Environmental Impact Assessment Report

Mongla Economic Zone

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Submitted by :

Bangladesh Economic Zones Authority (BEZA)

pwc

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Table of Contents

List of Figures

List of Tables

List of Annexures

Abbreviation & Glossary

Abbreviation

EZ	Economic Zone
UK-DFID	Department for International Development, United Kingdom
PSDSP	Private Sector Development Support Project
BEZA	Bangladesh Economic Zone Authority
BEPZA	Bangladesh Economic Processing Zone Authority
Ha	Hectares
EPZ	Economic Processing Zone
EIA	Environment Impact Assessment
DoE, B	Department of Environment, Bangladesh
IEE	Initial Environment Examination
ToR	Terms of Reference
WB	World Bank
HFL	Highest Flood Level
Ft.	Feet
KV	Kilo Volts
NPA	Non Processing Area
RCC	Roller Compacted Concrete
QA & QC Lab	Quality Analysis & Quality Check Laboratory
FSI	Floor Space Index
PCC	Pretoria Portland Cement
Km	Kilometer
KLD	Kilo liters Per Day
MPA	Mongla Port Authority
PGCL	Power Grid Company of Bangladesh
MVA	Mega Volts Ampere
TPP	Thermal Power Plant
BTCL	Bangladesh Telecom Company Limited
STP	Sewage Treatment Plant
ETP	Effluent Treatment Plant
MSW	Municipal Solid Waste
TPD	Tonnes Per Day

LA	Land Acquisition
O&M	Operation and Maintenance
BT	Bituminous
LPG	Liquefied Petroleum Gas
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
O.P.	Operational Policy
DPHE	Department of Public Health and Engineering
LU	Land Use
LC	Land Cover
GIS	Geo-Informatic System
PMC	Project Management Consultant
PF	Protected Forest
RF	Reserve Forest
ECC	Environment Clearance Certificate
HT	High Tension
LT	Low Tension
GSB	Geological Survey of Bangladesh
BUA	Built-up Area
BTCL	Bangladesh Telecom Company Limited
CEGIS	Centre for Excellence for Geo-spatial Information Science
PCU	Passenger Car Unit
°C	Degree Celsius
BRRI	Bangladesh Rice Research Institute
BMD	Bangladesh Meteorological Department
IFC	International Finance Corporation
MLD	Million Liters Per Day
MPFWB	Mongla Port Fairway Buoy
IWTAB	Inland Water Transport Authority of Bangladesh
LUMES	Lund University International Master's Programme in Environmental Studies
IWM	Institute of Water Modelling
BARC	Bangladesh Agriculture Research Council
PWC	Price Water Coppers
PL	Post Larvae
HYV	High Yielding Variety
T.	Transplanting Seedlings

B.	Broadcasting Seed
BBS	Bangladesh Bureau of Statistics
FMD	Foot & Mouth Disease
MT	Million Tonnes
ESBN	Estuarine Set Beg Net
dB(A)	Audible Decibel
dB(C)	Continuous Decibel
DG	Diesel Generator
E	East
EMP	Environmental Management Plan
GIS	Geographical Information System
gm/cc	gram per cubic centimeter
Kg	Kilogram
KLD	Kilo Liter per Day
Km	Kilometer
kmph	Kilometer per Hour
M	Meter
m/s	meter / second
m/yr	meter / year
max.	Maximum
mg/kg	microgram per kilogram
mg/l	microgram per liter
min.	Minimum
mm	Millimeter
MoEF	Ministry of Environment and Forest
N	North
NOx	Oxides of Nitrogen
NTU	Nephelometric Turbidity Unit
PM_{10}	Particulate Matter less than 10 micron size
$PM_{2.5}$	Particulate matter less than 2.5 micron size
PUC	Pollution Under Control Certificate
ROW	Right of Way
SC	Scheduled Caste
SE	Socio Economic
SO_2	Sulphur Dioxide
sq.km	Square kilometer

sq.m.	Square Meter
STP	Sewage Treatment Plant
ST	Scheduled Tribes
TW	Tube Well
WBM	Water Bound Macadam
WL	Water Level
WMM	Wet Mix Macadam
WNW	West-North-West
WP	Water Pollution
WSW	West-South-West
µmhos / cm	micromhos per centimeter
µg/m^3	microgram per cubic meter

Glossary

Boro	Rice transplanted in winters and harvested at end of pre-monsoon
AUS.	Seed Variety Sown in pre-monsoon and harvested in monsoon
Beel	A saucer-shaped natural depression, which generally retains water throughout the year and in some cases seasonally connected to the river system.
Khal	A drainage channel usually small, sometimes man-made. The channel through which the water flows. These may or may not be perennial
Aila	Cyclone hit Bangladesh Coast in 2009
SIdr	Cyclone hit Bangladesh Coast in 2007
Rabi	Dry agriculture season-winter season
Kharif	Pre-monsoon and monsoon growing season

1. Executive Summary

1.1. Introduction

The Bangladesh Economic Zone Act, 2010, was passed by Government of Bangladesh to make provisions for the establishment of Economic Zones (EZs) in all the potential areas with an ambit to encourage rapid economic development and to instil confidence in investors and signal the Government's commitment to a stable EZ policy regime.

With an ambit of enhancement of economic development in the country, Government of Bangladesh with support from World Bank and the Department for International Development, United Kingdom (UK-DFID) has proposed to develop EZs at various potential locations in Bangladesh as Private Sector Development Support Project (PSDSP).

Bangladesh Economic Zone Authority (BEZA) is the overall agency responsible for establishments of EZs in all the potential areas including the backward and undeveloped regions. BEZA has been formed under the Bangladesh Economic Zone Act, 2010 on 9th November, 2010. BEZA has identified various locations for development of EZs. One of the potential sites is located at Mongla Upzila and has an approximate area of 83 hectares (ha).

1.2. Project Background

BEZA has planned to develop EZ to be located at Mongla Upzila in Bagerhat District, adjacent to an existing EPZ. Economic zone will be developed under PPP mode. BEZA will develop the land and will also cover the off-site infrastructure at the proposed project site. Other services and infrastructure of EZ will be developed by the private developer at a later stage. Developer will hence carry out separate EIA study for developing the EZ and separate approval will be obtained from DoE, Bangladesh, for developing the EZ. The off-site development will broadly include the following:

- Development of boundary wall of 4 kms around the proposed site of Mongla EZ
- Construction of Administrative Building
- Access road of 350 m from existing Mongla Port Road
- 35 m bridge over Ghana Road to connect the proposed access road and proposed EZ
- External power supply system (transmission system and sub-station) from existing Mongla substation to the proposed EZ
- External water supply system (transmission pipes and underground reservoir) from Manik Nagar to the proposed EZ

Taking into consideration the site location, available infrastructure, existing industries, investors interest and infrastructure & logistic requirement of the proposed industries, Mongla Economic Zone will be most suitable for food processing, textile and light engineering industries. Options for other industries can also be explored by the developer at the time of development of EZ depending on the investor's interest and availability of resources. At present, off-site infrastructure will be developed by BEZA for the proposed site identified for Mongla EZ. This EIA Report therefore covers only the environmental and social aspects of the off-site infrastructure for the proposed Mongla EZ. Developer will carry out separate EIA study and will obtain separate approval from Department of Environment, Bangladesh, (DoEB) for development of economic zone.

BEZA has appointed M/s Price Water Coopers Pvt. Ltd. to provide transaction advisory services for development of EZs in Bangladesh which also includes Environment Impact Assessment (EIA) study of the upcoming projects. The project attracts the applicability of Environment Conservation Act, 1995 & Environmental Conservation Rules, 1997. The proposed project is classified under red category as per Environmental Conservation Rules, 1997. Thus it is required to carry out EIA study for the proposed project as per Environmental Conservation Rules, 1997 and obtain approval of DoEB before taking up any construction activity for the project. Project is being implemented with the support of World Bank. As per the World Bank Policy O.P.4.01and the Environment Management Framework of PSDS project, development of the economic zone is classified as Catrgory A project which requires a detailed environment assessment study prior development of zone to identify the potential threats of project to environment and to frame mitigation and environment management plan to reduce the negative impact of the project. Development of the off-site facilities for economic zone will have moderate effect and impacts will be site specific thus off-site development for EZ falls under Category B, which requires a site-specific rapid EIA study.

To obtain approval of DoEB, an Initial Environment Examination (IEE) Report for development of off-site facilities along with proposed Terms of Reference (ToR) was submitted vide letter dated 20.01.2015. DoE suggested making revisions in the ToR and the revised proposed ToR was submitted on 8.03.2015. Approved ToR was granted by DoE vide Memo No. 03. 761. 018. 00. 00. 66. 2013 - 946, dated 30th March, 2015. The EIA study for the development of off-site facilities for proposed Mongla EZ has been carried out as per the ToR issued by DoEB and World Bank's requirements and EMF of PSDS project.

1.3. Project Description

Mongla EZ is proposed to be located adjacent to existing Mongla EPZ at Kamardanga Mouza in Mongla Upzila, Bagerhat district, Kulna Division, Bangladesh. As of now, there is no infrastructure development including power, drainage, electrical, water, sewage and telecom line and buildings at the proposed project site. The proposed project site is filled to the level of 6 ft. (1.8 m) w.r.t surrounding areas by Mongla Port Authority by dredged sand from Pasur river (to make Pasur river navigable) raising the ground level of the site. Finished level of site will be app. 6 m above mean sea level after development of EZ. Ground level of EZ site will be 1.5-2.0 m above average HFL of Pasur River (4.45 m). The proposed land site initially belonged to Mongla Port Authority and has been transferred to BEZA for the development of proposed Mongla EZ. Land documents are attached as Annexure II

The location map of the proposed Project site is presented in following Figure. The proposed project site is bounded by Upazila Rampal in the north, Mongla EPZ on the south, the Mongla River in the east and the Pasur & Gona river/Mongla Port Authority on the west. Mongla town is at distance of 1.7 km in SE direction from the proposed project site. Mongla Port is at distance of 200 m from the site in West direction.

The bank of the river will not be used for any purpose and no Jetty will be constructed on the bank of the river.

In Mongla the probable type of industries will be light engineering, food processing and readymade garments. These industries will not generate significant waste except domestic effluent. There will be no "Dying Industry" in the Mongla EZ.

Geographical coordinates of the corners and centre of the project site is given in following tables.

