.5**).

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 may be expressed as: Total crop production = damage free area × normal yield + damaged area x damaged yield.

Total paddy production is about 11,792 metric ton of which the contribution of T Aman (HYV), T Aman (Local), T Aus(HYV), T Aus (Local) , B. Aus, and Boro (HYV) are 7,069 metric ton, 1,100 metric ton, 1,674 metric ton, 360 metric ton, 504 metric ton and 1085 metric tons respectively. The percentages of contribution of production of T Aman (HYV), T Aman (Local), T Aus (HYV), T Aus (Local), B.Aus, and Boro (HYV) are about 60, 9, 14, 3, 4 and 9 respectively. Total non-rice crop production is 15641 metric ton. The production of Sugarcane, Orchard, Potato, Water melon , Spices, Chilli, S Vegetables, W. Vegetables, Pulses and Oilseeds are 240, 180, 3420, 8,000, 375, 52.5, 1,860, 1200, 250 and 63 metric ton respectively (**Table 6.5**).

Table 6.5: Cropped area, production, damaged area and production lost in polder 33

Crop name	Total Cropped Area (ha)	Damage free area		Damaged area		Total production (ton)	Production lost (ton)
		Area (ha)	Yield (t/ha)	Area (ha)	Yield (t/ha)		
Rice-T. Aman HYV	3,570	2,142	2.5	1428	1.2	7,069	1,856
Rice-T. Aman Local	550	440	2.3	110	0.8	1,100	165
Rice-T. Aus HYV	620	620	2.7	-	-	1,674	-
Rice-T.Aus Local	240	240	1.5	-	-	360	-
Rice-B. Aus	420	420	1.2	-	-	504	-
Rice-Boro HYV	310	310	3.5	-	-	1,085	-
Total rice	5,710	4,172		1538		11,792	2,021
Sugarcane	8	8	30	-	-	240	-
Orchard	15	15	12	-	-	180	-
Potato	228	228	15	-	-	3,420	-
Water melon	200	200	40	-	-	8,000	-
Spices	67	67	5.6	-	-	375	-
Chilli	35	35	1.5	-	-	52.5	-
S.Vegetables	240	120	10.5	120	5	1,860	660
W.Vegetables	150	75	12	75	4	1,200	600
Pulses	200	200	1.25	-	-	250	
Oilseeds	45	45	1.4	-	-	63	
Total non -rice	1,188	993		195		15,641	1,260
Total	6,898	5,165		1,733		27,432	3,281

Source: Main consultant and field information, 2012

Figure 6.4: Fallow land in Boro season

6.1.9 Crop Damage

Crop damage data for the years 2007-2011 period (years) have been collected from the field in consultation with stakeholder, farmers and officials of the DAE. Average crop damage was calculated on the basis of crop damage of four years. 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 polder area about 1,538 ha and 195 ha area of rice and non-rice crop fields were affected due to drainage congestion, drought, salinity, natural calamities like cyclone Sidr, Aila, pest and diseases infestation etc. respectively. Total production loss of rice and non-rice has been estimated as 2,021 metric ton and 1,260 metric ton respectively (**Table 6.5**).

6.1.10 Agricultural Input

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 6.6**). The major fertilizers used in this area are Urea, TSP and MP. The quantities of fertilizer used by the majority of farmers are generally lower than the recommended doses and the proportions of Urea, tri superphosphate (TSP) and muriate of potash (MP)applied are unbalanced. The use of nitrogenous fertilizer (Urea) is higher than other chemical fertilizers. Generally farmers did not use manure or compost in their fields. Unbalanced used of chemical fertilizers would affect the soil health which would be ultimately reflected on crop yields.

Table 6.6: Fertilizer and pesticide use in the project area

Crop Name	Fertilizer (Kg/ha)						Pesticide (Tk/ha)
	Urea	*TSP*	*MP*	*Gypsum*	*Zinc*	*Manure*	
T. Aman (HYV)	150	130	60	-	-	-	1400
T. Aman (Local)	120	89	30	-	-	-	1100
T. Aus (HYV)	180	175	140	-	-	-	1000
T. Aus (Local)	112	75	48	-	-	-	500
Boro (HYV)	250	125	80			-	2500
Potatoes	250			-	-	-	1500
Chilli	80	60	40	-	-	-	400
S. Vegetables	130	100	67	-	-	-	2000
W. Vegetables	250	150	130	30	-	-	1500
Watermelon	100	60	50				700
Spices	70	50	40	-	-	-	500
Oil seeds	80	50	30	-	-	-	300

Source: Main consultant and field information, 2012

The use of pesticides depends on the degree of pest infestation. 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, Red pumpkin beetle, Epilachna beetle, Brinjal shoot and fruit borer, Fruit weevil etc. Local farmer reported that they are using different types of pesticides such as Ripcord, Sunfuran (granular), Diazinon (liquid), Rovral (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.

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 about those. The seed rate for different crops is presented in **Table 6.7**.

Table 6.7: 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. Aman (HYV)	35	-	90	-	4,500
T. Aman (Local)	40	-	90	-	4,500
T. Aus (HYV)	35	-	90	-	4,500
T. Aus (Local)	38	-	90	-	4,500
Boro (HYV)	30	4000			4,500
Potatoes	3500-4000	1000	90	-	4,500
Chilli	2.5	300	90	-	4,500
S. Vegetables	12	-	90	-	4,500
W. Vegetables	2-3	700	90	-	4,500
Watermelon	750	600			3,000
Spices	1-2	-	90	-	4,500
Oil seeds	10-12	-	90	-	4,500

Source: CEGIS estimation, 2012

Irrigation

Irrigation coverage of the polder area is only about 6% of the total NCA during the dry season. Irrigation is provided mainly in HYV Boro crops in the project area. Surface water is the major source of irrigation using LLPs. External rivers (*Passur, Chunkuri, Bhadra, Sutarkhali and Dhangmari*), Khals (*Bajua khal, Taltola khal, Dowani khal, Khutakhali khal, Laudubi khal, Khajuria khal, Banishanta khal*) and beels (*Daria Chital and Narkir*) are the major source of irrigation water. Most of the farmers provide irrigation with surface water for raising seedlings, land preparation and transplantation up to mid March. But the availability of surface water for irrigation has been declining due to siltation of the rivers, beels and khals. Irrigation cost for different crops in the polder area is presented in **Table 6.7**.

Labor

In the study 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 equal 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 6.8**.

Table 6.8: Labor used in the polder area

Crop name	Labor (No/ha)
T. Aman (HYV)	170
T. Aman (Local)	160
T. Aus (HYV)	160
T. Aus (Local)	150
Boro (HYV)	170
Sugarcane	180
S. Vegetables	180
W. Vegetables	180
Watermelon	120
Potatoes	140
Chilli	180
Spices	170
Oil seeds	120
Orchard	120

Source: CEGIS estimation, 2012

6.2 Water Resources

6.2.1 River System

The hydrological description of the polder area is defined based on external river system of Bhadra-Chunkuri which flows along the west, Chunkuri and Pashur River to the North, Passur River to the East and Dhangmari River to the south. These external rivers are connected with many internal khals through water control structures. The name of Khals are: *Bhojankhali Khal, Khajuriar Khal, Bani Santa Khal, Katakhali Khal, Borobaker Khal, Andarmanik Khal, Horitana Khal, Borobag Khal, Chara Khal, Bodlar Khal, Ramnagor Khal, Dhopadii Khal, Shitabunia Khal, Singzhara Khal, Chatnimary Khal,Dacope Khal, Jilakhali Khal, Kata Khal, Bajua Khal etc.* All the khals are getting tidal flow through water control structures. But, maximum khals are silted up due to loose soil from agriculture land and silt from sea through water control structures. A number of water bodies related to polder 33 is shown below from **Figure 6.5** to **Figure 6.8.**

Figure 6.5: Passur river

Figure 6.6: Bhadra river

Figure 6.7: Borobag khal

Figure 6.8: Bajua khal

6.2.2 Navigation in Rivers and Khals

The western periphery of the polder is bounded by Bhadra river and Chunkuri river. The Passur river (west), is a large river considering its depth and width. The river remains navigable throughout the year. The Chunkuri and Bhandra rivers are also navigable enough to be used for waterway transportation. In the southern direction navigation can be carried out using the Dhangamari river. However this river is shallow and not feasible for waterway transportation throughout the year. The internal khals/ lakes are shallow and not navigable enough for the water way transportation of large engine boats.

6.2.3 Drainage Congestion and Water Logging

The polder area 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 channels are also interconnected by a lateral channel running from the east to the west and draining into the main rivers. Rain water does not drain out sufficiently due to high siltation in rivers and Khals which remain disconnected from the main river Passur during the dry season.

Drainage congestion as a common issue has been defined for the total polder area though intensity varies from place to place. The drainage performance through linked canals has been gradually decreasing in the existing sub-project sites due to sedimentation both at the upstream and downstream of the regulators and also due to poor operation and maintenance. The major areas severely affected by drainage congestion problems are Baniasanta, Laudoba and Dacope etc. About 35 % areas face post monsoon drainage problem.

6.2.4 Tropical Cyclones and Tidal Flooding

Tropical cyclones are major threat to the coastal areas, causing loss of human lives and livestock and severe damage to crops, fisheries and properties. During last 125 years more than 42 cyclones had hit the coastal areas and 15 have occurred in the last 30 years. The recent most devastating cyclones hitting the SW coast under Khulna district were in 2007 (Sidr) and 2009 (Aila).

The cyclone Aila was more disastrous for the project area than that of Sidr. These cyclones directly affected 50% people of the total polder area. It was destructive for world heritage Sundarbans- the natural protection of SW Bangladesh. During Aila, surge water entered into the project area by overtopping the left bank of Sibsa. At that time the water level on the project site from the ground was 1 meter.

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.

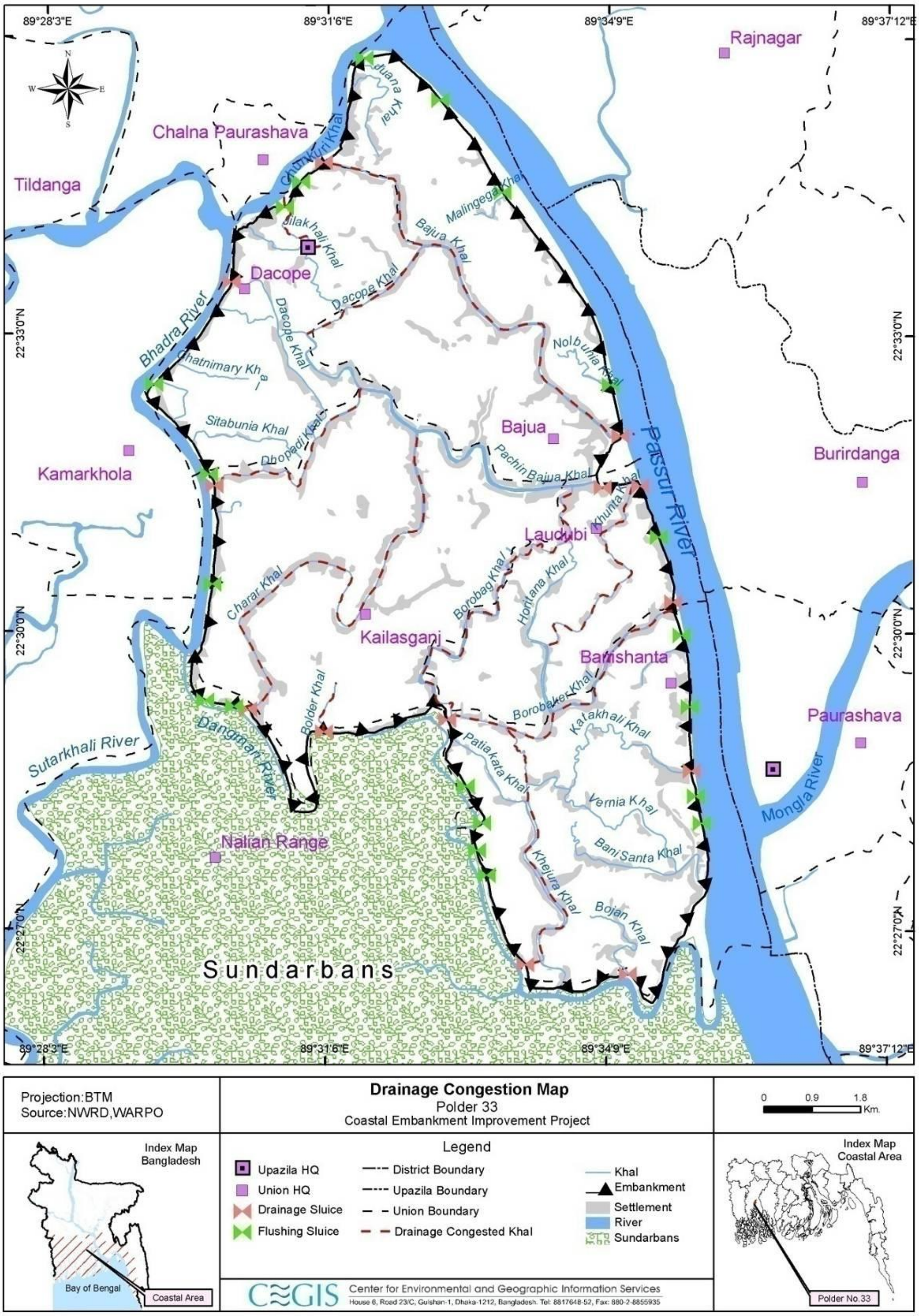

Figure 6.9: Drainage Congestion in Polder 33

6.2.5 Land Erosion and Sedimentation

Sedimentation is a common problem in the project area. The rate of sedimentation in the Chunkuri-Passur stream is more during dry season due to shortage of upstream pressure of river flow. On an average, roughly 1.5 to 2 feet sedimentation takes place in most of the main channels in the study area each year. As the rate of siltation is very high in Passur River, the dredging action cannot sustain any more.

The river Dhangmari is almost dead due to excessive silt deposition and trapping of saline water in bank side for shrimp cultivation. The rate of sedimentation on river bed and bank side deposition is increasing day by day in study area due to malfunctioning of water control structures. Sedimentation in most of the internal khals in existing sub-project sides are not controlled and the cumulative sedimentation causes rise of bed level and reduces the conveyance capacity of the canals. The River Bhadra and Dhangmari khal are going to be silted up due to functional inefficiency of the regulator. The khal network of the proposed sub-project area is less silted up than the existing.

This site is not subject to severe erosion. Some erosion has been found only on right bank of Passur River. People reported that the erosion rate in the Passur River is very low but accretion rate on the right side river bed is high. The following figures (**Figure 6.10** to **Figure 6.12**) show the erosion and accretion of Passur River.

Figure 6.10: Erosion at right bank of the Passur River (Chunkuri village)

Figure 6.11: Sand bar at project site (Playing football during low tide on the river bed)

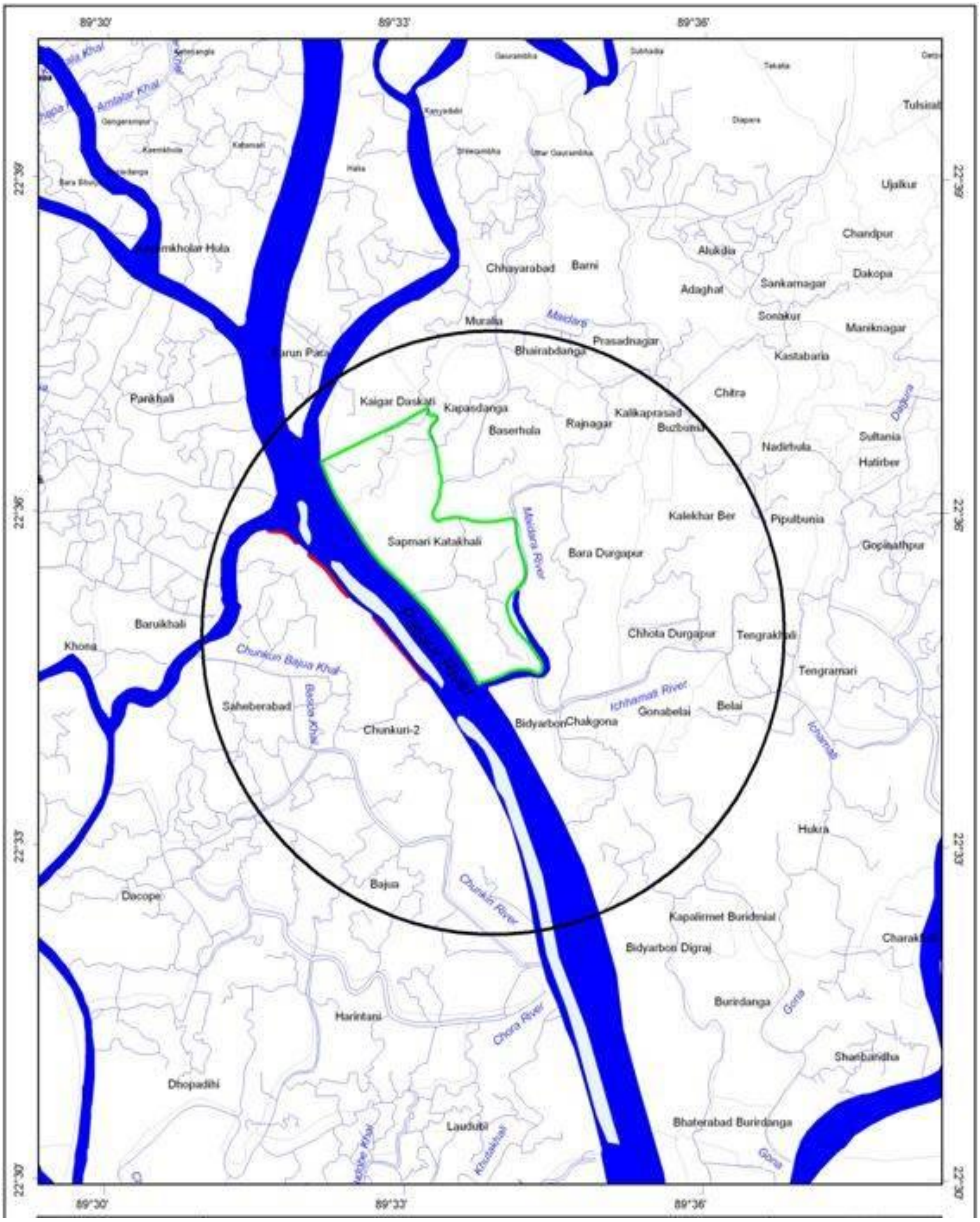

Figure 6.12: Sand bar of Passur river

6.3 Environmental Quality

Air, noise, water and soil quality were measured during the field survey. The objective of the measurement was to set up a strong baseline which will help to monitor the impact of the present during construction and operation phase. The locations for air, water, noise and soil quality are shown in **Figure 6.13.**

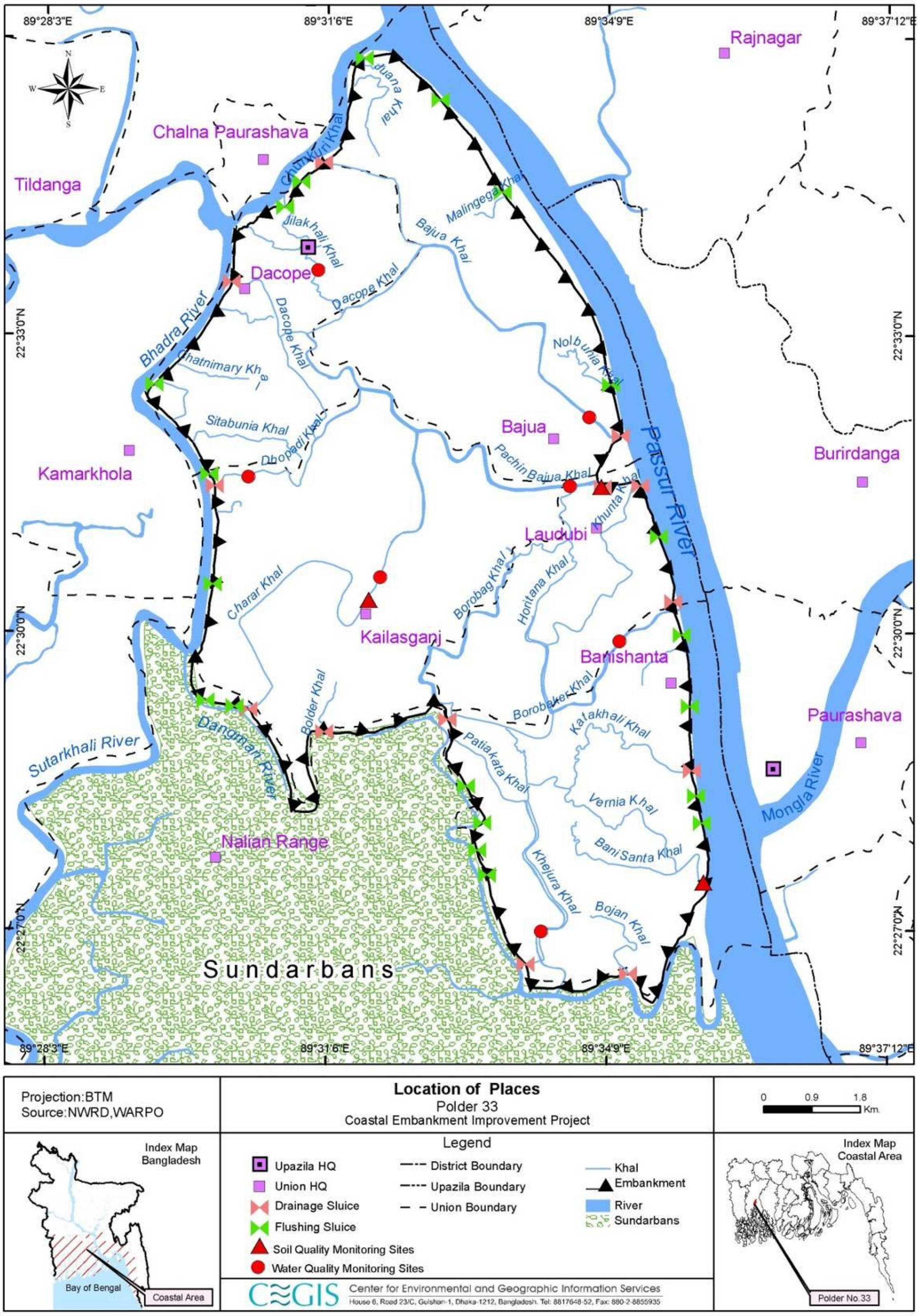

Figure 6.13: Locations of Air, Noise, Water and Soil Quality Monitoring Stations

6.3.1 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 during and after construction. The standards of air quality are given in **Table 6.9.**

Table 6.9: 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 6.10 shows the air quality data measured at Dakop upazila, under Bagerhat district. The values suggest that the concentrations of the measured air quality parameters (suspended particulate matter - SPM, oxides of sulpher - SOx, and oxides of nitrogen - NOx) lie within the range of standard values for Bangladesh (See **Table 6.9**).

Table 6.10: Values of ambient air quality parameters in the study area

Sample Location	Air Quality Parameters		
	SPM (µg/m3)	SOx(µg/m3)	NOx(µg/m3)
banishanta Bazar, Dakop, Khulna	120	<25	24
Kailashgang, Dakop, Khulna	114	<25	22

Source: CEGIS field survey, December 2012

6.3.2 Noise

Noise level has been measured in the field. The values of noise level are shown in **Table 6.11**:

Table 6.11: Daytime noise levels of the study area

Sl. No	Location	Sound level (dB)	GPS
1	Banishanta Bazar	48.7	22°27’31.9” 89°35’02.3”
2	Kailashgonj UP office	49.1	22°30’22.2” 89°31’23.6”
3	Bajua UP office	56.5	22°31’34.1” 89°33’54.8”
4	Laudobi UP office	50.2	22°31’31.0” 89°33’55.0”
5	Dacope ghat	50.6	22°31’31.7” 89°29’42.1”

Source: CEGIS field survey, December 2012

Table 6.12 shows the standard values for noise in Bangladesh. Noise levels exceeding 80 dB (with traffic situation) is usually considered as Noise pollution in our country. However the permissible limits for the country are less (see **Table 6.11**). The study area can be regarded as a mixed area, and the noise levels observed in the study area has been found to be within the permissible limits of mixed zones for daytime.

Table 6.12: 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

6.3.3 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 33 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 i.e. the Chunkuri river (north and west), Passur river (north and east), Dangmari river (south) and Bhodrariver (west) 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 6.13** 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 6.13: Water Quality in Polder 33

Sample Location	Water Quality Parameters					
	Salinity (ppt)	Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO (mg/L)	pH
Bojan Khali gate (Bojan Khal)	-	22.3°C	1383	1.77	5.1	7.1
Patikata Khal (Dhangmari, Banishanta)	-	23.1°C	1320	1.73	6.9	7

Sample Location		Water Quality Parameters					
		Salinity (ppt)	Temperature (°C)	TDS (ppm)	EC (mS/cm)	DO (mg/L)	pH
Badol Khal (Bollaudop gate, ali bot tola)		1	22.8°C	1291	1.35	5.7	7.1
Chora river (Bajua)		1	23.0°C	1362	1.89	5.9	7.1
Chora river (Chadpara)		-	23.4°C	1256	1.24	5.3	7.1
Shingzara Khal (Dakop)		-	23.3°C	1	2.1	2	7.1
Dakop Khal (Near Dakop porishod)		3	22.9°C	1334	1.79	4.9	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 20 percent of the Polder area is affected. This happens because of the following reasons: (i) about 5 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 6.13** 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 Shingzara khal was extremely low 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 22°C- 24°C (**Table 6.13**), 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 1,200-1,400 mg/l (see **Table 6.13**) because of the saline water intrusion. 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 1.5 - 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 6.14**.

Table 6.14: Groundwater Quality at Bagerhat Sadar

Sample Location	Temp (°C)	pH	Chloride (mg/l)	Iron (Fe) (mg/l)	SS (mg/l)	Pb (mg/l)	Coliforms	As (mg/l)
DTW of Bajua Primary School, Dakop	23.4	7.13	469	0.91	5	>0.02	Nill	0
Drinking water quality standard as per ECR'97		6.5 – 8.5	150 – 600	0.3 – 1.0	10	0.05	Nill	0.05

Source: CEGIS field survey, May 2012

6.3.4 Soil Quality

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 flashed 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 main reason of soil salinization in the area is inundation of the soils by saline tidal water. Repeated inundation of soil by the tidal impregnates them with soluble salts thereby rendering the soils saline. These lands are not favorable for most of the crop production. Soils in polder 33 area are strongly saline with some very strongly saline.

Two soil samples were collected from Boro field area under different location of Polder 33. 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 6.15.

Table 6.15: Pesticide Residues Analysis Report

	Location	Sample ID	Carbofuran (ppm)
1	Polder33	1A(0-15cm)	ND
2	Polder33	1B(15-30cm)	ND

6.3.5 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 and interrupted by occasional heavy rainfall. Meteorological information (temperature, rainfall, humidity, evaporation) of the projected area has been taken from Khulna station of Bangladesh Meteorological Division (BMD) and is presented in **Figure 6.14** to **Figure 6.20**.

Temperature

Mean maximum temperature stays between 19.3°C to 30.4°C over the year with the highest temperature experienced in the month of May. There is also significant fluctuation in minimum temperature, which varies between 15.37°C to 25.2°C. The lowest temperature is experienced in the month of January.

The results of monthly average, maximum and minimum temperature variations of the polder are shown in **Figure 6.14**.

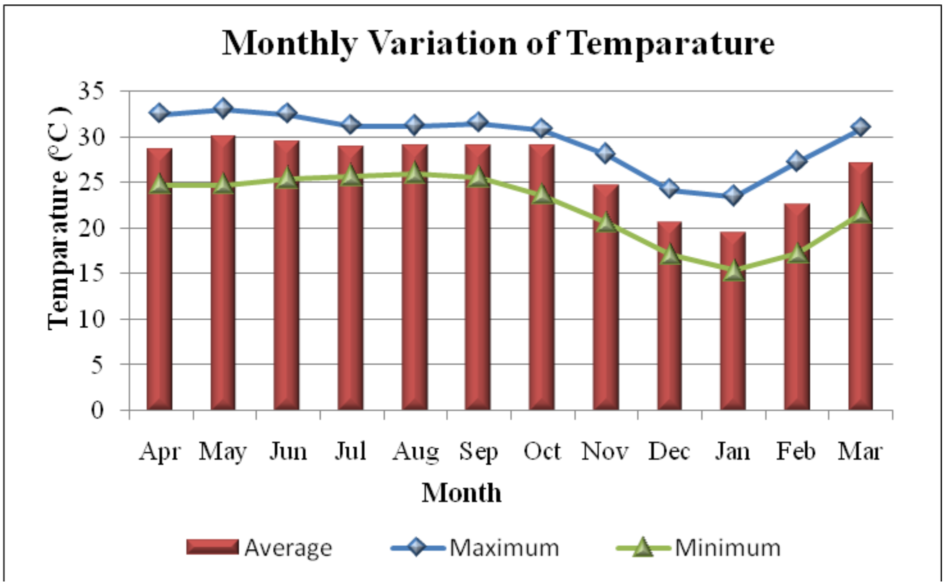

Figure 6.14: Maximum, average and minimum temperature at the project area

Yearly data of mean temperature have also been analyzed for the same station (from year 1961-2011). The trend analysis shows that the average temperature for polder 33 is increasing by approximately 0.001 °C each year (see **Figure 6.15**).

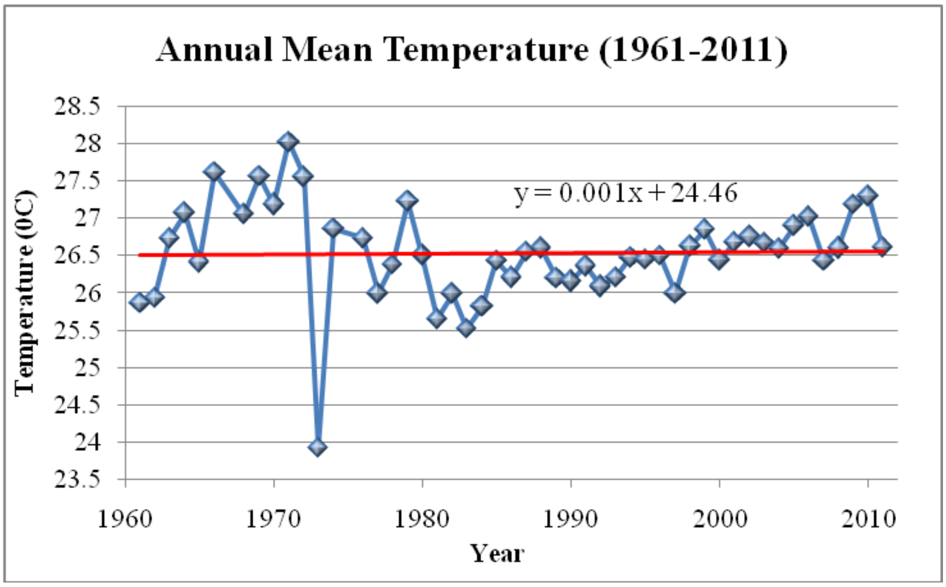

Figure 6.15: Annual Mean Temperature in Project Area

Humidity

The range of mean relative humidity is 74% to 88%. Humidity is highest during July-September.

The results of mean monthly humidity analysis are shown in **Figure 6.16.**

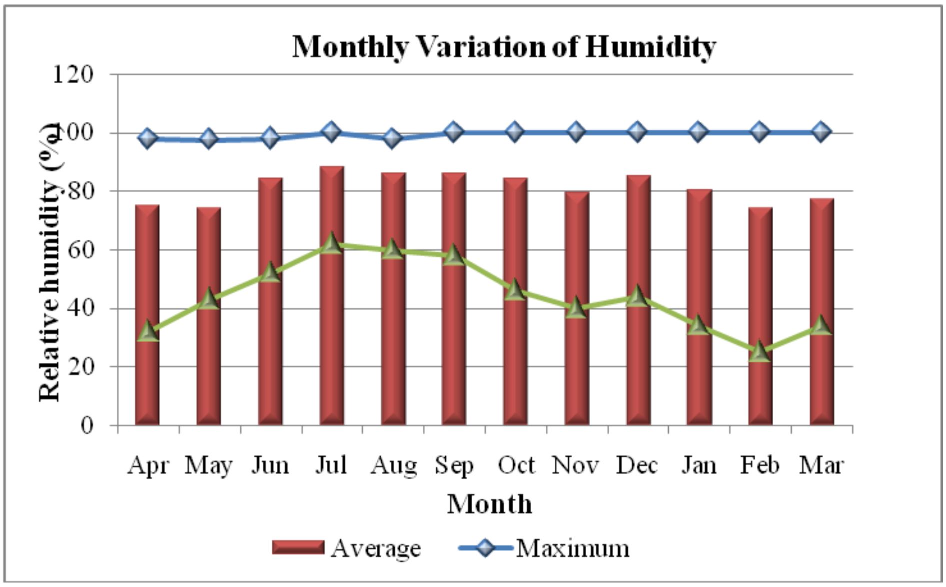

Figure 6.16: Maximum, average and minimum humidity at the project area

Data of yearly average relative humidity have also been collected. The trend analysis for the relative humidity values of polder 33 shows that the relative humidity increases by approximately 0.073 percent each year (**Figure 6.17**).

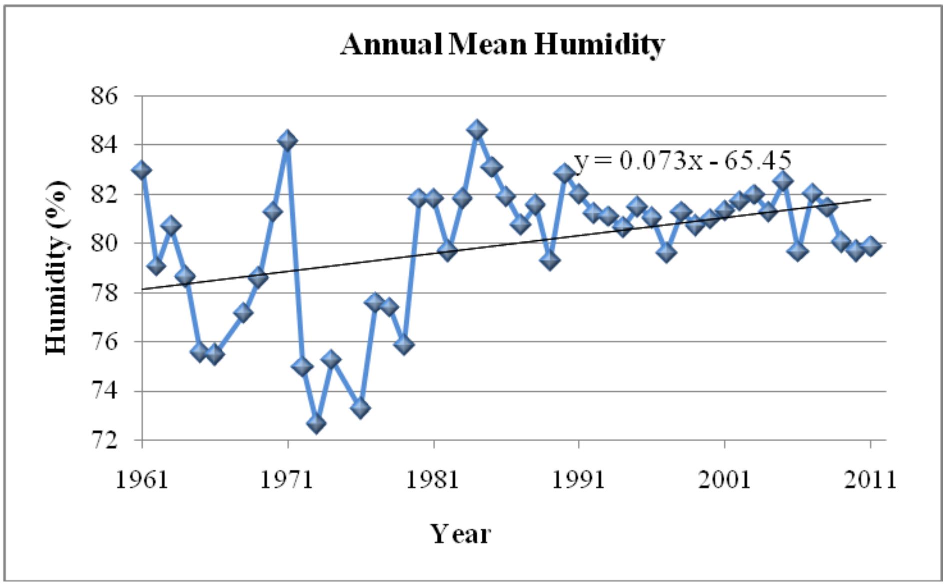

Figure 6.17: Annual Mean Humidity in Project Area

Rainfall

Mean rainfall rate varies within the range of 7 to 400 mm where the highest and lowest values are observed during the months of August and December. The results of mean monthly rainfall analysis are given in **Figure 6.18** for identification of the monthly distribution of mean rainfall.

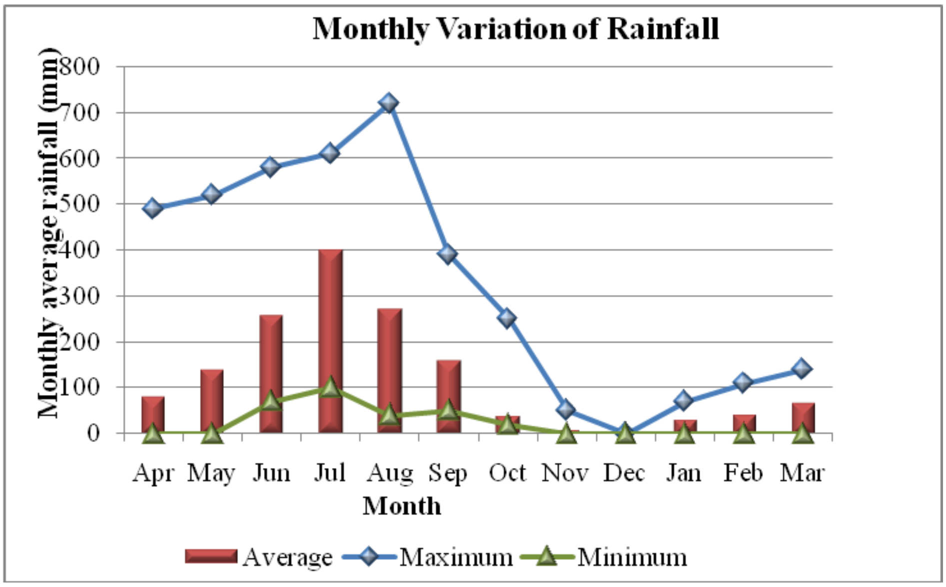

Figure 6.18: Maximum, average and minimum rainfall at the project area

A trend analysis has also been carried out collecting the summation of annual rainfall data from the BMD station at Khulna. The trend reflects that each year, the summation of rainfall in the Project area is increasing by approximately 12.30 mm (see **Figure 6.19**).

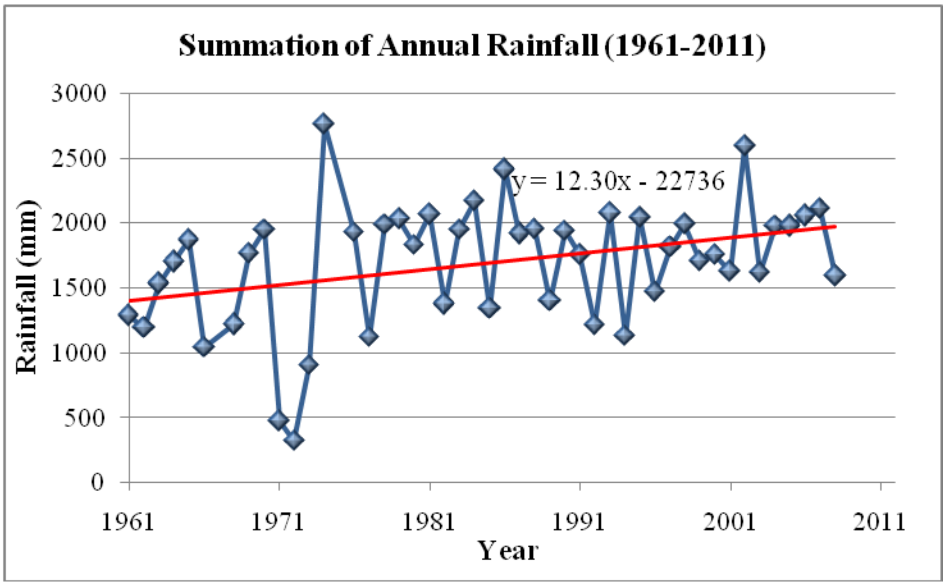

Figure 6.19: Summation of Annual Rainfall

Evaporation

Mean evaporation rate varies within the range of 1.12 to 3.4 mm/day where the highest and lowest values are observed during the months of April and November respectively. The results of mean monthly evaporation analysis are shown in **Figure 6.20**.

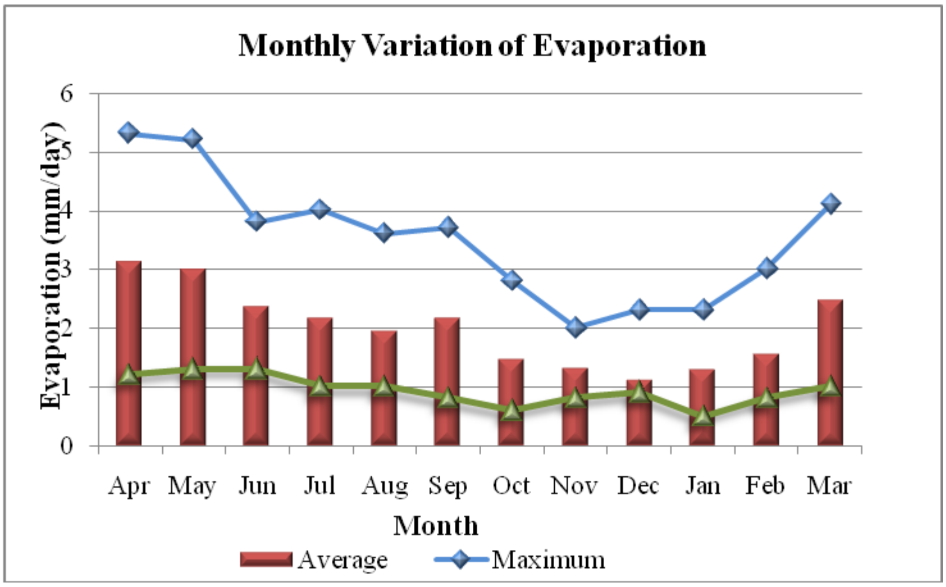

Figure 6.20: Maximum, average and minimum evaporation at the project area

6.4 Fisheries Resources

Fisheries resources of the study area are diversified with different fresh and brackish water fish habitats. Open water fish habitats of the study area include khals and tidal floodplain. The important khals are *Bajua khal, Taltola khal, Dowani khal, Khutakhali khal, Laudubi khal, Khajuria khal, Banishanta khal, Amtola khal, Chaura khal, Basoa khal, Bojonkhali khal, etc* which are acting as major arteries of fish migration into the polder area during filling up the *ghers* with river water. These khals are playing vital roles in maintaining fisheries productivity of internal open water. Bulk of the fish production is coming from capture fish habitats where the main catch of capture habitats comes from tidal floodplain. Fisheries resources of the polder area are also influenced by its peripheral rivers such as *Passur, Chunkuri, Bhadra, Sutarkhali and Dhangmari* River. As the rivers are peripheral and beyond the polder area, so fish production coming from them has not been considered in the polder fish production estimation. Fish production trend is declining gradually from the open water sources after devastating Aila. The numbers of fishermen are 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 in the polder boundary.

21(a): Bajua khal

21(b): Laudubi khal

Figure 6.21 (a & b): Perennial open water fish habitats of the study area

Major fisheries problems and issues identified during baseline survey are as follows:

- morphological changes in adjacent rivers, and khals
- increase of soil salinity thereby degrading of open water habitat quality;
- shrinkage of fish habitats (both area of perennial khals and borrow pits) due to rapid siltation and encroachment;
- overtopping of fish pond during high tide due to non-functioning of water regulators;
- fishing by dewatering of seasonal borrow pits and over exploitation of fishes by using huge number of small mesh sized lift net fishing;
- indiscriminate harvest of shrimp PL (Post Larvae) by local dwellers; complete dewatering of seasonal water bodies for irrigation and fishing;
- using of permanent fish barrier in different drainage khals;
- reduction of borrow pits fish habitat area due to their conversion into crop fields;
- reduction of fish spawning, nursing and grazing grounds; and
- limited areas for water holding capacity round the year.

6.4.1 Fish habitat description

Habitat classification

Fish habitats of the polder area are primarily classified into two types: capture and culture fisheries. The capture fish habitats are further classified into two types of habitats such as khals and tidal floodplain. The culture fish habitats include culturable ponds, ghers, rice-cum-fish and homestead ponds. Golda and bagda ghers occupy majority of the polder area though paddy is cultivated on such lands keeping aside golda and bagda by constructing canals. During dry season, about 5.62% (197 ha) of the total culture fish habitats remain under bagda and golda culture system whereas the area expands upto 94.38% (3,308 ha) during wet season. Among the fish habitats, golda gher covers 37.4% followed by bagda gher, khals, fish pond, culturable pond and rice-cum-fish as shown in **Figure 6.22**. Spatial distribution of fish habitats are shown in the **Figure 6.24**.

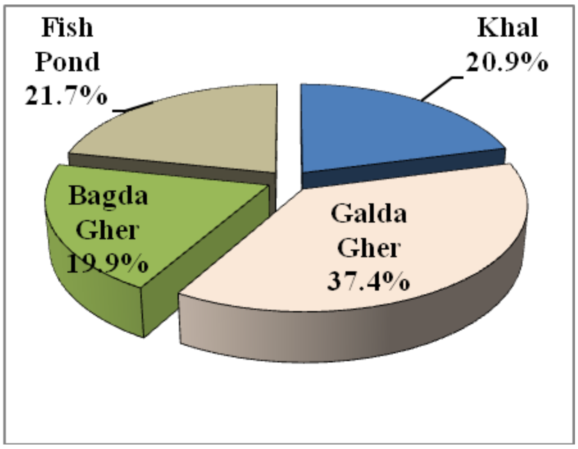

Figure 6.22: Fish Habitat in the polder area

The entire polder area falls in five unions of Dacope upazila. Among the unions, Bajua union occupies about 32.81% of the total fish habitat followed by Baniashanta, Dacope and Laudubi unions as shown in **Figure 6.23**.

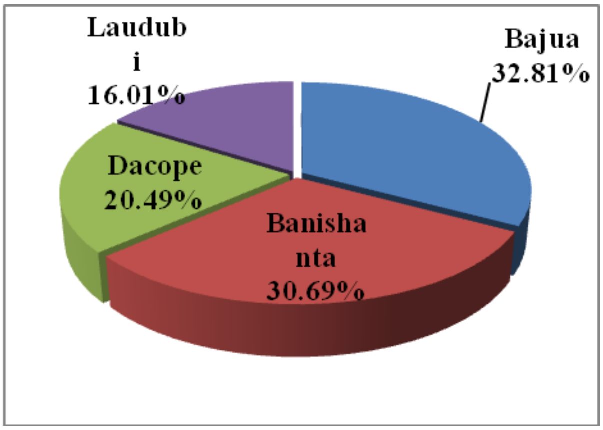

Figure 6.23: Distribution of fish habitat area within the study area

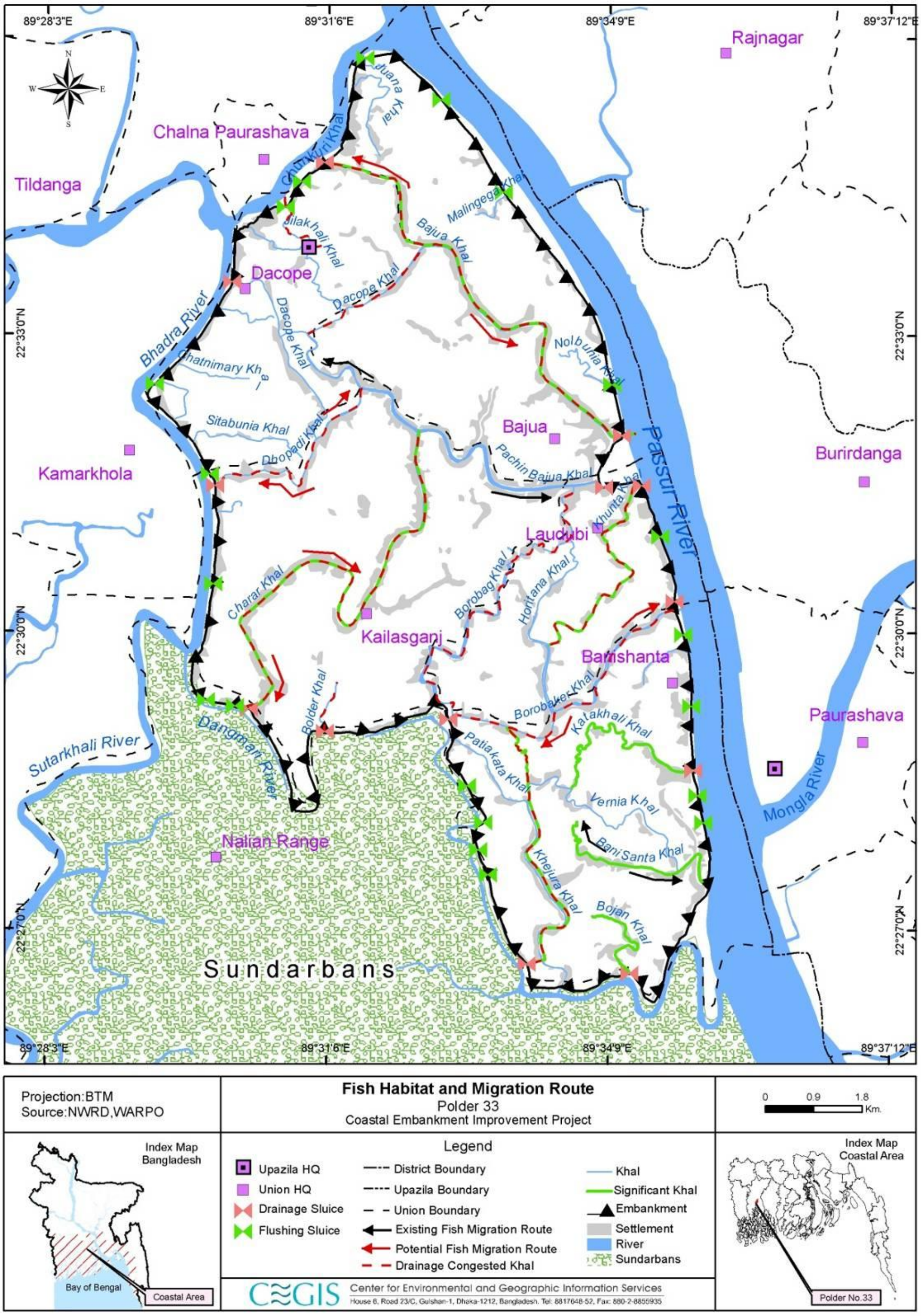

Figure 6.24: Fish habitats and migration routes surrounding the polder 33

Khutakhali khal

Rice-cum-fish culture

Figure 6.25: Natural fish habitats in the polder area

The estimated capture fish habitat of the polder area is 693 ha. Of the total capture habitat, the tidal floodplain occupy the most which is about 80 % and the rest is occupied by the internal khals (**Table 6.16**). The following table attributes the fish habitat areas by type.

Table 6.16: Fish habitat status of the polder area

Sl. No.	Fishery Category	Habitat type	Area (Ha)
1	Capture	Khals	141
2		Tidal floodplain	552
Capture Total=			*693*
3	Culture	Golda gher	252
4		Bagda gher	134
5		Fish pond	147
Culture Total=			*533*
Grand Total=			1,226

Source: Source: Draft final of fishery report, Volume-II, CEIP

The perennial khals namely Bajua khal, Taltola khal, Khutakhali khal, Laudubi khal, Khajuria khal, Banishanta khal, Amtola khal, Chaura khla, Basoa khal, etc are functioning as breeding, nursing and feeding grounds in the polder area.

Average depth of internal khals ranges from 0.5-1.5 m. Depth of seasonal water bodies of the polder area is also insufficient for sheltering of fish juveniles as khals are getting silted up. According to local people opinion, siltation rate in the internal fish habitats of the polder area is 0.1-0.2 inch per year. Influences from the peripheral rivers such as Passur, Chunkuri and Sutarkhali Rivers are causing sedimentation in the polder area habitats, thereby reducing the required water depth for fishes. Khal beds are also silted up by anthropogenic activities such as paddy cultivation, mud made transverse bund and water regulatory structures on vital khals.

Brackish water aquaculture is expanding gradually and steadily in the polder area after the Aila rehabilitation. Aila caused heavy damage to culture fish production in the polder area. More ponds and ghers are being constructed and ready to go for fish production in the following year. Various types of pond fish culture practices are adopted by the local people including mono-poly, and mix-culture. White fish is cultured as associated fish in the golda and bagda ghers.

The capture fish habitats occupy 533 ha (44% of total habitat). Among the culture habitats, Golda gher comprises over 47% followed by Bagda and fish pond (**Table 6.16**). Moreover, there are some commercial fish farms in the polder area which are producing bagda PL as well as producing bagda under semi-intensive culture practice.

Commercial Bagda gher

Golda gher

Fish pond

Culturable pond

Figure 6.26: Culture fish habitats in the study area

6.4.2 Fish production

Estimated total fish production of the study area is 584 ton. Culture fisheries produce bulk of the total production which accounts for 70% of total fish production (407) and the rest is contributed by the capture fisheries as presented in **Table 6.17.**

Table 6.17: Fish production from different habitats of the polder area

	Fishery Category	Habitat type	Production (MT)
1	Capture	Khals	51.4
2		Tidal floodplain	126.1
Capture Total=			*177*
3	Culture	Golda gher	116.4
4		Bagda gher	22.1
6		Fish pond	268.1
Culture Total=			*407*
Grand Total=			584

Source: Draft final of fishery report, Volume-II, CEIP

6.4.3 Fishing effort

Fishermen number

The fishermen of the project area are categorized as fulltime, subsistence and part time fishermen. During field visit it is found that about 65% people of the polder area are engaged in fishing, of which 30% are commercial fishermen and rest are subsistence level fishermen spend annually 310 days (10-12 hrs/days) and 180 days (8-10 hrs/day) in fishing respectively. The subsistence fishermen usually catch fish in the nearby rivers, khals, borrow pits. Around 75% of the total population of the project area is engaged in Post Larvae (PL) collection from February to October. A good number of women and children are engaged in PL collection in study area. The available fisheries occupations of the area are mainly fishermen/women, fish traders, fish farmers and fish labours (gher labours).

A woman PL Collector in Passur river

Fish trader at Laudubi bazaar

Figure 6.27: PL collector and fish trader in the study area

Fishing season

Seine net (Ber Jal/Kona jal) fishing is the major fishery of the study area. Next to push net (Thela jal, Net Jal), gill net (Kerrant Jal), cast net (Jhaki Jal) and fish trap (Atol, Baim Jal) fishing are prominent in the study area fish habitats. Fishing in water bodies (borrow pits) as well as in khals/river starts in June and continues up to November. The traditional fishermen catch fish in the perennial khals and borrow pits. During dry season fishing by bare hand picking takes place and this type activities govern by who have limited access of resources like, fishing gears and crafts. The seasonality of major fishing months and use of fishing gears are furnished in the **Table 6.18**.

Table 6.18: Fishing seasonality of the study area

Seasonality of fishing and frequency of gears & traps used																								
Fishing types	**Seasonality**																							
	Apr	**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**		**Jan**		**Feb**		**Mar**		**Apr**
	Boishakh		**Jaishthya**		**Ashar**		**Sravon**		**Bhadra**		**Ashyin**		**Kartik**		**Agrahayan**		**Paush**		**Magh**		**Falgun**		**Chaitra**	
Scine net (Ber Jal/Kona Jal)			Medium	Medium	High	High	High	High	High	High	High	Medium	Medium	Medium	Medium	Low	Low							
Gill net (Kerrant jal)		Medium	Medium	High	High	High	High	High	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low				
Cast net (Jaki jal)		Low	Low	Low	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	Low	Low	Low
Push net (Thela jal/Net Jal)		Low	Low	Medium	High	High	High	High	High	High	High	High	High	High	High	High	Medium	Medium	Medium	Low	Low	Low		
Charpata Jal	High	High	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	Medium	Medium	High	High	High	High	High
Trap gear (Atol/Baim Jal)			Low	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	High	High	High	High	Low	Low	Low	Low			
Besal Jal	Low	Low	Low	High	High	High	High	High	High	High	High	High	High	Medium	Medium									Low
Lining (Borshi)	Medium	Medium	Medium	Medium	Medium	High	High	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Hand Picking	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	High	High	High	High	High	High	High	High	High	High	Medium
	High					Medium						Low						No occurrence						

Source: Field Survey, 2012

Fishing crafts and location

The commercial fishermen of the study area catch fish in the peripheral rivers, khals and borrow pits. They catch fish using country boat and dingi boats especially in the khals, borrow pits and Sundarbans areas. According to the consultation with the fishermen, it is reported that most of the fishermen resided on the embankment of the study area and they require10-12 men to operate a Ber jal for catching fish and baim jal used for PL collection which requires 2-3 men in a boat. Much gathering of fishing boats and crafts has been observed during field visit in Banishanta, Laudubi, and Bajua of the study area.

Boat at Laudubi ghat

Fishing boats at Banishanta ghat

Besal set in Laudubi khal.

Fishing by hand picking

Ber jal

Angling by a woman

Figure 6.28: Fishing with different types of fishing gears and traps

Fishing Gears

Five types of nets/gears are used for fishing: (a) trap gear locally known as Atol/Baim Jal, which is used to catch small to medium sized fishes; (b) push net locally known as Thela jal/Net jal to catch PL of Golda and Bagda; (c) seine net locally known as Kona Jal to catch large fishes i.e. catfishes, shads, eels, etc.; (d) gill net locally known as Kerrant Jal is used to catch small to medium sized fishes i.e. topshey, catfishes, perch fishes, etc.; and (e) cast net locally known as Jhaki jal is used to small to medium sized fishes, puti, tengra, baim, icha, chanda, etc.; (f) charpata jal used to catch gobids, eels, tengra, etc.; (g) besal jal is used to catch small to large fish in the internal khals. Around 12% of fishermen have fishing boats and around 80% fishermen have fishing gears/nets.

Passur river

Bhadra river

Figure 6.29: Major fish migration habitats of the project area

6.4.4 Fish Migration

It is reported that feeding and spawning migration of riverine and khal resident fish species occur through regulators and sluices implanted in khals during late May to August when is filled up the gher. Many fish species migrate horizontally to these water bodies as part of their life cycle. Siltation of peripheral rivers and internal khals of the study area is causing the reduction of successive length of longitudinal and lateral migratory routes respectively. Overall fish migration status is poor to moderate in the study area due to the following reasons;

a) Most of the water control structures are non-functional.
b) Lack of proper technical knowledge of the local stakeholders for gate operation.
c) Lack of gate operation manual.
d) Absence of Water management organizations.
e) Least but not last, absence of fish friendly gate/ladder.

6.4.5 Fish Biodiversity

Fish diversity is found to be low as this area is prone to brackish water aquaculture and there is less space for open water fish habitation. The study area is a mingling zone of both fresh and brackish water fish species. Occurrences of shrimp is more along with other brackish water fin fish species, such as *Lates calcarifer*, *Liza parsia*, *Mugil corsula*, *Polynemous paradiseus*, etc. The area is abundant with crabs and also culture in captivity for fattening. Fish diversity has the decreasing trend as collection of PL of bagda and golda is a regular practice. Associated fish fries of different species during PL collection are also caught in the net and trash on the land as the harvester thought it consumes more time. In such way, fish diversity is depleting from the wild habitats. On the other hand, drying up of natural habitats is also responsible for depletion of fish diversity. Pollution leaching from the nearby crop field is causing damage to fish diversity. Moreover, obstruction to fish migration routes, morphological changes of internal khals, siltation of fish habitats, squeezing of spawning and feeding and grazing grounds are causal agents of declining fish biodiversity. Snakehead, minor carps, eels, perches, prawns and gobids are the dominant fresh water fishes of the catches as shown in **Figure 6.30**.

Bagda Chingri

Golda Chingri

Mixed catch

Poa


Guchi Baim


Tengra

Figure 6.30: Major fishes occupying the catch composition of study area fish habitats

Checklists of the fishes of different habitats reported by local fishers are analyzed to draw a tentative scenario of the local fish biodiversity of the polder area. List of the fishes of different habitats of the polder area is as follows:

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

Scientific Name	Local Name	Habitat Type						
		Khal	Borrow pit	Golda gher	Bagda gher	Rice-cum-Fish	Fish pond	Culturable pond
Brackish water fish species								
Penaeus monodon	Bagda chingri	P	P	P	P	P	P	A
Anguilla bicolor	Baim Machh	P	A	A	A	P	A	A
Dasyatis sp.	Shapla pata	P	A	A	A	P	A	A
Coilia neglecta	Olua	P	A	A	A	P	A	A
Nemapteryx nenga	Kata gogat	P	A	A	A	P	A	A
Plotosus canius	Kain magur	P	P	A	A	P	A	A
Harpodon nehereus	Lotia	P	A	A	A	P	A	A
Terapon jarbua	Barguni	P	P	A	A	P	A	A
Lates calcarifer	Koral	P	P	P	P	P	P	P
Tenualosa ilisha	Ilish	P	A	A	A	P	A	A
Liza parsia	Bata mach	P	P	A	A	P	A	A
Liza tade	Bata mach	P	P	P	P	P	A	A
Setipinna taty	Phesha	P	P	A	A	P	A	A
Polynemous paradiseus	Topse	P	A	A	A	P	A	A
Sillago domina	Tolardandi	P	P	A	A	P	A	A
Pama pama	Poa	P	P	A	A	P	A	A
Taeniodes anguillaries	Cheowa	P	P	A	A	P	A	A
Apocryptes bato	Chewa bele	P	A	A	A	P	A	A
Trichiurus haumela	Chhuri mach	P	A	A	A	P	A	A
Fresh water fishspecies								
Macrobrachium rosenbergii	Golda chingri	P	P	P	P	P	P	A

Scientific Name	Local Name	Habitat Type						
		Khal	Borrow pit	Golda gher	Bagda gher	Rice-cum-Fish	Fish pond	Culturable pond
Mystus gulio	Tengra	P	P	P	P	P	P	P
Mugil cephalus	Bata mach	P	P	P	P	P	P	P
Pangasius pangasius	Pangus	P	A	A	A	P	A	A
Wallago attu	Boal	P	P	P	P	P	P	
Sperata seenghala	Guijja Ayre	P	P	A	A	P	A	A
Puntius sophore	Puti	P	P	P	P	P	P	P
Glossogobius giuris	Bele	P	P	A	A	P	A	A
Puntius ticto	Tit puti	A	P	P	P	A	P	P
Puntius chola	Chola puti	A	P	P	P	A	P	P
Channa punctatus	Taki	A	P	P	P	A	P	P
Channa striatus	Shole	A	P	P	P	A	P	P
Heteropneustes fossilis	Shing	A	P	P	P	A	P	P
Eutropichthyes vacha	Bacha	P	P	A	A	P	A	A
Mystus vittatus	Tengra	P	P	A	A	P	A	P
Mastacembelus pancalus	Chirka baim	P	P	A	A	P	P	P
Mastacembelus aculeatus	Tara baim	P	P	A	A	P	P	P
Lepidocephalus guntea	Gutum	P	P	A	A	P	A	P
Anabas testudineus	Koi	A	P	A	A	A	P	P
Culture fish species								
Hypophthalmichthys molitrix	Silver Carp	A	A	A	A	A	P	A
Pangasius sutchi	Pangus	A	A	A	A	A	P	A
Labeo rohita	Rui	P	P	A	A	P	P	A
Catla catla	Catla	P	A	A	A	P	P	A
Cirrihinus mrigala	Mrigal	P	P	A	A	P	P	P
Oreochromis niloticus	Tilapia	P	P	A	A	P	P	A
Cyprinus carpio	Carpio	A	A	A	A	A	P	A
Puntius gonionotus	Sharputi	A	A	A	A	A	P	A

Here, A=Absent and P=Present

6.4.6 Species of conservation significance

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

Table 6.20: List of species of conservation significance

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Plotosus canius	Kain magur	√	
Lates calcarifer	Koral	√	
Wallago attu	Boal	√	
Labeo rohita	Rui	√	
Catla catla	Katla	√	

Scientific Name	Local Name	Local Status	
		Rare	Unavailable
Pangasius pangasius	Pangus	√	
Puntius sarana	Sharputi		√

6.4.7 Area of conservation significance

The part of *Bajua khal, Khutakhali khal, Chara khal, Bajua khal, Banishata khal, Khejura khal* are used as feeding and spawning ground of the open water fishes. These habitats are marked as the area of conservation significance.

6.4.8 Fish marketing and post harvest facilities

Local fishermen sell bulk of their catch either directly to the local fish market (Bajua bazar, Laudubi bazar, Koilashgonj bazaar, Dacope bazar, etc.) or to fish traders or buyers (*Bapari*) coming from Khulna, Dacope, Dumuria, etc. Fish marketing and grading of golda chingri is shown in **Figure 6.31**. During consultation with the local people in the study are it is reported that there are some fish traders in local markets in this project area and no structured fish landing centres are found in the area. There are no ice factories are present in the scheme area. Fishermen sell their catch as early as possible to nearby fish markets or to the fish traders. During the field visit, it is found that fish storage facility is in poor condition. Transportation facility at root level is moderately developed. Fish seeds for culture fishery are collected from the fish hatcheries and nurseries which are situated apart from the study area. It is reported from the bagda farms that they collect bagda PL from Cox's Bazar, Chalna, Paikgacha, etc. The gher owners also collect riverine PL from the PL harvester. Though few shrimp farms are situated in the project area and they produce PL for their own purpose. Fish feeds are also collected from the fish feed dealers from Khulna and Cox's Bazar. Quality of fish feeds is a major threat for the fish farmers as the growth of fishes may be retarded due to the impure fish feeds.

Grading of golda

Weighing of golda for marketing

Figure 6.31: Golda grading and marketing at Laudubi bazar

Average daily income of part-time and commercial fishermen ranges from Tk. 200 to Tk. 250 and Tk. 250 to Tk. 300 respectively. Income level of traditional fishermen is decreasing. Consequently, they are changing their occupation. They are also vulnerable to the musclemen who convert open water fish habitats into culture fishery and also to the natural degradation of fish habitats. During lean period (March-April), the fishers spend miserable life due to unavailability of fish in the fishing grounds. During this time they engaged in PL collection of golda and bagda which is also an earning source of the fishermen where they involved without considering the age limits. The sell price of each PL varies from Tk. 0.30 to 1.50 for bagda and Tk. 0.40 to 2.0 for golda.

6.4.9 Fish damage and wastage

Tidal flood as well as riverine flood sometimes wash away the aquaculture ponds, damages the pond dykes, aggrades the pond beds and happen to loss the pond owner as fishes escape from the ponds. The magnitude of fish loss from the aquaculture ponds ranges 70% to 80%. Tidal flood also causes sand carpeting on the khals which is less suitable for fish habitation. Inadequacy or lack of fish landing centers causes the wastage of fish at least by 4% of the total catch.

6.5 Ecological Resources

The Polder is located in the transitional zone between Sundarban Mangrove forest and general ecosystems. The area is encircled by tidal river Passur and its tributaries possing saline-brackish-fresh mixed vegetation. Due to its location in coastal region, the ecosystems are vulnerable to frequent natural calamity. Beside this, changing of landuse is resulting in habitat destruction and loss of its original ecological features.

6.5.1 Bio-ecological Zone

IUCN, the World Conservation Union has divided Bangladesh into 25 Bio-ecological Zones based on physiography, climate, soil types, flooding depth and biodiversity. The name of Bio-ecological Zones of polder 33 is Saline Tidal Floodplain. **Figure 6.32** shows the polder location in the Bio-ecological Zones of Bangladesh. A brief description of this Bio-ecological zone is presented below:

Saline Tidal Floodplain

Saline tidal floodplain is a transitional physiographyis located in the administrative districts of Satkhira, Khulna, Bagerhat, Jhalokathi and Borguna. It has a low ridge and basin relief, crossed by innumerable tidal rivers and creeks. Local differences in elevation are less than 1 m. The sediments are mainly composed of non-calcareous clays, although in the riverbanks they are silty and slightly calcareous. The soil is non-saline throughout the year over substantial amount of areas in the north and east, but they become saline to varying degrees in the dry season in the south west and are saline for most of the year in Sundarban. The rivers carry fresh water throughout the year to the east and northeast, but saline water penetrates increasingly further inland towards the west mainly in the dry season, and for most or all of the monsoon season in the southwest. In the northeast, there is moderately deep flooding during the monsoon season, mainly due to accumulation of rainwater on the land when the Ganges distributaries and the lower Meghna are in high flood levels. Elsewhere, there is mainly shallow flooding at high tide, either throughout the year or only in the monsoon season, except where tidal flooding is prevented by embankments. Within embankments, seasonal flooding only occurs through accumulation of rainwater (Brammer, 1996). Except for the Sundarban, the floral diversity of this zone is similar to those of the adjoining zones. Innumerable indigenous weeds grow in beel areas. Several types of palms and bamboo clumps grow in almost all the villages. The mango *(Mangifera indica)* and Jackfruit *(Artocarpus heterophyllus)* supply the commonest timber and are used for making doors, windows, boxes etc. (Bari, 1978). The zone affords very lucrative place to game bird watchers. At the advent of winter season, numerous game birds which include wild goose, wild duck, cranes, spines, jungle fowl and various waterfowl, begin to flock both in the Sundarban, and the beel ad char areas of this zone. Mangrove, the network of rivers and expanse of beels of this zone teem with different species of fishes.

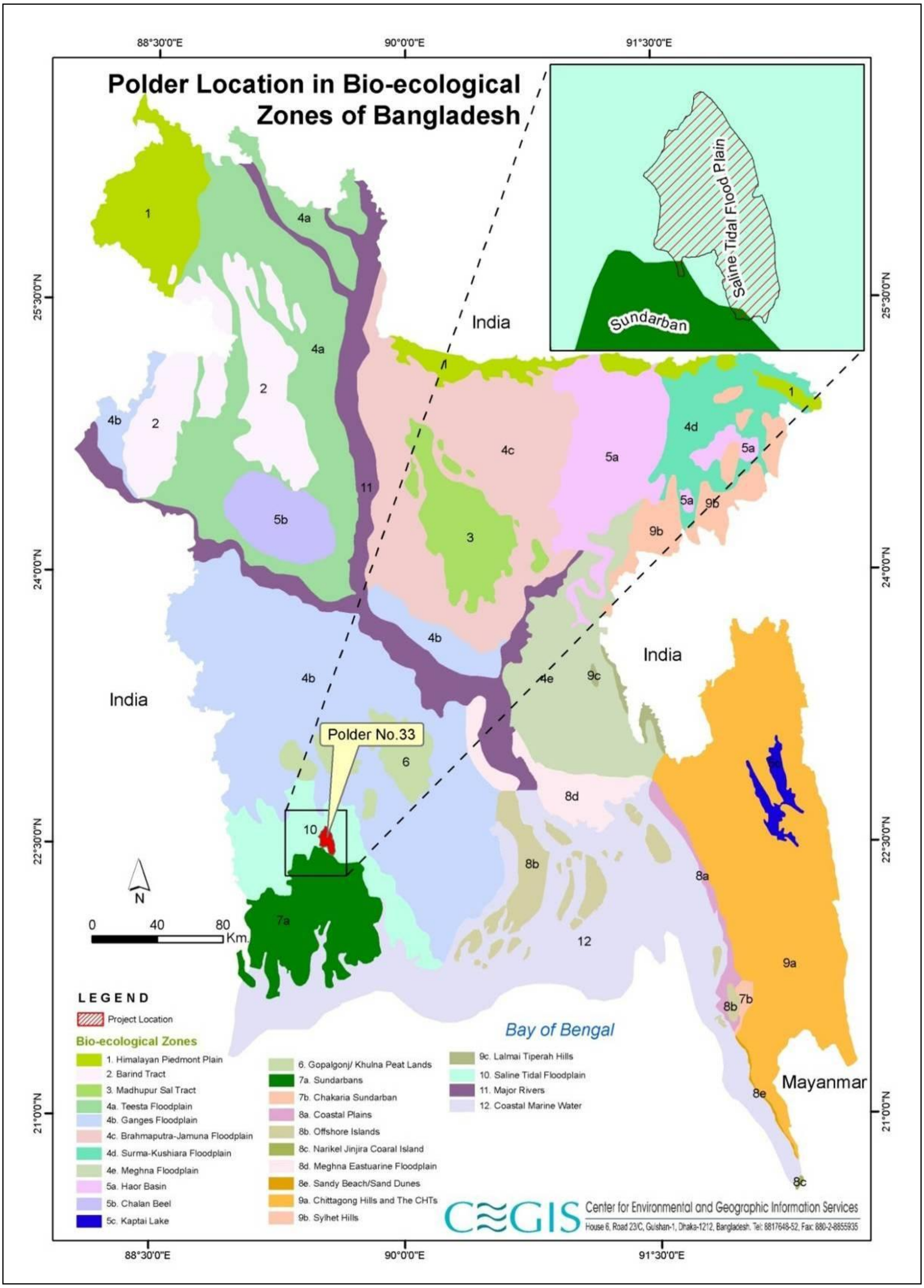

Figure 6.32: Location of Polder 33 in Bio-ecological Zones of Bangladesh

6.5.2 Ecosystem

Ecosystems of this polder are classified into two major categories, i.e. i) Terrestrial ecosystem and ii) Aquatic ecosystem. There is another ecosystem found in this polder namely the Mangrove ecosystem.