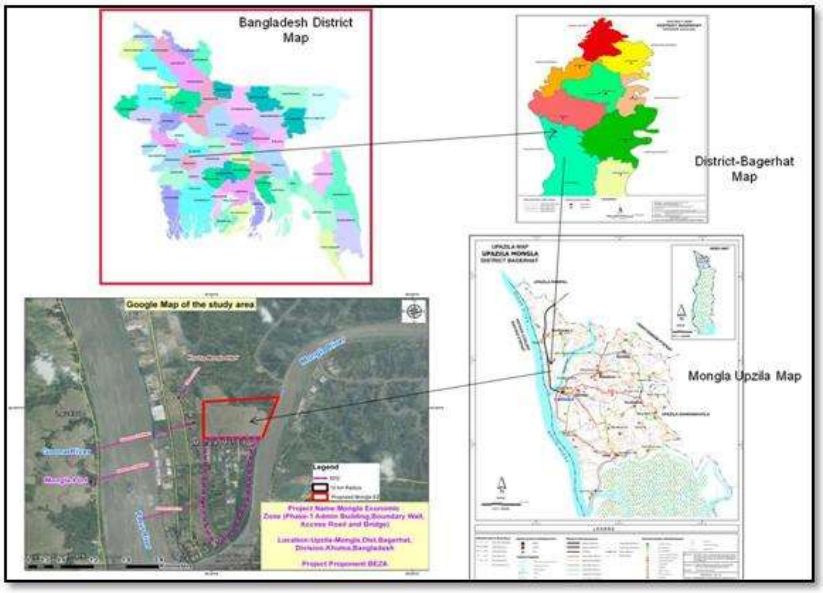

Figure 1: Location Map

Table 1: Coordinates of the proposed project site

	A	B	C	D	Centre
Latitude	22°30.056' N	22° 30.100'N	22° 29.684'N	22° 29.670'N	22° 29.856'N
Longitude	89°35.918' E	89° 36.671'E	89° 36.499'E	89° 35.935'E	89° 36.247'E

Table 2: Existing Features surrounding the project site

Direction	Features
North	Barirdanga Village
NE	Mongla River
East	Mongla River
SE	Mongla River, Mongla town and Old Mongla Port Colony
South	EPZ
SW	River Pasur & Mongla Port
West	River Pasur & Mongla Port
NW	River Pasur & Industries

The proposed project site is generally flat and poorly drained. Site has been raised with the sand dredged from Pasur River and is grey in colour by 6 ft w.r.t surrounding area. The proposed site will be required to be levelled due to iterative sand filling at different times. Finished level of site will be 6 m above mean sea level after development of EZ. The ground level of the EZ will be around 1.50 to 2.0 m above the average High Flood Level (HFL) of Pasur River (4.45 m). The elevation within the 10 km radius area varies from 1 m to 11 m.

1.4. Connectivity of the Project Site

At present, proposed project site is not accessible through any public road. The proposed site however can be accessed via EPZ through a narrow mud (kachcha) road. Mongla Port Road is at distance of 350 m and Kulna Mongla Highway is at distance of 600 m from proposed project site in west direction. Jessore Airport is the nearest airport which is located at a distance of 105 km in NNW direction from the proposed project site. There is also an unfinished airport, Rampal Airport, located

at a distance of 22 km from the proposed project site in NNE direction. Nearest Railway station is Kulna Railway station which is located at a distance of 38 km in North direction from the proposed project site. A proposed railway line is also under consideration of Government of Bangladesh to connect Kulna, Mongla Port, existing EPZ and the upcoming Mongla EZ.

To make site accessible, BEZA has proposed to develop an approach road of 350 m to connect the site to Mongla Port Road and a bridge of 35 m will be constructed over river Gona to connect proposed approach road and the proposed project site. Proximity of the site to existing EPZ, Mongla Port, Mongla town, Kulna city, Kulna Mongla Highway makes the proposed project site an ideal location for the development of an Economic Zone.

The Sundarban reserve forest is a mangrove forest. It is located at a distance of 5.00 Km in SW direction from the Mongla EZ site. Thus the Mongla EZ site falls completely under the ecological critical area of Sundarban Reserve Forest. This ia as per ECA, 1995.

Table 3: Connectivity & Surroundings of Proposed Project Site

Nearest Road/Highway	Mongla Port Road Kulna Mongla Highway	350 m 600 m	West West
Nearest Railway Station	Kulna Railway Station	38 km	North
Nearest Airport	Jessore airport	105 km	NNW
Available inland water transport	Mongla river Pasur river Mongla Port	Abuts the site 880 m 780 m	East West SW
Nearest Village/Residential Area	Burirdanga Village Mongla Port Colony	400 m 430 m	North NW
Nearest City	Mongla Kulna	2.3 km 35.0 km	SE North
Nearest Commercial Area	Mongla Port Commercial Colony	200 m	West
Nearest Industrial Area	EPZ Industrial area	Abuts the site 100 m	South WNW
Nearest Defence Installation	Mongla Navy Base	2.9 km	NW

Source: Based on analysis of area maps, satellite imageries and topo-sheets

1.5. Project Activities and Area Statement

Total area of the proposed EZ is approximately 83 ha. The proposed site has already been raised by 1.8 m (6 ft) from the sand dredged from Pasur River by Port Authority w.r.t surrounding areas. Site however will require levelling due to iterative filling of site for dredging purpose. Proposed project involves development of off-site facilities for EZ. Details are provided below:

Boundary Wall: A compound wall all along the EZ boundary to a height of 2.1 m above NGL is proposed to be constructed and provided with 0.9 m height barbed wire fencing on top. The total length of the compound wall is estimated to be 4000 m. Area covered by boundary wall will be 400 sq. m.

Approach Road: An access road will be constructed to give access to the EZ. Access road of length 350m will be constructed. Access road will have ROW of 15 m. Area covered by approach road will be 5250 sq. m. This access road will pass through port commercial colony and will provide direct access to EZ site from port road through a bridge. 25-30 trees & 8 Households will be affected while construction of the road. U shaped drain will be constructed on both side of the road. Plantation will also be carried out on both side of the road. Space will be left on both side of the road to accommodate telecom cables and street light cable.

Bridge: A bridge of 36 m length will be constructed on Gona River to connect approach road and the EZ site. Area covered by bridge will be 540 sq. m. Bridge consists of 3 spans each of 12 m and 4 pillars. Neither of the pillars will be constructed on Gona River. 2 pillars will be towards approach road other 2 towards the project site. 10-15 trees and some weeds are required to be removed for constructing the bridge.

Administrative Building: Administration building will be constructed within EZ site. Building will have ground coverage of 3600 sq. m and built up area of 1680 sq. m. It will consist of 3 floors (G+2).

Electrical supply system: It is planned to build a new 33 kV dedicated power transmission line from Mongla substation to EZ site for catering to the needs of industries occupying the EZ along with 33/11 KV substation with in EZ. The system parameters are as follows:

- Transmission line - 33 kV
- Number of phases - 3
- System frequency - 50 Hz
- Consumer supply voltage 33 kV /11kV/415/240 volt

As peak demand may vary for each facility in EZ, a diversity factor, which relates peak demand to rated load demand or calculated demand, is utilized in computation of maximum demand. A simultaneous factor of 40 - 70% is normally considered. Power losses generally occur in the distribution network depending upon the type of conductors and equipment installed. As this is a complete loss to the system, it is generally kept below 10% of the total load.

Water supply system: Water pumping station for potable and non-potable water is required for pumping from the underground storage sump to respective ELSR. It is planned to build three new bore wells cum pumping stations at village Manik Nagar to draw the ground water along with pumping main length of app. 21 km to the proposed EZ. It is also planned to construct an underground service reservoir to store the water within EZ. Approx. 669 trees will be affected for development of water supply system. The water supply scheme including distribution is planned based on the peak flow, minimum residual pressure and pipe material.

On-site facilities within economic zone will be developed by the developer at the later stage. Developer will be appointed as per the guidelines mentioned in EZ Act, 2010. Preliminary planning has been made for the economic zone on the basis of market and pre-feasibility study. As per the current planning, land use pattern of the EZ site is given in following table**.** After appointment of developer, developer will explore other options as per the investor's interest and there may be changes in the planning. Developer will carry out separate EIA study as per revised planning and will obtain separate approval from DoEB. Other developments like internal storm water drainage, power distribution, water distribution network, plotting, water treatment plant etc. will be carried out by developer.

Table 4: Preliminary Land Use Planning for the Economic Zone

Processing Area		
Industrial Sector		
Food Processing	14.99	18.06%
Textile	28.44	34.26%
Light Engineering	4.99	6.02%

Total Industrial Area	48.42	58.34%
Specialized Infrastructure		
Warehouse	0.94	1.13%
Truck lay bay	1.53	1.84%
Q.A & Q.C lab	1.14	1.37%
R&D facility	1.28	1.54%
Training centre	1.04	1.25%
Total Specialized Infrastructure	5.92	7.14%
Public amenities	1.53	1.85%
Utility	2.01	2.42%
Road	10.83	13.05%
Green & open space	9.75	11.75%
Total processing area	78.47	94.54%
Non-Processing Area		
Entrance plaza	0.62	0.75%
Admin block	0.96	1.16%
Guest house	0.32	0.39%
Investor club	0.45	0.54%
Crèche	0.18	0.21%
Residential	0.55	0.66%
Retail	0.12	0.14%
Place of worship	0.16	0.19%
Road	0.36	0.44%
Green & open space	0.82	0.99%
Total non-processing area	4.53	5.46%
Grand Total	**83.0**	**100.00%**

1.6. Drainage System Development

As part of off-site facility, access road will be developed to provide direct access to the EZ site. U-shaped drain will be provided on both side of access road to facilitate storm water drainage. RCC box/pipe culverts should be considered for cross drainage. Rain water harvesting structure should be proposed all along the drain.

Storm water drainage system will be developed by developer at the site. Cut-off drain will be provided all along the periphery of the site and will be connected to nearest existing discharge point. Peak-run-off should be considered for designing the drainage system. Stone pitching should be considered for the side walls and PCC for the base. Rain water harvesting structure should be proposed all along the drain. Lined rain water harvesting ponds should also be constructed so that rain water can be utilized for domestic and non-domestic purpose during operation phase of EZ. Calculations have been made to estimate available rain water after development of economic zone.

Project Schedule

Following table presents the implementation schedule of the off-site infrastructure details at the proposed Mongla EZ site.

Table 5: Implementation Schedule of Off-site Infrastructural Details

S. No	Offsite infrastructure	Duration in months
1	Access road	2
2	Bridge	9
3	Boundary wall	6
4	Admin building	12

S. No	Offsite infrastructure	Duration in months
5	Water supply network	6
6	Power distribution	9

1.7. Resources and Utilities Demand for Off-Site Developments

Construction Materials Sourcing

Construction material like steel, cement, concrete, bricks, aggregates etc. will be required for each of the proposed off-site facility construction. The quantity of each of the raw materials is detailed in Chapter 4 of the EIA Report.