Terrestrial ecosystems

Homesteads, crop fields, embankments and roadsides are the major terrestrial ecosystem found within the polder. Homesteads vegetation is the single most important plant community in terms of plant diversity and ecosystem services. Homesteads in this polder are dominated by Narikel *(Cocos nucifera)* which occupies the top canopy coverage. Other trees frequently found are Supari *(Areca catechu),* Rendikoroi *(Albizia saman),* Aam *(Mangifera indica),* Khejur *(Phoenix sylvestris),* Kola *(Musa sp.)* etc. Herbs and shrubs are moderately found. Species among these types are: Akonda *(Calotropis procera),* Vaant *(Clerodendrum viscossum),* Bashok *(Adhatoda vasica),* Patpotey *(Reulia tuberose),* Dumur *(Ficus hispida)* etc. Average tree height of settlement vegetation is not more than 40 feet and generally tree density is low. Vegetation composition of homesteads differs in terms of near river of canal side and far from river or canal. Mixed mangrove vegetation occupy a staple amount of homesteads vegetation near the river or canal where tidal flow reached regularly. Except canal and river side, the other settlements are followed as general vegetation pattern of the country. Homesteads vegetation has been severely damaged by the devastating cyclone Aila in the year 2009. The list of available homestead plants in the polder area is given in **Table 1 under Annex-C.**

Figure 6.33: A part of Homestead vegetation in polder area

Crop fields are mainly used for rainfed aman paddy cultivation and possess leased diversity of plants. Except crop species, others are treated as agricultural weeds like *Cynodn dactylon*, *Cyperus sp*, *Leucus aspera*, *Croton bonplandianum* and other biennials. Though agricultural weeds are less importance in terms of economic return, but it is not negligible to local birds and arthropods as their habitat.

Embankment of this polder is barren or vegetated by few grass species and with small tree like Babla *(Acacia nilotica).* River erosion and frequent shifting cause unfavorable condition of plant growing on embankment. Internal roads and village ways are commonly decorated by Jiga *(Lennea coromandelica)* and Berachita. These plants are usually found at those portions of roads where cross through the settlement. Local villagers use these types of plants for bounding and fencing their homesteads.

Figure 6.34: Berachita, a fencing plant found along internal roadside

Figure 6.35: Portion of embankment looks barren

A total of 59 terrestrial fauna species were observed within the project area. Of these, 42 species were birds and 7 species were mammals, 7 reptiles and 3 amphibians.

Terrestrial birds can be divided into two major groups; birds observed in floodplains and wetland, and birds observed in dry land habitat such as homestead, open woodland, scrub and grass land. Birds of prey survive well in the area. Common bird of prey species found in the project area are: Black Drongo *(Dicrurus macrocercus)*, White throated Kingfisher *(Halcyon smyrnensis)*, Common Kingfisher *(Alcedo atthis)*. Other common birds species in the project area are: Oriental Magpie Robin *(Copsychus saularis)*, Spotted Dove *(Streptopelia chinensis)*, Red vented Bulbul *(Pycnonotus cafer)*, Rufous Treepie *(Dendrocitta vagabunda)*, Common myna *(Acridotheres tristis)*, asian Koel *(Eudynamys scolopacea)*, Greater Coucal *(Centropus sinensis)*, Black Drongo *(Dicrurus macrocercus)*, Black Hooded Oriole *(Oriolus xanthornus)*, Blue-throatrd Barbet *(Megalaima asitica)*.

All bigger mammal species have already disappeared from the locality for habitat changing due to agricultural extension and expansion of human habitat. Small mammals such as Indian Mongoose *(Herpestes auropuntatus)*, Cham Badur *(Pipistrellus coromandra)*, Indian Flying Fox *(Pteropus giganteus)*, House Rat *(Mus masculus)*, and House Shrew *(Suncus murinus)* are the major species. Among the reptiles, Keeled Grass Skink *(Mabuya carinata)*, Bengle monitor *(Varanus flabescens)*, Checkered Keelback *(Xenochrophis piscator)* are known to occur in the area. The common lizards found within the project area include Common House gekko *(Hemidactylus frenatus)*, Common Garden Lizzard *(Calotes versicolor)*. Among other species that once were common but now are only occasionally seen are the Large Indian Civet *(Viverra zibetha)*. Amphibian species favor wetland areas and the marginal dried areas. Some species, Common Toad *(Bufo melanostictus)*, Jurdon's Bull Frog *(Hoplobtrachus crassus)* prefer the cool, damp habitat of the bamboo grooves.

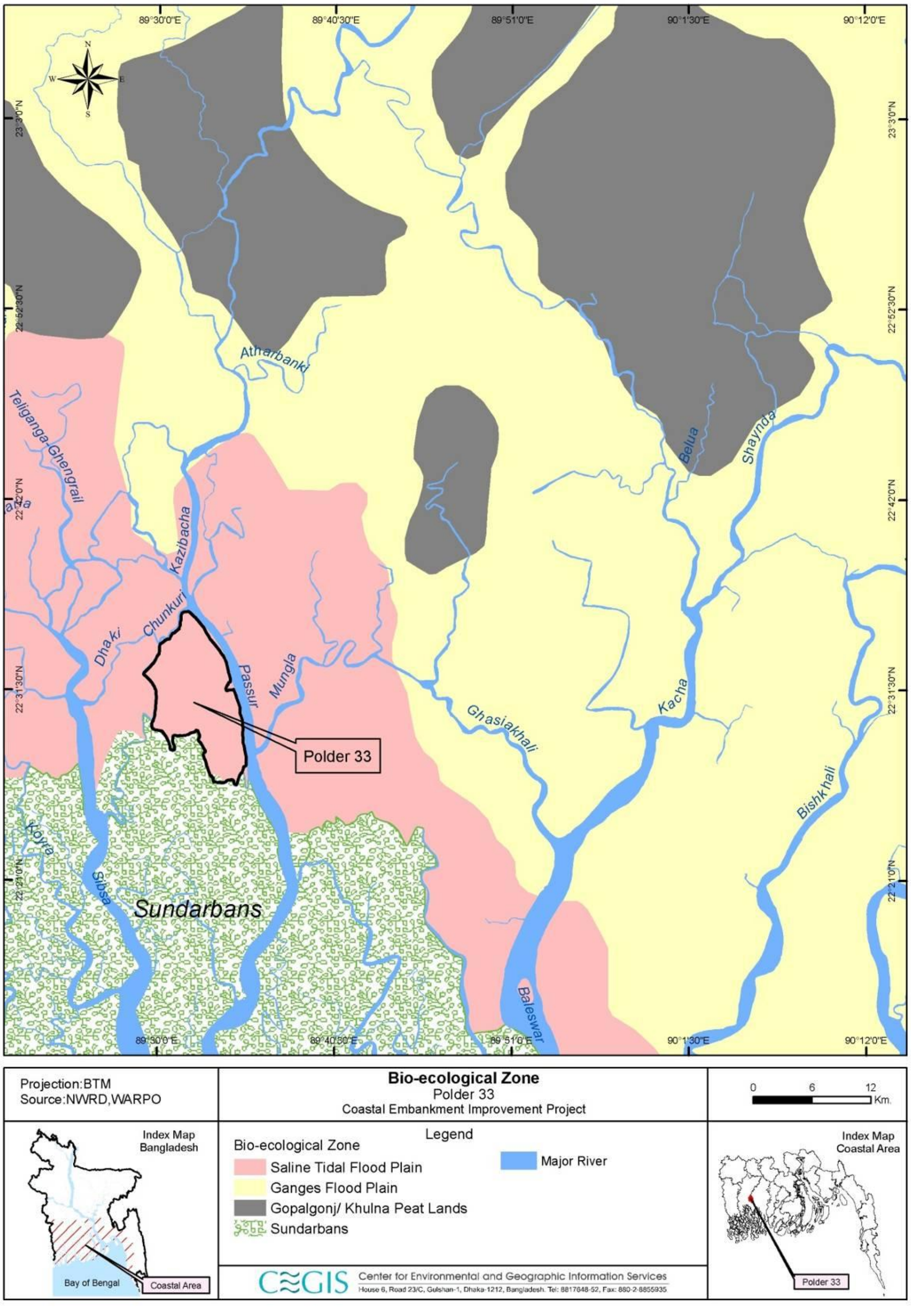

Figure 6.36: Ecosystems of project area

Some of the wildlife species are listed in the IUCN Red Data Book occur within the polder area. These are Bengal monitor *(Varanus flabescens)* (VU), Dark-bellied Marsh Snake *(Xenochrophis cerasogaster)* (VU), Cantor's Kukri Snake (*Oligodon cyclurus)* (VU), Monocelate Cobra *(Naja* *kaouthia)* (VU), Spectacled Cobra (*Naja naja*) (VU), Bengal Fox *(Vulpes bengalensis)* (VU), Jungle Cat *(Felis chaus)* (VU).

Aquatic Ecosystems

Aquatic habitat in this area includes external rivers, internal channels, some seasonal wetlands and homestead ponds (**Figure 6.35**). 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.

Polder 33 is surrounded by Passur River in its eastern part, Chunkuri and Bhadra river in its western part and Dhangmari River in its southern part. All these rivers possess no floating or rooted floating hydrophytes. River banks are vegetated by few saline tolerant grass species mainly found at ecotone.

Figure 6.37: Internal canal shows low aquatic floral diversity

Internal canals also have lower diversity of aquatic flora. Marginal vegetation is richer than floating vegetation. Saline water shrimp farms having least species of aquatic flora and contain one or two species of saline tolerant grasses and algae. Shrimp farm is expanding quickly inside the polder and is causing habitat degradation and increasing soil salinity.

Homesteads ponds and ditches contain comparatively higher floral diversity. At the species level, in free floating hydrophytes, *Pistia* and *Salvinia* are the dominant followed by *Eicchornia*. Marginal vegetation is quite common and composed of *Enhydra, Lersia, Eragrostis* etc. Homesteads ponds are commonly used for domestic purposes and traditional fish cultivation. Aquatic plants are commonly found in the polder area is presented in **Table 2 under Annex-C**.

Presence of different type of wetlands provides vast habitats for many aquatic faunal species. A total of 23 aquatic fauna species were observed in the project area. Of these, 18 species were totally dependent on wetland (beels, river, ponds), and 5 species were partially dependent on wetland. Wetland areas were intensively exploited. Some species have not adapted to the altered environment whilst others have flourished.

Among amphibians, Skipper Frog *(Euphlyctis cyanofhlyctis)*, Indian Bull Frog *(Hoplobtrachus tigerinus)*, Ornate Microhylid *(Microhyla ornata)*, Cricket Frog *(Feservarya limnocharis)* are common and found in most wetland habitat and has been the most successful in adapting to the habitat. Turtle species very rarely found in the project areas are Spotted Flapshell Turtle *(Lissemys punctata)*, Indian Roofed Turtle *(Pangshura tectum)*. Checkered Keelback *(Xenochrophis piscator)*, Common Smooth Water-snake *(Enhydris enhydris)* are common snakes found most of the aquatic habitats.

Common wetlands bird species available in the polder area are: White browed Wagtail *(Motacilla maderaspatensis),* White throated Kingfisher *(Halcyon smyrnensis),* Common Snipe *(Gallinago gallinago),* Common Kingfisher *(Alcedo atthis),* Great Egret *(Casmerodius albus),* White-brested Waterhen *(Amaurornis phoenicurus),* Little Cormorant *(Phalacrocorax niger)*, Indian Pond Heron *(Ardeola grayii)*, Little Egret *(Egretta garzetta)*, Little Heron *(Butorides striatus)*. Grey Heron *(Ardea cinerea)* is found inside big shrimp farms.

6.5.3 Mangrove Ecosystem

Mangroves are a unique ecosystem hosting incredible biodiversity: migratory birds, marine creatures and reptiles in addition to associated species of flora. They function as a natural water treatment system; as spawning grounds for fish they provide several resources to local communities who directly or indirectly depend upon them for their livelihoods and sustenance. Biodiversity, the diversity of life forms – plants, animals, microbes – is the ecological basis of life. Mangrove ecosystem plays a central role in transferring organic matter and energy from the land to marine ecosystems. The dense root systems form a home for fish, crabs, shrimps, and molluscs. They also serve as nurseries for juvenile fish. Many coral reef fish, for example, spawn in mangrove forests. The young fish stay in the forest, where there is plenty of food and they can shelter from predators, until they are old enough to move to the reef. In addition, mangrove ecosystem is nesting and migratory sites for hundreds of bird species, as well as home to a wide variety of reptile, amphibian, and mammal species.

The mangroves of the Sundarban are unique when compared to non-deltaic coastal mangrove forest. Unlike the latter, the Rhizophoraceae are of only minor importance and the prime species are sundri (*Heritiera fomes),* from which the Sundarban takes its name, and gewa (*Excoecaria agallocha)*. The reason for this difference is the large freshwater influence in the north-eastern part and the elevated level of the ground surface. The Sundarban can be classified as moist tropical serial forest, comprising a mosaic of beach forest and tidal forest. Of the latter, there are four types: low mangrove forests, tree mangrove forests, salt-water Heritiera forests and freshwater Heritiera forests. Sundarban West occurs within the salt-water zone, which supports sparse (*Ecoecaria agalloch)a*, a dense understory of Ceriops, and dense patches of hantal palm (*Phoenix paludosa*) on drier soils. Dhundal and passur (*Xylocalpus* spp), and Bruguiera occur sporadically throughout the area. Sundri and gewa cover most of the Sundarban but (*Oryza coarctata)* , *Nypa fruticans* and *Imperata cylindrica* are prevalent on mud flats. Large stands of keora (*Sonneratia apetala*) are found on newly accreted mud banks and provide important wildlife habitat.

The polder area shows scattered mangrove vegetation at foreshore, internal canal banks or even at the homesteads near wetlands. Species composition vegetation is Kewra *(Sonneratia apetalla),* Gewa *(Excoecharia agallocha),* Bain *(Avecenia alba)* and Hargoza *(Acanthus illicifolious).* Kewra is dominant tree whereas Hargoza is the dominant shrub abounded at foreshore mudfloods, internal canal banks and near most of the tidal flow bearer wetlands. Population of Bain tree is comparatively lower than other mangroves at foreshore area. Bushes of Golpata *(Nypa fruticans)* were also sighted at some of the locations inside and outside of the polder. No specific wildlife composition in mangrove vegetation was observed.

Figure 6.38: Mangrove vegetation of the polder area

6.5.4 Protected areas: The Sundarbans

The polder is located near the Sundarbans Reserved Forest and it is isolated by Sutarkhali River system from its eastern portion. The protected area, Sundarbans Wildlife Sanctuary (South) is about 35 Km south from this polder boundary.

6.6 Livestock and Poultry

Livestock and poultry play an important role in the economy of the polder area. Livestock 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 raise poultry and livestock, a practice that significantly reduce poverty through generating income and employment. The livestock and poultry population in the polder area has been estimated to 29,361 cattle, 695 buffaloes, 15,650 goats, 1,087 sheep, 9,800 duck, and 13,9350 chickens. Detailed status of livestock/poultry is presented in **Table 6.21**.

Table 6.21: Status of livestock and poultry of the polder area

Name of Livestock/poultry	Number of livestock and poultry
Cow/Bullock	29,631
Buffalo	695
Goat	15,650
Sheep	1,087
Duck	9,800
Chicken	1,39,350

Source: Estimation from main consultant and field information

6.6.1 Feeds and Fodder

The owners of the livestock population are facing problems in respect of availability of fodder and feeds during the month of July to December due to (causes). Rice straw is the main fodder. Oil cakes, Bushi etc. are the other common fodders in this scheme area. Shortage of grazing areas throughout the year aggravates the feed problem to 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 as in other polder areas.

Figure 6.39: Livestock and poultry of the polder area

6.6.2 Livestock and Poultry Diseases

Productions of livestock and poultry of the polder area 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. Major poultry diseases are Ranikhet, Fowl Pox, and Cholera. The most vulnerable period is around year for spreading diseases to livestock and poultry populations.

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

6.7 Socio-economic Resources

6.7.1 Area and Location

The Polder 33 covers part of Dacope upazila of Khulna district. The Polder area falls in five unions namely Laudubi, Dacope, Banishanta, Bajua and Kailasganj as shown in **Table 6.22**.

Table 6.22: Unions and UpazilasinPolder33

Name of district	Name of upazila	Name of unions	Percentage of union within polder
Khulna	Dacope	Laudubi	87
		Dacope	83
		Banishanta	79
		Bajua	76
		Kailasganj	93

Source: Spatial GIS Analysis, CEGIS, 2012

6.7.2 Demography

Based on the Census Report of Bangladesh Bureau of Statistics (BBS) for 2011, the population in the Polder 33 is 50,883. This includes 25,350 males and 25,533 females. A total of 11,896 households exist in the polder with average size of 4.28 persons per household. The density of population is about 1051 persons per square kilometer. The key demographic data of the Polder is presented in **Table 6.23**.

Table 6.23: Demographic Data of Polder

Households	Population			Size of Household
	Total	Male	Female	
11,896	50,883	25,350	25,533	4.28
		49.8%	50.2%	

Source: Population Census 2011, BBS

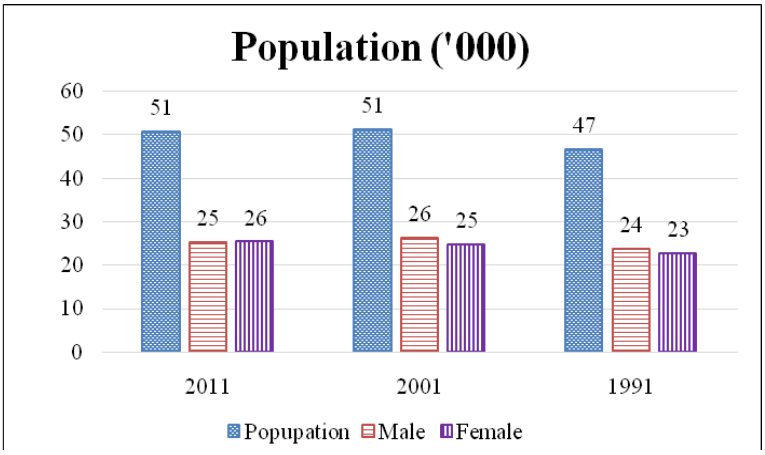

Figure 6.40: Trend of population in the study area.

Population trend is shown in thousands in the above figure (**Figure 6.40**). It is found that total number of population remain same in 2011 as found in 2001. But, it increases four thousands than in 1991. It is also noticeable that the number of male and female remains same both in 2011 and 2001.

Table 6.24 shows the age group composition of the people of the polder area. About 26 percent of the population is less than 15 years, 63 percent in between 15 to 59 years and 11 percent is over 60 years of age. The data shows that around 37 percent of the population depends on the 63 percent of the earning members of their households. Hence the dependency ratio is 59.

Table 6.24: 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	7	9	10	8	9	9	28	8	3	7

Source: Population Census 2011, BBS

6.7.3 Livelihood

Occupation

According to the census report 2011, around 67 percent households report agriculture as their main occupation. About 26 percent population is engaged in service sector and only 7 percent is engaged in industrial sector. Most of the population is engaged in agriculture and service sector. (**Figure 6.41** and **Table 6.25**).

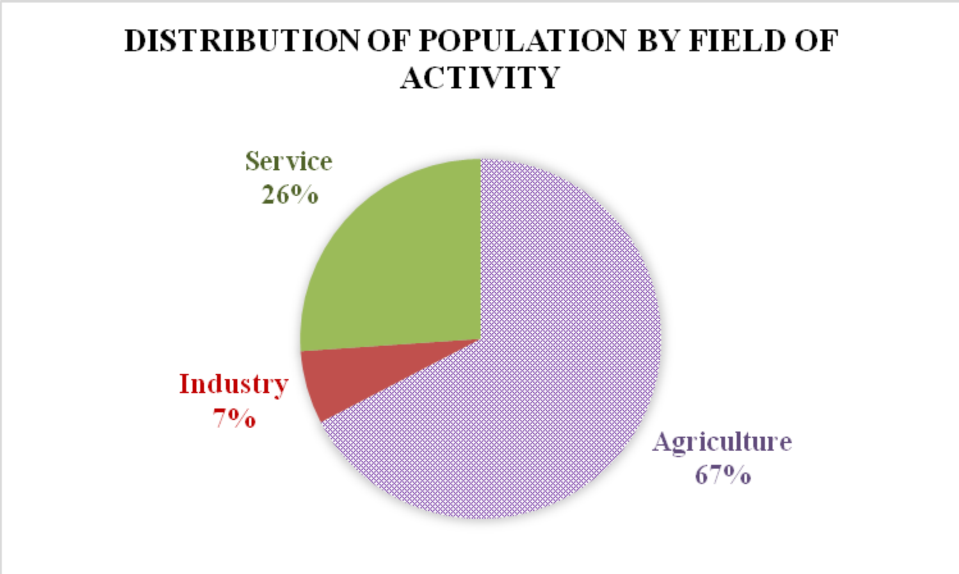

Figure 6.41: Distribution of population by field of activity

Source: Population Census 2011, BBS

Table 6.25: Main Occupation in Polder

Union	Agriculture (%)		Industry (%)		Service (%)	
	Male	Female	Male	Female	Male	Female
Laudubi	8.14	0.32	0.73	0.15	3.94	1.50
Dacope	7.18	0.56	-	0.06	0.59	0.36
Banishanta	18.14	0.45	2.27	0.19	4.14	5.68
Bajua	16.43	0.44	1.80	0.08	7.44	1.31
Kailasganj	15.51	0.19	1.16	0.13	0.53	0.60

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 12 percent female members are working whereas 88 male members are engaged in income generating activities.

Employment

In the Polder, about 31 percent of total population is employed, 44 percentis engaged in household work, only one percent is looking for work andabout 24 percent of total population is not working (it includes children and physically challenged population). **Figure 6.42** shows the employment status of the people in the Polder area.

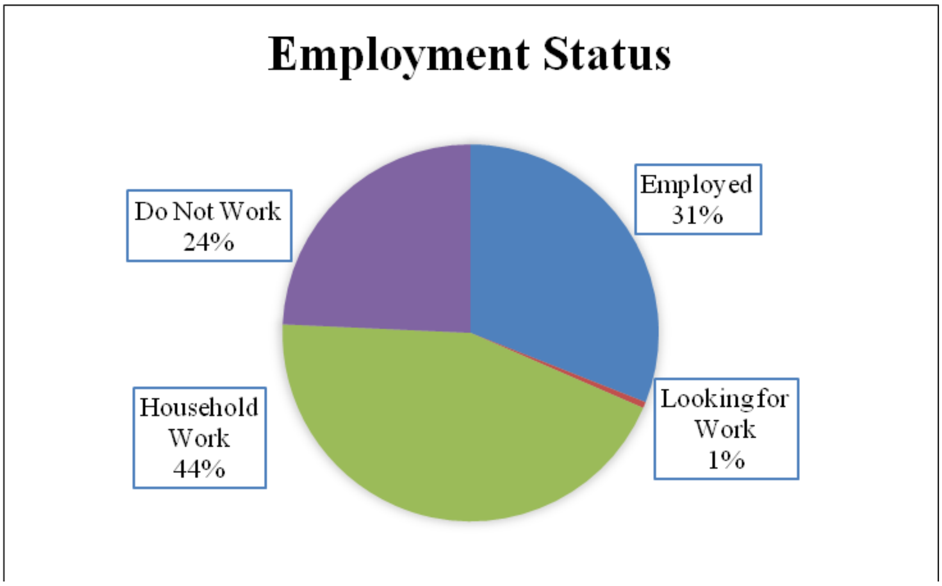

Figure 6.42: Employment status in the polder area.

Source: Population Census 2011, BBS

The following table (**Table 6.26**) 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 27 percent male members are employing in the study area.

Table 6.26: Employment status in Polder

Union	Employed (%)		Looking for Work (%)		Household Work (%)		Do Not Work (%)	
	Male	Female	Male	Female	Male	Female	Male	Female
Laudubi	3.97	0.61	0.03	0.04	0.05	6.23	1.11	2.34
Dacope	2.41	0.30	0.02	-	0.09	5.18	0.42	1.80
Banishanta	7.61	1.96	0.19	0.15	0.09	10.04	2.52	4.32
Bajua	7.95	0.56	0.01	0.02	0.07	11.41	2.15	3.79
Kailasganj	5.33	0.28	0.08	0.00	0.06	10.99	1.38	4.46

Source: Population Census 2011, BBS

6.7.4 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 88 percent are kutcha (made of wood/bamboo, and other local materials). **Figures 6.44 and 6.45** present photograph of housing types. Statistics show that kutcha households are dominant in whole of the polder area. However, jhupri households are found to be more common in Kailasganj union (20%). It can be concluded that the people living in the study area belong to extremely poor category in term of housing type.[9]

[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**:

Table 6.27: Housing condition in the study area

Union	Type of Structure (%)			
	Pucka	Semi-pucka	Kutcha	Jhupri
Laudubi	4.5	4.5	89.2	1.8
Dacope	2.3	4	92.5	1.3
Banishanta	1.9	0.9	93.8	3.4
Bajua	3.1	4	91.5	1.4
Kailasganj	1.7	4.4	73.6	20.3

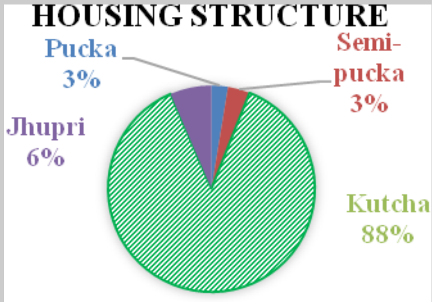

Figure 6.43: Housing Types in Polder Area

Source: Population Census 2011, BBS

Figure 6.44: *Jhupri* house

Figure 6.45: *Kutcha* house

Drinking Water

Overall status of drinking water in the area is not satisfactory. Most of the people can collect drinking water from other sources such as ponds, PSF, rain water etc. salinity is the main problems in the polder area. The detail is presented in **Table 6.28**, which shows that percentage of tube-well coverage is insignificant. People are to collect drinking water from different source.

Table 6.28: Source of Drinking Water in Polder

Union	Sources of Drinking Water (%)		
	Tap	Tube-well	Other
Laudubi	0.8	21.4	77.7
Dacope	0	14.2	85.8
Banishanta	0.4	9.1	90.5

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.

Bajua	0.9	23.8	75.3
Kailasganj	0.7	7.5	91.8

Source: Population Census 2011, BBS; and Baseline Survey, 2012.

Figure 6.46: Domestic level rain water harvesting

Figure 6.47: Community level PSF

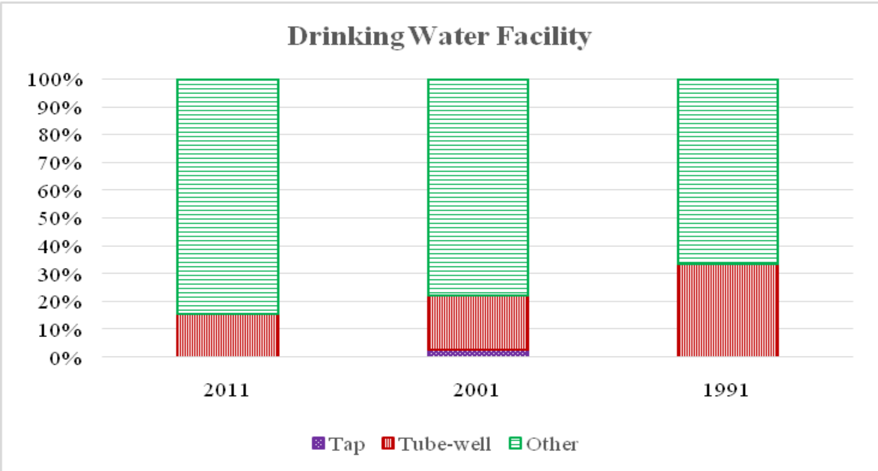

Figure 6.48: Drinking water sources in the polder area.

(Source: BBS, Population Census)

The above figure (**Figure: 6.48**) shows the sources of drinking water in various years. It is noticeable that the coverage of tube-well is decreasing than the previous years. People reported that salinity is the sole cause of decreasing the coverage of tube-well. As a result, local people are to depend on other sources for drinking water such as PSF, pond water and rain water harvesting.

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 6.29 and Figure 6.49**. It shows that about 60 percent households have hygienic sanitation facility (water-

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

sealed), 23 percent have not water-sealed sanitation facility, 08 percent have non-sanitary sanitation facility and 09 percent have no sanitation facility. Local people face the worst situation regarding the sanitation facility.

Table 6.29: Sanitation Facilities in the Polder

Union	Type of Structure			
	Sanitary (water-sealed)	Sanitary (not water-sealed)	Non-sanitary	None
Laudubi	71.2	17	6.8	5.1
Dacope	82.2	11.8	3.5	2.5
Banishanta	54.8	21.5	13.5	10.2
Bajua	54.6	29.1	7.3	9
Kailasganj	54.6	27.3	6.1	12

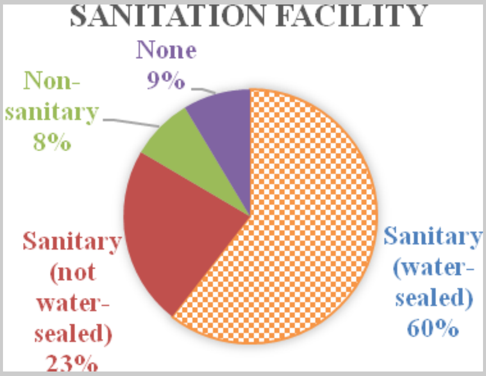

Figure 6.49: Sanitation facility in study area

Source: BBS and Baseline Survey, 2012.

Sanitation facility is quite satisfactory in Dacope and Laudubi unions (82% and 71% eater-sealed sanitary).About 10% and 20% have no sanitation facility respectively in Banishanta and Kailasganj unions.

Figure 6.50: 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 6.30**. According to the ranking, the incidence of Diarrhea is the most prevalent ailment in the area. Dysentery, skin diseases are also common in the Polder area.

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 6.30: Disease Profile in the Polder

Disease	Ranking by Incidence
Diarrhea	1
Dysentery	2
Skin diseases	3
Influenza/Common fever	4
Cough/cold	5
Chicken pox	6
Typhoid	7
Diarrhea	8
Asthma	9
Hypertension	10
Diabetes	11
Hepatitis	12

Source: CEGIS fieldwork, 2012

Health Services and Facilities

Field findings show that there are one union health complex and seven community clinics in the polder area. These health services are not adequately functioning (**Table 6.31**). As a result, local people are to receive health service and facility from these peripheral hospital. However, it is observed that communication between polder area and upazila is so poor that patients cannot go to these peripheral hospitals easily.

Table 6.31: Health service facilities in the study area

	Union Name	No of Union health complex	No of Community Clinic	Outside of Polder health facilities
1	Banishanta UP	-	1	Mongla, Khulna
2	Koylashgonj UP	1	2	Mongla, Khulna
3	Bajuya UP	-	3	Mongla, Khulna
4	Laudub UP	-	1	Dacope Khulna
5	Dacope UP	-	-	Dacope Khulna
Total		1	7	

Source: RRA, CEGIS, 2012

It is found that about 40 percent people tend to receive health service from quack and 35 percent from paramedic/diploma physicians and only 15 percent from trained physicians. However, it is noteworthy that about 10 percent cannot receive treatment facility due to their impoverishment and communication problems (**Figure: 6.51**).

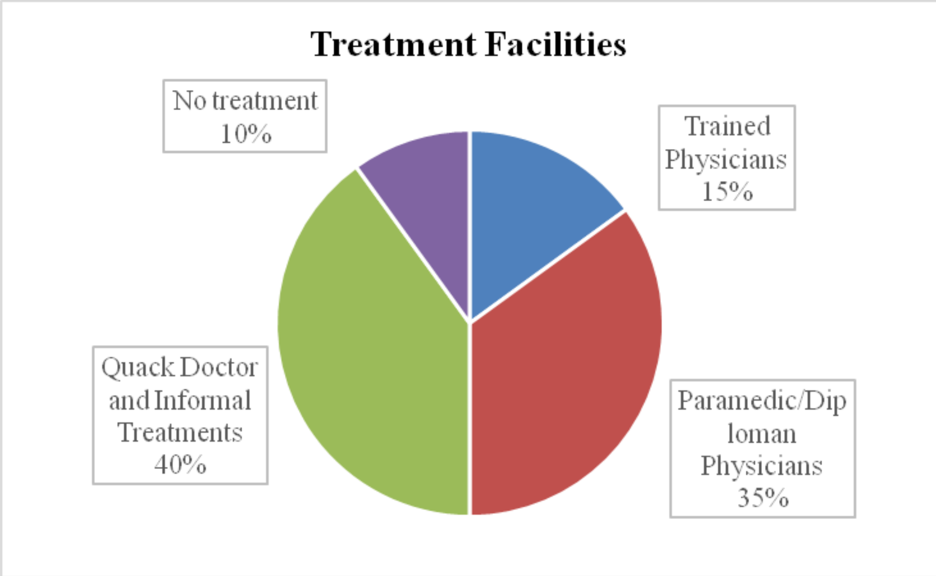

Figure 6.51: Health Service Providers in Polder

Source: RRA, CEGIS, 2012

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 good in terms of national average. The highest literacy rate comprises in Dacope and Kailasganj unions (respectively 66% and 62%). Literacy rate is unsatisfactory in Banishanta union (48%) (**Table 6.32**).It is known that Banishanta union comprises one of the notable brothels of Bangladesh. The inhabitants of brothel have no opportunity of education. Thus, literacy rate is lower in this union.

Table 6.32: Literacy Rate at Polder 33 Area

Union	Literacy Rate (%)		
	Total/Both	Male	Female
Laudubi	58.5	64.6	52.5
Dacope	65.6	74.3	57
Banishanta	47.6	53.4	41.7
Bajua	50.5	56.2	44.8
Kailasganj	61.5	69.7	53.4

Source: Population Census 2011, BBS

The following figure (**Figure 6. 52**) 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.

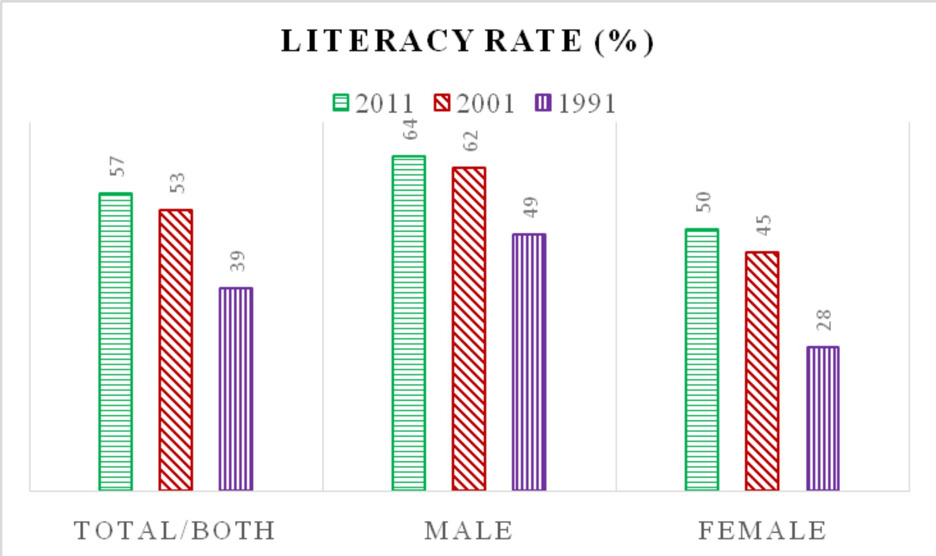

Figure 6.52: Trend of literacy rate in the polder 33 area

Source: Population Census 2011, BBS

Figure 6.53: Schools in the polder area

Electricity

Electrification as reported in the Population Census is not satisfactory in the Project area. On an average, only 27 percent households are under electricity coverage. Very few households use solar electricity in the Project area. **Figure 6.54** shows the percentage of electricity connection in different unions of the Polder areas. It shows that the electricity coverage is below the national average.

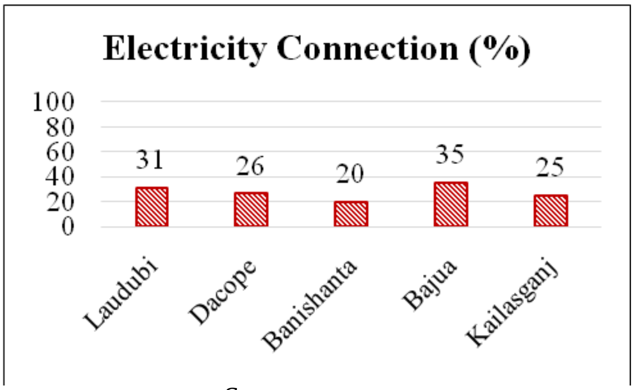

Figure 6.54: Trend of electricity facility.

Source: Population Census 2011, BBS

6.7.5 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 77 percent smallholders, 20 percent medium and only 03 percent large landholders (**Table 6.33**).

Table 6.33: Landownership Pattern in Polder

Land Ownership Classes	Households (%)
Small (0.05 to 2.49 acres)	77
Medium (2.5 to 7.49 acres)	20
Large (7.5 acres and above)	3

Source: BBS, Agriculture Census, 2008

The following figure (**Figure: 6.55**) 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.