Water

Water requirement during construction phase of offsite facilities is estimated to be app. 50 KLD, which includes Domestic water requirement of construction workers. Water for construction can be sourced from ponds, EPZ supply or Mongla Port Authority water supply.

To fulfil water requirement during operation phase, a water line system has been proposed from Manik Nagar to EZ site (app 21 km). Fresh water aquifers are present in this region at the depth of ± 350 m. BEPZA and Mongla port authority are also withdrawing water from nearby region, i.e. Foyla village.

Three production tube wells are proposed to be dug in Manik Nagar to fulfil water demand during operation phase. This water will be extracted from the deep aquifer i.e. at a depth of ± 366 m (±1200 ft) from the ground. The local people takes water from a shallow aquifer i.e. at a depth of ± 106 m (± 350 ft). By no means the extraction of water from the production tube well from the deep aquifer will interrupt the water extraction from the shallow aquifer, from where the local inhibitants gets water.

An underground pipeline will be laid from Manik Nagar along the Khulna Dhaka Highway till EZ site. An underground reservoir will also be constructed to store this water based on 48 hrs storage capacity. Provision of rain water harvesting tank should be made so that rain water will also be used during operation phase. An attempt has been made to estimate the water demand for the economic zone after development. It is estimated water demand of app. 8 MLD will be generated during operation phase of the project.

Power Requirement

Power demand during construction phase is insignificant. Power required during operation phase is estimated to be 15 MVA. Source of power will be PGCL substation located at Mongla at about 1 km distance from EZ site in NW direction. A substation of capacity 33/11 KV is proposed at the EZ site for power distribution within the EZ site during operation phase. Also Rampal TPP is under construction in that area. It is at app. 9 km from project site. This option can be explored in future, if power demand exceeds the estimated demand.

Distribution substation is proposed in a strategic location. Individual facilitation and all power reticulation are to be carried out at 11 kV. Power demand of 19.8 MVA has been estimated for the economic zone after processing and non-processing area.

Telecommunications

Mongla has mobile connectivity from almost all mobile companies. There is no fixed network. It is recommended to install BTCL (Bangladesh Telecom Company Limited) network, as fixed Phone Network of BTCL is the only reliable network.

Sewage & Effluent Treatment

All industries should be responsible for treatment of the sewage and effluent generated from their unit so that all industries are zero discharge. Sewage should be treated in the STP and effluent should be treated in the ETP. Treated water should be recycled and re-used within the site.

Green Belt Development

Green buffer of 10 m width will be developed all around the EZ site. Multi-layered plantation will be carried out in the buffer. Peripheral green belt will be developed by the developer. In addition to this all industries will develop green belt all around their respective plots. Native plant species consuming less water and requiring less after care and monitoring should be considered. Such species include Neem, Chambol, Sirish, Palms, Gewa, Mango, Mahagony etc. Green buffer should consist of minimum 3 rows of vegetation. First row of green buffer should be small shrubs and herbs, second row of tall shrubs and small/medium height trees and last row of medium to tall heighted trees.

Solid Waste Generation from Proposed EZ Project

Waste to be generated during construction phase will be left out construction material like metal piece, wood piece, unused concrete, broken bricks, glass, ceramic, demolition waste etc. Quantity of the solid waste to be generated during construction phase may vary from 30-50 kg/day. This waste should be collected and segregated at the site itself. Recyclable and Re-usable waste should be separated and should be sent to recycler. Rejected waste should be disposed off at the designated sites by local authority.

Nature of solid waste generated during the operation phase will be highly variable due to presence of different kind of industries in the EZ. Majorly as per the feasibility study light engineering industries, food processing industries and readymade garment factory may come up in the EZ. These industries are less polluting industries. Solid waste generated by industries should be managed by industries. Solid waste to be generated from EZ can be industrial non-hazardous waste, hazardous waste, bio-degradable, non-biodegradable, e-waste, construction debris, hospital and bio-medical waste. A secured scientific landfill should be developed for disposal of municipal solid waste within the EZ site. Hazardous waste from industries should be disposed off only through authorized hazardous waste handling agencies by DoEB. Else all industries should incenrate the hazardous waste generated by them taking the required air pollution control measures.

An attempt has been made to estimate the municipal solid waste to be generated from the economic zone after development. Total MSW of 22.4 TPD is estimated to be generated from the site after development of economic zone.

Transportation System

Road Transportation System and Traffic Survey

At present, site is not accessible through any public road. Site can be accessed via EPZ through a narrow mud (kaccha) road. Mongla Port road is at distance of 350 m and Kulna Mongla Highway is at distance of 600 m from site in West direction. To make site accessible, BEZA has proposed to develop an approach road of 350 m to connect the site to Mongla port road and a bridge of 35 m to be constructed over river Gona to connect proposed approach road and the site.

Rail & Air Transportation System for Project Site

Nearest airport is Jessore airport at distance of 105 km in NNW direction from site. An unfinished Rampal airport is at 22 km from site in NNE direction. Nearest Railway station is Kulna Railway station which is at distance of 38 km in North direction from site. A railway line is also under proposal of Govt. of Bangladesh to connect Kulna, Mongla Port, existing EPZ and upcoming Economic zone.

Water Transportation System

Inland water transportation system at the study area is well developed. Both Pasur and Mongla River are navigable. Pasur River is main water communication system in the study area. Depth range of Pasur River is 8-11 m during high tide. Mongla port falls within the study area. The river is very deep and navigable throughout the year and large marine ships can easily enter the Mongla seaport through from Akram point. The water depth at Akram point is 15 to 20 meter. Pasur is an important river route through which Kulna-Barisal steamboats and other vessels ply. Few local boat points exist in Mongla, Dighraj, Biddarbaon and Kaigar Dashkati in the study area.

1.8. Cost of the Project

The total estimated cost of the proposed project is about 4932 lakh taka that includes the construction cost of access road, bridge, boundary wall, administration building, external water supply system, external power supply system and land development. Details of cost of each component are given in the following table.

Table 6: Cost of the Development of Proposed Off-site Facilities

S. No.	Description of work	Amount in Lakh Taka
1	Access Road	309
2	Bridge	463
3	Boundary Wall	380
4	Administration Building	558
5	External Water Supply System	1922
6	External Power Supply System	800
7	Land Development	500
Total		**4932**

1.9. Baseline and Social Environment

The monitoring of the existing environmental conditions of the proposed project site and of its close vicinity have been collected through secondary sources with respect to physical, biological and socio-economic environment. A zone of 10 km area around the EZ site and 100 m on either side of proposed alignments for water and electrical supply is considered as project influence area.

The project area lies in the South-central climate zone of the country and shows tropical monsoon climate. Seasonal variation of rainfall, temperature, and humidity is the noteworthy aspect of the climate. The rainy season is hot and humid, and characterized by heavy rainfall, tropical depression and cyclone. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall. Gentle north/north-westerly winds with occasional violent thunderstorms called northwester during summer and southerly wind with occasional cyclonic storm during monsoon are prominent wind characteristics of the region. Project site is prone to natural disasters like floods, cyclones, tornado and earthquake. Several devastating earthquakes, cyclones, floods have struck the Bangladesh till date.

PM10 within study area varies from 41 to 139 µg/m3. PM2.5 levels were found ranging from 19 to 47 µg/m3. SO2 levels were found ranging from 9 to 28 µg/m3. NOx levels were found ranging from 23 to 44 µg/m3. CO concentration ranges from 65 µg/m3 to 230 µg/m3 while of O3 vary from 13-49 µg/m3.

Noise level in the area are found to be within the standards prescribed by DoE. Average noise levels at the site and nearby area varies from 41.2 dB(A) to 59.79 B(A).

Surface water system of the study area comprise of Pasur, Mongla and Gona rivers. Pasur river floods during monsoon season. The water level of the Pasur river rises from January-February to till July-August then recedes up to December-January. As per the data of 25 years (1990-2014) from Mongla port authority, highest water level observed in Pasur river is 4.96 m in year 2009 and lowest water lever observed is -0.37 m. Average twenty five year high flood level of Mongla river is 4.45 m. The water level of Pasur river brings the variation in water level of Mongla and Gona rivers as well through tidal effect.

Water of project area rivers (Pasur and Mongla river) is highly saline as they carry large amount of sediments from upstream and influenced by tidal effect. Salinity in Pasur River varies from 9.5 to 23.0 ppt during April, 2014 and 0.0 to 19.5 ppt during June, 2014. Salinity lowers in June, 2014 due to rains.

Ground water in Shallow aquifers in Mongla region is also saline. Ground water samples are withdrawn from well of depth 600 ft (app. 180 m). Salinity of ground water salinity varies from 0.0-0.5 ppt..

1.10. Environment and Social Impacts of the Proposed Project

Environmental impacts assessment was carried out considering present environmental setting of the project area, and nature and extent of the proposed activities. Proposed project involves development of off-site facilities for upcoming Economic Zone at Mongla. Potential environmental impacts associated with each of the proposed off-site facility are classified as: (i) impacts during design and construction phase and ii) impacts during operation phase/Post-construction phase. Sensitive environmental and social components were identified during the site visits and qualitative and quantitative techniques have been applied for direct and indirect assessment of impacts on the identified environmental and social sensitive components. Impacts are classified as being insignificant, minor, moderate and major.

Some of the important impacts associated with the proposed off-site facilities for economic zone will be associated with land use (land acquisition), land stability (soil erosion), soil compaction and contamination, water availability, water quality of river/stream/canal, ground water contamination, waste and wastewater disposal, ambient air quality, ambient noise levels, vegetation, tree cutting (including social forestry tree), fauna (terrestrial and aquatic), drainage pattern, hydrology, climate change, socio economic, places of social/cultural importance (religious structures, community structure), construction material sourcing and occupational health and safety. Adequate mitigation measures are devised to mitigate/minimise all likely environmental impacts and the same have been presented along with the impacts.

Impact on Air Environment

Pre-construction Phase: Pre-construction phase will involve site clearance activity for development of access road and pump houses for water supply system. Clearance of site will involve removal of vegetation and land levelling activities. These activities will lead to dust generation. But these emissions will be limited to the site only and have impact for short duration only during clearance activity. To minimize the dust generation, water should be sprinkled regularly at the site and low sulphur diesel should be used in land levelling equipment to control the SO_2 emissions.

Construction Phase: Land filling, site establishment, earth works, construction materials processing, construction activities, vehicle movement, etc. may generate fugitive dust particles. The proposed project involves construction activities like civil construction, mechanical construction, handling and stocking of construction materials, etc. It is necessary to adopt management plan for controlling the fugitive particulate matter during construction activities. However, these ground

sourced generation will be limited to the construction site and the impact might be for short period, only during the construction activities.

Carbon dioxide and nitrogen oxides may be emitted from combustion of the petroleum products in project related vehicles, machinery, generators, and vessels/barges etc. during the construction period. Their impact on air quality will not be significant as the pollutant emission activities (point and area sources) will be limited within the project boundary and the activities will be short term (only for construction period). However, this impact may further be minimized by adopting following mitigation measures:

- Sprinkling of water at construction site and haul roads
- Covering the scaffolding (in case of administration building) to reduce the dust emission in outside environment
- Provision of face mask to workers to minimize inhalation of dust particles
- Construction vehicles and machinery should be regularly serviced and check for pollution control
- Low sulphur diesel should be used for running construction equipment and vehicles
- Adequate parking space should be provided for the construction vehicles so as to prevent idling of the vehicles and the emissions generating from them
- Vehicles carrying construction material and debris should be covered with tarpaulin cover
- Raw materials, excavated soil and other debris should be stored under covered sheds
- Green buffer should be developed all along the EZ boundary
- Plantation should be carried out along the both side of access road

Operation Phase: Development of BT access road will reduce the dust emissions that results from movement on the kaccha roads. No adverse impact is anticipated on air environment during operation phase due to development of off-site infrastructure.

Post development of the economic zone & setting up of industries, there could be some impacts on the ecosystem of the area. Industrial development will involve generation of emissions, effluents and increased vehicular movements. These altogether may have overall negative impact on the air quality of the site and the nearby areas. But the industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution are taken there will be no significant impact on the air quality of the area. Mitigation measures to be adopted during operation phase by the industries are given below:

- No red industry should be allowed within industrial zone
- All industries should obtain clearance from DoE, Bangladesh.
- Latest technology, methodology and machinery involving minimal air emissions should be adopted by industries
- Air pollution control measures should be taken by industries as prescribed in consent
- Periodic renewal of consent should be obtained by all the industries
- Air pollution monitoring should be carried out quarterly by all industries to check the air pollution level
- Preference of usage of clean fuel like LPG, low sulphur diesel should be explored
- Energy conservation should be adopted by opting the alternate energy options like solar power.
- Development of thick green belt , i.e. 10 m and organized greens within each industrial plots

Impact on Noise Environment

Pre-construction Phase: Pre-construction phase will involve site clearance activity for development of access road and pump houses for water supply system. Clearance of site will involve

removal of vegetation and land levelling activities. Some noise may generate during pre-construction phase but that will be site specific and for short duration. Machinery to be used should comply with the noise standards prescribed by DoE.

Construction Phase: Operation of different machineries and equipment for construction activities, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period. The produced noise may have impact on existing acoustic environment of rural category defined in ECR, 1997. Local inhabitants may feel disturbed due to noise from line sources (traffic movement). Following measures should be taken to minimize the negative impacts:

- No construction activities to be undertaken during night hours to prevent any disturbance to nearby residents and labours in labour camps.
- Acoustic enclosures should be provided with DG sets and machinery to control the noise levels at construction site.
- Temporary noise barriers like barricades will be provided in the area which involve high noise generation during construction phase like excavation sites, demolition sites etc.

Operation Phase: After construction of the road and upcoming economic zone, traffic in the area will increase significantly which will increase the noise level of the area. Operation of water pumps during operation phase of economic zone may also increase the noise level. Following mitigation measures should be taken to prevent noise pollution during operation phase:

- Pumps should be fitted in acoustic enclosure to reduce the noise generation
- Avenue plantation should be developed along both the side of access road which will act as noise buffer
- Green buffer of 10 m should be developed all along the project boundary. Green buffer should compose of the 2-3 rows of plants of variable height and thick canopy so as to form continuous barrier. This will help in reducing the noise level significantly.

Impacts on Water Resources

Pre-Construction & Construction Phase:

Impacts on Ground & Surface Water Resources:

Significant quantity of water will be required for various construction activities & domestic purpose. Approx. 50 KLD of water will be required during construction phase. Source of water for these activities will be the ground water, either through BEPZA or Mongla Port water supply system. Ground water is available in the withdrawal area at greater depth. Excess withdrawal of ground water may lead to depletion of aquifers. Shallow water aquifers in the area are saline and fresh water is available at the depth of 210-270 m (700-900 ft). Measures should be taken to minimize the water extraction by reducing water consumption and wastage. Mitigation measures are given below.

Mitigation Measures

Best management practices will be required to be adopted to minimize water wastage and water loss. Best management practices to be adopted are given below:

- Temporary storm water drains and rain water harvesting ponds should be constructed so as to store rain water for construction activities.
- Water for curing can be saved by carrying out curing in early morning or late evening and covering structures with gunny bag so as the moisture can be restored for longer time.
- Regular inspections at site to monitor leakages in water storage tanks
- Creating awareness among construction workers about the importance of water conservation

- Adoption of the advance technologies and machinery which helps in minimizing water requirement for construction
- Storing the curing run-off and waste from other construction activity and using the same for sprinkling.
- Covering the water storage tanks at site to prevent evaporation losses.

Impacts on Surface Water Quality

Run-off from the construction site may carry the higher quantity of sediments and oil which may pollute the surface water and impact the aquatic life. Thus measures are required to be taken to minimize the surface water pollution

Mitigation Measures

- To avoid excavation activities during rains
- To carry out construction activities in phases
- To prevent piling up of excavated soil, raw material and construction debris at site by proper management and disposal
- Minimize run-off by using sprays for curing
- Maintaining appropriate flow of water sprinklers at site
- Construction of storm water drains along with sedimentation tanks with sand bags as partition to retain the soil particles from storm water drain
- Collection & Reusing of curing over flow, tyre wash water etc. within the site
- Construction of adequate nos. of toilets and proper sanitation system to prevent open defecation along the river banks/water supply lines
- Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies
- Proper collection, management and disposal of construction and municipal waste from site to prevent mixing of the waste in run-off and entering the water bodies

Impacts on Ground Water Quality

Ground water is saline in shallow aquifers of the study area. No significant impacts are anticipated on the ground water quality due to development of the off-site facilities for economic zone. Following measures should be taken to prevent any ground water contamination

Mitigation Measures

- No sewage or waste water should be accumulated in any unlined structure
- Timely disposal of the construction/chemical/haz. waste so as to prevent leaching of any pollutant to ground

Impacts on Drainage Pattern & Hydrology

Site has been raised with the sand dredged from Pasur River and is grey in colour by 6 ft w.r.t surrounding area. The proposed site will be required to be levelled due to iterative sand filling at different times. Finished level of site will be 6 m above mean sea level after development of EZ. The ground level of the EZ will be around 1.50 to 2.0 m above the average High Flood Level (HFL) of Pasur River (4.45 m). Storm water from the site will be drained into Gona and Mongla River through peripheral drains developed along the EZ site. Gona (small stream) and Mongla River finally drains into Pasur river. Pasur river is at distance of 900 m from project site in West direction.

Mongla River abuts site in East direction and Gona River abuts site in West direction. Clay bund is constructed along Mongla river which prevents flooding of nearby areas. Storm water from the site is drained through these rivers. No significant impact on drainage is anticipated with development of the off-site development except access road. For drainage of storm water from access road, masonry drains will constructed on both side of the roads. These drains will carry run-off from the nearby areas

also and will be connected to the Gona River. These drains will help in preventing the local flooding during heavy rains.

After development of the economic zone, natural drainage pattern of the site may be altered. Natural drainage pattern should be maintained. Run-off from the site is estimated to be 8614 cum/day presently. Site is adjacent to the Gona and Pasur River. Run-off from site presently is drained into these rivers. Run-off from the site will increase after development of the economic zone. To manage the storm water from the site, after development of the economic zone, storm water collection network and storage system should be provided at the site. Storm water should be collected, treated and stored within the site and should be used for meeting daily water demand as per the availability.

Operation Phase:

Impacts on Ground & Surface Water Resources:

Expected population for administrative building is 112 Nos. Water requirement of 5.04 KLD has been calculated for administrative building during operation phase taking criteria of 45 LPCD for staff members. This demand can be fulfilled by withdrawing water through water supply system developed for the project.

It is estimated app. 4 MLD of water will be required during operation phase ***after development of economic zone at Mongla***. This water is proposed to be taken from Manik Nagar which is at app 20-21 km distance from the site as shallow ground water aquifers in study area are saline. Mongla Port Authority and BEPZA are also withdrawing water from nearby areas of Manik Nagar for app. 10 years. Withdrawal of huge amount of water may deplete the ground water aquifers of the area. Following Measures should be taken to minimize the impacts on water resources

Mitigation Measures

- Conjunctive usage of water by using surface water along with the ground water. Desalination plant can be set up as the surface water in the area is saline
- Rain water harvesting system and storage should be constructed so as to minimize ground water construction
- All industries should practice rain water harvesting
- Adoption of best management practices to prevent water wastage and minimize water loss
- Usage of water conservation fixtures to minimize water consumption
- Installation of leakage detection system to minimize the water loss
- Regular monitoring of ground water level in the area should be carried out. Estimations should be made to calculate the draught and recharge of the ground water aquifers. If draught is more than recharge, then corrective measures should be taken immediately. Rain water harvesting should also be carried out in Manik Nagar Area. Harvested rain water should be recharged into deep ground water aquifers. This will help in augmentation of depleting ground water resources.

Impacts on Surface Water Quality

Construction of road and the administration building will increase the sealed area thereby increasing the run-off from the site. Run-off will increase but not significantly by development of off-site infrastructure. Lined drains are proposed to be constructed along the access road to carry the surface run-off and this will be connected to Gona River. Road side drains will also accommodate run-off from near-by areas and will prevent the local flooding during heavy rains. Waste water from administrative building will be disposed off through soak pits and septic tanks proposed to be located within the EZ site.