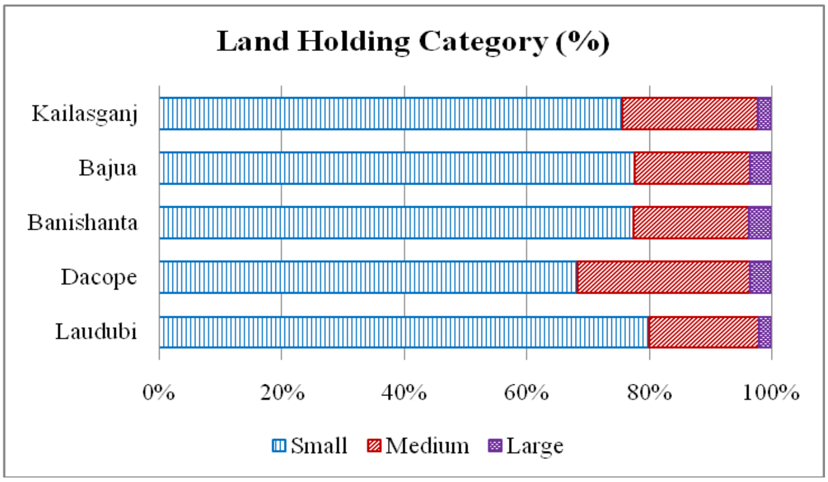

Figure 6.55: Land holding categories in project area

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 6.56**). It is observed that about 60 percent of the households in average belong to the 'deficit' category. 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.

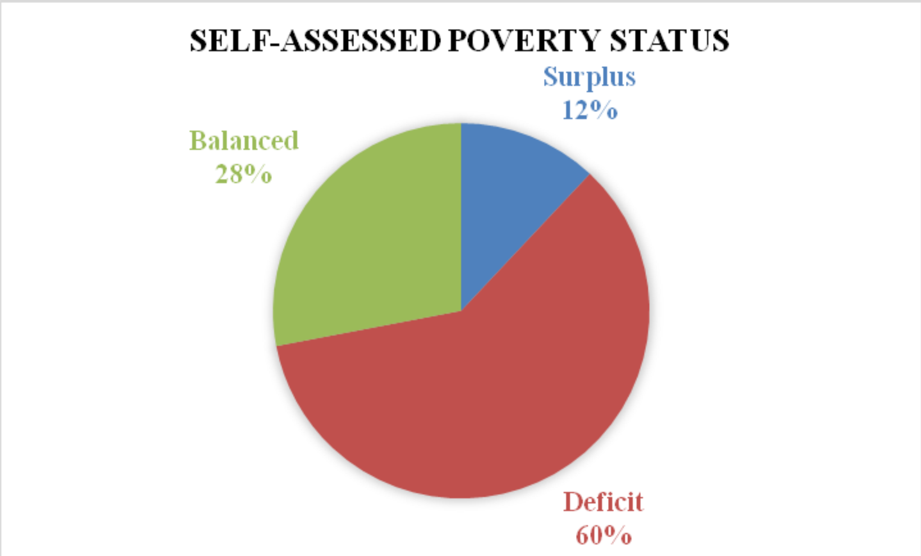

Figure 6.56: Self-Assessment of Poverty Status

Source: RRA, CEGIS, 2012

Income and Expenditure

The income and expenditure at the household level in the Polder area is shown in **Table 6.34**. It is found that most of the people belong to 12,001 taka to 108,000 taka income and expenditure category annually. Their monthly income varies from 1000 tk. to 9000 tk. per month.

Table 6.34: Annual Income and Expenditure Level

Range in Taka	Percentage (%) of Households	
	Income	Expenditure
Up to 12,000	10	7
12,001to 24,000	30	25
24,001to 60,000	24	46
60,001to 108,000	27	19
108,001 to 240,000	9	3
More than 240,000	-	-

Source: CEGIS fieldwork, 2012

Natural Disasters

The local inhabitants of Polder 33have identified tidal flooding, salinity intrusion and cyclones as the major hazards in the area. Details about the disasters and their affects in the area are presented in **Table 6.35**.

Table 6.35: 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
Salinity	2007, 2009, 2011	65	68	40	Rice
Cyclone	2007 (Sidr), 2009 (Aila)	100	100	98	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 6.36**).

Table 6.36: 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, Karitas, Prodipan and Shusilan (**Table 6.37**). These NGOs are serving with micro credit while BRAC, ASA, World Vision and JJS are working for non-formal education, Health, human rights, water and sanitation, gender and children development programs. On the other hand Karitas is working to build awareness for natural disaster. 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 6.37: NGOs and their Programs in Project Area

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

NGOs	Type of Programs						
	Credit	Education	Water and Sanitation	Health	Disaster	Gender	Food security
ASA	✓	✓	-	-	-	-	-
Shusilan	-	✓	-	-	-	-	✓
Prodipan	-	-	-	-	✓	-	✓
World Vision	-	✓	✓	-	-	-	-
Karitas	-	-	-	-	✓	-	-
JJS	✓	-	-	✓	-	-	-

Source: CEGIS fieldwork, 2012

6.7.6 Social Capital

Roads

Road networks and communication system is so far poorest in the polder area. Local people communicate through both roadways and waterways. It is found that there are three connecting roads in the across the polder area (**Table 6.38**). Most of the roads are earthen and undeveloped.

Table 6.38: Road Network in Polder

.	Description	Type of Road	Length (Km)
1	Banishanta Bazar to Bajua Bazar	Herringbone/Brick soling/ Earthen road	15 km
2	PurbaDhangmari to PuschimDhangmari	Brick soling/Earthen road	3.5km
3	Khajuria to Bajuya	Paved / Earthen road	15Km
4	PuschimDhangmari to Faruk Bazar	Earthen road	3.5Km
5	Pudderganj to Koylashgonj	Paved	18Km
6	Koylashgonj to Bajua Bazar	Paved / Earthen road	13Km
7	Koylashgonj to Bajua Bazar	Earthen road	8Km

Source: CEGIS fieldwork, 2012

Figure 6.57: Muddy and soling roads in the Polder area.

The following table shows the traffic entry and exit in the polder are. It appears that motor bike is the dominant mode of communication since the road networks and condition appears poorest.

Table 6.39: Traffic entry and exit in the polder area.

Type of Vehicles	Entry	Exit
Motorbike	22	23
Van	3	6
Nosiman	11	5
Trawler	7	8
Kheya	5	12
Bi-cycle	7	5

Source: CEGIS fieldwork, 2012

Waterways

Waterway is one of the most important modes of communication. There are twelve boat ghats those are used by the local people as the main mode of communication. There are two main internal waterways:

1. Banishanta to Bajuya to Khajura
2. Bajuya to Laudub to Burirdob

Local people are to communicate through waterways due to poor road networks. Most of the goods and commodities are carried by this mode.

Table 6.40: Major Navigation Routes in the Area

	Union Name	Name of Boat Ghats	No of Boat Ghats
1	Banishanta UP	Banishanta Bazar, Police Camp, Rakhamari	3
2	Koylashgonj UP	Dhupadi, Thakurbari, Ramngar	3
3	Bajuya UP	Katakhali, Bajuya (Launch), MoydaraBarani	2
4	Laudub UP	Laudub Bazar, Chunkury,	2
5	Dacope UP	Dacop, Poddarganj	2
Total			12

Source: CEGIS fieldwork, 2012

Educational Institutions

According to the field findings there are 50 primary schools, 17 secondary schools, 2 colleges and 3 Madrashas in the study area (**Table 6.41**). There is no college seen in the study area.

Table 6.41: Academic Institutions

	Union Name	Nos of Primary School	Nos of Madrasha	Nos of High School	Nos of Collage
1	Banishanta UP	10	1	4	-
2	Koylashgonj UP	16	1	4	-
3	Bajuya UP	10	1	6	1

	Union Name	Nos of Primary School	Nos of Madrasha	Nos of High School	Nos of Collage
4	Laudub UP	6	-	1	1
5	Dacope UP	8	-	2	-
Total		50	3	17	2

Source: CEGIS field work, 2012

Markets

There are 6 markets/bazaars in the study area, among them two in Kamarkhali union and another two in Sutarkhali union (**Table 6.42**). These are serving better for the local people.

Table 6.42: Markets in Project Area

Sl No	Union Name	Name of Market	No of Market
1	Banishanta UP	Banishanta Bazar	1
2	Koylashgonj UP	Koylashgonj Bazar	1
3	Bajuya UP	Khutakhali Bazar	1
4	Laudub UP	Buridabor Bazar	1
5	Dacope UP	Ramnagar Bazar,Poddargonj Bazar.	2
Total			6

Source: CEGIS database, 2012

6.7.7 Gender and Women

Like other part of the country women in the polder area are also restricted to household works. Most of the decision making power goes to family maintenance. They have limited access to social sphere (**Figure 6.58**). Women mobility in the area is mostly localized except when going for medical treatment, fetching water, farming activities, and visiting relatives.

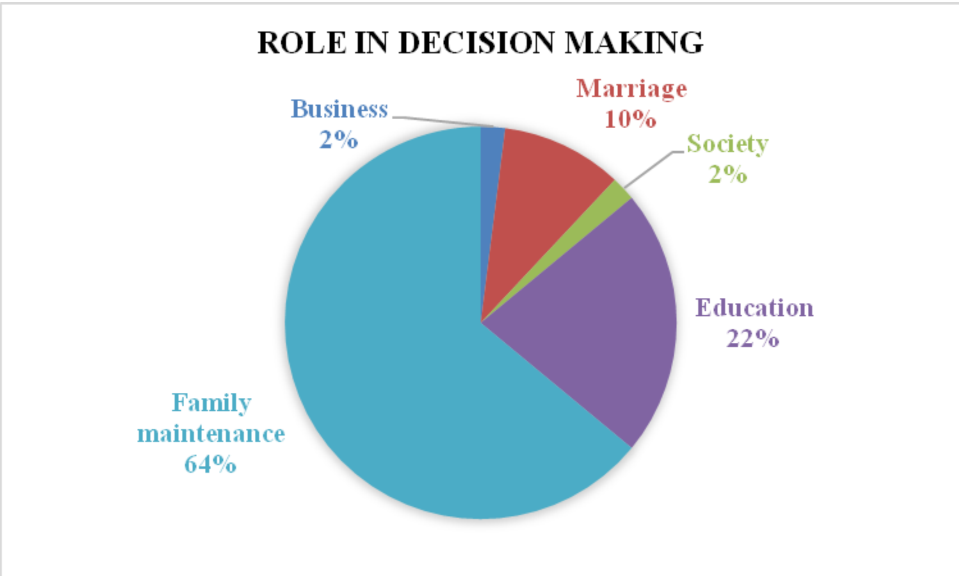

Figure 6.58: Scope of Decision Making by Women

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 26 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 18 percent women are getting proper nutrition and about 20 percent have access to the health centers, which are around 15 km away on average from their residence.

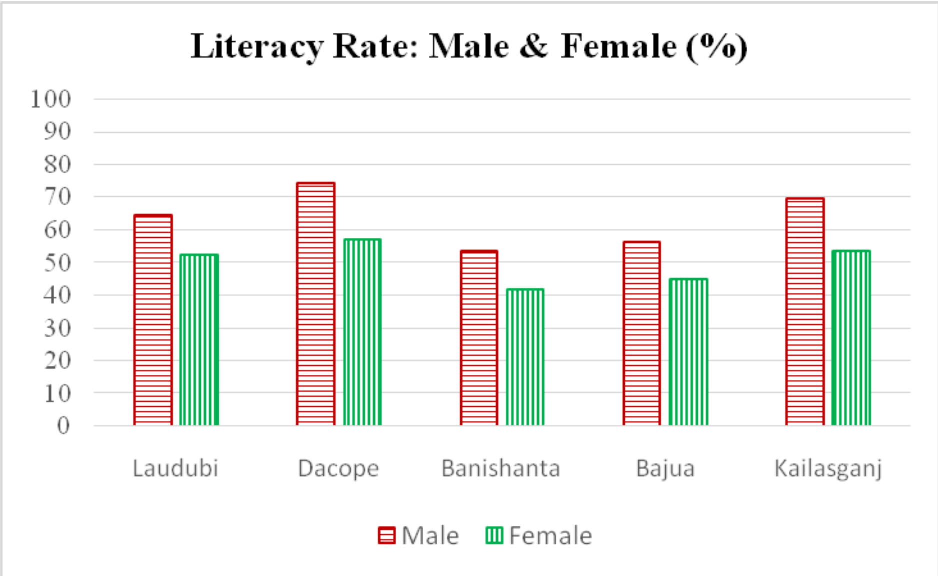

Figure 6.59: Literacy rate of both male and female

Source: RRA, CEGIS, 2012

Statistics shows the male literacy rate is higher than female. Dacope union comprises the highest literacy rate. However, literacy rate of both male and female is ever increasing than the privous year.

6.7.8 Vulnerable Communities

Sex worker is the most vulnerable community in Banishanta union. At present, there are 250 households in whole Banishanta brothel area. For last couple years at least 50 households was migrated to other areas (Khulna, Dhaka) due to severe river bank erosion and frequent incidence of natural disasters. Besides there are some shrimp culture ghers inside the polder occupying about 20% of the total area as reported by the local people. Conflicts between Gher owners and farmers are there in the polder area. Thus, for consolidation of agricultural activities, conflicts in between the Gher owner and the farmers have to be resolved.

6.7.9 Common Property Resources

The common property places/resources of the area are different social amenities e.g. mosques, graveyards, 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. Besides these, the BWDB embankment is also used very commonly for different livelihood purposes of the local inhabitants.

There are 44 mosques, 49 temples, 15 graveyards, 3 churches and 32 crematoriums in the polder area. Besides there are 20 cyclone shelters among them five are under construction. However, there is no known historical and archeological site declared by government in the Polder area (**Table 6.43)**.

Table 6.43: Common Property Places/Resources in Polder 33

Sl. No.	Union Name	No of Mosque	No of Temple	No of Church	No of Graveyard	No of Cremation	No of Cyclone Salter	
							Functional	Under construction
1	Banishanta UP	17	16	3	3	10	3	2
2	Koylashgonj UP	6	11	-	4	5	2	2
3	Bajuya UP	11	6	-	4	2	4	-
4	Laudub UP	4	4	-	2	3	4	-
5	Dacope UP	6	22	-	2	12	2	1
Total		44	59	3	15	32	15	5

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 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.

7.3 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:

7.3.1 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.

7.3.2 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.

7.3.3 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.

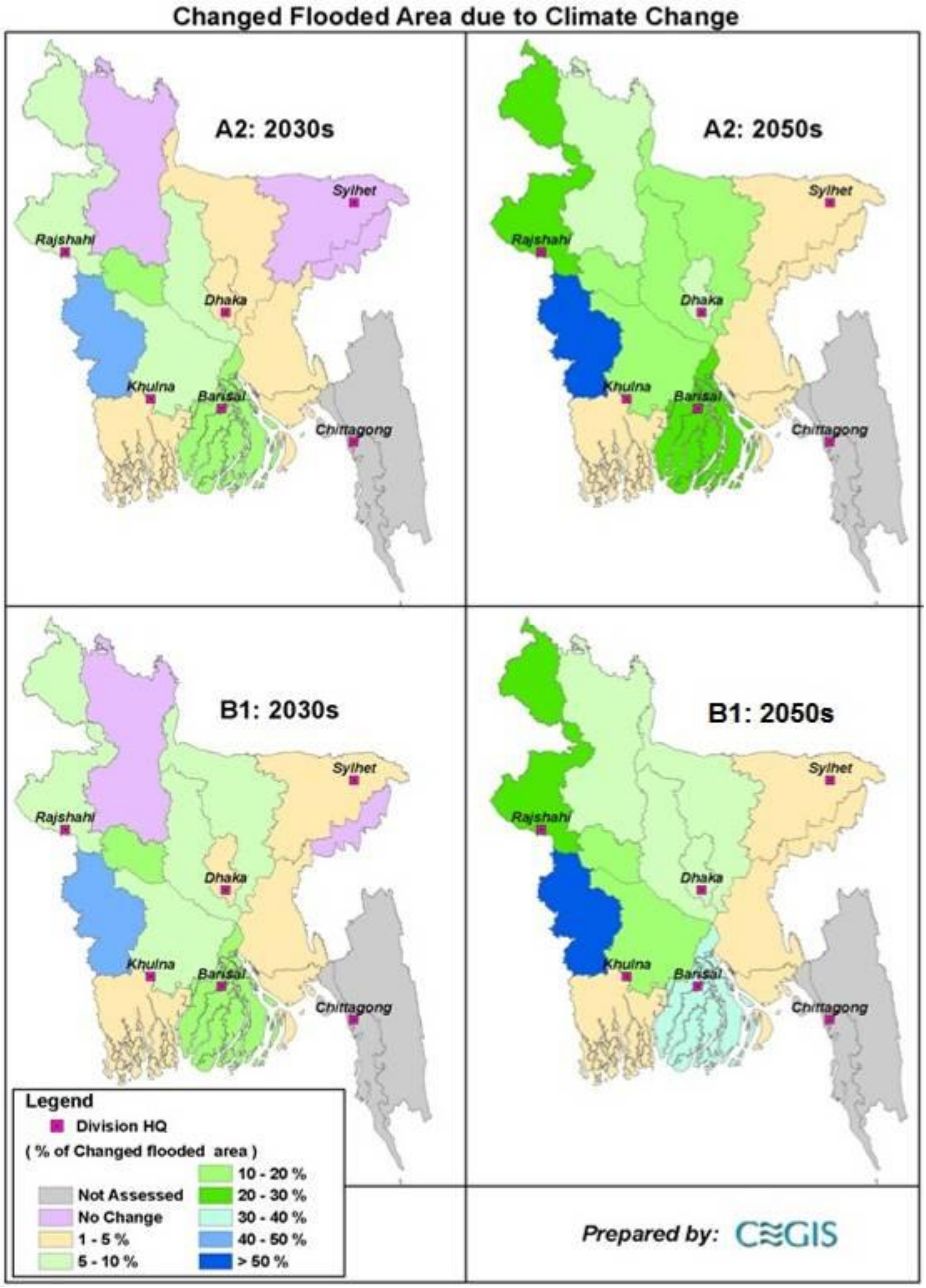

Figure 7.1: Changes in flooded area in Bangladesh in the 2030s and 2050s

(Source: Hassan et. al., 2010)

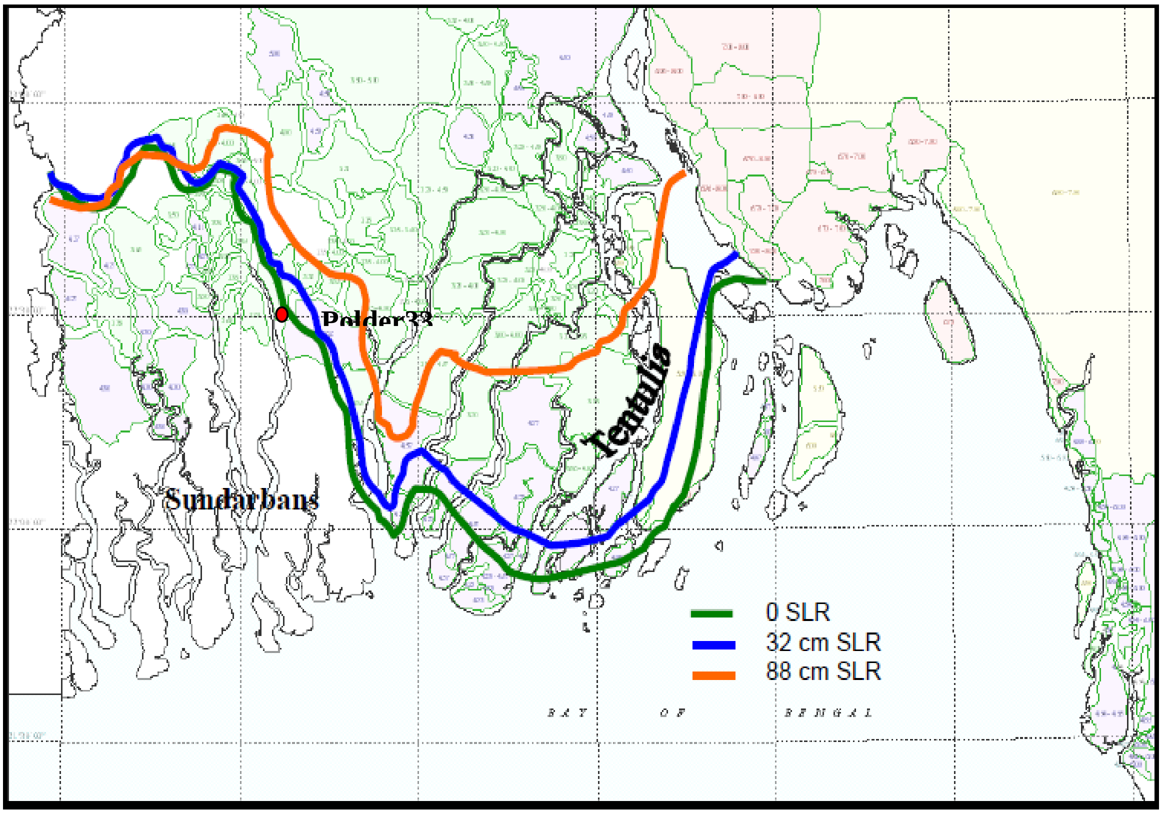

Figure 7.2: Five ppt isohaline line for different sea level rise in dry season (IWM and CEGIS, 2007)

7.3.4 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)
1.	30 Oct	1960	211	4.6-6.1
2.	30 May	1961	160	6.1-8.8
3.	28 May	1963	203	4.2-5.2
4.	11 May	1965	160	6.1-7.6
5.	15 Dec	1965	211	4.6-6.1
6.	1 Nov	1966	146	4.6-9.1
7.	23 Oct	1970	163	3.0-4.9
8.	12 Nov	1970	224	6.1-9.1
9.	25 May	1985	154	3.0-4.9
10.	29 Nov	1988	160	3.0-4.0
11.	29 Apr	1991	225	6.0-7.5
12.	2 May	1994	210	2.0-3.0
13.	25 Nov	1995	140	2.0-3.0
14.	19 May	1997	220	3.1-4.2
15.	15 Nov (Sidr)	2007	240	up to 10
16.	25 May (Aila)	2009	120	3.0
Source: MCSP, 1993; Bangladesh Meteorological Department and field survey, 2010				

7.3.5 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 33 is satisfactory.

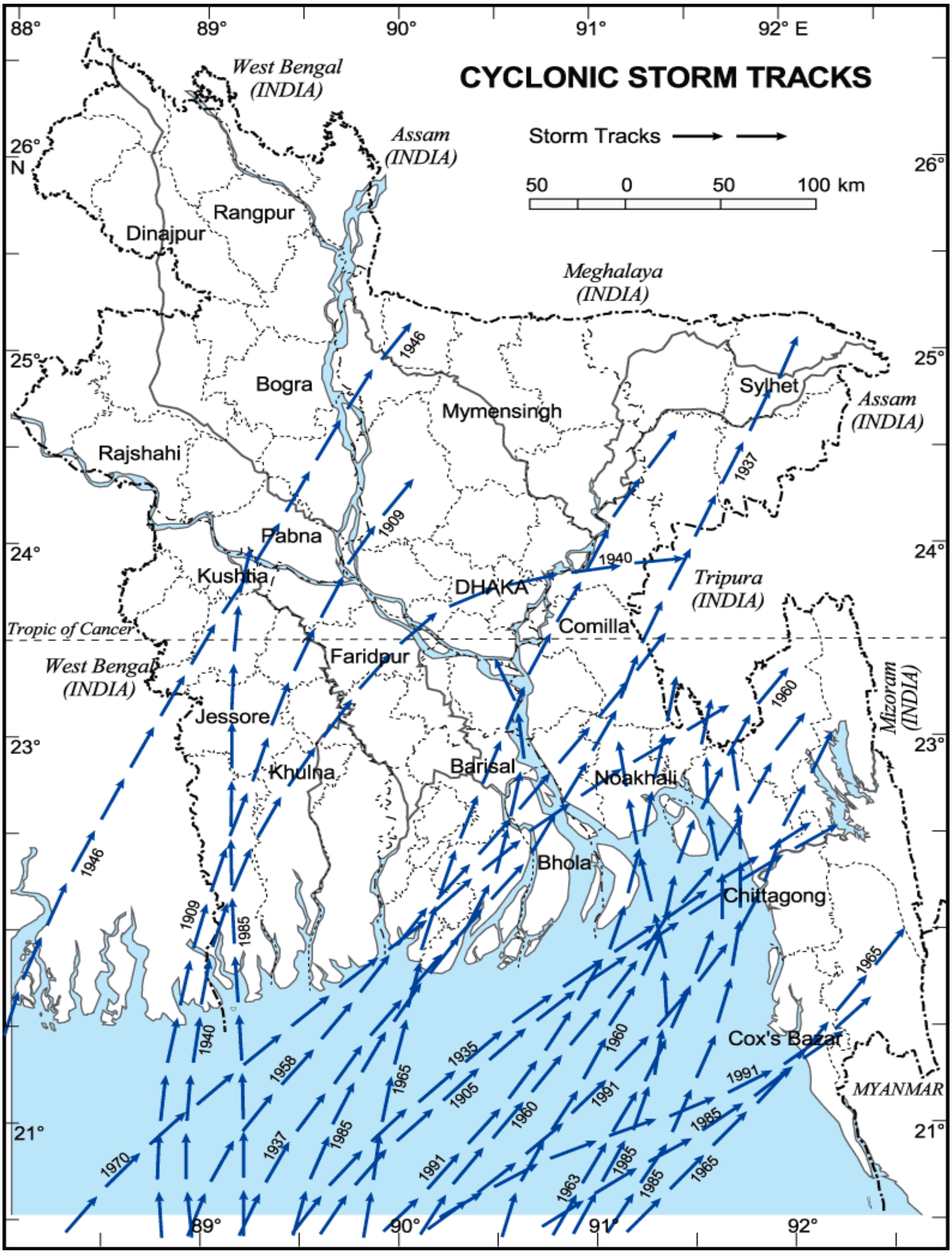

Figure 7.3: Previous Cyclonic Storm Tracks

(Source: MCSP, 1993)

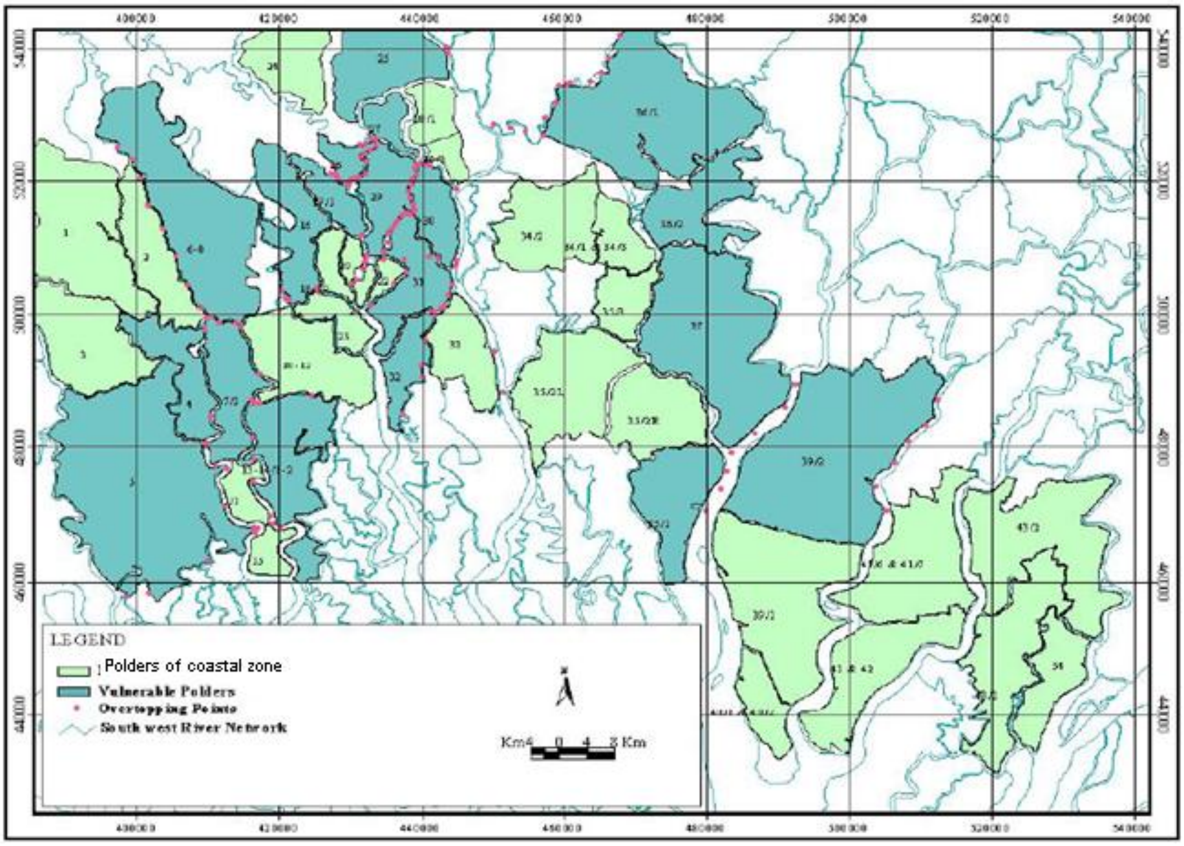

Figure 7.4: Drainage Congestion in Affected Polders due to Sea Level Rise

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.

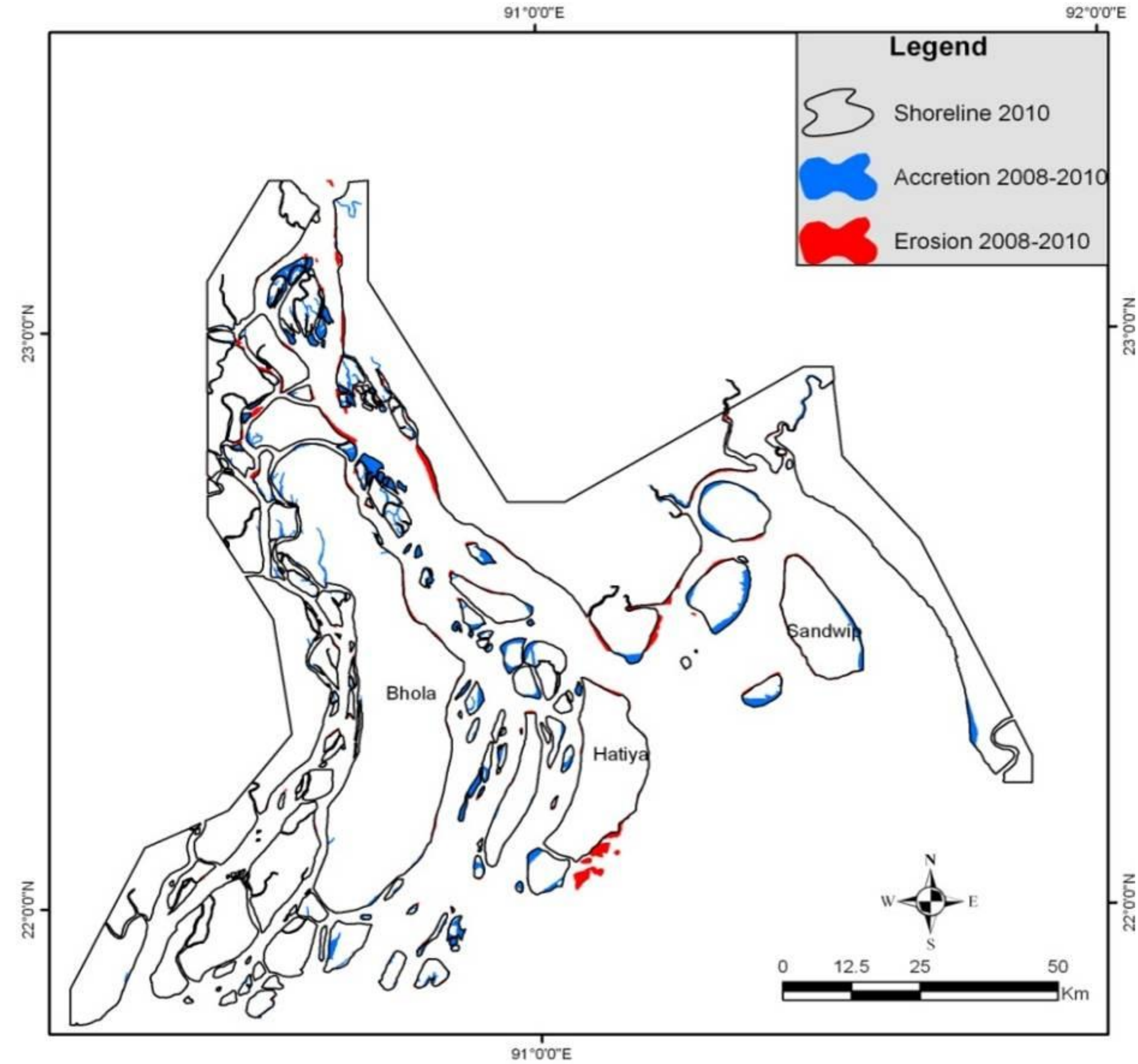

Figure 7.5: Erosion and Accretion of Land in the Meghna Estuary from 2008 to 2010

7.4 Adaptation Strategy for Climate Change Impacts in the Project Area

7.4.1 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.

7.4.2 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 33 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 33, 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 33. 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-33 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 33. 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** to .**8.6 and Annex-F**.

Table 8.1: Consultation Details

Sl. No.	District	Upazila	Union	Meeting venue	Type of consultation	Meeting date	Time
1	Khulna	Dacope	Banishanta	Banishanta union Parishad	PCM	01/06/2012	10:30
2	"	"	Bajua	Banishanta village	FGD	08/03/2012	10:00
3	"	"	Banishanta	Chunkuri	"	09/03/2012	10:00
4	"	"	Banishanta	Banishanta Bazar	"	13/12/2012	10:10
5	"	"	Kailasganj	Koylashgonj UP	"	13/12/2012	13:30
6	"	"	Bajua	Bajuya UP	"	13/12/2012	17:00
7	"	"	Laudubi	Laudubi UP	"	14/12/2012	09:30
8	"	"	Dacope	Dacop	"	14/12/2012	15:30

Figure 8.1: Public consultation at Banishanta UP

Figure 8.2: Discussion with local people

Figure 8.3: Woman participant expressing her views

Figure 8.4: Discussion with local people

Figure 8.5: Woman participant expressing her views

Figure 8.6: Decisions write up on flip chart

8.5.2 Consultation Participants

The main participants of the consultation meetings included public representative, farmer, trader and daily-wage laborers of the Polder 33 and nearby areas. A total of 107 participants attended these consultations. The participant details are provided in **Table 8.2** below. List of participants of PCM and FGD are given **in Annex-D**.

Table 8.2: Participant Details

Sl. No.	Meeting venue	Type of consultation	Type of Participants	No. of participants
1	Banishanta union Parishad	PCM	Primary and secondary stakeholders	38
2	Banishanta village	FGD	Primary stakeholders	10
3	Chunkuri	"	"	05
4	Banishanta Bazar	"	"	10
5	Kailasganj UP	"	"	12
6	Bajuya UP	"	"	10
7	Laudubi UP	"	"	11
8	Dacope	"	"	11

Figure 8.7: FGD at Loudob UP and Banishanta bazaar

Figure 8.8: FGD at WAPDA Colony Khay Ghat and Kamarkhola UP

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 33 area.	Comprehensive rehabilitation of the polder should be taken up at the earliest with the active involvement of the local community.
Water Resources	The local people of Polder have identified tidal flooding, water logging and salinity intrusion as major problems of water resources in the area. Cyclone Sidr and Aila had affected almost all area of the polder 33 and damaged crops and assets of all households; The shortage of drinking water is another problem. Present condition of embankments is deplorable, which have been eroded during the cyclone Sidr and Aila. Pond is the main source of drinking water. According to the participants, about fifty percent (50%) people depend on pond water for household chores and drinking as well. The availability of surface water became low because of low rainfall in recent years; therefore pond water level is going down and creating scarcity of fresh water. The problem of getting surface water for agriculture, fishery and livestock rearing purposes is gradually increasing in recent years; There is severe river erosion in this	Damaged part of the embankment should be re-sectioned as early as possible and slope of embankment must include protection with forestation. Bank protection measures should be taken in the critical river bank erosion prone areas. Replace the damaged/non-functional sluice gates and construct new ones where required The intrusion of saline water would be controlled by the improvement of embankment at the Bansbaria, Sarkerdanga and Madardia sites. Introduce re-excavation program in internal canals, increase height of the embankment and improvement sluice gates are very essential; Scope of sweet water storage will be improved dramatically within internal khals due to proper functioning of associated water control structures. The re-excavation of rivers and khals are urgently needed for the improvement of irrigation facilities and removal of drainage congestion/stagnant water at Polder 33 area;

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	polder; erosion is found mainly in Banishanta, Kailasganj and Dacope union along the Pushur River. Erosion has destroyed local peoples land, homes and has become an environmental and social hazard. During Sidr and Aila, the surge wave action had eroded the flood control embankment seriously; The water control infrastructures are not suitably functional in this polder. The height of embankment has reduced; Sedimentation is another problem in the polder area. Due to sedimentation in river and channel's bed Pushur River becomes disconnected during dry season; Water logging is another problem in the project area, especially at Kailasganj since over 5 yrs; The farmers of this area mainly cultivated paddy and shrimp. Because of salinity intrusion in the agriculture land, the production of crops is reducing. On the other hands, the erosion of embankment, which initiates tidal flooding, has been damaging crops partially; Agriculture is the main source of income of the people of polder 33. Other occupations of the people of study area are business, fishing, fish/shrimp culture, farm labor, non-farm labor, service etc. Above one-third of laborer population used to migrate temporarily for obtaining better livelihood opportunities; About half of the people are within the food deficit level. Health condition is very poor and only 8% of the women are in a better situation. The rate of literacy is about 54%. Most of the houses are Kutcha, which shows a poor quality of life in the polder; Absence of embankment along the rivers also makes the surface water unavailable for the users. Saline water is being trapped for long time in vast	Should ensure water management Organizations (WMOs) to manage properly water control structures i.e. embankment, sluice gate, regulator, inlets, bridge, culverts etc. and growing of awareness among the population of the polder. Ensure water distribution by compartmentalization/zoning system for shrimp cultivation, white fish and agriculture practice through WMOs. Salt tolerant varieties of rice need to be practiced and in this regard necessary extension works need to be organized by the respective departments; According to participants after implementation of interventions overall quality of life will improve in the polder 33 areas. VuMNerabilities of this area will reduce. Damage from disasters will also reduce.

Themes/Topics	Concerns/Issues/Problems	Suggested Solution/Remedies
	area and this is responsible for intrusion of salinity in the groundwater aquifers.	

8.8 Environmental Aspect from 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 33. 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 Polder33. 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 33 are presented in **Table 8.4**; some photographs of these meetings are presented in **Figures 8.9** and **8.10**.

Table 8.4: Consultation Meetings Held in Polder 33

Location, Date and Time	Category of Participants
Banishanta Bazar December 13, 2013 at 10.10 am	UP Chairman, UP members, Service, Social Worker, farmers, and fishermen
Kailasganj UP December 13, 2013 at 13.30 pm	UP Chairman, UP members, and farmers.
Bajua UP December 13, 2013 at 17.00 pm	UP Chairman, Social Worker, Farmers and fishermen.
Laudubi UP December 14, 2013 at 09.30 am	UP members, farmers, Fisherman and Service.
Dacope December 14, 2013 at 15.30 am	UP Chairman, Service, farmers, businessmen and fishermen.

Figure 8.9: Consultation with local people

Figure 8.10: Consultation with farmer at

at Banishanta union **Banishanta union**

During these meetings, the key features of the proposed interventions in Polder 33 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

Regional Workshop

The EIA report and Bengali translation of its executive summary was disclosed to the public on 13th January, 2013 in Dacope, Khulna. The main aim of the meetings was to present the findings of the final draft report on FS and EIA and having feedback from the local stakeholders attended. The report was also finalized through incorporation of comments and suggestions got from the meetings. The communities including the persons to be affected of polder 33 by the Project expressed their views in favor of the Project and wanted early implementation to protect them from natural disasters. They demanded following actions to be taken immediately. These are:

- The intrusion of saline water might be controlled by the improvement of embankment.
- Need awareness building among the communities about water management;
- Ensure proper compensation for affected people
- O & M for embankments and sluice gates in the polder area
- Need formation of Water Management Organizations (MWOs) to manage properly water control structures
- New embankment is required to be constructed by developing village road.

National Workshop

Coastal Embankment Improvement Project (CEIP) organized a national workshop on the "Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA)" studies under CEIP at Spectra Convention Centre, Gulshan 1, Dhaka on 28 February 2013. Mr. Md Shaikh Altaf Ali Senior Secretary, Ministry of Water Resources, Government of the People's Republic of Bangladesh was the chief guest of the Workshop, while Mr. Mohammad Azizul Haque, Director General, Bangladesh Water Development Board (BWDB) and Dr. Sultan Ahmed, Director, Natural Resource

Management, Department of Environment (DoE) were the special guests. The meeting was chaired by Mr. Salim Bhuiyan, Chief Planning, BWDB.

The program started with registration of the participants at 9:30 am. The main program then started at 10:00 am through recitation from the holy Quran. Mr. Sarafat Hossain Khan, Project Coordinator, CEIP, BWDB made the introductory speech. After that Mr. Md. Waji Ullah, Deputy Executive Director (Operations) and Team Leader of Environmental Studies of CEIP presented the findings of the Environmental study and EA findings of five polders. Mr. Kh Khairul Matin presented the Social Impact Assessment (SIA).

Figure 8.11: Welcome Speech by the Project Coordinator of CEIP

Figure 8.12: Presentation of EIA findings by Team Leader of Environmental Study

Figure 8.13: Participant fs of the Workshop

Figure 8.14:Chief Guest delivering his speech

National experts from multi disciplinary fields such as engineers, agriculturists, economists, sociologists as well as local stakeholders were present in that workshop.

Finishing the presentation, the floor was opened for all to take part in discussion on the presentation. The participants attended and exchanged their views on different issues which were noted by the professionals of CEGIS with a view to furnishing the final report.

Findings of the National Workshop

The comments and Suggestions from participants are as follows:

i. Impacts on health and hygienic need to be considered in the study

ii. Subsidence due to climate change needs to be included in the study

iii. The cumulative impacts of five polders are assessed in the study why not for the other polders to be constructed in future?

iv. The cumulative impacts have used "may increase/decrease". This should be more specific.

v. As fisheries sector specially Shrimp Gher plays vital role in economy of coastal region, a Fisheries Specialist is to be included in the proposed Institutional Framework of the EMP of CEIP

vi. Mal-functioning of structures to be defined in the report

vii. Net value of fisheries impact to be provided

viii. Fish-friendly structure should be constructed. The location of these structures is important.

ix. Involvement of DoE during implementation of project activities should be ensured.

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 communities during Compliance Monitoring and Effects Monitoring (discussed later in the document).	Affected communities.	BWDB; Supervision Consultants; Contractors
	Consultations with the project affectees / communities during the external monitoring (discussed later in the document).	Affected communities.	External monitoring consultants.
	Consultations with the project affectees / communities during the site visits by the WB monitoring mission.	Project site staff; Contractors; Affected communities.	WB monitoring mission.
Project Operation Phase	Community participation in O&M activities (see Section 4.9)	Institutional stakeholders; Grass root stakeholders, including the beneficiary communities.	BWDB

9. Assessment of Environmental Impacts

9.1 Preamble

This Chapter identifies the environmental and social impacts that may potentially be caused by various Project phases, and also proposes appropriate mitigation measures to avoid, offset, reduce, or compensate these impacts. Potential Intervention which may cause potential environmental impacts during pre-construction, construction, and O/M stages have been identified in Chapter 4. The project influence area has been identified in Article 2.2.1 of Chapter 2. The following detailed investigations are being carried out or proposed to assess the magnitude of these prioritized impacts:

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

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

Table 9-1: List of Environmental Components and Updating of EIA report by BWDB

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
Natural Environment			
graphy	Topography analysis for the afforestation component of the project	Sites for the location of the afforestation component are underway. The possible locations have been identified. However, the team is now out for field	End of August, 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
		checking.	
	Topography analysis for construction camp.	Sites for construction camp will be decided by the contractors	End of December, 2013
oil	Total Loss of Top Soil	Will be finalized once the information regarding the construction yards and exact locations of borrow pits are obtained	End of December 2013
scape	Landscaping to the side slopes of the embankment and surrounding areas to tree plantation	Location, length and geometry of the afforestation area are yet to be finalized	End of August, 2013
Ecological Environment			
Endangered Species	None	None	None
Vegetation	Change in vegetation from the project	Require additional information for area of construction yards and afforestation	End of December 2013
Wetlands	Total Impact on the wetlands	Require additional information for area of wetland coverage (if any) for the construction yards	End of December 2013
Environment Quality			
Noise Quality	Noise quality impact around all facilities during	Type and number of equipment, vehicles, dredger etc to be used by	End of December 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
	construction	the contractors, Their locations, time and extent of works etc.	
Air Quality	Air quality impact around all facilities during construction	Type and number of equipment, vehicles, dredger etc to be used by the contractors, Their locations, time and extent of works etc.	End of December 2013
Soil Quality	Total amount of lands adjacent to proposed facilities including construction yard, borrow and dredged material	Requires final location and amounts of lands for construction yards and stacking of construction material and dredged spoil.	End of December 2013
Wastes	Total wastes likely to be generated at different proposed facilities during construction works. Total population to be occupied at the construction camps	Input requires form the contractors about the required number of skilled and unskilled labors.	End of December 2013
Spoils	Dredged Spoil amount and how it will be managed. Preliminary finding say that it will be kept on the two sides of the dredged canal	The contractor needs to come up with the dredged spoil management plan	End of December 2013
Socio Economic Environment			
Agriculture	Land needed for the	Pending on finalization of	End of December 2013

Environmental Component	Present Gap/Pending Issue in the EIA	Information in the pipeline to finalize the EIA report	Tentative date of finalization
	construction camp set up, widening of embankment base, afforestation	design, plan for land acquisition	
Health and Hygiene	Analysis on the total workers likely to take part in the construction	Pending on the output of the contractors plan	End of December 2013
Transport	Number and type of construction equipment, vehicles, their possible routes which will conflict with the existing transport	Pending on the outcome from contract units	End of December 2013
Road Accidents	Number and type of construction equipment, vehicles, their possible routes which will conflict with the existing transport	Pending on the outcome from contract units	End of December 2013
Water Transport Accidents	Number, type of water transport for carrying equipment and their possible access routes	Pending on the outcome from contract units	End of December 2013
Irrigation	Irrigation affected by the construction	Pending work-plan from the contractors for rehabilitation of the hydraulic structures	End of December 2013

9.2 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 33 is provided in **Table 9.1** (next page). 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 9.2: 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	Resettlement	Blocked Access Routes	Noise and Vibration	Impacts on Agriculture and grazing	Impacts on Fisheries	Flooding	Vehicular Traffic	Safety Hazard	Damage to Infrastructure	Public Health	Aesthetic Value	Gender and Cultural Issues	Employment Opportunities
Design Phase and Pre-Construction Phase																				
Land Acquisition	0	0	0	0	0	0	0	HN	0	0	0	0	0	0	0	0	0	0	0	0
Contractor Mobilization	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Construction Camp Establishment	MN	MN	MN	0	0	MN	MN	MN	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	MP
Construction Phase																				
Equipment / Material Transportation	MN	MN	MN	0	0	0	0	0	MN	MN	MN	MN	0	MN	HN	MN	MN	0	MN	MP
Operation of Construction Camp	HN	MN	HN	MN	MN	0	MN	0	MN	MN	0	MN	0	MN	HN	MN	HN	0	MN	MP
Site Clearance	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	MN	HN	MN	MN	MN	MN	HP
Borrow and disposal area management	HN	MN	HN	0	0	MN	MN	0	MN	MN	HN	MN	MN	MN	HN	MN	HN	MN	MN	HP
Excavations of water channels	MN	MN	HN	0	0	MN	HN	0	MN	MN	0	HN	MN	MN	HN	MN	MN	MN	MN	HP
Re-sectioning of Embankments	HN	MN	MN	0	0	MN	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Retirement of Embankments	HN	MN	MN	0	0	MN	0	0	HN	MN	MN	0	MN	MN	HN	MN	MN	MN	MN	HP
Installation/replacement/repair of Regulators	HN	MN	MN	0	0	0	MN	0	HN	MN	0	MN	HN	MN	HN	MN	MN	MN	MN	HP
Demobilization	MN	MN	MN	0	0	MN	MN	0	MN	MN	MN	MN	0	HN	HN	HN	MN	0	MN	MP
Operation Phase																				
Operation of Regulators	MN	0	HN	0	MN	0	MN	0	0	0	HN	HN	HN	0	0	0	0	0	0	MP
Repair and Maintenance	MN	0	MN	0	0	0	MN	0	MN	MN	HN	HN	HN	MN	MN	0	0	0	0	MP
Monitoring	0	0	0	0	0	0	0	0	0	0	0	0	0	MN	0	0	0	0	0	MP

Key:-HN: High negative impact; MN: moderate negative impact; 0: insignificant/negligible impact; HP: high positive impact; MP: moderate positive impact.

9.3 Impact during Pre-construction Phase

Site development involves the following activity:

- Mobilization of equipment, construction material/vehicles
- Clearing of sites
- Collection of earth materials from borrow pits and Passur and Dhangmari river bed
- Construction of civil amenities and development and
- Establishment of temporary construction yards

The activities will cause the following environmental impacts

9.3.1 Damages due to Project Intervention and Land Acquisition

Impact

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 20 ha of land would be acquired resulting in displacement of about 1,302 households. In addition, *Gher* field (in between km 14.2 to km 17.5) will also be affected as a result of land acquisition. The details of these damages in Polder 33 are presented in **Tables 9.3** to **9.7**, whereas the resettlement cost estimates are provided in **Table 9.8**.

Table 9.3: Land to be Acquired in Polder 33

Description	Area (ha)
Houses	3.26
Single cropped fields	14.0
Double cropped fields	0
Multi cropped fields	0
Orchard	2.74
Pond	2.50
Total	20.00

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.4: Primary Structures to be Affected in Polder 33

Description	Covered Area (square feet)
Pucca (made of bricks and mortar)	4693
Semi pucca	26069
Tin	110779
Katcha	67631
Thatched	189585
Total	1,447

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.5: Secondary Structures to be Affected in Polder 33

Description	Quantity
Pucca latrine (numbers)	9
Slab latrine (numbers)	198
Katcha latrine (numbers)	12
Tube well (numbers)	7
Boundary wall (running feet)	180
Pillar (no)	10
Gate (rft)	68
Stairs (rft)	110
Gates (numbers)	187

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.6: Trees to be Affected in Polder 33

Types	Big	Medium	Small	Plant	Total
Fruit trees	0	0	0	0	0
Timbers trees	0	35	55	37	127
Banana	0	0	0	0	0
Bamboo	0	0	0	0	0
Totals	***0***	***35***	***55***	***37***	***127***

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Table 9.7: Common Properties to be Affected in Polder 33

Description	Quantity
Mosque	3
Mandir	18
Club House	8
School/Pathshala	10
Graveyard	0
Government Office	1
Madrasa (religious school)	2
Latrine	5
Political Party office	8
Clinic	0
Passenger Shed	1
Miscellaneous	8
Total	**56**

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

Mitigation

The resettlement cost estimate is provided below.

Table 9.8: Resettlement Budget for Polder 33

Description	Amount (BDT)
Compensation for land acquisition	30,177,082
Compensation for structures	110,405,295
Compensation for Trees	15,000
Compensation for Fish Stock	1,096
Other Resettlement Benefits	40,699,375
Capacity building training for EA	1,000,000
Development of Resettlement sites	5,000,000
Operation cost for RAP Implementing Agency/ INGO	10,000,000
Operation cost for External Monitoring Agency	2,000,000
Contingency @ 10% of the above	20,033,685
Total Estimate Budget (in BDT)	220,370,533
Total budget in USD (1 USD = 82 BDT)	2,687,445.52

Source: Socioeconomic survey conducted by KMC in Dec 2011-Feb 2012

The significance of this potential unmitigated impact has been assessed as **Major** on the basis of impact magnitude and receptor sensitivity. The project has the provision for implementation of resettlement action plan, social action plan and environmental management plan. The following measures will be implemented to address the damages due to project intervention and land acquisition:

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

- Effective implementation of the Resettlement Action Plan (RAP) prepared in accordance with OP 4.12 will be ensured.
- Compensation will be paid prior to commencement of the project construction in accordance with RAP. Complete documentary record will be maintained for compensation assessment and payment.
- Contractor will maintain liaison with communities.
- Grievance redress mechanism (GRM) will be established.
- “Chance Find”Procedures will be followed for social common properties lke mosques

Residual Impacts

Despite implementing the above mitigation measures, the impacts associated with the involuntary resettlement are not likely to be fully eliminated, essentially because of the severity and extent of the involuntary resettlement. The significance of residual impact will therefore be **Moderate**, and regular monitoring will be essential to ensure that RAP is effectively implemented and the community grievances related to resettlement are promptly addressed.

9.3.2 Changes in Land Use

Impact

Land would be needed to establish temporary facilities including construction camp (labour shed) and borrow areas. It is estimated that about 20 labour sheds will be constructed out of 52 to established temporary facilities for the rehabilitation works. All the labour sheds will be constructed in the acquired land BWDB besides the drainage sluices of the polder, which was acquired during 60’s. But some trees will be falling during the establishment of temporary facilities (**Table 9.9**). But location of borrow pits area have been mentioned in the in Chapter 4. The use of borrow pits area are majorly fallow during dry season. But in wet season, these borrow pits area from chainage 35.05 km to 52.05 km is used scattered for seedbed or grazing of livestock by the dwellers of the polder.

Table 9.9: 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
3.45	D/S-1	-	0	-	-	-	-
5.90	D/S-2	5	-	-	2	-	-
11.10	D/S-3	-	-	-	27	0	0
13.825	D/S-4	3	2	10	2	0	0
18.42	D/S-5	0	0	0	0	0	0
23.60	D/S-6	0	0	0	0	0	0
28.19	D/S-7	2	3	0	0	4	0
31.33	D/S-8	2	0	0	4	0	0
42.70	D/S-9	0	0	0	0	0	2
43.85	D/S-10	0	2	0	0	1	0
44.665	D/S-11	0	0	2	0	0	0
47.00	D/S-12	7	4	15	0	4	0
50.135	D/S-13	0	1	0	0	1	1

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

Mitigation

- Established all the construction camps within the area owned by BWDB specially on the foreshore or river side area of the thirteen regulators;
- Arrange floating vessels with facilities near the river besides embankment for arranging accommodation for labours. These facilities can minimize the tree cutting and reduce the land use loss.
- All the temporary shops will be re-constructed by the contractor after completion of rehabilitation works and the owner of the shop can be used as gate operator by the Bangladesh Water development Board.
- Pay compensation/rent if private property is acquired on temporary basis, which instructions will be specified in the tender document.
- Consult local stakeholders in the polder area in presence of elected executive body of Union parishad.

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,** if the labour sheds would be constructed in the foreshore area near the regulators then the tree falling will be reduced 60%**.**

9.3.3 Increased Vehicular Traffic during Mobilization

Impact

Mobilization of contractor, equipment, machinery, 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 water ways. **Figure 9.1** shows the key locations of the project area where this impact is likely to take place.

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

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.
- Ensure minimal hindrance to local communities and commuters, specifically in the Mongla port ghat (Figure 9.1).
- Liaise with local communities and concerned authorities. 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.

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.

9.3.4 Preparation of Facilities for Contractor and Labour force

Impact

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 12 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.

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**.

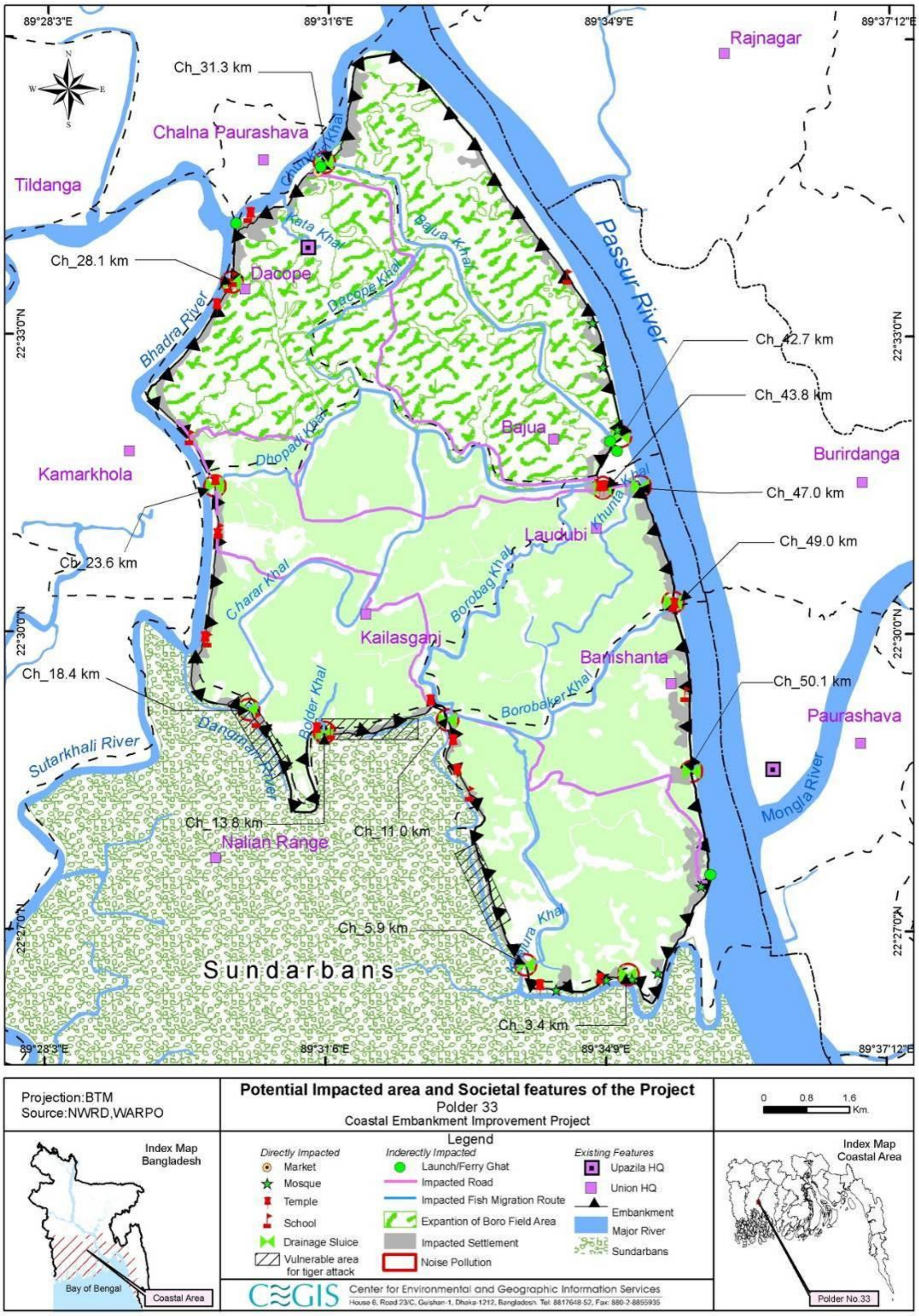

Figure 9.1: Key potential impacts in Polder 33

9.4 Impacts during Construction Phase

Reconstruction and rehabilitation of embankment and polder area will involve the following tasks during construction phase:

- ✓ Mobilization of equipment, construction material/vehicle
- ✓ Placement and compaction of earth
- ✓ Re-excavation of canals
- ✓ Demolition of non-repairable hydraulic structures
- ✓ Disposal of canal excavated wastes

9.4.1 Loss of Agriculture

Impact

About 14 ha of single cropped land out of 20 ha is likely to be affected as a result of embankment retirement from Chainage km 3.2 to km 3.7 , from Chainage km 14.2 to km 17.5 (See **Figure 9.1**). The total crop damage of the land is 24.5 M. ton. 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(Ch.3.75-4.75; Ch.25.35-26.05; Ch.35.55-37.55; Ch.38.05-39.05; Ch.41.55-42.05). This occurrence of crop damage is uncertain and it will be compensated by the contractors, which will be documented in the Tender document of the project works. During collection of earth from the Borrow pit areas (**See Chapter 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 Passur and Dhangar *Khal* through dredging. This borrow pit areas will be filled up by one year due to tidal water. This tide water carries huge sediment from the sea.

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

Mitigation

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

- 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
- Compensation will be paid for any crop damage
- 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**.

9.4.2 Drainage Congestion and Water Logging

Impact

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 areas of Pachim Bajua, Chandpara, Purbo Bajua and Bajua (See **Figure 9.1**) and negatively affecting the cultivation and the associated communities. In particular, areas along *Chara Khal, Dhopadi Khal, and Bajua Khal* 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 6.9**). In addition, excavation of eleven *khals* in the Polder (see **Table 4.4**) 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.

Mitigation

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

- Contractor will constructing bypass canal before replacement of regulators specifically in the regulators located at Ch 47.0km (DS-12), Ch 42.70km (DS-9), Ch 22.83km (DS-6), Ch 5.90 (DS-2).
- Sequence of work at the Andarmanik (DS-12), Bajua (DS-9) and Khajuriar (DS-2) regulators and in the water channels will be carefully planned to avoid drainage congestion.
- Contractor will ensure that re-excavated (See **Figure 9.1**) drainage channels are not obstructed or clogged by the construction activities
- Contractor will ensure that regulators replacement (See **Figure 4.2**) 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**.

9.4.3 Soil and Water Contamination

Impact

Wastes particularly effluents from the work sites may contaminate the soil and water. Construction material, demolition debris, or fuel/oils may enter the river 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.

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

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**.

9.4.4 Soil Erosion

Impact

The construction activities particularly near banks of rivers and other water bodies can potentially cause soil erosion. Similarly, material borrowing can also potentially cause soil erosion (**Figure 4.10**). Soil erosion can increase the sediment load and turbidity in the water bodies thus decreasing the amount of sunlight penetrating in the water. Erosion of river and *khal* banks may increase the risk of damage to nearby settlements and infrastructure. The vulnerable erosion prone area are at Ch 0.00 to Ch 0.2, Ch 1.25 to Ch 1.75, and Ch 20.25 to Ch 21.00km (see **Figure 9.1**) may increase the risk of damage to nearby settlements and infrastructure.

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

Mitigation

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

- Avoid operating heavy construction machinery and vehicles close to the banks of rivers and water channels (*khals*)
- Implement appropriate erosion control measures (eg, stone pitching) where needed
- Re-contour borrow areas where needed
- Protect untreated embankment slopes
- Avoid works in rainy season.

Residual Impacts

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

9.4.5 Sedimentation

Impact

Borrowing material from the river banks may potentially cause increased sediments in the rivers. Similarly, excavation of water channels (see **Table 4.4 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 possible locations of labour camps are near the sluices which are Ch.3.45km (D/S-1), Ch5.90km (D/S-2), Ch 11.10km (D/S-3), Ch13.88 (D/S-4), Ch18.42km (D/S-5), Ch 22.83 km(D/S-6), Ch 28.19 (D/S-7), Ch 31.33 km (D/S-8), Ch 42.70 (D/S-9), Ch. 43.85 (D/S-10), Ch.44.665 km (D/S-11), Ch.47.00 (D/S-12), Ch 49.95 km (D/S-13).

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

Mitigation

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

- Contractor will protect untreated embankment slopes
- Contractor will excavate channels after dewatering them.
- Contractor will not leave excavated earth and silt on channel banks and use proper fencing for preventing washing out of excavated material
- 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**.

9.4.6 Affects on Irrigation

Impact

Irrigation is vitally important for the agricultural activities in the Pachim Bajua, Porikata, Chandpara and Purbo Bajua 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 chaniange of the sluices sites are Ch.3.45km (D/S-1), Ch5.90km (D/S-2), Ch 11.10km (D/S-3), Ch13.82 (D/S-4), Ch18.42km (D/S-5), Ch 22.83 km(D/S-6), Ch 28.19 (D/S-7), Ch 31.33 km (D/S-8), Ch 42.70 (D/S-9), Ch. 43.85 (D/S-10), Ch.44.665 km (D/S-11), Ch.47.00 (D/S-12), Ch 49.95 km (D/S-13) [see **Figure 9.1**].

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

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**.

9.4.7 Impacts on Fish Habitat and Migration

Impact

About 13 existing drainage sluices will be replaced by new ones as part of the Project. All of these sluices are connected with the internal *khals* of the Polder. Construction activities on these sluices can potentially affect aquatic habitat and fish migration in the *khals* (see **Figure 6.24**). Though the habitat in these *khals* is already modified as a result of construction of embankments and sluices in 1960s, some fish migration between outside rivers and internal *khals* still takes place particularly along those regulators. In addition, the fish species including Paisa, Betki, Horina Chingri, Khorsula, and Chatka Chingri are reported to move between the internal *khals* and *beel* during breeding season (mid May to July). The perennial khals namely Bajua khal, Taltola khal, Khutakhali khal, Laudubi khal, Khajuria khal, Banishanta khal, Amtola khal, Chaura khla, Basoa khal, etc are functioning as breeding, nursing and feeding grounds in the polder area. During the construction activities, the fish migration between the outside rivers and internal *khals* is likely to be affected. Similarly, fish migration within the Polder between *khals* and *low lying areas* can also be affected by the construction activities particularly the *khal* re-excavation (see **Table 4.4**).

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

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**.

9.4.8 Impacts on Benthic Fauna

Impact

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*, dredging of Passur and Bhadra rivers and discharge of solid wastes and waste effluents can potentially impact the benthic communities of the water bodies. Most of the activities will be implemented during dry season. Therefore, its phenomenon would be potentially impact to the benthic communities. This impact will be accelerated, if the upstream flow of Gorai-Modhumoti River would not sufficient to the Passur River.

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

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**.

9.4.9 Damage / Disturbance to Faunal Resources

Imapct

No significant faunal resources exist in the Polder primarily because of the presence of human settlements and cultivation fields, and most of the species that now exist in the area are essentially those which have adapted to the modified habitat. Hence the Project activities are not likely to have any 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. In addition, the southern side of Sundarban may face disturbances due to construction activities particularly noise generation, any material borrowing or waste generation inside the Forest.

The significance of this potential unmitigated impact has been assessed as **Moderate** based on impact magnitude and receptor sensitivity.

Mitigation

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

- No material will be borrowed from and no waste will be disposed in Sundarban.
- Liaison with the Forest Department will be maintained to forestall any negative impacts on Sundarbans.
- Contractor will not release untreated wastes on soil or in water.
- Labor will not indulge in hunting, trapping, or shooting wild animals.
- Social forestry program along both sides of the embankment and other khas areas.

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**.

9.4.10 Impacts on Floral Resources

Impact

It is estimated that more than 127 trees of different species and varying sizes exist along the embankments of the Polder 33. During the construction works, a large proportion of these trees will need to be felled 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 the following Table 9.9.

Table 9.10: Location of trees along the embankment and regulators

Chainage (Km)	Name of Existing Interventions	Number of Trees	
		CS	RS
Ch0.00-Ch.1.25	Embankment	44	
Ch 3.45	DS-1;		
Ch 4.0 - Ch 6.0	Embankment		
Ch 5.9	DS-2		
Ch 9.0 - Ch 9.75	Embankment		1
Ch 11.1	DS3		27
Ch 12.2- Ch 14.00	Embankment	10	
Ch 13.825	DS4		
Ch 18.42	DS5		
Ch 21.0 - Ch 21.6	Embankment		3
Ch 22.30- Ch 23.60	DS6		
Ch 29.0- Ch 30.30	Embankment	4	3
Ch 30.30- Ch 31.50	Embankment		
Ch 31.33	DS8		
Ch 37.50- Ch 41.6	Embankment	13	
Ch 42.7	DS-9		
Ch 43.80	DS-10		
Ch 43.85 -Ch 44.7	Embankment	3	
Ch 44.665	DS11		
Ch 44.7 -Ch 47.0	Embankment	18	Mangrove saplings
Ch 47.0	DS12		
Ch 47.0 -Ch 50.2	Embankment		1
Ch 50.125	DS13		
Total		92	35

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

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;
- No material to be borrowed from and no waste to be disposed in Sundarban.

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**.

9.4.11 Air Quality

Impact

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 4.10** for the Project interventions in Polder 33). 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**). Twelve schools 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 (See Figure 4.9)

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

Mitigation

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

- Demolishing of drainage regulators (**Figure 9.1**) will be stopped during school time (10.00 am to 13.00 pm)
- 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.
- 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.
- 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**.

9.4.12 Noise and Vibration

Impact

The construction activities particularly demolition of existing 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 (see **Figure 9.1** for the key locations where noise generated by the Project activities will be of concern). The locations of schools near the embankment are within 200 to 300 meter range.

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

Mitigation

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

- Restricting/limiting construction activities during the school 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**.

9.4.13 Inland and Waterway Traffic

Impact

Transportation of construction materials is a key concern during the Project since the Polder 33 is located in a remote area of Khulna near Sundarbans. Two broad options are available for carrying construction materials to the Project stockyards in the Polder. The first option would involve water way transportation along Khulna - Mongla port - to inside the Polder through troller. The second option would involve road transportation from Khulna to Mongla port boat ghat, troller transportation to inside the Polder.

Material transportation along the major roads and waterways may not create a significant problem, however, additional traffic at smaller jetties such as the one at Mongla boat ghat jetty may cause traffic congestion and hindrance to other commuters, travelers, and transporters.

Similarly, for the material transportation from the stock yard to the construction sites, Polder's internal roads can be used; alternatively, the outer rivers can also be used for this purpose. However not all water bodies around the Polder are suitable for material transportation (e.g. Dhangar *khal*).

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

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 Mongla port)
- River crossing for material transportation during night time where possible and appropriate
- Material transportation through rivers during high tide where needed (eg, Dhangar khal)
- Liaison to be maintained with community and Mongla Port Authority (MPA).

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**.

9.4.14 Safety and Public Health Hazards

Impact

Construction work near Dhangar Khal will be conducted during dry season. This area is near Sundarban and prone to attacks by the Royal Bengal Tigers. The construction workers are likely to be exposed to this hazard during the construction phase.

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.

Mitigation

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

- All the construction work near Dhangar Khal will be conducted in the presence of Forest Guards for safety of labor against the tiger attacks. 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.
- 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 temporary facilities including labor camps will meet minimum safety, hygine and sanitation requirements (safe drinking water, proper sewage disposal, solid waste management, general cleanliness, protection against disease vectors, protection against weather elements, fire fighting, and other similar essential services)
- All workers must be provided with and use appropriate Personal Protective Equipment (PPE). First aid must be provided and there would be procedures in place to access appropriate emergency facilities;
- The construction sites will have protective fencing to avoid any unauthorized entry, where appropriate and possible
- Health screening of employees would be a Contractor obligation prior to 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 site staff will undergo screening against communicable diseases. Communicable disease careers will not be employed at the site.

- All employees need to carry out induction health and safety training prior to commencement of work. OHS issues would be part of the employee training plan. Training would include the provision of 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**.

9.4.15 Hindrance for Pedestrian and Vehicle Movement

Impact

Three major Bazar and other small markets are located in the polder besides the embankment; these are Baniashanta, Kutakhali, and Podderganj Bazar. These markets (see Figure 9.1) play an important role by providing source of livelihood of the Polder inhabitants as well as meeting the daily needs of the people. Construction activities along the embankments are likely to disrupt these markets. The construction activities along these embankments will cause communication and transportation problems to the local population.

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

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**.

9.4.16 Social and Gender Issues

Impact

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.

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.

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**.

9.5 Impacts during Post-construction Phase

9.5.1 Water Contamination and Reduced Soil Fertility

Impact

At present, about 310 ha of land are under *boro* (rice) cultivation. According to the initial estimates, about 1.50 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 670 ha. Specifically, Boro cultivation will be expanded in the medium high land and medium low land areas (see the **Figure 9.1**). 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 for the communities. This runoff may also lead to eutrophication of the water bodies, a phenomenon which 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.

Mitigation

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

- A Pest Management Plan will be prepared before the completion of the construction phase of the project.
- Capacity building and awareness raising of the farmers will be carried out to practice Integrated Pest Management (IPM), if needed 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**.

9.5.2 Impact of Tidal Flooding

Impact

Polder 33 is facing severe tidal flooding after cyclone Sidr and Aila for the existing breach points (Ch.1.75km, 5.25km, 20.55km and 37.00km) of the embankment and low height of the embankment. This is a localized problem and would be reversible through proper rehabilitation works, which have been considered in the Feasibility Study by re-sectioning of embankment and slope protection (see **Figure 4.1**). If the proposed implementation works are not implemented immediately, the problem will be further aggravated.