Run-off may significantly increase post development of economic zone. It is required to manage storm water which will be generated from EZ site post development. Measures should also be taken to prevent contamination of storm water with any industrial pollutant. Following measures should be

adopted during operation phase to minimize impacts of development of Economic zone on water resources:

Mitigation Measures

- Each industry should obtain consent of DoE Bangladesh before construction and operation and should comply to the conditions laid by them
- Each industry should treat the effluent and sewage generated by them so as to achieve zero discharge and no untreated effluent should be discharged into any water body
- Common STP (in modules) should be constructed within the EZ to treat sewage from residential and commercial areas
- Each industry should practice rain water harvesting to minimize the water consumption and reduce run-off from the site
- Proper management of waste should be done to prevent any contact between the waste and storm water
- Storm water drains should be separate from effluent drains
- Storm water system should be inspected & cleaned before monsoon every year

Impacts on Ground Water Quality

No impact on ground water quality is anticipated during operation phase due to off-site developments.

After development of economic zone there may be some ground water pollution due to industrial activities. Following measures should be taken to minimize the ground water pollution.

Mitigation Measures

- Each industry should treat the effluents and sewage and should not discharge into ground.
- No leachate, waste water and waste material should be stored in pervious unlined area/pond.
- Water quality testing at distribution point to monitor and detect contamination through any leakage

Impacts on Land resources

Pre-construction & Construction Phase:

Impact on Land Use

EZ site is spread over an area of 83 ha and off-site facilities development also requires significant land area. Efforts have been made to minimize the change in land use and acquisition of agriculture land by making use of Government/Khas land.

Land required for development of EZ belonged to Mongla Port Authority. The land has now been transferred to Bangladesh Economic Zone Authority (BEZA) for development of economic zone. Administration building will be developed within the economic zone site. Land ownership of access road is with Mongla Port Authority. BEZA can develop the access road and can use the road as access for their site. Land for constructing electrical supply system belongs to Govt. of Bangladesh and the system will be developed with consent of GoB.

Water supply will be taken from Manik Nagar, which is app 21 km from the EZ site. For development of water supply system, 3 pump houses will be constructed. Out of three, one location is private land and rest are Khas land (Govt. Land). Land will be required for construction of pump house. Private land will be purchased/acquired for development of the pump house. Water pipeline will be laid along the Kulna Dhaka Highway and Manik Nagar Gaurmanava Road which is Govt. Land. After laying the

pipeline, roads will be restored to their original state. Only a small piece of agriculture land will be diverted for development of pump house. No significant change in land use is associated with the project development.

Impact on Topography & Geology

No impact on topography & Geology is anticipated due to development of of-site infrastructure for economic zone. Economic zone site is already filled to level of 6 ft. Which is well above the HFL level thus no more raising of land is required. Excavation made for laying pipeline and constructing towers will be filled back to same level. Thus no impacts on topography are anticipated due to project development.

Impact on Top Soil

Development of the structures, construction of the road & laying of the pipeline may disturb the soil profile of the area. EZ site is filled with the dredged sand from Pasur River. Thus no loss of valuable top soil will occur during construction of administration building and boundary wall. Access road of 15 m will be developed in place of existing 6 m wide road therefore no loss of top soil is involved during road construction. Electrical supply system will require construction of the towers, laying of HT lines and construction of substation. Tower will be constructed along the Gona River and substation will be constructed within EZ site. No significant impact on soil quality is anticipated due to electrical supply system.

For water supply system, three pump houses will be constructed. One pump house out of 3 will be constructed on agriculture land. Top soil should be removed from agriculture land (to be acquired) and will be used for landscaping or spread on other agriculture fields. Pipeline will be laid along the road, thus no significant impact on soil quality is anticipated.

Impact on Soil Quality

Storage of raw material, fuel and construction debris may contaminate the soil thus measures should be taken to prevent the soil pollution. Mitigation measures to be adopted are mentioned below. Contractors are required to take all the proposed mitigation measures. PMC and BEZA will ensure that all the proposed mitigation measures are being incorporated in the bid document issued to the contractor and the implementation of the same during construction.

Mitigation Measures

- No piling of raw material at site
- Raw material will be stored under covered sheds and paved surface
- Fuel storage area should be paved
- Adoption of best management practices to prevent any spillage of raw materials
- Construction debris should be stored under covered sheds and paved surface and should be disposed off regularly to designated sites
- Waste from labour camps can be segregated at site. Food waste/wet waste should be composted in pits within the camp site. Recyclable waste should be sold to the authorized dealers and the remaining should be disposed off at designated sites through local agencies responsible for waste management in the area.

Impact on landscape and scenic beauty

EZ site is devoid of any vegetation and is raised at level of 6 ft. Only levelling will be required prior to construction of the site. All construction activities for administration building & boundary wall will be carried out within economic zone and will not cause any impact on landscape and scenic beauty.

Constructions activities involved in construction of access road, electrical supply and water supply system may change the visual landscape of the project area. Site clearance activities, gathering of equipment and construction materials, machinery and camp establishment on green field site may reduce the scenic beauty. Nevertheless, the impact is for a short duration, and reversible as the project plan includes landscape planning, green belt development etc.

Operation Phase

Impact on Soil Quality

No impact due to off-site developments is anticipated on soil quality of the project site during operation phase.

Disposal of industrial domestic and industrial waste may contaminate land and soil quality. . The impact can be significant and long term in case of uncontrolled discharges.

Mitigation Measures

- Treatment of the effluents and sewage and ensuring proper disposal
- Industrial waste generated should be stored on sealed surfaces and should be disposed off as per guidelines of DoE, Bangladesh.
- No chemical/hazardous raw material should be allowed to spill over the land and should be operated in covered systems

Impact on Land Use

No impact due to off-site developments is anticipated on land use of the study area during operation phase. Development of economic zone will attract more infrastructural development around the project site to facilitate industrial growth which may alter the land use of area significantly. Some of the developments will include, construction of roads, housing facilities, commercial areas including hotels, hospital, food joints, schools etc, small scale industries etc. This will help in development of the area significantly.

Impacts on Agriculture resources

Pre-construction & Construction Phase:

No agriculture land will be required to acquire for development of proposed off-site activities as well the economic zone except 0.166 acres of land for development of pump house & water supply system. That land will either be purchased/acquired by the BEZA. Thus no significant impact on agriculture activities/resources is anticipated due to the project development.

Operation Phase: No impact on agriculture resources is anticipated from off-site infrastructure during operation phase. Some agro based or aquaculture based industries may come up in proposed economic zone. These industries will have positive impacts favouring the growth of agriculture and aqua culture.

Impacts on Fisheries

Pre-Construction & Construction Phase:

No impacts on fisheries due to off-site developments are anticipated during the pre-construction phase. No significant impact on fisheries is anticipated during construction of the proposed off-site developments.

For withdrawing ground water three pump rooms are proposed to be constructed. Two out of three pumps are located on Khas land. Both khas land are small pond excavated by local people and they use it for minor aquaculture activities. Filling up of these ponds will impact the aquatic life in the ponds thus the small fisheries.

Construction work including land filling by dredging, sand lifting, site clearance and physical construction of plant setup, may have impacts on open water fish habitats, fish diversity and hence to some extent on capture fisheries production. The project adopts waste management plan, so impact on fish habitat due to waste discharge would be minimum.

Operation Phase:

No impact on fisheries is anticipated during operation phase due to the proposed off-site developments. After development of economic zone, some of the aquaculture based industries may come up. This will help in boosting the aquaculture activities & fisheries development in the region.

The fisheries may get severely impacted if untreated industrial effluent is discharged to river. Therefore effluent management system shall be implemented strictly. Fish kill may happen due to contamination of water due to discharge of untreated effluent. Effluent may contain toxic components like heavy metals etc which leads to fish poisoning and may lead to large scale fish death. Also fishes contaminated with these pollutants if consumed may affect the consumer health (birds/bigger fishes/humans).

Impacts on Eco-system

Pre-construction & Construction Phase:

There is no vegetation at the economic zone site. No vegetation removal will be required for construction of administration building, electrical substation and boundary wall. No agriculture or aquaculture activity is reported at the site thus no impact on crop and aquatic eco-system is anticipated due to off-site development.

For construction of access road and the bridge, it is required to fell app. 30-40 trees and some bushes. These trees and bushes provide habitat to birds, insects, reptiles and small mammals like squirrel etc. For laying the water pipeline app 671 trees will required to be fell for laying water pipeline. Cutting of the trees will disturb the eco-system and the habitat of the dependant organisms.

Operation Phase:

Green buffer of 10 m all around the project site will include most of the native plant species, which will significantly improve the ecology of the area. This green buffer will provide habitat for the avifauna, reptiles and small mammals and will enhance ecology of the area. Plantation should also be carried out along the both side of access road. Twice the number of trees fell (for access road, bridge and water pipeline) should be planted.

Post development of the economic zone & setting up of industries, there could be some impacts on the ecosystem of the area. Industrial development will involve generation of emissions, effluents and increased vehicular movements. These altogether may have overall negative impact on the eco-system of the site and the nearby areas as the air pollutant will impact the existing vegetation and avifauna in the area. But the industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution are taken there will be no significant impact on the eco-system of the area.

Mitigation Measures:

- Periodic monitoring shall be carried out for air, water, noise and soil as per the monitoring plan and ensure that no impact
- No waste shall be discharged in water bodies.
- Tree survival rate shall be monitored

Impacts on Socio-Economy

Pre-construction & Construction Phase

A 15 m wide access road will be developed to connect the project site with Mongla port road. The road will be constructed in place of existing 6 m road. Habitations, small shops and Mongla commercial colony exists along both side of the road. 8 HHs will be required to displace and rehabilitate for construction of the road. Land to these HHs is given on lease by Mongla Port Authority. Another section of land will be identified in close vicinity on Mongla port land to rehabilitate the displaced HHs.

For construction of water pump houses in Manik Nagar, it is required to acquire/purchase private land of app. 0.166 acres. The land belongs to two farmers of the Manik Nagar village. This will have impact on livelihood of the farmer but not significant as only 0.083 acres will be acquired from each farmer which is a small piece of land. The issue has been addressed in SIA and will be dealt as per the applicable laws of land, Act of resettlement and rehabilitation and Social Management Framework of PSDSP to minimize the impact on livelihood of the affected people. In total 10 HHs/55 people are affected due to project development.

Construction activities lead to generation of dust, unpleasant view, obstruction in access of public properties due to excavation etc. which may impact the society significantly. Adequate waste management plan, air, soil, noise and water pollution controls are required to be adopted to prevent any impact on society. Also various health hazards are associated with construction activity which may significantly impact the workers if not taken care.