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

Mitigation

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

- Regular monitoring of embankment, regulators, and seepage of surface waters from Passur River through the regulators will be conducted during dry seasons and necessary steps will be taken to check seepage, if any.
- Afforestation will be undertaken at both side of the embankment, which will help strengthen the embankment.

Residual Impacts

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

9.5.3 Risk of Embankment Failure

Impact

Public cuts (Ch 22.05km, Ch 12.75km) due to farming of shrimp fish are the major causes of embankment breaching of the Polder 33. 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 eastern embankment 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.

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 eastern 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 stock yard of local BWBD colony.

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**.

9.5.4 Drainage Congestion and Increased Sedimentation in Water Channels and Rivers

Impact

Drainage congestion is a key issue in southwest zone of Bangladesh, and Polder 33 is facing this problem due to siltation of *khals* and external rivers, as discussed in **Section 6.2.3**. Specifically, external River and khal is silted up due to reduced flow from the upstream. This problem is localized and reversible by proper re-excavation of khals, which has been considered in Feasibility Study. However, it is a recurring problem and silt deposition in the rivers outside and water channels inside the Polder is likely to continue. Particularly, the low lying areas of the polder **(Figure 6.9**) may face severe drainage congestion in the future.

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

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 of WMGs.

- Proper land zoning plan will be prepared in the Polder for controlling unplanned development works. For this purpose further research will 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.

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**.

9.5.5 Increase Salinity Intrusion due to Leakage of Regulators

Impact

Salinity intrusion during operation of regulators [Ch 42.70 (D/S-9), Ch. 43.85 (D/S-10), Ch.44.665 km (D/S-11), Ch.47.00 (D/S-12), Ch 50.125 km (D/S-13) (see **Figure 9.1**)] will cause severe damage to the soil, water resources, and crops in the area of Andharmanik, Khutakhali and Amtala under the Polder 33. The Proposed project has been designed to address such damages which are currently caused by the salinity intrusion. But, mishandling of these control structures will undermine the objectives of the Project.

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

Mitigation

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

- Regular monitoring and careful maintenance of the water control structures of above mentioned chainages 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**.

9.5.6 Reduced Fish Migration

Impact

Construction of new water control structures on water channels which are currently directly connected with the outer rivers will potentially result in reduction in fish migration (see **Figure 6.24**). This can potentially result in decrease of fish population (see **Table 6.17**) in the Polder thus adversely affecting the fish catch and fishermen.

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

Mitigation

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

- Proper sluice gate operation allowing fish migration.
- Provide training to WMOs;
- Transferring juvenile fish from rivers to Polder;
- Construction of fish sanctuaries in the internal khal.

9.5.7 Impacts on Shrimp farming and livelihood

Impact

Shrimp farming is a common practice in the polder area. A significant number of farmers are involved in shrimp farming in this area. It is more profitable than paddy. Shrimp export contributes significantly to the local and national economic development, employment and income generation as well as livelihood improvement. Improved drainage system, or protection of saline water intrusion by embankment and water control structures, the salinity problem will be reduced within the project area. As a result, rice area would be increased compared to its base condition. On the other hand, shrimp farm area would be adversely impacted due to reduction in saline prone area and would be reduced to corresponding shrimp production. It is expected that the livelihood of the shrimp farmers will be impacted unfavorably no doubt. Many local labours who are exclusively engaged in shrimp farming will become jobless.

Mitigation

1. Prospective of golda farming should be encouraged through campaigning and by providing training on improved culture practices as well as rice-cum-golda farming within available sweet water;
2. Alternative income generation i.e. livestock rearing, poultry and integrated fish culture may create scope of alternative income for shrimp farm labour;
3. Shrimp farming is not environmentally sound practice. In shripmp farm area, there is no green environment due to salinity intrusion. But after completion of the CEIP project, people will be benefitted by different type of by-products like paddy straw, vegetable garden, yard garden, poultry and livestock and finally food security from their crop fields. So it may ensure the proper extension service as well as proper training for betterment of life and livelihood;
4. Shrimp farming is suitable and profitable for only rich farmer but not for landless people, marginal and small farmer. Considering poverty reduction the proposed CEIP project will be very helpful for landless people, marginal and small farmer as a whole.

9.5.8 Impacts on Sundarbans

Impact

Sundarbans exist in the south part of polder 33. In the south from Chainage 1250 to Chainage 20500, Dangamari river is in between Sundarbans and Polder 33. The main impact of the polder on the Sundarban ecosystem situated across the river is the intrusion of more water on the forest floor of Sundarban. This may enhance the height of the tidal inundation of the forest. This enhanced tidal inundation, may imbalance the natural tide inundation features of the given ecosystem. It is commonly observed that in areas that have higher tide inundations, the species composition is different than that is found in the areas that have lower tide inundations. It has been observed that the species such as Sundri (*Heritiera fomes*), Passur (*Xylocarpus moluccensis*), Kakra (*Bruguiera gymnorhiza*), etc. prefer lower tide inundation. As against this, species such as Jhana (*Rhizophora mucronata*), Goran (*Ceriops decandra*), etc. prefers higher inundation. Thus with the enhanced inundation the species composition may gradually change. Secondary information obtained from interviewing local forestry officer reveals that the proportion of Goran on the patch of forest north of "Dabrir Bhorani" across the Shoronkhola Range has increased tremendously and population of crabs have reduced significantly.

Again if the quantity of water entering the Sundarbans increases, consequently the speed at which the water enters the forest floor also increases, which in turn may cause two things, namely

- brings in more of coarser soil particles on the forest floor as it enters and majority of these get deposited on the river banks or nearby
- drains off more of the heavier detritus from the forest floor as it recede s, which otherwise would have got retained by the given ecosystem.This may ultimately cause the loss of soil fertility.

It is however very difficult to isolate what part or what quantum of these above said impacts are because of the polders alone. It needs to be mentioned herein that the quantum of these impacts will be lower if the width of the river between the Sundarban & Polder is more. In future, the Dhangar khal may be silted up and the area of Polder 33 may be merged with the Sundarbans.

Mitigation

1. Although there is no definite study on how much width should be maintained between the river and polder to have no impact on Sundarbans, the study advised to avoid any kind of realignment for polder 33 from chainage 1250 to 20,550 towards Sundarbans.

2. The long term monitoring study under the project will incorporate the study on the impact on the ecology of Sundarbans.

3. BWDB will continue to monitor the ecology on Sundarbans due to project intervention and will guide the design consultant for finalizing the design of other polders close to Sundarbans like Polder 15 under this project.

9.6 Positive Impact of the Project

9.6.1 Employment opportunities for local labor

During construction phase, employment opportunities considering agricultural labor will be increased due to new intervention implementation for the polder area. The intensity with changes in cropping pattern will increase employment opportunities. It is estimated that, total man-days availability during with project situation will be increased three times. The employment opportunities for non-agricultural labor will also improve during implementation of the project

9.6.2 Income from paddy crop

With project saline intrusion would protected as well as agriculture production as well paddy production might increase. The pattern of agriculture would change and employment in paddy field will increase. Due to implementation of proper intervention in with project condition, per capita income from paddy production will increase significantly.

9.6.3 Out migration

The seasonal out migration of day laborers from the polder area to other areas will reduce due to creation of employment opportunity in agriculture and other sectors respectively within polder area. However, the scale of this out migration will be low.

9.6.4 Women status

Construction work requires various types of skilled and unskilled labors. It is found that in Bangladesh a portion of construction labors are female. These females are vulnerable to natural disaster and mostly distressed and widow who are dependent on others and do not have any definite source of income. Therefore, employment access to them in the construction works and during operation/maintenance phase is significantly positive.

The women status will get better progressively as the opportunity of employment in different income generating activities under agriculture, livestock, and poultry sectors is likely to be created as a consequence of the project benefit. The initiative of GOs and NGOs will increase the micro-credit and other socio-economic services for the womenfolk of the project area. The improved communication will make access easy to employment as well decision making in family. Overall women status will progress gradually.

9.6.5 Quality of life: Housing and drinking water

The proposed interventions of the project will have impact on the income of the households. The public and private investment will increase in the new sub-projects. As a result the socio-economic condition will improve significantly. All these will initiate improvement of livelihood quality of the people to some

9.6.6 Livelihood Development

Polder 35/1 was one of the worst affected polder during cyclone Sidr. The project is expected to increase resilience of people within Polder 35/1. Agriculture production increase, reduction of drainage congestion, income generation is expected to improve the livelihood of the people.

9.6.7 Affroestation

The project will promote afforestation which is expected to largely mitigate the negative impact associated with felling off the trees. However the impact is expected to be positive in the long run.

9.6.8 EMP Promotion

The project has in built component which will facilitate implantation of Environmental Management Plan. Under the project, the capacity building for environmental management of BWDB and WMO will be performed. The project is expected to have long term positive impact on institutional development of BWDB and WMO for ensuring environmental sustainability.

9.7 Summary of Assessed Impacts

A summary of these impacts and their significance discussed in the sections above is presented in **Table 9.10.**

Table 9.11: Significance of Environmental Impacts

Potential Impacts	**Temporal Aspects**	**Spatial Aspects**	**Reversibility**	**Likelihood**	**Sensitivity**	**Significance (Unmitigated)**	**Mitigation Measures**	**Residual Impact**
	(See Table 2.1)				**(Table 2.2)**	**(Table 2.3)**		
A. Pre-construction Phase								
Involuntary resettlement	Long term	Local	Irreversible	Certain	High	Major	• Effective implementation of the Resettlement Action Plan (RAP) prepared in accordance with OP 4.12 will be ensured. • Compensation will be paid prior to commencement of the project construction in accordance with RAP. Complete documentary record will be maintained for compensation assessment and payment. • Contractor will maintain liaison with communities. • Grievance redress mechanism (GRM) will be established.	Moderate
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	• The contractor will identify the potential sites for establishing the temporary facilities in consultation with the BWDB, DCSC, and local communities. The sites will be finalized after obtaining approval from DCSC. • All temporary facilities will preferably be located	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							within the area owned by BWDB • If the BWDB-owned land is not sufficient, contractor will consider floating camps outside the Polder. Such camps will be equipped with all necessary facilities to avoid river water pollution, and safeguard measures to protect labor from health and safety hazards. • Ensure that no private structure or property is affected by the temporary facilities. • Pay compensation/rent if private property is acquired on temporary basis. • Consult and maintain liaison with the communities.	
Increased traffic for contractor mobilization	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate to major	• The contractor will prepare a traffic management plan (TMP) and obtain approval from the DCSC. The TMP will be shared with the communities and will be finalized after obtaining	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							their consent. • The TMP will address the existing traffic congestion particularly at the academic institution. Similarly, schools will be avoided during the school time. Project-related traffic will be minimized during the peak traffic hours (from 8 am to 2 pm). • Ensure minimal hindrance to local communities and commuters. • Liaise with local communities and concerned authorities.	
Preparation of facilities for contractor and labour facilities	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Low	• Contractor will prepare site establishment plan and obtain approval from the DCSC • Approval from DCSC 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	Nil

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• 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.	
B. Construction Phase								
Drainage congestion and	Short term	Local	Reversible	Occasional	Medium to high	Major	• Contractor will constructing bypass canal	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
water logging							before replacement of regulators specifically in the regulators located at Ch 47.0km (DS-13), Ch 42.70km (DS-9), Ch 23.55km (DS-6), Ch 5.90 (DS-2). • Sequence of work at the Andarmanik (DS-12), Bajua (DS-9) and Khajuriar (DS-2) regulators and in the water channels will be carefully planned to avoid drainage congestion. • Contractor will ensure that re-excavated drainage channels are not obstructed or clogged by the construction activities • Contractor will ensure that regulators replacement activities do not cause any water ponding near cultivation fields	
Soil and water contamination: large volume of construction wastes, leakage, spillage of oil from vessels and	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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
engine boat, camp wastes, disposal of demolition material, spoil, and excavated silt							in the workshop and equipment yard • 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.	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
Soil erosion	Short term	Local	Mostly Irreversible	Likely	High	Major	• Avoid operating heavy machinery close to the banks of rivers and water channels (khals) • Implement appropriate erosion control measures (eg, stone pitching) where needed • Re-contour borrow areas where needed • Protect untreated embankment slopes • Avoid works in rainy season.	Low
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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							excavation.	
Loss of 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
Fish habitat and 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							settling • Transferring fish from rivers to Polder water channels where appropriate. • Maintain liaison with communities.	
Safety and Public Health Hazards	Short term	Local	Reversible	Likely	High	Major	• All the construction work near Dhangar Khal will be conducted in the presence of Forest Guards for safety of labor against the tiger attacks. 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	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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 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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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 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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							Project; • 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;	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• 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)	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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.	
Air quality deterioration (dust, combustion gases)	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Demolition of the regulators will not be carried out during the school time (8 am to 1 pm) particularly near the schools • Exhaust emissions from	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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. • 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. • Liaison with the communities will be maintained and grievance redress mechanism will be	

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							established at the site.	
Noise generation	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Demolition of the regulators will not be carried out during the school time (8 am to 1 pm) particularly near the schools • 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							maintained and grievance redress mechanism will be established at the site.	
Increased inland and waterway traffic	Short term	Local	Reversible (after construction phase)	Certain	Medium to high	Moderate	• Contractor to prepare and implement mobilization plan considering water vessels and launch movement in the external rivers and, avoid the launch movement time. • Ensure minimal hindrance to local communities and commuters, specifically in the Mongla port ghat . • Liaise with local communities and concerned authorities. 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	Low
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 /	Short term	Local	Reversible	Likely	Medium	Moderate	• No material to be borrowed from and no	Negligible

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
disturbance to faunal resources							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.	
Damage to floral resources	Short term	Local	Reversible (in medium to long term)	Likely	Medium	Moderate	• Contractor will prepare a tree cutting plan and re-plantation plan, obtain approvals from DCSC, and will carry out compensatory tree plantation towards the end of construction phase. A plant nursery will 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	Negligible

Potential Impacts	Temporal Aspects (See Table 2.1)	Spatial Aspects	Reversibility	Likelihood	Sensitivity (Table 2.2)	Significance (Unmitigated) (Table 2.3)	Mitigation Measures	Residual Impact
							mangrove plants; • No material to be borrowed from and no waste to be disposed in Sundarban.	
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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							with local community • GRM will be put in place.	
Social Unrest	Short term	Local	Reversible	Likely	Medium	Moderate	• 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. • 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.	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							• Avoiding construction activities during Prayer time.	
C. Post Construction Phase								
Tidal flooding	Long term	Local	Reversible	Likely	High	Major	• Regular monitoring of embankment, regulators, and seepage of surface waters from Passur River through the regulators will be conducted during dry seasons and necessary steps will be taken to check seepage, if any. • Afforestation will be undertaken at both side of the embankment, which will help strengthen the embankment.	Low
Risk of embankment failure	Long term	Local	Reversible	unlikely	High	Major	• Regular monitoring and careful maintenance of the embankment and existing water control structures especially along the eastern 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	Low

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							situation. • WMG will develop a fund for this kind of emergency situation. • Structural measures like geo bag and sand bag will be kept in local BWBD office Dacope, Khulna	
Drainage congestion and increased sedimentation in *khals* and rivers	Long term	Local	Reversible	Likely	High	Major	• An ongoing program of de-silting of water channels will be considered with full community involvement and participation. WMGs will take the lead for this purpose. • Proper land zoning plan will be prepared in the Polder for controlling unplanned development works. • 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-	Moderate

Potential Impacts	Temporal Aspects	Spatial Aspects	Reversibility	Likelihood	Sensitivity	Significance (Unmitigated)	Mitigation Measures	Residual Impact
	(See Table 2.1)				(Table 2.2)	(Table 2.3)		
							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).	
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
Soil and water contamination (increased use of chemical inputs) and reduced soil fertility	Long term	Local	Reversible	Likely	High	Major	• Using IPM method for reducing pesticide use; • Awareness raising of communities	Moderate
Reduced fish migration	Long term	Local	Reversible	Likely	Medium	Moderate	• Proper sluice gate operation allowing fish migration. • provide training to WMOs; • Transferring juvenile fish from rivers to Polder.	low

Potential Impacts	**Temporal Aspects**	**Spatial Aspects**	**Reversibility**	**Likelihood**	**Sensitivity**	**Significance (Unmitigated)**	**Mitigation Measures**	**Residual Impact**
	(See Table 2.1)				**(Table 2.2)**	**(Table 2.3)**		
							• Construction of fish sanctuaries	

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 **Figure 4.1**, Polder 33 is surrounded by a number of rivers and lakes/ khals. There is Passur river along the eastern periphery, Chunkuri river in the north, Bhadra river in the west, and Dhangar khal in the south directions of the polder. **Figure 10.1** shows the location of the Polder along with the surrounding polders.

Polder 30, 31, 34/2 are located on the north direction of Polder 33. Polder 34/2 also covers the eastern part of the polder. Polder 32 is located in the western periphery of the polder. Among these polders, Polder 32 is under CEIP-I whereas Polder 34/2 has been planned but not yet implemented.

Polder 32 is located in the opposite direction of Polder 33 (see Figure 10.1) with a design crest level of 5 - 4.5 m. The design crest level of Polder 33 is 4.5 m. The construction works in Polder 32 will have significant effects on Polder 33. The major impact would be the transferring of risk of inundation into Polder 33. The embankment constructed around Polder 32 would prevent the entry of cyclonic surge and hence there will be immense hydraulic pressure created on the western part of embankment around Polder 33. Also the embankment around Polder 32 would cause increased amount of siltation in the Bhadra river and Dhangar khal increasing overtopping chances of river water during monsoon for both polders. In future, the Dhangar khal may be silted up and the area of Polder 33 may be merged with the Sundarbans.

The development of livelihoods in Polder 32 would generate socio-economic impacts on Polder 33. There will be more employment opportunities created in Polder 32 during the implementation of CEIP-I, hampering the labor availability to some extent in Polder 33. Also Polder 32 would provide food security, market options to Polder 33 at times. Polder 32 and Polder 33 will pollute the water of Bhadra river due to the overall developments. Such pollutions are likely to affect the flora-fauna of Polder 33 (Polder 32 as well), may result in migration of species as well in future.

The other polders located adjacent to Polder 33 under CEIP, i.e. Polder 23, 34/3 are not considered for detailed design in the first phase of the project. The locations of these polders are located far from Polder 33, and the effects that would be generated by these polders into Polder 33 due to implementation of CEIP are unforeseeable.

The other polders under CEIP-I (Polder 35/1, 35/3 and 39/2C) are located far from Polder 33 and generate very negligible cumulative impacts (if any). Therefore, from the context of Polder 33, discussions on such negligible cumulative impacts (if any) are avoided.

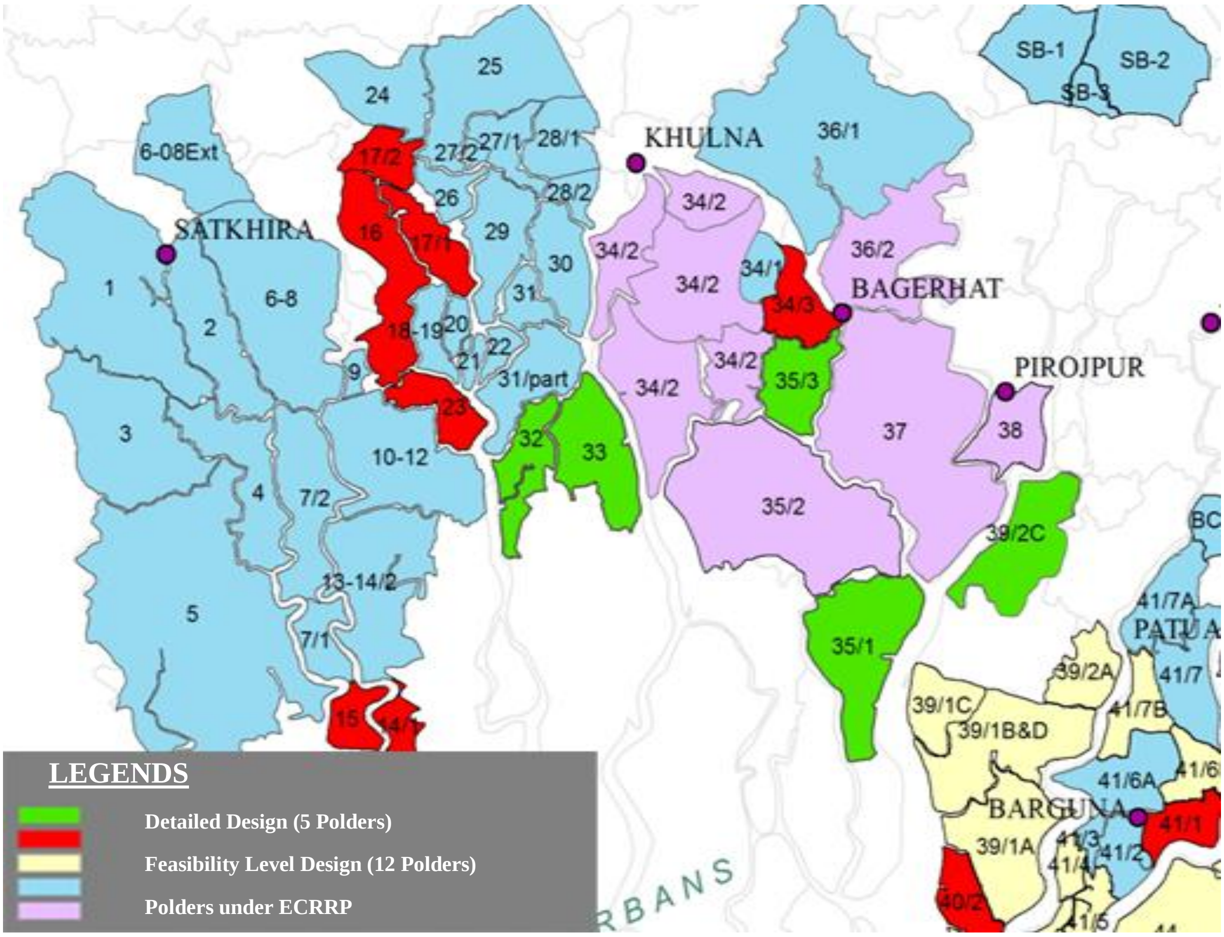

Figure 10.1: Locations of polders under CEIP-I

10.2 Other Projects around Polder 33

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 33. 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 district of Khulna, where Polder 33 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
	Biodiversity Conservation in Sundarban Reserve Forest.	1999-2005	Satkhira, Khulna, Bagerhat
DoF	Extension of Culture Technology of Marine	1997-	Khulna, Bagerhat,

Agency	Project Name	Duration	Location
	Shrimp	2004	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
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 also generated in polder 35/1, 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 35/1, but the consequences of such impacts need to be investigated. The cumulative impacts found in polder 35/1 for different projects are discussed below:

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, potualkhali, 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).

The Polders under ECRRP are located far from Polder 33. Therefore the cumulative impacts generated by such interventions into the polder are negligible and hence not considered here.

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 GoB projects listed in Table 10.1 generate the following foreseeable impacts into Polder 33.

To provide protection from salinity intrusion in Nazirpur, BWDB implemented a project naming "Protection from Saline Water at Nazirpur and its Surrounding Areas" from 1994 to 2004. This project generates notable hydrological influence in the rivers surrounding Polder 33. Over the years, the flow of Possur river has seen marginal change in flow due to the project implemented in Nazirpur. Due to the upstream river dredging under the project, the flows in Possur river have increased in recent times.

There is a flood rehabilitation project implemented by Local Government Engineering Department (LGED), at local level in Khulna, Satkhira, Bagerhat districts. The project improved the status of local people living in Polder 33. Due to agricultural development caused by the flood rehabilitation project, food security has been developed for Polder 33. The effective implementation of the project ensured growth in development, and hence many people from polder 33 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. There had been biodiversity conservation plans on smaller scale in the districts of Bagerhat, Khulna and Sathkhira. Such biodiversity conservation plans in Sundarbans have eventually led to improvement of habitats, people, water quality etc. in Polder 33.

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 shrimp culture in Polder 33 during dry season is a very common practice. The culture of shrimp is not a labor intensive practice, thus shrimp culture in Polder 33 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 33 is that it ensures 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 33.

The Mongla EPZ, Phase-1 project completed in 2004. The development in Mongla EPZ generates increased amount of waste that somehow pollute the Passur river. 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 Dhangar khal and Chunkuri river have further improved due to the implementation of the project by KCC. Therefore, the environment of Polder 33 is being improved.

NGO projects

In recent times, there are number of projects implemented in Khulna 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 33 consider floating garden as a very useful practice in response to climate change effects. Such adaptable measures adopted by the people of Polder 33 may help their economic status on crisis situations.

10.4 Induced impacts caused by CEIP

In Polder 33, 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 33.

a) Sedimentation

The proposed interventions will guard the Polder against direct intrusion of tidal water during high tides or cyclonic hazards. The water of the rivers (Passur, Sutarkhali, Bhadra) carrying huge amount of sediments will move further downstream or upstream and may cause sedimentation. Sedimentation would occur in the Passur river and new morphological changes may be established in course of time (i.e. new lands may be formed inside the rivers through accretion). There are areas outside the polder that may suffer the consequences of siltation in the big rivers. Gunari, ChaMNa, Mongla etc. locations (see **Figure 10.2)** will be subjected to the risk of being inundated due to tidal flooding and cyclonic events. This is because the increased amount of siltation would reduce the water carrying capacity of the surrounding rivers.

In future, the Dhanger khal may be silted up due to sedimentation in the upstream and other factors caused by Polder 33 (i.e. waste generation, increased fertilizers etc.).

The effects of project implementation in Polder 33 will be significant in the nearby areas. The Polders situated farther beyond the discussed areas will bear negligible effects of the interventions in Polder 33. The following figure (**Figure 10.2)** is a satellite image that shows the names of the unions near Polder 33.

Figure 10.2: Satellite image of polder 33

b) Erosion

The blockage of tidal flow into the polder will result the flow of the peripheral rivers (Sibsa and Bhadra) to be diverted further downstream and upstream. This may lead to erosion on the river banks of the unprotected areas (including parts Sundarbans).

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. Bhadra river, Dhangamari khal etc. would undergo frequent congestion. Especially during low tides, Dhangamari khal in the south gradually becomes shallower. In the next few years, there is possibility of the Dhangamari khal (on the south, connected to the Sundarbans) 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 (sundarbans, Polder 32, 31 etc.). The polders beyond these locations may undergo some congestion affects but these are negligible in the context of Polder 33.

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 Passur river and Chunkuri river (Polders 31, 34/2 etc.)

d) Flooding

Polder 31, 32, 34/2 are adjacent to Polder 33 and located along the Passur river. The crest level of Polder 33 willbe raised upto 4.5 m. If Polder 33 is raised as per the proposed design, the adjacent polders (31, 32, and 34/2) might be overtopped in the extreme cyclonic events or tidal flooding. Tidal water would not be able to enter polder 33 during monsoon, as a result water will be diverted towards the nearby polders. This will surely increase the risk of flooding in the nearby polders. Polder 34/2, which is under construction, is located on the eastern bank of Passur river, opposite side of Polder 33 (see Figure 10.1). Although the existing crest level of Polder 34/2 is not known yet, the raising of embankment of Polder 33 might increase storm surge level during extreme storm surge events. This will inundate certain areas of Polder 34/2 (parts of Mongla).

Table 10.3 shows the crest levels of embankments in polder 32, 33, 31 and 34/2. The existing crest level of polder 31 is relatively low compared with the crest levels of polder 32 and 33. This shows that polder 31 will bear the major risk of being flooded during storm surge or tidal activities of the surrounding rivers (of Polder 33) due to their lower elevation.

Table 10.3: Crest level of embankments of five polders

Polder Number	Design crest level (mPWD)
33	4.5 (design)
32	4.5-5 (design)
31	3.66 (existing)
34/2	On going

Source: Data collected by CEIP

e) Water quality

The implementation of interventions would lead to infrastructural developments, increased labor sheds, increased residences and hence population would 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 Passur river and Sutarkhali river. Due to increase in agricultural area inside the polder, 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 33 (Polder 31, 32 and 34/2) will be more exposed to saline water intrusion. Saline water may 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 Passur river some parts (Gunari, ChaMNa, parts of Mongla) of Polder 32, 31 and 34/2 would undergo flooding on a more frequent basis. Agricultural areas may be reduced in these polders. The increased salinity of surface water during dry season might encourage local people to culture shrimps. In future, the local residences of these polders 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 33 would cause erosion in the adjacent areas, but for areas beyond the adjacent polders such affects would be negligible.

a) 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 (Khulna, Bagerhat etc.). 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 unsuitable for agricultural practice in future. There would be increased salinity intrusion on areas along of the Passur river and Bhadra river. However in areas in the upstream of the river (Polder 31, parts of Polder 34/2), salinity intrusion would be limited and boro cropping may still be practiced during dry seasons.

b) Habitat of flora-fauna

Depth of smaller water bodies outside the polder i.e. Sutarkhali river, Bhadra river 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.

In the next few years, the fisheries of the areas near Polder 33 may eventually decrease while fish culture practices might increase. For improvement of the polder, the risk of inundation might be transferred to nearby areas of little protection. Therefore tidal flood plain for capture fisheries may increase in that area whereas overtopping chances for culture fisheries pond may be further aggravated.

c) Fish Migration and biodiversity

Due to protection of Polder 33 from flood water, water will move towards the upstream and downstream of Passur river during high tide. This increased volume of water may 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 Passur and Cunkuri rivers.

d) Housing Condition

The embankment giving protection around the polder area would prevent the intrusion of surface water during monsoon. As a result, the nearby areas with little or no protection (polder 31, 32 and 34/2) may be subjected to flooding at regular intervals. This may eventually deteriorate the housing conditions of the people in these areas.

e) Employment opportunities

The development of the polder would create better employment opportunities of local people. Employment will be properly distributed and in the nearby areas the employment opportunities would be enhanced as well. In a few years time, due to the development of Polder 33, new employment opportunities would be created. This will encourage people from outside the polder to visit the polder for work and improve their economic status.

f) 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 33 would not only be able to resist the damage of cyclonic hazards or flooding; but may also provide safety against food crisis for the nearby areas undergoing probable damage. Polder 32 suffered heavily due to Aila and Sidr and is likely to heavily suffer again if such disasters occur in future. In crisis situations, Polder 33 would be able to provide a stable security in terms of food and other goods for Polder 32.

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 33, more detailed studies are recommended.

11. Environmental Management Plan

This Chapter presents the Environmental Management Plan (EMP) for the CEIP-I activities in the Polder 33. The EMP essentially provides the implementation mechanism for the environmental and social mitigation measures discussed in **Chapter 9**.

11.1 Objectives of EMP

The basic objective of the EMP is to manage, prevent, and mitigate potentially adverse impacts of Project interventions in the Polder 33. The specific objectives of the EMP are to:

- Facilitate the implementation of the environmental and social mitigation measures identified during the present EIA and discussed in **Chapter 9**.
- Assign responsibilities for project proponent, contractors, consultants, and other members of the Project team for the environmental and social management of the Project;
- Define a monitoring mechanism and identify monitoring parameters to ensure effective implementation of the mitigation measures.
- Assess environmental training requirements for different stakeholders at various levels.
- Describe communication and documentation requirements.

The EMP should be included in all the bid documents of Polder 33 and will become a part of the civil works contract. The strict implementation of the EMP and project management's strict enforcement of the adequate construction practices and standards will greatly reduce the negative impacts of the Project.

11.2 EMP Components

The EMP components are listed below:

- Institutional Arrangement
- Mitigation Measures and Plan
- Monitoring Plan
- Documentation and reporting
- Contractual arrangements for EMP implementation
- EMP implementation cost
- Capacity building
- Grievance redress mechanism
- These components are discussed in **Sections** below.

11.3 Institutional Arrangement

Clearly defined and functional institutional arrangements are essential for ensuring effective and sustainable implementation of the EMP, particularly the mitigation measures identified in the EIA. The institutional arrangements proposed to implement the EMP of Polder 33 are described below.

11.3.1 Overall Responsibility

The overall responsibility of EMP implementation and fulfilling other environmental obligations during the Project rests with the Project Director (PD). For this purpose, the PD will be supported by environmental and social staff of the PMU, Design and Construction Supervision Consultants (DCSC), and contractors.

11.3.2 Construction phase

Environment and Social Staff in PMU

As described in **Section 4.8**, the BWDB will set up the PMU to manage the Project implementation. The PMU will be led by theProject Director (PD). To manage and oversee the environmental and social aspects of the Project, the PMU will have an Environment, Social, and Communication (ESC)Unit .The Unit will supervise compliance with and implementation of the EMP. The Unit will include a Senior Environmental Specialist.One environment specialist will be posted at the field level to support all three divisions. The ESC unit will maintain liaison with WB safeguards team, regulatory agencies, and other stakeholders during the Project implementation. The ESC unit will also coordinate with the environmental staff of the Construction Supervision (CS) Consultants.In order to effectively manage the EA process and EMP implementation, the ESC will be established and made operational before awarding the contract to contractor. ESC will be responsible for updating the EIA after receiving the pending information.

Environment and Social Staff with Construction Supervision (CS) Consultants

The CS consultants will be responsible for overall supervision of polder rehabilitation related activities. The CS consultants will ensure quality control and report to PD. The CS will also assist the ESC for ensuring environmental compliance and monitoring of progress including EMP and/or ECP implementation. The CS will supervise the contractors, ensuring design compliance and quality of works. For supervising the EMP implementation, CS will have dedicated and adequately qualified and experienced environmental staff including field-based environmental monitors (EMs). The EMs will supervise and monitor contractors to ensure compliance with the EMP. The CS consultants' environmental staff will maintain coordination with the ESC unit for the effective implementation of EMP and other environmental commitments and obligations of the Project.

Contractor's Environment Supervisors

The construction contractors will have adequate number of dedicated, properly qualified and experienced, site-based Environment Supervisors (ESs) at the construction sites. The ESs will be responsible to implement various aspects of the EMP particularly the mitigation measures to ensure that the environmental impacts of the construction works remain within acceptable limits. The ESs will maintain coordination with the CS (Ems) at the site level. The ESs will also be responsible to conduct environmental trainings for the construction crew.

11.3.3 Post-construction Phase

BWDB core unit has posts of 4 Assistant Chief and 2 Deputy Chief to oversee the overall environmental compliance of BWDB implemented projects. Under CEIP, the ESC unit will provide training to the BWDB people responsible for monitoring of environmental compliance. Thus smooth transition to BWDB will happen to ensure environmental compliance during the O&M after the project completion. These staff will be responsible to manage the environmental aspects of the operation and maintenance of Polder, its water control structures, and other relevant issues such as protection of key environmental resources of the Polder and fish migration. Water Management organizations (WMO) will be formed under the Bangladesh Guidelines for Participatory Water Management (Nov 2000) and involve the beneficiary communities. WMOs will be trained by BWDB to ensure environmental management during project operation. Environmental Management Unit of BWDB will ensure and oversee the environmental management during project implementation and operation.The Water Management Organization will also be trained and involved in EMP implementation during the operation phase.

11.3.4 Need of sound O&M regime

BWDB field offices have a little amount of fund for Operation and Maintenance (O&M) of large scale water resources projects which is not only inadequate to cover the exact requirement of major preventive maintenance works; but also in most cases it is so meagre compared to the total needs that even no minor maintenance work is possible to undertake. Thus for the years together vital works of preventive maintenance are deferred and eventually pushed down to expensive rehabilitation measures. 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 is required which will continue to remain. BWDB should ensure preparation of ***Detail operation and Maintenance of polder*** which will include ***standing operation procedure for hydraulic structure***.

11.3.5 Need of Inter-agency coordination and MoUs

The proposed interventions of CEIP may affect many sectors in the coastal region, it is very much essential to maintain liaison and coordination with all stakeholders, especially with all institutions who are implementing their development projects in the coastal area. BWDB will need to coordinate with major stakeholders such as PAPs, BIWTA, WMOs, FD, DoF, DoE, DAE, BADC, SRDI, LGED, BRDB, DC, DLS, MoL, LGI (Upazila and Union Parishad) and NGOs. Coordination with all relevant stakeholders and agencies should be done by the Project Director, CEIP and particular member of the project implementation unit within BWDB. Inter-agency co-ordination mechanism can be institutionalized as follows:

- Forming coordination committee with the provision of regular review meeting with specific intervals
- Signing Memorandum of Understanding (MoU) or contract among stakeholders, if needed for particular information sharing or for implementing particular tasks specified in the EMP
- Involvement of stakeholders in the implementation and O &M of the sub-projects
- Regular capacity building programme for stakeholders through training/ seminar/ workshop

During implementation of the EMP, the institutional mechanism for inter-agency co-ordination can be assessed using the following:

x. Co-ordination committee formation

xi. MoU or contract signed among stakeholder for involvement in CEIP

xii. Stakeholders consultation workshops

11.4 Mitigation Measures& Plan

Mitigation is an integral part of impact evaluation. Where mitigation is deemed appropriate, a proponent should strive to act upon effects, in the following order of priority, to:

- Eliminate or avoid adverse impacts, where reasonably achievable.
- Reduce adverse impacts to the lowest reasonably achievable level.
- Regulate adverse impacts to an acceptable level, or to an acceptable time period.
- Create other beneficial impacts to partially or fully substitute for, or counter-balance, adverse effects.