No sensitive feature like religious structures, school, hospital etc. are located along the proposed access road. Approx. 30-40 trees planted along the proposed access road may require to be removed during construction. No impact is anticipated on social sensitive receptors due to construction of access road. Water pipeline will be laid along the Manik Nagar Gaurmanava road and Kulna Dhaka highway. Approximate 669 trees (both planted and natural) will required to be removed for laying water pipeline along Nagar Gaurmanava road. Majorly agriculture fields and aquaculture ponds are located along the Kulna Dhaka highway in alignment of proposed water supply line. No sensitive features have been recorded along the proposed water supply alignment. Mitigation measures are required to be taken to minimize the impact of projects on the society and they are given below:

- Provision of proper training to all workers for handling the construction equipment
- Provision of cautionary and guiding signage in local and English language indicating the hazard associated with the site
- Employment should be provided preferable to local & affected people
- Entry to the fuel storage area and construction equipment rooms should be restricted and should be allowed for trained personnel
- Wastewater from the toilet should be disposed off in septic tanks and soak pits and should not be allowed to accumulate at labour camp site or construction site
- Dustbins should be provided at labour camps for collection of waste and waste should be regularly disposed off through the concerned agency
- Temporary storm water drainage system should also be provided at camp site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies
- Arrangement of fire-fighting should be made at site and workers should be trained to use the system in case of fire
- Provision of personal protective equipment like safety jackets, helmets, gumboots, gloves, face mask, ear buds, goggles, safety shoes etc. as per requirement and nature of job in which they are involved
- Job rotation should be carried out for workers exposed to high noise and dust areas
- Provision of First aid facility at the site and the labour camp
- Labour camps should be located at neat and clean location with no water logging issues
- Proper sanitation facility including toilets, bathing facility and washing facility should be provided at site and at labour camps for workers

- Clean drinking water supply should be provided to labour
- Crèche facility should be provided for kids if female workers are employed
- Regular inspection for hygiene and safety in labour camps should be done
- Compensation should be given to the people as per the policy for the planted tress
- Construction debris should not be allowed to enter into aquaculture ponds located along the road
- Entrance to any road/structure should not be blocked for laying pipeline and construction of access road
- A major segment of the population on the area is unemployed. Construction activity will provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This will improve the quality of life of people.

Operation Phase: Development of off-facilities will improve the infrastructure of the area and will facilitate local people. Development of economic zone and setting up of industries will provide significant direct and indirect employment for the local people. This will significantly improve the quality of life of people.

Post development of the economic zone & setting up of industries, there could be some impacts on the Socio-economic conditions of the area. Industrial development will involve generation of emissions, effluents, waste and increased vehicular movements. These altogether may have overall negative impact on the health of the people and aesthetics of area. But the industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution are taken there will be no significant impact on the society

Environmental Management Plan

The Environmental Management Plan (EMP) is the synthesis of all proposed mitigation and monitoring actions, set to a time frame with specific responsibility assigned and follow-up actions defined. EMP is a plan of actions for avoidance, mitigation and management of the negative impacts of the project. Environmental enhancement is also an important component of EMP. A detailed set of mitigation measures have been compiled in view of the likely impacts associated with the proposed off-site development in Mongla EZ.

The EMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation (post-construction) stages of the project. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Minimum disturbance to the native flora and fauna
- Compliance with the air, water, soil and noise quality norms.
- Conservation of water to the extent possible through rain water harvesting, wastewater recycling

The detailed EMP is provided in Chapter 9.

Enhancement Plan

As part of enhancement measures it is proposed to consider providing drinking water and medical facilities to villagers.

Contingency Plan

In order to be in a state of readiness to face adverse effects of accidents, a Contingency Plan is required to be prepared which includes on-site and off-site emergency plan by the individual industry and industrial estate. BEZA is committed to develop a Contingency Plan in consultation with district

authorities and industry association. The Contingency Plan will have the following minimal components:

- Accidents preventions procedures/ measures
- Fire prevention planning and measures
- Fire water storage and foam system
- Accident/emergency response planning procedure
- Communication
- Emergency control centre
- Emergency information system with role & responsibility and command structure
- Recovery procedure
- Assessment of damages and rectification
- Evaluation of functioning of disaster management plan
- Accident investigation
- Clean-up and restoration

Compensation Plan

8 households shall get relocated because of the construction of the access road and 0.166 acres of land will be acquired for the construction of the pump house. Compensation shall be provided based on the findings of Social Impact Assessment (SIA) Report. Details are given in Chapter 9 of this report. The total budget for ARP is estimated around BDT 0.74 million. This includes the 10% contingency. Without the contingency, the total budget estimate is BDT 0.67 million

Monitoring Plan

The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. A monitoring schedule has been sketched based on the environmental components that may be affected during the construction and operation of the project. Following table presents the Environmental Monitoring Plan for the proposed project.

Table 7: Environmental Monitoring Plan

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
1.0	**Construction Phase**						
1.1	Local Manpower Absorption	Construction Works	Contractor's report No. of people working in the project	Monthly	Civil Contract Awardee	BEZA & PMC	4 No.
1.2	Soil Erosion	Excavation, disposal, cut & fill and land clearing activities for site levelling and internal roads, disposal	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	During Rainy Season	Contractor	BEZA & PMC	
1.3	Greenbelt Development	-	Survival rate of species planted;	Half Yearly	Contractor/BEZA	BEZA & PMC	

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
			Density of vegetation				
1.4	Air Quality	Transportation of construction materials, road construction, construction of utilities	Survey & observations; Levels of PM_{10}, $PM_{2.5}$, SO_2, NOx, CO	Once in each season for twice a week for two weeks at 3 locations		BEZA & PMC	
1.5	Waste Management	Restoration of disposal sites and construction areas	Status of protection measures	Quarterly	Contractors	BEZA & PMC	
1.6	Noise Level	Noise levels compliance with respect to industrial standards	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time at 6 to 8 locations	Daily	Contractors	BEZA & PMC	
1,7	Drinking Water	Contamination	All physio-chemical & biological parameters	Once in month	Contractor	BEZA & PMC	
2.0	**Operation Phase**						
2.1	Noise Levels	Noise levels compliance with respect to industrial standards	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time at 6 to 8 locations	Once in every month		BEZA	6 Nos
			Plant periphery and near noise generation sources	Monthly	Individual Industrial Units	BEZA	
2.2	Biological Environment	Horticulture/ Greenbelt Development	Survival rate of plants and shrubs	Quarterly	BEZA	BEZA	
			Survival rate of plants and shrubs at individual unit	Quarterly	Individual unit	BEZA	

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
2.3	Ambient Air Quality	Dust levels	Ambient PM levels as per ECR, 1997	Quarterly	Individual unit	BEZA	
		Emissions from vehicles and industrial operations	Ambient emissions levels as per ECR, 1997	Quarterly	Individual unit	BEZA	
2.4	Drinking water Quality	All physio-chemical parameters including TDS, pH, salinity, As.	Water quality standards as per ECR, 1997	Quarterly	Individual unit	BEZA	
2.5	Sewage & Effluent	TSS, BoD, CoD, Oil & Grease & pH	Water quality standards as per ECR, 1997	Daily	Individual unit	BEZA	

2. Introduction

2.1. Prelude

The Bangladesh Economic Zone Act, 2010, was passed by Government of Bangladesh to make provisions for the establishment of Economic Zones (EZs) in all the potential areas with an ambit to encourage rapid economic development and to instil confidence in investors.

To meet the above objective of rapid economic development, Government of Bangladesh with support from World Bank and the Department for International Development, United Kingdom (UK-DFID) has proposed to develop EZs at various potential locations in Bangladesh as Private Sector Development Support Project (PSDSP). The PSDSP design consists of the public sector portion of investment in land, infrastructure and services for a number of pilot EZs, selected to implement new approaches to EZs in Bangladesh. EZs identified under PSDSP will be developed on Public Private Partnership (PPP basis.

Bangladesh Economic Zone Authority (BEZA) is the overall agency responsible for establishments of EZs in all the potential areas including the backward and undeveloped regions. BEZA has identified various locations for development of EZs. One of the potential sites is located at Mongla Upzila and has an approximate area of 83 hectares (ha). The proposed site is located adjacent to an existing Economic Processing Zone (EPZ).

Taking into consideration the site location, available infrastructure, existing industries, investors interest and infrastructure & logistic requirement of the proposed industries, Mongla Economic Zone planned targeting non-polluting industries primarily food processing, textile and light engineering industries. Options for other industries can also be explored by the developer at the time of development of EZ depending on the investor's interest and availability of resources. At present, off-site infrastructure will be developed by BEZA for the proposed site identified for Mongla EZ. This EIA Report therefore covers in detail the environmental and social aspects of the off-site infrastructure for the proposed Mongla EZ. It also covers aspect of industrial area as well based on above broad industrial classification. Developer will carry out detailed EIA study on later stage.

2.2. Project Background

BEZA shall develop the land and the following off-site infrastructure development:

- Development of boundary wall of 4 kms around the proposed site of Mongla EZ
- Construction of Administration building
- Access road of 350 m from existing Mongla Port Road
- 35 m bridge over Ghana Road to connect the proposed access road and proposed EZ
- External power supply system (transmission system and sub-station) from existing Mongla substation to the proposed EZ
- External water supply system (transmission pipes and underground reservoir) from Manik Nagar to the proposed EZ

Industrial area development will be planned by prospective PP developers on later stage.

BEZA has appointed M/s Price Water Coopers Pvt. Ltd. to provide transaction advisory services for development of EZs in Bangladesh which also includes Environment Impact Assessment (EIA) study of the upcoming projects.

As per the procedure, an Initial Environment Examination (IEE) Report for development of off-site facilities along with proposed Terms of Reference (ToR) was submitted to DOE in January 2015. Approved ToR was granted by DoE vide Memo No. 03. 761. 018. 00. 00. 66. 2013 - 946, dated 30th March, 2015. Copy of the approved ToR by DoEB is attached as Annexure I. The EIA study for the development of proposed Mongla EZ has been carried out as per the ToR issued by DoEB, World Bank's requirements and Environmental Management Framework of PSDSP.

2.3. Project Description

Mongla EZ is proposed to be located adjacent to existing Mongla EPZ at Kamardanga Mouza in Mongla Upzila, Bagerhat district, Kulna Division, Bangladesh.

The proposed project site is bounded by Upazila Rampal in the north, Mongla EPZ on the south, the Mongla River in the east and the Pasur & Gona river/Mongla Port Authority on the west. Mongla town is at distance of 1.7 km in SE direction from the proposed project site. Mongla Port is at distance of 200 m from the site in West direction. Geographical coordinates of the corners and centre of the project site is given in the following table.