Mitigation measures should be considered starting with Environmental Assessment process. It is important therefore, that there is good integration between the EIA team and project design engineers. Project specific environmental construction guidelines will be developed. These guidelines will specify precautions and mitigation measures for construction activities, and to be included with the EMP. Good Environmental Construction guidelines has been compiled in Appendix 10 of Environmental Management Framework.

Impacts identified severe in consequence category and or likelihood category will be further analyzed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted level of impact. Potential mitigation measures will include:

- habitat compensation program
- species specific management program
- engineering design solutions
- alternative approaches and methods to achieving an activity‘s objective
- stakeholders participation in finalizing mitigation measures
- construction practice, including labor welfare measures.
- operational control procedures
- management systems

Based on the past experience, a generic Mitigation Measures for EMP has been presented in Table 11.1below for reference. This can be used as a reference material for comprehending the scope of the EMP. Table 11.1 will be used in conjunction of the polder specific mitigation measure stated in Chapter 9. BWDB will be responsible for implementing the EMP with the help of Contractor and Construction Supervision Consultants.

Table 11.1: Generic Mitigation/Compensation Measures/Guideline

(ECoP: Environmental Code of Practice)

Parameter/Activities	Mitigation/Compensation Measure/Guideline
ECoP 1: Soil/ Land Management	
Sources of Material for Earthwork	• During design the segment wise soil requirement and location of the sources of soil for earthwork for each polder construction/rehabilitation will be identified. • Selection of Borrow Areas for earthen material collection. • No objection from land owner/Revenue authorities as applicable • Contractor shall ensure that borrow materials used for embankment filling is free of pollutants • Disposal of excess soil will be done at site with no objection from DoE and local authority
Borrowing of Earth	**Borrow Area Selection** Borrowing close to the toe line on any part of the embankment is prohibited. Earth available from dredging as per design, may be used as embankment material (if necessary and applicable), subject to approval of the Engineer, with respect to acceptability of material. Borrowing to be avoided on the following areas: • Lands close to toe line and within 0.5 km from toe line. • Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. • Grazing land. • Lands within 1km of settlements. • Environmentally sensitive areas such as reserve forests, protected forests, sanctuary, wetlands. Also, a distance of 500 m will be maintained from such areas. • Unstable side-hills. • Water-bodies (only if permitted by the local authority, and with specific pre-approved redevelopment plans by the concerned authority and engineer-in-charge) • Streams and seepage areas. • Areas supporting rare plant/ animal species. **Documentation of Borrow Pit** The contractor must ensure that following data base must be documented for each identified borrow areas before commencing the borrowing activity that provide the basis of the redevelopment plan. • Chainage along with offset distance; • Area (Sq.m); • Photograph and plan of the borrow area from all sides; • Type of access/width/kutcha/pucca etc. from the roadway; • Soil type, Slope/drainage characteristics; • Water table of the area or identify from the nearest well, etc; • Existing land use, for example barren / agricultural /grazing land; • Location/name/population of the nearest settlement from borrow area; • Quantity excavated (likely and actual) and its use; • Copy of agreement with owner/government; and • Community facility in the vicinity of borrow pit. • Rehabilitation certificate from the land owner along with at least four photograph of the rehabilitated site from different angles.
Excavation operation and Management of Excavated Material	To minimize the adverse impact during excavation of material following measures are need to be undertaken: • Adequate drainage system shall be provided to the excavated area • At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff. The followings precautions shall be undertaken during quarry operations. • Overburden shall be removed. • During excavation slopes shall be flatter than 20 degrees to prevent their sliding. • In case of blasting, the procedure and safety measures shall be taken as per DOE

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	guidelines. • The Contractor shall ensure that all workers related safety measures shall be taken. • The Contractor shall ensure maintenance of crushers regularly as per manufacturer‘s recommendation. • During transportation of the material, measures shall be taken to minimize the generation of dust and to prevent accidents.
Handling Dredged Material from River Dredging	• Deposition of dredged material will be away from the channel edge to limit damage to streamside habitats. This also allows a degree of flooding to occur on the floodplain, thereby creating opportunities for wet grassland, scrub/wet woodland, wetlands and seasonally grazed rough grass. • Where possible biotechnical engineering, for example geo textiles, may be used to help stabilize the material and aid re-colonization. • Other possibilities include: drying and spreading the spoil over adjacent land, which can improve soil fertility in some cases, but may also smother important flora and habitats; excavating a trench and infilling it with spoil, thus minimizing disturbance to agriculture and the local environment; dumping off-site is possible but expensive, using spoil to create artificial wetlands.
Contamination of soil by fuel and lubrication	
ECoP 2: Water Resource & Hydrology Management	
Hazardous Waste Management	The contractor will minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes).
Ponding of water/water logging	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position • Reinstate relief and landscape • Monitor drainage pattern after high down pouring and recession flood • Connect water pockets to the nearest drainage structures/canals
Soil Erosion and siltation	The Contractor shall • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds) • All the work sites (except permanently occupied by the road and supporting facilities) will be reinstated to its initial conditions (relief, topsoil, vegetation cover). • Ensure that roads used by construction vehicles are swept regularly to remove sediment
Dredging	• Disturbance can be minimized if mechanical excavators work from one bank. If the channel is too wide, the digger must work within the channel. Disruption can be minimized by diverting the river down one side of the channel and dredging the other side while it is 'dry’. Smaller plant equipment generally limits the level of impact on bank-side and in-stream habitats.
Construction activities in water bodies	• Protect water bodies from sediment loads by silt screen or bubble curtains or other barrier. • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary
ECoP 3: Air Management	
Construction vehicular traffic	The Contractor will • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition.

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Operate the vehicles in a fuel efficient manner • Cover haul vehicles carrying dusty materials (cement, borrow and quarry) moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Materials will be transported to site in off peak hours.
Construction activities	• Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. • Increase the watering frequency during periods of high risk (e.g. high winds). • Stored materials such as excavated earth, dredged soil, gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas/side of the embankment as soon as practicable by plantation/vegetation/grass-turfing • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems
Odor from Construction labor Camps	• Construction worker‘s camp shall be located at least500 m away from the nearest habitation. • The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odor is generated.
ECoP 3: Agriculture Management	
Loss of Top Soil	• Soil from fallow lands/ non-agricultural lands will be used in earthwork in embankments • Collect/strip top soil before earth filling and store and reuse it for final surfacing of embankment top and tree plantation/afforestation. • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m • Remove unwanted materials from top soil like grass, roots of trees and similar others • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. • The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites • Topsoil stockpiles will be monitored and will any adverse conditions be identified corrective actions will include: o Anaerobic conditions-turning the stockpile or creating ventilation holes through the stockpile; o Erosion – temporary protective silt fencing will be erected;
Soil salinity	• Use of duckweed will remove soil salinity • Flushing with pre-monsoon rain water will reduce soil salinity. • Saline tolerant crops need to be cultivated. • Environmentally and socially responsive shrimp farming e.g. shrimp-rice farming system is encouraged. • Increasing upland discharge of fresh water will push back ingress of saline water from the sea • Green manure application is promoted • Ground water abstraction for shrimp farming will be avoided.
ECoP 4: Noise Management	

Parameter/Activities	Mitigation/Compensation Measure/Guideline
Construction vehicular traffic	• Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise at the work site.
Construction machinery	• Appropriately site all noise generating activities to avoid noise pollution to local residents • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures.
Construction activity	• Notify adjacent landholders/Schools prior any typical noise events outside of daylight hours • Employ best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Plan activities on site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required • Avoid working during 09:00pm to 06:00 am within 500m from residences.
ECoP 5: Ecology Management	
Flora	
Vegetation Clearance	• Tree felling will be performed upon preliminary notification to the relevant authority (District Forest Office, DoE). • Preparation of maps in GIS format, cadastral description of trees to be felled, marking, and supervision of Forest Department are necessary elements of the procedure. • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Fruit and timber trees owned by local population will be compensated at their replacement cost according to market prices
Plant Management	• Tree seedlings are planted in a way that minimizes damage to the soil, while facilitating seedling survival. Tree seedling species are selected appropriate for maintaining long-term productivity. • Focus on tree species suitable for site condition • Prevent unreasonable species resulting in slow growth, less water and soil conservation and pest or disease outbreaks • Local species as planting materials, since natural selection and succession are most suitable for local climates and natural conditions • Ensure avoid single species or clone monoculture • Choose suitable species for berm, turfing and side
Planting	• Leave set back requirements around streams, restricted areas e.g. native vegetation, protected riparian strips, historic and heritage sites, research areas. • For nursery raising, physical and biological controls are practiced to control the pests and diseases in the nurseries. • Do not plant spread-prone species on sites where there is a high risk of uncontrollable wilding spread beyond the boundaries of the plantation. • Consider appropriate species, patterns and layout when planting areas with high visual values and/or with important recreational values
Polypropylene Bags Handling	• Make a Borrow Pit at each site for collection of poly bags • Collect all bags at the pits after plantation • If feasible, inform private sector to collect those bag for recycling
Pest Management to Nursery	• During outbreak of any deadly plant disease develop a plan to manage pest in coordination with neighbors by identifying existing pests and diseases and the risks for the introduction of new pests and diseases. • Share the plan with Bank before application.
Water Management	• Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from nursery • Divert runoff from undisturbed areas around the harvesting site • Stockpile of fertilizer or agrichemical away from drainage lines

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, fertilizer waste and transport to an approved waste disposal site
Fauna	
Construction works in the surrounding lands	• Pre-entry survey and prevention of damage to fauna prior to start up • Limit the construction works within the designated sites allocated to the contractors • Not be permitted to destruct active nests or eggs of migratory birds • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.
ECoP 6: Fisheries Management	
Construction works in the rivers and on the surrounding lands	• Critical breeding areas of major fish species will be identified and declared as sanctuaries. • Creation of small lagoons and pools that may trap the fishes will be avoided. • Creation of artificial waterfalls and other barriers for migration will be avoided. • Natural river channel will be reinstated after completion of construction works
Hydraulic Structure	• Sufficient free flow will be guaranteed in the design and construction work to ensure free pass of migrating fishes. • Hydraulic structure will be operated considering fish migration and spawning time • A guideline for area specific hydraulic structure operation guideline will be developed
Dredging	• Ensure dredging activity will create minimum sediment load in the water • Avoid dredging during spawning period of fish
ECoP 7: Socio-Economic Management	
Construction Camp Management	
Siting and Location of construction Camps (MRDI, 2011)	• Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • BWDB will endorse detailed layout plan for the development of the construction camp submitted by the contractor. The plan will show the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters
Construction Camp Facilities	The following facilities will be provided by the contractor • Adequate housing for all workers • Safe and reliable water supply • Hygienic sanitary facilities and sewerage system. • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities • Provide in-house community/common entertainment facilities, dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
Solid Waste Management	• Ensure proper collection and disposal of solid wastes within the construction camps • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. • Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approved disposal sites
Fuel supplies for	• Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass.

<table>
<tr><th>Parameter/Activities</th><th>Mitigation/Compensation Measure/Guideline</th></tr>
<tr><td>cooking and heating purposes</td><td>• Conduct awareness campaigns to educate workers to protect the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection.</td></tr>
<tr><td>Health and Hygiene</td><td>• Provide adequate health care facilities within construction sites
• Provide first aid facility round the clock. Maintain stock of medicines in the facility
• Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals.
• Initial health screening of the laborers coming from outside areas
• Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work
• Provide HIV awareness programming, including STI (sexually transmitted infections)
• And HIV information, education and communication for all workers on regular basis
• Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon.
• Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers.
• Place display boards at strategic locations within the camps containing messages on best hygienic practices</td></tr>
<tr><td>Payment of Wages</td><td>• The payment of wages will be as per the Minimum Wages Act, Department of Labor, and Government of Bangladesh for both male and female workers.
• Display of the minimum wages board at camps and major construction sites will be done in local languages at the construction and labor camp sites.
• Wages will be paid to the laborers only in the presence of BWDB staff;
• Contractor is required to maintain register for payment of labor wages with entry of every labor working for him. Also, he has to produce it for verification if and when asked by the Engineer, EMUand/or the concerned BWDB staff/Engineer‘s representative</td></tr>
<tr><td>Rehabilitation of Labor and Construction Camp</td><td>At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works.
Various activities to be carried out for site rehabilitation include:
• Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
• Soak pits, septic tanks shall be covered and effectively sealed off.
• Debris (rejected material) will be disposed of suitably.
• Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
• If the construction camp site is on an agricultural land, preserve top soil and good earth can be spread back for a minimum 30cm for faster rejuvenation of the land.
• Proper documentation of rehabilitation site is necessary.
This shall include the following:
• Photograph of rehabilitated site;
• Land owner consent letter for satisfaction in measures taken for rehabilitation of site; and
• Undertaking from contractor;
In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. The rehabilitation is mandatory and will be include in the agreement with the landowner by the contractor. Also, he would have to obtain a certificate for satisfaction from the landowner.</td></tr>
<tr><td colspan="2">Damage and Loss of Cultural Properties</td></tr>
<tr><td>Conservation of Religious Structures and Shrines</td><td>• All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important structures as identified during design and all properties / sites / remains notified. No work shall spillover to these properties and premises. The design options for cultural property relocation and enhancement need to be prepared.</td></tr>
</table>

Parameter/Activities	Mitigation/Compensation Measure/Guideline
	• All conservation and protection measures will be taken up as per design. Access to such properties from the road shall be maintained clear and clean.
	• During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archaeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from the PD. The Archaeological Department shall be intimated of the chance find and the Engineer shall carry out a join inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work. • All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation.
Worker's Accident Risk	
Risk from Operations	• The Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labor Organization(ILO) convention. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, books, etc., to the workers and staff. The contractor has to comply with all regulation regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and outlet.
Risk from Electrical Equipment	• Adequate precautions will be taken to prevent danger from electrical equipment. No materials on any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public. All machines to be used in the construction will conform to the relevant Bangladesh Standards (BS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per BS provisions and to the satisfaction of the Engineer.
Risk from Hazardous Activity	• All workers employed on mixing material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stone-breakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.
Malarial Risk	• The Contractor shall, at his own expense, conform to all anti-malarial instructions given to him by the Engineer and the EMU, including filling up any borrow pits which may have been dug by him.
Disruption to Users	
Loss of Access	• At all times, the Contractor shall provide safe and convenient passage for vehicles, pedestrians and livestock. Work that affects the use of existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the Engineer. • The works shall not interfere unnecessarily or improperly with the convenience of public or the access to, use and occupation of public or private roads, and any other access footpaths to or of properties whether public or private.
Traffic Management	• Special consideration shall be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night • The temporary traffic detours in settlement areas shall be kept free of dust by frequent application of water
Traffic Control and Safety	• The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the cross section.

11.5 Chance-Find Procedures for Physical Cultural Property

The Contractor will be responsible for familiarizing themselves with the following “Chance Finds Procedures” in case culturally valuable materials are uncovered during excavation or any project activities as per Antiquities Act, 1968, including:

- Stop work immediately following the discovery of any materials with possible archeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
- Protect artifacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artifacts;
- Prevent and penalize any unauthorized access to the artifacts; and
- Restart construction works only upon the authorization of the relevant authorities (e.g. Upazila Nirbahi Officer, Deputy Commissioner and Department of Archeology).

11.6 Monitoring Plan

Extensive monitoring of the environmental concerns of the CEIP project will be required as per World Bank guideline. The monitoring program will help to evaluate: (i) the extent and severity of the environmental impacts against the predicted impacts and baseline; (ii) the performance of the environmental protection measures or compliance with pertinent rules and regulations; (iii) trends in impacts; and (iv) overall effectiveness of the project environmental protection measures. The monitoring plans will be included in the EMP for specific sub-projects. Moreover, for all type of monitoring, a comprehensive **database of the polder specific Environmental Impact and Monitoring information** will be created, which will help to evaluate the impacts easily.

The Monitoring activities during design/preconstruction period are:

i. checking the contractor’s bidding documents, particularly to ensure that all necessary environmental requirements have been included; and

ii. checking that the contract documents’ (Environmental Action Plan) references to environmental mitigation measures requirements have been incorporated as part of contractor’s assignment and making sure that any advance works are carried out in good time.

Environmental monitoring during construction phase is a function of supervision, and the essential purpose is to ensure adherence to the EMP. The monitoring is a daily process, which ensures that departures from the EMP and RAP are avoided or quickly rectified, or that any unforeseen impacts are quickly discovered and remedied. This monitoring will be carried out by the Design and Supervision Consultants on a regular bassis. Additional monitoring will be carried out by the Environmental and Social Unit.

Post project monitoring evaluation will be carried to evaluate the impacts of the Project during first three (3) years of operation of the Project. Regular monitoring of the condition of the embankment, drainage structures and slope protection structures and afforestation are important from an environmental management point of view. In addition to this activity, information on the locations, type and consequences of flooding, erosion, flora and fauna mortality, availability of fish, occupational shift, migration is required. Recommended air, noise and water quality monitoring, greening and landscaping and community feedback are also included in the Monitoring Plan. The monitoring plan and details of monitoring locations for environmental condition indicators of theproject during the construction and operation stage are presented in Table 11.2 and Table 11.3

Table 11.2: Environmental Monitoring Plan during Construction and Operation of Rehabilitation and Improvement of Polders System

(Source: MRDI, 2011, LGED, 2011)

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Construction					
Sources of Material	Work Site	Possession of official approval or valid operating license of suppliers materials (Cement, soil).	Before an agreement for the supply of material is finalized.	Contractor	CS, M&E Consultant, BWDB
Operation of borrow site	Borrow pit/site	Visual inspection of borrow site and ensuring operational health and safety	monthly	Contractor	CS, M&E Consultant, BWDB
Top Soil	Storage area	Top soil of 0.15 m depth will be excavated and stored properly	Beginning of earthwork	Contractor	CS, BWDB
	do	The stored top soils will be used as cladding material over the filled lands	Immediately after filling and compaction of dredge materials	Contractor	CS, BWDB
	Work Site	Some of the top soil are placed on top and berm of embankment for turfing and plantation	At the end of filling activity	Contractor	CS, BWDB
Erosion	Side slopes of the embankments and material storage sites	Visual inspection of erosion prevention measures and occurrence of erosion	At the end of filling activity	Contractor	CS, M&E Consultant, BWDB
Hydrocarbon and chemical storage	Construction camps	Visual Inspection of storage facilities	Monthly	Contractor	CS, BWDB
Traffic safety	Construction area	Visual inspection to see whether proper traffic signs are	Monthly	Contractor	CS, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
		placed and flagmen for traffic management are engaged			
Air quality (dust)	Construction site	Visual inspection to ensure good standard equipment is in use and dust suppression measures (spraying of waters) are in place.	Daily	Contractor	CS, BWDB
	Material storage sites	Visual inspection to ensure dust suppression work plan is being implemented	Monthly	Contractor	CS
Air Quality (PM_{10}, $PM_{2.5}$)	Close to School/ Madrasha, Hospital &Villages	Air quality monitoring	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Noise	Construction sites	Visual inspection to ensure good standard equipment are in use	Weekly	Contractor	CS, M&E Consultant, BWDB
	Construction sites	Ensure work restriction between 09:00 pm-6:00 am close to School/ Madrasha, Hospital & Villages	Weekly	Contractor	CS, M&E Consultant, BWDB
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Half Yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB
Drinking Water Quality(TDS, Turbidity, pH, FC, as if groundwater	Sources of drinking water at construction camp/site	Sampling and analysis of water quality	yearly	Contractor through a nationally recognized laboratory	CS, M&E Consultant, BWDB

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
etc)					
Sanitation	Construction camp/site	Visual Inspection	Weekly	Contractor	CS, M&E Consultant, BWDB
Waste Management	Construction camp and construction site	Visual inspection of collection, transportation and disposal of solid waste and solid waste is deposited at designated site	Weekly	Contractor	CS, M&E Consultant, BWDB
Flora and Fauna	Project area	Survey and comparison with baseline environment	Yearly	Contractor through nationally recognized institute	CS, M&E Consultant, BWDB
Cultural and archeological Sites	At all work sties	Visual observation for chance finding	Daily	Contractor	CS, M&E Consultant, BWDB
Reinstatement of Work Sites	All Work Sites	Visual Inspection	After completion of all works	Contractor	CS, M&E Consultant, BWDB
Safety of workers Monitoring and reporting accidents	At work sites	Usage of Personal Protective equipment	Monthly	Contractor	CS, M&E Consultant, BWDB
During Operation and Maintenance					
Surface Water Quality (TDS, Turbidity, pH, DO, BOD, COD etc)	Water sample at each of river for each polder	Sampling and analysis of surface water quality	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Air Quality (Dust PM_{10}, $PM_{2.5}$)	At the baseline monitoring site	24 hours Air quality monitoring	Yearly	BWDB through a nationally recognized laboratory	M&E Consultant
Flora and Fauna specially fisheries	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized institution	M&E Consultant
Agriculture	In the project	Compare the	Yearly	BWDB	M&E

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
	area	production with the baseline		through a nationally recognized institution	Consultant
Operation of hydraulic structure	In the project area	Visual inspection and public feedback	Yearly	BWDB	M&E Consultant

Table 11.3: Environmental Monitoring Plan during Construction and Operation of Afforestation

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
During Implementation					
Plant Selection	Nursery	Visual inspection. Type and variety of plant species to be planted for turfing on the top of embankment and foreshore	Before plantation	Contractor	CS, BWDB, M&E Consultant
Water Quality	Water bodies near nursery	Odor and chemical testing	Half yearly	Contractor through nationally recognized laboratory	CS, BWDB, M&E Consultant
Waste Management	Work site and Nursery	Visual inspection of collection,transportation and disposal of grasses, debris and is deposited at designated site	Weekly	Contractor	CS, BWDB, M&E Consultant
	Work site and Nursery	Visual inspection of Water bars & cut-offs .sediment traps to prevent water pollution caused by run-off from harvesting areas	Beginning of work	Contractor	CS, BWDB, M&E Consultant
Nursery Embankment Management	Nursey	Visual inspection of height of embankment, possibility of water logging and connection to the waterbodies	Beginning of each nursery	Contractor	CS, BWDB, M&E Consultant
During Operation and Management					
Multilevel belt of trees	Polder top and along the polder	Visual inspection	yearly	BWDB through nationally recognized institution	M&E Consultant
Flora and Fauna	In the project area	Detail species assessment and compare with baseline	Yearly	BWDB through a nationally recognized	M&E Consultant

Parameter	Location	Means of Monitoring	Frequency	Responsible Agency	
				Implemented by	Supervised by
				institution	
Erosion	Along Alignment	Visual Inspection presence of gullies or erosion	Yearly	BWDB	M&E Consultant

11.6.1 Qualitative Spot Checking Indicators

Moreover a rapid environmental monitoring will be carried out according the following checklist in terms of visual judgment during field visit as an indirect control to implement Environmental Mitigation plan. Table 11.4 can be followed during project construction and operation process.

Table 11.4: Spot Checking Indicator

Parameter	Visual Judgment		
	Poor	Moderate	Satisfactory
Workers Safety			
Camp Site Management			
Plant Site Management			
Borrow Area Management			
Top Soil Prevention			
Waste Management			
Occupational Health and Safety			
Stockpiling of construction materials			
Reporting and Documentation			

Third Party Validation

BWDB will engage independent consultants to conduct a third party validation (TPV) of the EMP implementation on a yearly basis during the construction phase. During the TPV, the consultants will review the implementation and effectiveness of various EMP activities including mitigation measures, environmental monitoring, trainings, and documentation. The consultants will also identify gaps and non-compliances in EMP implementation and propose actions for their remediation.

11.7 Documentation, Record keeping and Reporting

11.7.1 Record Keeping

Proper arrangements are necessary for recording, disseminating and responding to information which emerges from the various environmental monitoring and management programs. They are also necessary for rendering the environmental management system "auditable". However, the primary focus must remain on the pragmatic control of pollution, not the creation of complex bureaucratic procedures. BWDB will maintain **database of the polder specific Environmental Impact and Monitoring information** for keeping all type of monitoring record. **ESC** unit will assist BWDB for keeping those records initially. The trained BWDB staff will take the responsibility of record keeping and monitoring during operation phase.

11.7.2 Monitoring Records

Quantitative Physical Monitoring

The objective of quantitative physical monitoring is to ensure that the mitigation measures designed to prevent, reduce and where possible offset any significant adverse impacts on the environment are being implemented throughout the Project lifecycle. CS will regularly monitor and provide information to ESC for updating the database. CS will provide the following information bi-weekly to ESC, if not urgent.

- Sampling points;
- Dates and times of sample collection;
- Test results;
- Control limits;
- "Action limits" (circa 80 percent of the control limits) at which steps must be taken to prevent the impending breach of the control limit; and
- Any breaches of the control limits, including explanations if available.

The monitoring data would be continually processed as it is received, so as to avoid a buildup of unprocessed data.

General Site Inspections and Monitoring

A Site Inspection Checklist for recording the findings of the general site condition surveys would be developed by the respective contractors, on the basis of the Environmental Mitigation Plan described in **Chapter 9 and Section 11.4**, during the construction phase. The Site Inspection Checklist would be supported by sketches, as necessary.

11.7.3 Information Sources

A complete and up-to-date file of all relevant sources of information will be maintained by the ESC unit of PMU. This file would be readily accessible and include, as a minimum, copies of the following documents:

- Current environmental permits and consents;
- Action to fulfill the requirement of annual site clearance for polder area
- All relevant national regulations, international guidelines and codes of practice;
- Manufacturers' MSDSs for all hazardous substances used on the plant;
- Manufacturers' operating manuals for all the environmental monitoring equipment;
- Current calibration certificates for all the equipment that requires calibration by an external organization; and
- The latest version of this Environmental Management and Monitoring Plan.

11.7.4 Non-Compliance Report

Any breaches of the acceptable standards specified, would be reported to the PMU using a standard form, i.e. a Non-Compliance Report (NCR).

A copy of each completed NCR would be held on file by CS, to be replaced by the reply copy when it is received. A record of corrective actions would also be made and tracked to their completion.

11.7.5 Monthly Internal Reports by CS

The CS will prepare a monthly report for issue to the ESC of PMU. These reports will summarize the following:

- Progress in implementing this EMP;
- Findings of the monitoring programs, with emphasis on any breaches of the control standards, action levels or standards of general site management;
- Any emerging issues where information or data collected is substantially different from the baseline data reported in the Environmental Assessment;
- Outstanding NCRs;
- Summary of any complaints by external bodies and actions taken / to be taken; and
- Relevant changes or possible changes in legislation, regulations and international practices.

11.7.6 Half Early Progress Report by BWDB

ESC of BWDB will prepare the **half yearly progress report** on environmental management and will submit to the World Bank for review during construction phase. The progress report will summarize the information presented in Article 11.6.5.

11.7.7 Environmental Audit Report & Third Party Monitoring Report

It is expected BWDB will conduct annual environmental audit. In addition, the environmental audit will be carried out before the mid-term evaluation and before project closing. All Environmental Audit Report will be shared with Bank. Environmental monitoring will be conducted during the project Third Party Monitoring. The Third Party Monitoring report will also be shared with Bank.The Bank would also supervise the environmental compliance as part of regular implementation support missions.

11.8 Contractual arrangements for EMP implementation

Since many contractors do not have clear understanding the need of environmental management, some quoted very low price for implementation of EMP and eventually cannot implement EMP as per design. To avoid this problem, fixed Budget will be assigned for EMP implementation. The contractors may need orientation on the requirement of the EMP in the pre-bidding meeting. The contractor needs to submit an **Environmental Action Plan (EAP)** based on the EIA in line with the construction schedule and guideline. The EAP needs to be reviewed by the supervision consultant and cleared by BWDB and World Bank.

11.8.1 Guideline to Incorporate Environmental Management in Bid Document & Preparation of EAP

- Prepare cost estimates, to be incorporate in Bid Documents.
- Environmental Management Plan along with the good environmental construction guidelines to be incorporated in the bid document‘s work requirements.
- Preparation of work requirement (addendum/corrigendum to polder & hydraulic structure construction/afforestation) and
- Corrigendum / Addendum to polder/embankment specification, if any, as special provisions to be incorporated in bid document.
- Penalty clauses for not complying with EMP requirements to be incorporated. Indicative penalty clauses proposed in the CEIP are presented below (Addendum to Clause 17.2 Contractor‘s Care of the Works of FIDIC).
    - The contractor has to follow all traffic safety measures as defined in the technical specification. Damage shall be levied at the rate Tk. 3000/- per day per location for non – conformity of traffic safety measures as per the decision of the engineer.
    - The contractor has to follow all environmental mitigation measures as defined in the technical specification read along with the Environmental Management Plan for the specific CEIP activities. Damage shall 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 contractor has to ensure that prior to every monsoon season, during the construction period; all the temporary and permanent cross drainage structures are free from debris as defined in the Technical Specifications read along with the Environmental Management Plan. Damage shall be levied at the rate of Tk.3000/- per day per location for non-conformity as per the decision of the Engineer.
    - The contractor has to ensure that sufficient numbers and good quality Personnel Protective Equipment (PPE), will be provide to staff and labor all time as defined in the labor codes read along with the EMP. Damage shall be levied at the rate of Tk. 1000/- per day for non-conformity as per the decision of the Engineer.

11.9 Guideline for Compensation and Contingency Plan during Project Period

Compensation becomes necessary when project impacts cannot be satisfactorily mitigated. This can be paid in cash or kind and the emphasis will be on ensuring fairness and causing minimum inconvenience to the affected party. The most common cause of compensation payment is displacement of people and loss of productive land due to land acquisition, tree cutting, or property damage. Such impacts can rarely be fully compensated. The compensation will be given as per provision of the Resettlement Action Framework. Any disputes over the compensation will be handled by the Grievance Redress Committee.

In addition to the compensation, water management projects should also have a contingency plan to deal with emergencies and accidents. Such incidences encompass a whole range of situations from personal injury during operation of a machine to breaching of an embankment. Therefore, BWDB would prepare for the following emergency situations:

- Embankment failure during a flood – keep sufficient number of sand bags in reserve.
- Bank caving/erosion – keep sufficient number of concrete blocks and sand bags in reserve.
- Have an emergency evacuation plan for the people in the line of danger.
- Have a place designated as emergency shelter and ensure proper water supply, power supply and sanitation at this site.
- Accidental spill of harmful chemicals – train some members on how to confine such a spill and minimize potential danger to humans and other animals.
- Fire – keep fire extinguisher or emergency water pump ready at local project office.
- Personal injury – keep a first aid box at the project office. Have a plan for quickly transporting a seriously injured person to the nearest hospital.

11.10 EMP Implementation Cost

The estimated costs for the environmental management and monitoring activities are set out in **Table 11.5** below.

Table 11.5: Tentative Cost Estimates for Environmental Management and Monitoring*

SL. No	Description of EMP activities	Cost Million BDT	Cost Million US$
1	Construction of alternative or bypass channels at each construction sites	3.0	0.037
2	Crop compensation to the direct loser land owner/ share croppers of construction sites /damage to dredge spoils	1.50	0.017
3	Installation of fugitive particulate matter system and Spraying water on embankment/road	Included in contractor budget	
5	Conservation and stocking of threatened fish species (at least 3 spots of *Bajua khal*, *Jilakhali khal*, *Chara khal*, *Boro bag khal*, *Boro baker khal and Horitana khal*)	1.5	0.005
6	Awareness program on plant and wild life conservation	.40	0.005
7	Campaigning and providing training on improved culture practices as well as the rice-cum-golda farming instead of bagdha	.50	0.006
8	Social forestry program along both sides of the embankment and other khas areas	Included in afforestation budget	

SL. No	Description of EMP activities	Cost Million BDT	Cost Million US$
9	Emergency budget allocation for closing breach points of embankments and repairing the damage of structure	10.00	0.122
10	Monitoring cost to fish biodiversity, migration, fish production	1.0	0.012
11	Air and noise quality monitoring analysis cost	.50	0.006
12	Water quality monitoring cost	.40	0.005
13	Waste disposal arrangement	.50	0.006
14	Soil and water salinity monitoring cost	.50	0.006
15	Land acquisition and compensation cost	Budget included in RAP report	
16	Resettlement cost	Budget included in RAP report	
17	O &M cost during construction	Budget included in O & M report	
18	WMOs monitoring cost	1.00	0.012
19	Capacity building and training	4.00	0.049
20	Consultancy services cost for supervisions and monitoring	5.00	0.061
Total Cost of EMP		29.80	0.424

11.11 Grievance Redress Mechanism

BWDB will establish a grievance redress mechanism (GRM) as a means to ensure social accountability and to answer to queries and address complaints and grievances about any irregularities in application of the guidelines adopted in this EMF for assessment and mitigation of social and environmental impacts. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal action. The procedure will however not pre-empt a person’s right to go to the courts of law.

11.11.1 Grievance Redress Focal Points

A Grievance Redress Committee (GRC) at local level will be formed for each Union with union level representation to ensure easy accessibility by the project affected persons and communities. This local GRC will be the local focal points of the project GRM. The GRM sets out the information and communications strategy to ensure that PAPs and communities are fully informed about their rights to offer suggestions and make complaints. All grievances received through the GRM process will primarily 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.

Membership of GRC

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

Members of the GRCs will be nominated by the Executive Engineer at division level and approved by the Project Director, PMO, BWDB, Dhaka.

11.11.2 Grievance Resolution Process

All complaints will be received at the GRCs facilitated by the implementing agency. The aggrieved persons may opt to make complaints directly to the Project Director or Secretary of the MoWR or even to the court of law for resolution. The Member Secretary will review and sort the cases in terms of nature of grievance, urgency of resolution, and schedule hearings in consultation with the Convener. All cases will be heard within four weeks from the date of receiving the complaints.

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 ESC at PMO for review the grievance cases and assist Project Director in making decision. The ESC 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 headquarters levels. At the ministry level, decisions on unresolved cases, if any, will be made in no more than four weeks by an official designated by the Secretary, MoWR. A decision agreed with the aggrieved person(s) at any level of hearing will be binding upon BWDB.

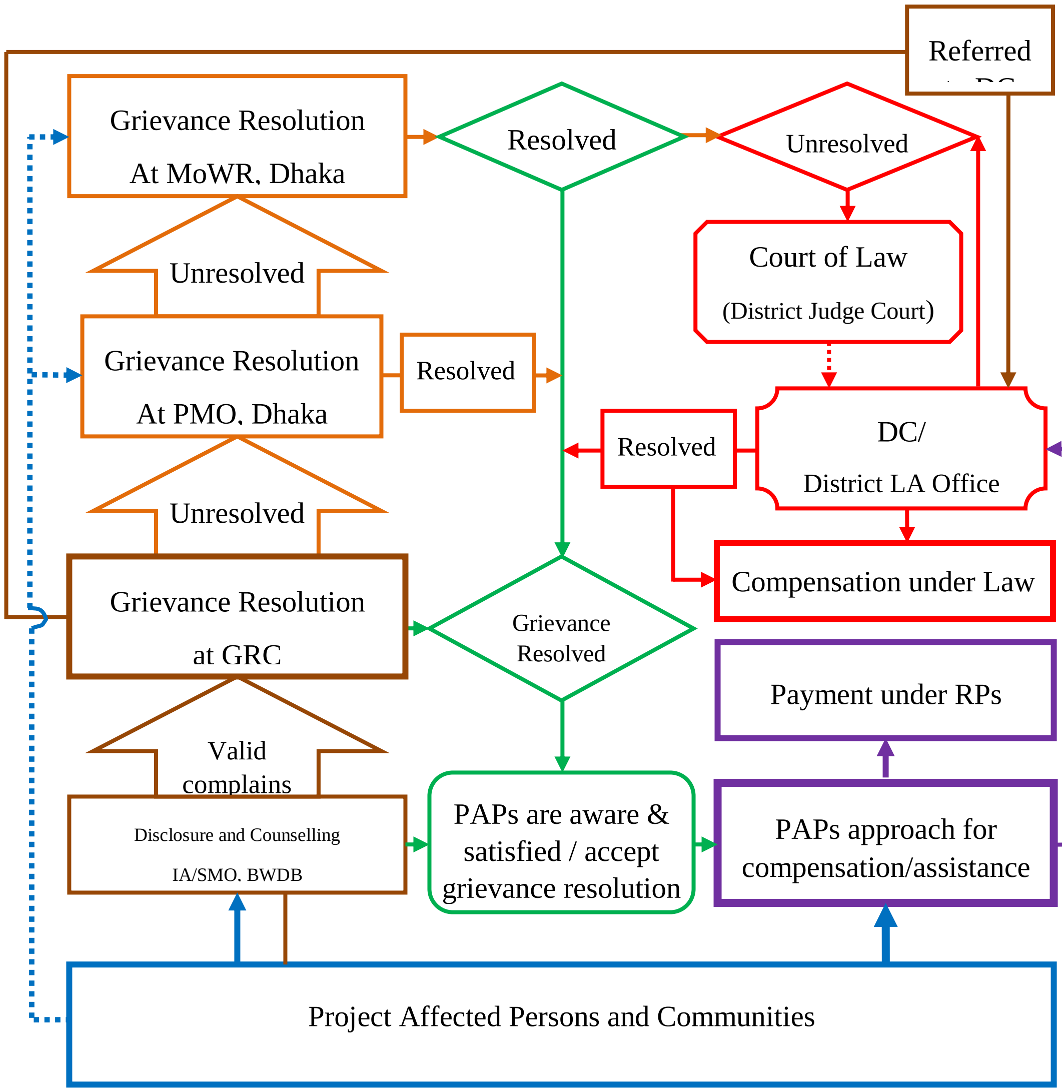

Figure 11.1: GRM Process Flow Chart

To ensure that grievance redress decisions are made in formal hearings and in a transparent manner, the Convener will apply the following guidelines:

- Reject a grievance redress application with any recommendations written on it by a GRC member or others such as politicians and other influential persons.
- Remove a recommendation by any person that may separately accompany the grievance redress application.
- Disqualify a GRC member who has made a recommendation on the application separately before the formal hearing:
    - Where a GRC member is removed, appoint another person in consultation with the Project Director.
- The Convener will also ensure strict adherence to the impact mitigation policies and guidelines adopted in this SMRPF and the mitigation standards, such as compensation rates established through market price surveys.

11.11.3 GRM Disclosure, Documentation and Monitoring

The affected persons and their communities will be informed of the project's grievance redress mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the EMF and the GRM in the form of information brochures will be distributed among the project affected persons. The PAPs will also be briefed on the scope of the GRC, the procedure for lodging grievances 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 or husband, (6) Complete address, (7) Main grievance regarding social (loss of land/property or entitlements) or environmental, (8) Complainants' story and expectation with evidence, and (8) Previous records of similar grievances.
- **Resolution Register**: (1) Serial no., (2) Case no.,(3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.
- **Closing Register**: (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants' satisfaction, and (8) Management actions to avoid recurrence.

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 these on the BWDB website. The format in Annex 3 of SMF may be used for periodic grievance reporting.

11.12 Capacity Building

Since the effectiveness of the Environmental Assessment & implementation depends considerably on the understanding and preparedness of their Engineers and in particular their Environmental Team (**Consisting of Contractor Environmental specialist, Consultant environmental specialist, and ESC of BWDB**). It is important that the project authority makes effort to sensitize the Engineers and Environmental Team on management of environmental issues, provides guidance, and encourages them to build requisite capacities.**Table 11.6** provides a summary of various aspects of the environmental and social trainings to be conducted at the construction site. PMU may revise the plan during the Project implementation as required.

During the O&M phase of the Project, these trainings will continue to be conducted by BWDB staff for all relevant O&M personnel and community.

Table 11.6: Environmental Trainings

Contents	Participants	Responsibility	Schedule
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Key findings of the EIA; Mitigation measures; EMP; Social and cultural values of the area.	Selected BWDB; PMU; DC & CS staff	DC & CS & ESC	Prior to the start of the Project activities. (To be repeated as needed.)
General environmental and socioeconomic awareness; Environmental and social sensitivity of the project area; Mitigation measures; Community issues; Awareness of transmissible diseases Social and cultural values.	PMU; DC & CS; selected contractors' crew	DC & CS & ESC	Prior to the start of the field activities. (To be repeated as needed.)
EMP; Waste disposal; HSE	Construction crew	Contractors	Prior to the start of the construction activities. (To be repeated as needed.)
Road/waterway safety; Defensive driving/sailing; Waste disposal; Cultural values and social sensitivity.	Drivers; boat/launch crew	Contractors	Before and during the field operations. (To be repeated as needed.)
Camp operation; Waste disposal; HSE Natural resource conservation; Housekeeping.	Camp staff	Contractors	Before and during the field operations. (To be repeated as needed.)
Restoration requirements; Waste disposal.	BWDB core unit , Restoration teams	Contractors	Before the start of the restoration activities.
Strengthening of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	Member of water management organizations(i.e. WMGs, WMAs and WMF) and beneficiaries organizations	BWDB, ESC, Contractor	Before and during construction activities

Capacity building training programs will be undertaken in the following area:

- Training of the management level officials of BWDB, BWDB environmental compliance personnel on the overall environmental concerns and responsibilities for implementing EMP

- Recruitment of new professionals with background on environment, if required and provide necessary training
- Organizing workshop, seminar, with stakeholders on the environmental concerns of CEIP
- Special training program for the contractors and workers on the EMP and their responsibilities, who will actually be involved in the construction of the project interventions. The Contractors will be provided guideline for preparation of Environmental Action Plan in line with the construction workplan
- Training of the WMOs on successful operation of hydraulic structures
- Training on structured format in reporting for all stages of implementation and those of relevant agencies who are involved in EMP implementation.

The training programs will be arranged before implementation of the interventions in the polder area. Detail plan can be made by the proposed ESC Unit of BWDB.

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EIA Study Team

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

2. Water Resources Engineer/ Team Leader:	3. Md. Waji Ullah
4. Water Resource Expert:	5. Md. Sarfaraz Wahed
6. River Morphologist:	7. Nazneen Aktar
8. Socio-Economists:	9. Dr. Dilruba Ahmed 10. Subrata Kumar Mondal
11. Soil and Agriculture Specialist:	12. Mujibul Huq
13. Agronomist	14. Dr.Anil Chandra Aich
15. Fishery Specialists:	16. Mohammed Mukteruzzaman 17. Ashraful Alam
18. Ecologist/Junior Ecologists:	19. Ashoke Kumar Das 20. Mohammed Amanat Ullah 21. Mohammad Kamruzzaman
22. Environmentalist:	23. Dr. Ashraful Alam
24. Geographical Information System (GIS)/Remote sensing (RS) specialist:	25. Kazi Kamrull Hassan
26. GIS/RS Analysts:	27. Mohammed Saidur Rahman 28. Hasan Tawfique Imam
29. Junior Engineers/Junior environmental Engineers:	30. Syed Ahsanul Haque, 31. Mohammed Shibly Shadik 32. Mohammed Shakil Ahmed 33. Mohammed Jafrul Alom 34. 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. On behalf of BWDB, an Internation Independent Environment Specialist, Mr. Mohammad Omar Khalid reviewed the document.

Annex A: Checklist for Field Survey

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

<table>
<tr><td colspan="8">Public Cuts: 1. Yes 2. No Public Cuts (If yes): (Please specify the spot names, length, GPS reading)</td></tr>
<tr><td rowspan="2">Location of Public Cuts</td><td rowspan="2">Reasons</td><td colspan="2">Moderately affected</td><td colspan="2">Badly affected/
Vulnerable</td><td colspan="2">Completely damaged</td></tr>
<tr><td>GPS ID</td><td>Length</td><td>GPS ID</td><td>Length</td><td>GPS ID</td><td>Length</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td colspan="5">Re-sectioning: 1. Yes 2. No Re-sectioning (If yes): (Please specify the spot names, length)</td></tr>
<tr><td>From</td><td>To</td><td>Length</td><td>Height</td><td>Actual reasons</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Regulators</td></tr>
</table>

Location of Structure	GPS ID	Type	Vent Size	No of Vent	Service Condition (VG/G/M/B/VB)[11]	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)											

11 VG – Very Good, G – Good, M – Moderate, B – Bad, VB – Very Bad

Barrage										
Pipe Sluices										
Irrigation Inlets										
Bridge/Culverts										
Others										

Drainage Channels

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)12	Problems	Reasons	From – To (Approx. length)	GPS ID (Protection Work)

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

12 G – Good, MD – Moderately Damaged, CD – Completely Damaged

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	Onset:
F0 (< 30 cm)			
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.

People's 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

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				

Name of Livestock/poultry	Name of Disease	Disease (Timing)	Causes	Remarks
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	Dura	Area	Length	Width	Depth	Dura
Capture Fisheries:	a. Total No. of fisher HHs:	River																
	b. %/No. of CFHHs:																	
Culture	c. %/No. of SFHHS:																	

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	Dura	Area	Length	Width	Depth	Dura
Fisheries: Indiscriminate Fishing Activities:	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																

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
		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.	Season (Months):	Routes:	Significant areas	1. 2.

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				

	4. 5.				3.						Small Pprawn				
Vertical Migration Pattern	Species : 1. 2. 3. 4. 5.	Season (Months):	Habitats:	Species of Conservation Significance	Rare:						Silver carp				
											Carpu				
											Grass carp				
											Tengra				
					Unavailable:						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 of Ecological Information Collection

Center for Environmental and Geographic Information Services (CEGIS)

(1) Basic Information

Date		Prepared by	
Name of the Polder			
BWDB Circle Name			
District/s		Upazila/s	
Location of the FGD			

(2) 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	

(3) Terrestrial Vegetation Checklist (List of Major Plant Species)

Species Name	Status	Utilization
Homestead Vegetation		

Species Name	Status	Utilization
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		

(4)Terrestrial Wildlife Check List

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			

Species Name	Habitat	Status	Migration Status
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			

(5) Aquatic Wildlife Checklist

Species Name	Habitat	Status	Migration Status
Mammals			
Amphibians			
Reptiles			
Birds			

Species Name	Habitat	Status	Migration Status
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			

(6) 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			

(7) 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=Fish; 2= migratory bird; 3= other wildlife; 4=aquatic flora

(8) Wetland vegetation Checklist

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

(9) 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)				

(10)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	

(11) 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
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	
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 waterways (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
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					
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?			
c)	Number of members	Male	Female	Comments

Sl	Issue/Question	Response/Suggestion		
	(male-female)			
	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			
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.

Name	Age	Occupation	Address/Phone No.

Annex B: No Objection Certificate

৯নং বানীশান্তা ইউনিয়ন পরিষদ কার্য্যালয়

উপজেলা ঃ দাকোপ, জেলা ঃ খুলনা।

স্মারক সংখ্যা ঃ

পূর্ব সূত্র ঃ

তারিখ ঃ ১/০৫/১২

অনাপত্তি পত্র

এই মর্মে প্রত্যায়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্ব ব্যাংক কর্তৃক গৃহীত উপকূলীয় বাঁধ উন্নয়ন কর্মসূচীর আওতায় (CEIP) বাংলাদেশ পানি উন্নয়ন বোর্ড এর অধীনে দাকোপ উপজেলার অন্তর্গত পোল্ডার ৩৩ প্রকল্পটির জরুরি ভিত্তিতে পুনর্বাসন ও উন্নয়নের কাজে আমার ও অত্র ইউনিয়নের জনগণের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগণের সক্রিয় অংশগ্রহণে পরিচালিত হবে। তাছাড়াও বাংলাদেশ পানি উন্নয়ন বোর্ড এর প্রকল্প বাস্তবায়নের সময় অত্র ইউনিয়নের জনগণ সার্বিকভাবে সহযোগিতা করবেন।

০৯/০৬/১২

সুদেব কুমার রায়
চেয়ারম্যান
৯নং বানীশান্তা ইউনিয়ন পরিষদ
দাকোপ, খুলনা।

কার্যালয়

৮নং বাজুয়া ইউনিয়ন পরিষদ

পোঃ-বাজুয়া, উপজেলা-দাকোপ
জেলা ঃ-খুলনা।

স্মারক নং

তারিখ ঃ ৯/০৬/১২

অনাপত্তি পত্র

এই মর্মে প্রত্যায়ন করা যাচ্ছে যে, বাংলাদেশ সরকার ও বিশ্ব ব্যাংক কর্তৃক গৃহীত উপকূলীয় বাঁধ উন্নয়ন কর্মসূচীর আওতায় (CEIP) বাংলাদেশ পানি উন্নয়ন বোর্ড এর অধীনে দাকোপ উপজেলার অন্তর্গত পোল্ডার ৩৩ প্রকল্পটির জরুরি ভিত্তিতে পুনর্বাসন ও উন্নয়নের কাজে আমার ও অত্র ইউনিয়নের জনগণের কোন আপত্তি নাই।

এখানে উল্লেখ্য যে, উক্ত প্রকল্পের কার্যক্রম জনগণের সক্রিয় অংশগ্রহনে পরিচালিত হবে। তাছাড়াও বাংলাদেশ পানি উন্নয়ন বোর্ড এর প্রকল্প বাস্তবায়নের সময় অত্র ইউনিয়নের জনগণ সার্বিকভাবে সহযোগিতা করবেন।

(দেবপ্রসাদ পাইন)
চেয়ারম্যান
৮নং বাজুয়া ইউনিয়ন পরিষদ
উপজেলা-দাকোপ, জেলা-খুলনা।

Annex C: Tables

Table 1: Available Homestead plants in the polder area

Scientific Name	Family	Local Name	Habit	Usage	Local Status
Acacia moniliformis	Mimosaceae	Akashmoni	Tree	Timber and fuelwood	R
Acacia nilotica	Mimosaceae	Babla	Tree	Timber And fuelwood	C
Moringa dulcis	Mimosaceae	Sazna	Tree	Food, Timber and fuelwood	C
Achyranthes aspera	Amaranthaceae	Apang	Herb	Medicine	C
Adhatoda zeylanica	Acanthaceae	Bashok	Shrub	Medicine	C
Aegle marmelos	Rutaceae	Bel	Tree	Food and Medicine	R
Albizia lebbeck	Leguminosae	Sirish	Tree	Timber and fuelwood	VC
Albizia richardiana	Leguminosae	Gogon Sirish	Tree	Timber	C
Anthocephalus chinensis	Rubiaceae	Kadom	Tree	Timber and fuelwood	C
Areca catechu	Palmae	Supari	Monocot	Food and Timber	C
Artocarpus heterophyllus	Moraceae	Kathal	Tree	Food, Timber and fuelwood	R
Azadirachta indica	Meliaceae	Nim	Tree	Timber and medicine	C
Bambusa sp.	Gramineae	Bans	Bushes	Thaching	C
Borassus flabelifer	Palmae	Taal	Tall Monocot	Fruit, Fuelwood and Timber	C
Carica papaya	Caricaceae	Papay	Shrub	Fruit	C
Cassia fistula	Leguminosae	Badarlathi/Sonalu	Tree	Ornamental and Medicine	R
Centella asitica	Umbelliferae	Thankuni	Herb	Medicine and Vegetables	R
Citrus grandis	Rutaceae	Jambura	Tree	Fruits	C
Cleorodendrum viscosum	Verbenaceae	Bhat	Herb	Fuelwood	C
Cocos nucifera	Palmae	Narikel	Tall Monocot	Fruit and Fuelwood	VC
Dalbergia sissoo	Fabaceae	Sisso	Tree	Timber and fuelwood	C
Datura suaveolens	Solanaceae	Dutura	Herb	Medicine	C
Diospyros discolor	Ebanaceae	Bilatigab	Tree	Fruit	C
Diospyros perigrina	Ebenaceae	gab, deshigab	Tree	Fruit and Timber	R
Erythrina variegata	Leguminosae	Mandar	Tree	Fuelwood	R
Ficus benghalensis	Moraceae	Bot	Tree	Fuelwood	C
Ficus hispida	Moraceae	Dumur	Shrub	Fruit and Fuelwood	VC
Ficus religiosa	Moraceae	Assawath	Tree	Fuelwood	R
Glycosmis pentaphylla	Rutaceae	Daton	Shrub	Medicine	VC

Scientific Name	Family	Local Name	Habit	Usage	Local Status
Leucauna laucocephalata	Mimisaceae	Ipil ipil	Tree	Timber	R
Mangifera indica	Anacardiaceae	Aam	Tree	Fruit and Timber	C
Manilkara zapota	Zapotaceae	Chabeda	Tree	Fruit	C
Mikania scandens	Compositae	Assamlata	Herb	Medicine	VC
Moringa oleifera	Moringaceae	Sajna	Tree	Vegetable	C
Musa spp	Musaceae	Kala	Monocot	Fruit	C
Ocimum americanum	Labiatae	Tulshi	Herb	Medicine	C
Phoneix sylvestris	Palmae	Khejur	Monocot	Fruit and Fuelwood	C
Pithecolobium dulce	Mimosaceae	Khai Babla	Tree	Timber and Fruits	C
Ruellia tuberosa	Acanthaceae	Patpaty	Herb	-	VC
Spondias dulcis	Anacardiaceae	Amra	Tree	Fruit	C
Streblus asper	Urticaceae	Sheora	Tree	Fuelwood	C
Swietenia mahagoni	Meliaceae	Mahogoni	Tree	Timber and medicine	C
Syzygium cumini	Myrtaceae	Kalojam	Tree	Fruit	C
Tamarindus indica	Leguminosae	Tetul	Tree	Fruit	R
Terminalia arjuna	Combretaceae	Arjun	Tree	Timber and medicine	C
Terminalia catappa	Combretaceae	Katbadam	Tree	Fruit	R
Trewia nudiflora	Euphorbiaceae	Pitali/Latim	Tree	Timber and fuelwood	C
Zizyphus mauritiana	Rhamnaceae	Kul Baroi	Tree	Fruit	VC
Zizyphus rugosa	Rhamnaceae	Anai	Tree	Fruit	C

Local Status Code: C=Common, VC=Very Common, R=Rare

Table 2: Common agricultural weeds in cropfield vegetation of the polder

Scientific Name	Family	Local Name	Local Status
Abutilon indicum	Malvaceae	Patari	C
Acalypha indica	Euphorbiaceae	Muktajhuri	C
Achyranthes aspera	Amaranthaceae	Apang	C
Ageratum conyzoides	Compositae	Fulkuri/Chaglagacha	VC
Alternanthera sessilis	Amaranthaceae	Sachishak	C
Amaranthus spinosus	Amaranthaceae	Kata note	C
Calotropis procera	Asclepiadaceae	Akand	C
Cardiospermum halicacabum	Sapindaceae	Lata futki	C
Ceratopteris thalictroides	Parkeriaceae	-	R
Chenopodium ambrosoides	Chenopodiaceae	Chapali ghash	VC
Clerodendrum inerme	Verbenaceae	Bhant	C
Commelina benghalensis	Commelinaceae	Kanchira	C
Cotula hemispherica	Compositae	Kancha ghash	C
Crotolaria retusa	Leguminosae	Ban-san	C
Croton bonplandianum	Euphorbiaceae	Banjhal	VC
Cuscuta australis	Convolvulaceae	Swarnalata	R

Scientific Name	Family	Local Name	Local Status
Cyanotis cristata	Commelinaceae	Kanaya ghash	C
Cynodon dactylon	Gramineae	Durba	VC
Cyperus diformis	Cyperaceae	Mutha	C
Cyperus sp.	Cyperaceae	Mutha	VC
Digitaria longiflora	Gramineae	Sadaphuli	C
Ethulia conyzoides	Compositae	Gaicha	C
Eupatorium odoratum	Compositae	Assamlata	C
Euphorbia hirta	Euphorbiaceae	Dhudhia	R
Fimbristylis aphylla	Cyperaceae	Baranirbishi	C
Marsilea quadrifolia	Marsileaceae	Susnishak	C
Nicotiana plumbaginifolia	Solanaceae	Bantamak	C
Rhynchospora rufescens	Cyperaceae	Shimbhatraji	VC
Rorippa indica	Cruciferae	Bansarisha	C
Ruellia tuberosa	Acanthaceae	Chatpotey	C
Sesbania rostrata	Leguminosae	Dhaincha	C
Scirpus articulatus	Cyperaceae	Chenchur	C
Solanum ferox	Solanaceae	Gotabegun	R
Solanum filicifolium	Solanaceae	Titbegun	C
Solanum indicum	Solanaceae	Futkibegun	C

Local Status Code: C=Common, VC=Very Common, R=Rare

Table 3: List of Aquatic plant species and their status occurred inside the polder area

Scientific Name	Family	Local Name	Local Status
Aponogeton natans	Aponogetonaceae	Ghechu	C
Arundo donax	Gramineae	Baranal	C
Azolla pinnata	Salviniaceae	Kutipana	C
Colocasia esculenta	Araceae	Kachu	C
Cyperus cephalotes	Cyperaceae	Mutha	VC
Eclipta alba	Compositae	Kalokeshi	C
Eichhornia crassipes	Pontaderiaceae	Kochuripana	C
Enhydra fluctuans	Cyperaceae	Helencha	VC
Fimbristylis squarrosa	Cyperaceae	Jumka chaise	C
Hydrilla verticillata	Hydrocharitaceae	Jhangi, kureli	C
Ipomoea aquatica	Convolvulaceae	Kalmi sak	C
Lemna perpusilla	Lemnaceae	Khudipana	C
Ludwigia repens	Onagraceae	Panidoga	C
Mersilea quadrifoliata	Mersileaceae	Susnisak	C
Monochoria hatata	Pontaderiaceae	Kechur	R
Nachamendra alternifolia	Hydrocharitaceae	Kaisa	C
Nymphaea nouchali	Nymphaeaceae	Shapla	C
Nymphaea stellata	Nymphaeaceae	Nilshapla	R
Nymphoides indicum	Menyanthaceae	Panchuli	C
Oryza rufipogon	Gramineae	Jhara dhan	R
Phragmites karka	Gramineae	Nol	R
Pistia stratiotes	Araceae	Topapana	VC
Polygonum barbatum	Polygonaceae	Bishkatali	C

Scientific Name	Family	Local Name	Local Status
Saccharum spontaneum	Gramineae	Khag	R
Sagittaria sagittifolia	Alismataceae	Chhotokul	C
Salvina natans	Salviniaceae	Tetulpana	C
Spirodela polyrhiza	Lemnaceae	Khudipana	C
Trapa natans	Trapaceae	Singra	R
Utricualria exoleata	Lentibulariaceae	Chotojhangi	C
Ludwigia abscendens	Onagraceae	Keshordam	C
Trapa bipinosa	Trapaceae	Singra	R
Typha sp.	Typhaceae	Hogla	R
Cyperus rotundus	Cyperaceae	Mutha	VC

Local Status Code: C=Common, VC=Very Common, R=Rare

Annex D: List of Participants of PCM and FGD

List of participants of PCM

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক
মতবিনিময় সভা

স্থানঃ বালিয়াডাঙ্গা ইউ.পি. কার্যালয়

তারিখঃ ০৩/০৬/২০২২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১	সুদেব কুমার রায়	চেয়ারম্যান বালিয়াডাঙ্গা ইউ.পি	01920545453	[illegible] ০৩/০৬/২২
২	দেব প্রসাদ গাইন	চেয়ারম্যান বাজুয়া ইউ.পি, দাকোপ, খুলনা	01712557555	[illegible]
৩	তন্দ্রা রায়	সদস্যা ৪,৫,৬ নং ওয়ার্ড বাজুয়া ইউ.পি.	0193516445 6	[illegible]
৪	রুমু মল্লিক	সদস্য ১,২,৩ নং ওয়ার্ড বাজুয়া ইউ.পি	01926312691	[illegible]
৫.	নিমাই চন্দ্র মন্ডল	ইউ.পি সদস্য ৮ নং ওয়ার্ড	01913598389	[illegible]
৬.	দিলীপ কুমার মন্ডল	সহকারী প্রা: শি: [illegible]	01937732893	[illegible]
৭.	রবীন্দ্র নাথ গাইন	[illegible]	01724115817	[illegible]
৮.	[illegible] চন্দ্র [illegible]	[illegible] UP [illegible]	01928221073	[illegible]
৯	দুলাল চন্দ্র বিশ্বাস	সমাজসেবক ৯ ওয়ার্ড		[illegible]
১০	হোসাইন	ব্যবসায়ী [illegible]		হোসাইন
১১	সন্তোষ রানী	৮ নং ওয়ার্ড	01926943047	সন্তোষ রানী

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক মতবিনিময় সভা

স্থানঃ বানীশান্তা ইউপি কার্যালয় তারিখঃ ০৩/০৫/২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
১২	বিশ্বপতি মন্ডল	জেলুরিয়া		বিশ্বপতি মন্ডল
১৩	দিনেশ	জেলুরিয়া		দিনেশ
১৪	বিমল দেও	গোলবাড়ী		বিমল দেও
১৫	পরিমলচন্দ্র বর্মন (তুজান)	সমাজ সেবক জেলুরিয়া	০১৮১৯৮৬৮২০ ৭৫	[illegible]
১৬	প্রশান্ত কুমার হালদার	প্রধান শিক্ষক [illegible]	০১৭২২২২৭৪২ ৩৪	[illegible]
১৭	তপন কুমার মন্ডল	প্রধান শিক্ষক [illegible]	০১৭২৮২৮০- ৫৭২	[illegible]
১৮	[illegible]	[illegible] ৮নং ওয়ার্ড	01915-516970	[illegible]
১৯	নিমাই চন্দ্র মন্ডল	ইউপি সদস্য বানীশান্তা ৯নং ওয়ার্ড	01913592989 389	[illegible]
২০	বিশ্বনাথ রায়	ইউ পি সদস্য ৯নং বানীশান্তা	01712632603	[illegible]
২১	সঞ্জীব কুমার রায়	প্রাঃ ইউ পি সদস্য	01917272491	[illegible]
২২	মো: ইব্রাহিম আলী	শাখা কর্মকর্তা পাউবো/খুলনা	01712-821425	[illegible] 03/05/12

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক মতবিনিময় সভা

স্থান: বানিশান্তা ইউপি কার্যালয়

তারিখ: ০১/০৬/২০১২

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
২৩	দেবাশীষ মন্ডল	ইউ, পি, সদস্য	01924394688	[illegible]
২৪	ইসমাইল হোসেন	ইউ,পি, সদস্য		[illegible]
২৫	মো: মোস্তফা [illegible]	ইউ, পি, সদস্য		[illegible]
২৬	বীনা সরদার	ইউপি সদস্যা	01915193937	বীনা সরদার
২৭	হেলেনা খাতুন	"	01914203958	[illegible]
২৮	নিরঞ্জন মন্ডল	ইউ, পি, সদস্য ২নং ওয়ার্ড, বানীশান্তা	01911848489	[illegible]
২৯	তরুণ সরকার	লাউডোব ইউপি সদস্য ৯নং ওয়ার্ড	01916-490675	[illegible]
৩০	সুনীল মন্ডল	এনজিও প্রতিনিধি বানীশান্তা ইউ	01711-837322	[illegible]
৩১	প্রভাতী সরকার	নারী নেত্রী বানীশান্তা		প্রভাতী
৩২	কল্পনা বিশ্বাস	নারী নেত্রী বানীশান্তা	01915-632169	কল্পনা
৩৩	তাপসী রায়	নারী নেত্রী বানীশান্তা	01715499834	তাপসী রায়

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক
মতবিনিময় সভা

স্থানঃ

তারিখঃ ০২/০৬/২০১২ ইং

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৩৪	আরোতিমী মন্ডল	নারী নেত্রী বানিশান্তা	০১৭১৮২২২৭ ৭১	আরোতিমী মন্ডল
৩৫	ইতি রায়	বানিশান্তা		ইতি রায়
৩৬	বিথীকা মজুমদার	বানীশান্তা		বিথীকা মজুমদার
৩৭	মো: [illegible]	ব্যবসায়ী	0	[illegible]
৩৮	মো: রুহুল আমিন হাওলাদার	ব্যবসায়ী		রুহুল আমিন
৩৯	শ্যামল কান্তি মজুমদার	অফিস সহকারী বানীশান্তা [illegible]		[illegible]
80	অনিরুদ্ধ বৈদ্য	ইউপি সদস্য 8নং ওয়ার্ড	01724-11 4766	অনিরুদ্ধ বৈদ্য
81	নিহার মন্ডল	ইউপি সদস্য 2নং ওয়ার্ড বানীশান্তা	01720-28 7872	[illegible]
82	কৃষ্ণ পদ রায়	[illegible]	01721-68 7034	[illegible]
৪৩	কমলা বেগম	বানীশান্তা [illegible]	0172[illegible] 086	কমলা বেগম
88	চন্দ্রা রায়	ইউপি সদস্য [illegible]	01922-88 0488	[illegible]

উপকূলীয় বাঁধ উন্নয়ন প্রকল্পের সম্ভাব্য পরিবেশগত ও সামাজিক প্রভাব প্রশমনের উপায় ও ব্যবস্থাপনা নিরূপণ বিষয়ক
মতবিনিময় সভা

স্থান:

তারিখ:

ক্রমিক নং	অংশগ্রহনকারীর নাম	পদবী ও ঠিকানা	মোবাইল নং	স্বাক্ষর
৪৫	[illegible] মণ্ডল	ইউ,পি, সদস্য ৭,৮,৯ [illegible]	০১৯৩৬২৮ ৭৪২৫	[illegible]

Table a: List of FGD participants

Table: Banishanta Bazar, Banishanta, Dacope, Khulna (FGD-1)

Sl.No.	Name of the Participants	Age	Occupation	Address/Mobile Phone Number
1	Sudab Kumar Dab	43	UP Chairman	01920545453
2	Mrs. Amirun Nasha	38	UP Member	01724114766
3	Md. Golam Masum	35	Business	01828003599
4	Md. Ballal Shakh	39	Farmer	01922142640
5	Nami Chandra Mondol	44	Farmer	01913598389
6	Delip Kumar Mondol	49	Teacher	01937732893
7	Romandranath Gain	50	Social Worker	01724115817
8	Sontos Khomai	38	UP Member	01926943047
9	Dulal Chandra Mondol	58	Farmer	Banishanta
10	Fochu Mondpl	41	Fisherman	Banishanta

Table b: Kailasganj UP, Koylashgonj, Dacope, Khulna. (FGD-2)

Sl.No.	Name of the Participants	Age	Occupation	Address/Mobile Phone Number
1	Mihir Mondol	51	UP Chairman	01920722875
2	Anita Roy	38	UP Member	01929651562
3	Chompa Roy	31	UP Member	01922880486
4	Shova Mondol	42	UP Member	01936287825
5	Bedhan Mondol	45	Farmer	01933844385
6	Amulasu Badau	48	Farmer	01925175720
7	Beshubad Mitro	41	Farmer	01923074191
8	Robindronath Mondol	51	Farmer	01931675150
9	Durgapado Mondol	38	Farmer	01925325200
10	Robindronath Mondol	42	Farmer	01942090706
11	Proshanto Roy	46	Farmer	01728437366
12	Shopon Sordar	39	Farmer	01922622698

Table c: Bajua UP, Bajua, Dacope, Khulna (FGD-3)

Sl.No.	Name of the Participants	Age	Occupation	Address/Mobile Phone Number
1	Dev Prosad Gain	52	Chirman (Bajua UP)	01712 557555
2	Md. Aminur Rahman	28	Farmer	Chunkuri
3	Tondra Roy	40	Member	01935164456
4	Bulo Mondol	51	Farmer	01926312691
5	Bissow podo Mondpl	38	Farmrr	Chunkuri
6	Dinbondhu Mondol	42	Member	01915516990
7	Somir Kumar Roy	51	Fermer	01917292891
8	Md. Musha Mia	35	Farmer	Bajuya
9	Khurshed Talukder.	28	Fisherman	Bajuya
10	Poromodi Mondol	55	Social Worker	01819832075

Table d: Laudubi UP, Laudubi, Dacope, Khulna (FGD-4)

Sl.No.	Name of the Participants	Age	Occupation	Address/Mobile Phone Number
1	Sorojit Kumar Roy	38	Farmer	01711350408
2	Torun Kumar Roy	40	Member	01916490675
3	Madhob Bala	31	Service	01912382799
4	Aujoy Kumar Banargy	49	Farmer	01934512852
5	Subod Sorder	37	Farmer	Burir Dabor
6	Betan Mridha	41	Farmer	01944842935
7	Horin Mondol	45	Farmer	Burir Dabor
8	Horipada Mondol	51	Farmer	Burir Dabor
9	Babu Sunil Mondol	39	Business	01937282810
10	Bipul Mondol	28	Fisherman	Laudubi
11	Bidan Mondol	31	Fisherman	Laudubi

Table e: Dacope Up, Dacope, Khulna (FGD-5)

Sl.No.	Name of the Participants	Age	Occupation	Address/Mobile Phone Number
1	Sonjuy Kumar Morol	56	Chairman (DacopUP)	01712768404
2	Sunil Mondol	52	Business	01922142640
3	Md. Firoj Mia	39	Farmer	Ramnagar
4	Din Mondol Sordar	65	Farmer	01963285070
5	Md. Eashak Ali	43	Service	01712821425
6	Md. Emran ali	33	Service	01725564835
7	Torun Sorkar	29	Farmer	Ramnagar
8	Gobindo Roy	53	Farmer	01926960338
9	Dhurobuo Roy	31	Fisherman	Dacop
10	Shubanonda Mondol	48	Farmer	01931278138
11	Benoy Mondol	51	Fisherman	Ramnagar

Annex E: ToR for Environmental Impact Assessment (EIA) of Polder 33

*Backg*round

Bangladesh Water Development Board (BWDB) requires to conduct Environmental Impact Assessment (EIA) study for Polder 33 under CEIP-I, 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

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 F: Photo Album

Photo Album Polder-33

<table>
<tr><td></td><td></td></tr>
<tr><td>Figure1: D/S 9 at Khutakhali Bazar</td><td>Figure 2: D/S 3 at Paschim Dangmari Village</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 3: FS 8 at Shingjora khal</td><td>Figure 4: FS3 near Dhangmari Village</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Figure 5: FS13 at Malinga Parsurdar village</td><td>Figure 6: D/S1 at Bojan Khal</td></tr>
</table>

Figure 7: River bank erosion at Chunkuri River

Figure 8: Slope protection at Chunkuri Village

Figure 9: Water Salinity testing in the Polder

Figure 10: Noise level collection

Figure 11: Embankment in the Polder

Figure 12: Shifting of house due to repaire embankment

	
Figure 13: Navigation in Poddarganj Kheya ghat	Figure 14: Navigation of Passur River
	
Figure 15: Internal navigation in the Polder	Figure 16: Goods transfer of Passur River
	
Figure 17: Internal Kutcha road in the Polder	Figure 18: Pucca Road (ongoing) in the Polder

Figure 19: Internal Heringbone road in the Polder

Figure 20: Internal Bridge

Figure21:View of Aman crop land

Figure 22: Crop collect to field in the Polder area

Figure 23: Rice cum fish culture in the Polder area

Figure 24: Amon Crop Field in the Polder

	
Figure 25: Fishing by khepla jal	Figure 26: Fishing by khepla jal (Woman)
	
Figure 27: Fish Gher	Figure 28: Varities Fish
	
Figure 29: Jam-e Mosque in the Polder	Figure 30: Jam-e Mosque in the Polder

Figure 31: Temple in the Polder

Figure32: Cremation ground in the Polder

Figure 33: Pucca House in the Polder

Figure34: Semi Pucca House in the Polder

Figure 35: Kacha House in the Polder

Figure 36: Jhupre House in the Polder

Figure 37: Pucca latrine in the Polder

Figure 38: Ring slab latrine in the Polder

Figure39: Kacha latrine in the Polder

Figure 40: Hanging latrine in the Polder

Figure 41: Bazua High School

Figure 42: Bazua Govt. Primary School

Figure 43: Koilashgonj School cum Cyclone Shalter

Figure 44: School cum Cyclone Shalter in the Polder

Figure 45: Village market near Dakope Khal

Figure 46: Kailashganj Union Health Complex

Figure 47: Pond Sand Filter(PSF)

Figure 48: Rain Water Collect

Figure 49: Rain Water Collect

Figure 50: Supply for drinking Water

Figure 51: FGD at Kailasganj UP

Figure 52: FGD at Loudob Union

Figure 53: FGD at Banishanta bazar

Figure 54: FGD at Dacope Bazar

Figure 55: RRA at Banishanta village

Figure 56: FGD at Chunkuri

Figure 57: Public consultation at Banishanta UP

Figure 58: Discussion with local people

Figure 59: Woman participant expressing her views

Figure 60: Discussion with local people

Figure 61: Discussion by CEGIS professional

Figure 62: Discussion with local people

Figure 63: Woman participant expressing her views

Figure 64: Decisions write up on flip chart

PDM

Figure 65 : FS report presented by DTL, VEIP

Figure 66: EIA report presented by TL, CEIP