Table 8: Coordinates of the proposed project site

	A	B	C	D	Centre
Latitude	22°30.056' N	22° 30.100'N	22° 29.684'N	22° 29.670'N	22° 29.856'N
Longitude	89°35.918' E	89° 36.671'E	89° 36.499'E	89° 35.935'E	89° 36.247'E

At present, proposed project site is not accessible through any public road. The proposed site however can be accessed via EPZ through a narrow mud (kachcha) road. Mongla Port Road is at distance of 350 m and Kulna Mongla Highway is at distance of 600 m from proposed project site in west direction. Jessore Airport is the nearest airport which is located at a distance of 105 km in NNW direction from the proposed project site. There is also an unfinished airport, Rampal Airport, located at a distance of 22 km from the proposed project site in NNE direction. Nearest Railway station is Kulna Railway station which is located at a distance of 38 km in North direction from the proposed project site. A proposed railway line is also under consideration of Government of Bangladesh to connect Kulna, Mongla Port, existing EPZ and the upcoming Mongla EZ.

To make site accessible, BEZA has proposed to develop an approach road of 350 m to connect the site to Mongla Port Road and a bridge of 35 m will be constructed over river Gona to connect proposed approach road and the proposed project site. Proximity of the site to existing EPZ, Mongla Port, Mongla town, Kulna city, Kulna Mongla Highway makes the proposed project site a proffered ideal location for the development of EZ.

The infrastructure development with regard to power supply, water supply, sewage, and drainage essential for EZ success will be developed by BEZA under this project. The proposed project site is filled to the level of 6 ft. (1.8 m) w.r.t surrounding area by Mongla Port Authority by dredged sand from Pasur river (to make Pasur river navigable) raising the ground level of the site. Finished level of site will be app. 6 m above mean sea level after development of EZ. Ground level of EZ site will be 1.5-2.0 m above average HFL of Pasur River (4.45 m). The proposed Mogla BZ land Mongla is Government land has been transferred to BEZA from Mongla Port authority. Land ownership paper is attached as Annexure II to the report.

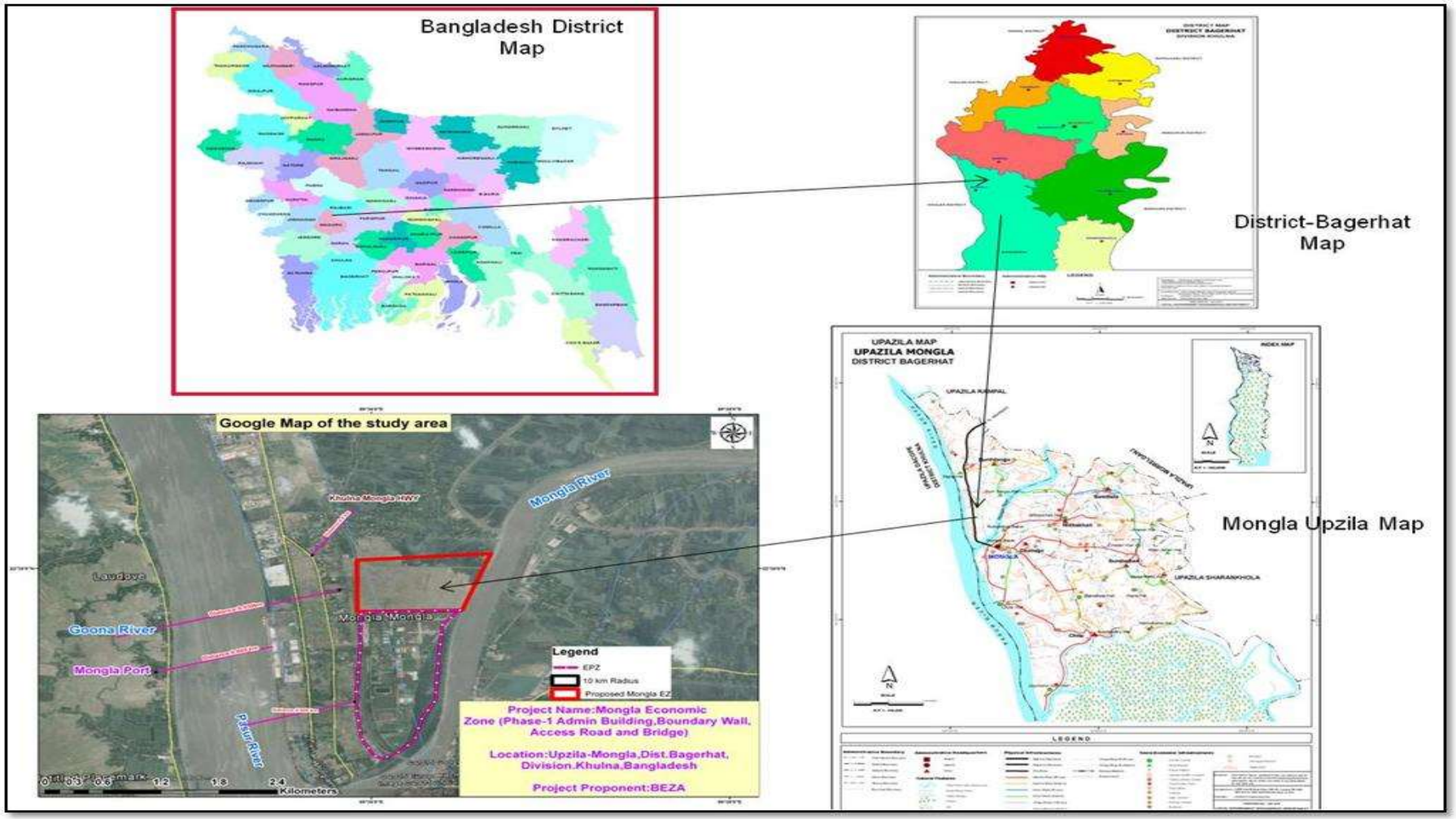

Figure 2: Location Map of Mongla EZ

2.4. Need for the Proposed Project

Bangladesh is primarily an agricultural economy with close to 50% of the labor force employed in agriculture. Industry sector contribution to Gross Domestic Product (GDP) has hovered around 25-30% only for past few years. Manufacturing sector of Industry shows predominance of export led garments and textile industries and comprise of 52% share of total exports in Bangladesh making it the world's second largest garment manufacturer.

But it also reveals relatively low emphasis and export competitiveness of its other items. Therefore, the country needs to bolster exports of other indigenous products, which will happen through enhanced industrial infrastructure, capacity building, and policy initiatives. Similarly, the country may choose to substitute imports of capital goods and other items of domestic consumption, provided there is adequate investment in industrial infrastructure to enable domestic manufacturing.

The Government of Bangladesh has, in the past, successfully provided tailored infrastructure services and business environment conditions through EPZs. EPZs were used as a strategic instrument for attracting Foreign Direct Investment (FDI) and dealing with the shortcomings of the overall investment climate, business registration, licensing, etc. which were restricting investments in the Domestic Tariff Area (DTA).

To overcome the limitations of EPZ model, new EZ regime has been adopted by the Government of Bangladesh so as more spill-over can be harnessed by local firms from FDI , additional investments can be encouraged within value chains, more local produce can be procured and better linkages can be established between manufacturing firms and educational institutions.

The EZ development, a zoned industrialization, is required in Bangladesh to maximize the growth benefits of agglomeration and ease the increasing urban congestion. More importantly, the project will enable new sources of growth, where investor will show their interest.

2.5. Need of Study

The proposed project comprises of development of land and off-site facilities for the upcoming Mongla EZ with an approximate area of 83 ha. Off-site facilities will include construction of 4 km boundary wall around the project boundary, development of administration building at site, construction of 350 m long access road, 35 m bridge over Gona river to connect proposed access road and site, external power supply line from existing Mongla substation to site and external water supply line from Manik Nagar to site. The project attracts the applicability of Environment Conservation Act, 1995 & Environmental Conservation Rules, 1997. The proposed project component is classified under red category as per Environmental Conservation Rules, 1997. Thus it is required to carry out EIA study for the proposed project as per Environmental Conservation Rules, 1997 and obtain approval of DoEB before taking up any construction activity for the project.

Project is being implemented with the support of World Bank. As per the World Bank Policy O.P.4.01and the Environment Management Framework of PSDS project, development of the economic zone is classified as Catrgory A project which requires a detailed environment assessment study prior development of zone to identify the potential threats of project to environment and to frame mitigation and environment management plan to reduce the negative impact of the project. Development of the off-site facilities for economic zone will have moderate effect and impacts will be site specific thus off-site development for EZ falls under Category B, which requires a site-specific rapid EIA study.

2.6. Scope and Methodology of the Study

For the purpose of environmental assessment, area within 5 km radial zone of the proposed project have been studied and classified as Study Area. Following methodology has been adopted for the EIA study:

- Collection of primary and secondary baseline information
- Analysis of project component and its activities with respect to environmental aspects
- Public consultation to identify their concern and acceptance to the project
- Analysis of Alternatives
- Impact assessment and identification of mitigation measures for elimination, or minimisation of impacts
- Assessment of institutional aspects, and development of Environmental Management and Monitoring Plan.
- Identification of sources of pollution during construction and operation phases of the project at the proposed site
- Identification of utilisation of resources obtained during construction and operation phases of the project
- Assessment of extent of pollution and resource utilisation in the proposed area
- Recommend measures to optimise resource utilisation
- Develop an environmental monitoring plan to ensure effective implementation of the environmental management plan

The board diagram for impact identification and mitigation and management is shown below.

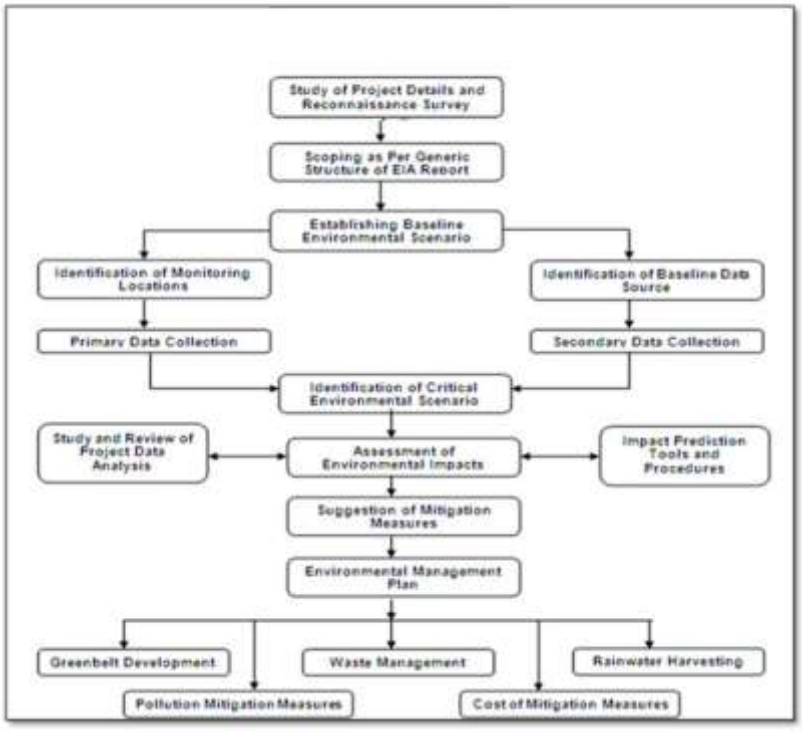

Figure 3: Methodology of EIA Study

2.7. Limitation of the Study

The present EIA Report has been prepared based on the Primary field investigations / assessment, and secondary data from data collected from Department of Public Health and Engineering (DPHE), Mongla Port Authority, BEPZA, DoEB and published journals, and books, public consultation and site observations. The environmental and social assessment is based on the information collected from the various Agencies, community consultations and observations. Professional judgement and subjective interpretation of facts and observations has been applied for the preparation of the EIA Report. Since offsite facilities are proposed to be developed by BEZA, required information essential for EA are available. The onsite (industrial area detailed planning will be carried out by prospective private developer) information are available limited to feasibility assessment.

2.8. ToR Compliance Matrix

The EIA study has been conducted in accordance with the approved ToR issued by DOE (ToR letter is attached as Annexure I) and the Terms of Reference included in the EMF for the PSDSP. Table 9 presents the point-wise compliance of the issued ToR .

Table 9: Compliance of TOR Points

S. No.	ToR Point	Compliance
I	The project authority shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of the said project in accordance with this ToR and following additional suggestions	EIA study has been carried out in line with the ToR Approved by DoE and WB guidelines
II	The EIA Report should be prepared in accordance with following indicative outlines:	Agreed
1	Executive Summary	Refer Chapter 1
2	Introduction: (background, brief description, rationale of the project, scope of study, methodology, limitation, EIA team, references)	Refer Chapter 2
3	Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)	Refer Chapter 3
4	Project Description	Refer Chapter 4
i.	Introduction	Section 4.1
ii.	Project objective	Section 4.2
iii.	Project options	Section 4.2
iv.	Interventions under selected options	Section 4.3
v.	Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation	Section 4.5
vi.	Project schedule: The phase and timing for development of the project	Section 4.6
vii.	Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project	Section 4.7
viii.	Map and survey information Location map, cadastral map showing land plots (project and adjacent area), geological map showing geological units, fault zone, and other natural features	Section 4.12

S. No.	ToR Point	Compliance
ix.	Project plan, Design, Standard, Specification, Quantification, etc.	Section 4.5
5	Environmental and Social Baseline	Refer Chapter 5
5.1	Meteorology	Section 5.3
5.1.1	Temperature	Section 5.3.1
5.1.2	Humidity	Section 5.3.2
5.1.3	Rainfall	Section 5.3.3
5.1.4	Evaporation	Section 5.3.4
5.1.5	Wind Speed	Section 5.3.5
5.1.6	Sunshine hours	Section 5.3.6
5.2	Water Resources	Section 5.6
5.2.1	Surface Water System	Section 5.6.1
5.2.2	Tropical cyclones and Tidal Flooding	Section 5.6.2 & 5.6.3
5.2.3	Salinity	Section 5.6.6
5.2.4	Drainage Congestion and Water Logging	Section 5.6.8
5.2.5	Erosion and Sedimentation	Section 5.6.9
5.2.6	River Morphology	Section 5.6.10
5.2.7	Navigation	Section 5.6.11
5.2.8	Ground Water System	Section 5.6.12
5.3	Land Resources	Section 5.7
5.3.1	Archaeological Regions	Section 5.7.1
5.3.2	Land Types	Section 5.7.2
5.3.3	Soil Texture	Section 5.7.3
5.3.4	Land Use	Section 5.7.4
5.4	Agriculture Resources	Section 5.8
5.4.1	Farming Practice	Section 5.8.1
5.4.2	Cropping Pattern and Intensity	Section 5.8.2
5.4.3	Cropped Area	Section 5.8.3
5.4.4	Crop Production	Section 5.8.4
5.4.5	Crop Damage	Section 5.8.4
5.4.6	Main Constraints of Crop Production	Section 5.8.4
5.5	Livestock and Poultry	Section 5.8.5
5.5.1	Feed and Fodder Shortage	Section 5.8.6
5.5.2	Livestock/Poultry Diseases	Section 5.8.7
5.6	Fisheries	Section 5.9
5.6.1	Introduction	Section 5.9.1
5.6.2	Problem and Issues	Section 5.9.2
5.6.3	Habitat Description	Section 5.9.2
5.6.4	Fish Production and Effort	Section 5.9.4
5.6.5	Fish Migration	Section 5.9.3
5.6.6	Fish Biodiversity	Section 5.9.4
5.6.7	Fisheries Management	Section 5.9.5
5.7	Ecological Resources	Section 5.10
5.7.1	Bio-ecological Zone	Section 5.10.1
5.7.2	Common Flora and Fauna	Section 5.10.2
5.7.3	Ecosystem Services and Function	Section 5.10.3
5.8	Socio Economic Condition	Section 5.11
5.8.1	Socio Economic Condition	Section 5.11.1
5.8.2	Quality of Life Indicators	Section 5.11.3
5.8.3	Income and Poverty	Section 5.11.4
5.8.4	Gender and Women	Section 5.11.5
5.8.5	Common Property Resources	Section 5.11.7
5.8.6	Conflict of Interest and Law and Order Situation	Section 5.11.8
5.8.7	Historical, Cultural and Archaeological Sites	Section 5.11.9
6	Identification and Analysis of Key Environmental	Refer Chapter 6

S. No.	ToR Point	Compliance
	Issues (Analysis shall be presented with Scenarios, Maps, Graphics, etc. for the Case of Anticipated Impacts on Baseline)	
6.1	Environmental Sensitivity Investigation	Section 6.1
6.2	Environmental Aspect	Section 6.2
6.1	Environmental Hot Spots	Section 6.3
6.1	Likely Beneficial Impacts	Section 6.4
6.1	Community Recommendations	Section 6.5
6.1	Alternate Analysis	Section 6.6
7	Environmental and Social Impacts	Refer Chapter 7
7.1	Introduction	Section 7.2
7.2	Impact on Water Resources	Section 7.5
7.2.1	Pre-construction Phase	Section 7.5.1
7.2.2	Construction Phase	Section 7.5.1
7.2.3	Post-construction Phase	Section 7.5.2
7.3	Impact on Land Resources	Section 7.6
7.3.1	Pre-construction Phase	Section 7.6.1
7.3.2	Construction Phase	Section 7.6.1
7.3.3	Post-construction Phase	Section 7.6.2
7.4	Impact on Agriculture Resources	Section 7.7
7.4.1	Pre-construction Phase	Section 7.7.1
7.4.2	Construction Phase	Section 7.7.1
7.4.3	Post-construction Phase	Section 7.7.2
7.5	Impact on Fisheries	Section 7.8
7.5.1	Pre-construction Phase	Section 7.8.1
7.5.2	Construction Phase	Section 7.8.1
7.5.3	Post-construction Phase	Section 7.8.2
7.6	Impact on Ecosystem	Section 7.9
7.6.1	Pre-construction Phase	Section 7.9.1
7.6.2	Construction Phase	Section 7.9.1
7.6.3	Post-construction Phase	Section 7.9.2
7.7	Socio Economic Impact	Section 7.10
7.7.1	Pre-construction Phase	Section 7.10.1
7.7.2	Construction Phase	Section 7.10.1
7.7.3	Post-construction Phase	Section 7.10.2
8.	Public Consultation and Disclosure	Refer Chapter 8
8.1	Introduction	Section 8.1
8.2	Objectives of Public Consultation and Disclosure Meeting	Section 8.1
8.3	Approach and Methodology of Public Consultation and Disclosure Meeting	Section 8.2
8.4	Public Consultation Meetings (PCMs)	Section 8.4
8.5	Public Disclosure Meetings (PDMs)	Section 8.4
9.	Environmental Management Plan and Monitoring Indicators	Refer Chapter 9
9.1	Introduction	Section 9.1
9.2	Mitigation Plan	Section 9.3
9.3	Enhancement Plan	Section 9.4
9.4	Contingency Plan	Section 9.5
9.5	Compensation Plan	Section 9.6
9.6	Monitoring Plan	Section 9.7
9.7	Monitoring Indicators	Section 9.8
10	Cost Estimation for Environmental Mitigation Measures and Monitoring	Refer Chapter 10
11.	Conclusions and Recommendations	Refer Chapter 11

S. No.	ToR Point	Compliance
III	Without obtaining approval of EIA report by the Department of Environment, the Project authority shall not be allowed to conduct earth filling or any kind of physical intervention in the proposed project site and also not be able to start the physical activity of the project.	Agreed
IV	This approval of the Terms of Reference (ToR) would not mean any acceptance or site clearance of the Project.	Agreed
V	The proposed EIA study would not establish any claim, right in favour of the proponent for getting site clearance or environmental clearance.	Agreed
VI.	Without obtaining Environmental Clearance, the project authority shall not be able to start the operation of the project.	Agreed
VII.	The project authority shall submit the EIA along with the No Objection Certificate (NOC) from the local authority, NOC from Forest Department (if it is required in case of cutting any forested plant, private or public) and NOC from other relevant agencies for operational activity etc. to the Bagerhat District Office of DOE with a copy to the Head Office of DOE in Dhaka.	Agreed

2.9. Structure of the Report

This EIA report has been prepared strictly following the report structure desired by DOE as per TOR. The EIA report contains project features, baseline environmental conditions, assessment of environmental impacts, and formulation of mitigation measures along with environmental management and monitoring plan.

The report includes the following chapters:

Chapter 1: Executive Summary

The executive summary gives the synopsis of the EIA Report.

Chapter 2: Introduction

This chapter provides background information of the project proponent, need for the EIA study as per prevailing legislation, Location and brief description of the project, methodology adopted for EIA study and structure of the report.

Chapter 3: Legislative, regulation and policy consideration

This chapter deals with the details of the potential legal, administrative, planning and policy framework which have beed used in the preparation of the EIA Report.

Chapter 4: Project Description

This chapter deals with the details of the proposed EZ such as location, connectivity, project requirements, Infrastructure development, environmental consideration, project cost, implementation schedule, etc.

Chapter 5: Environmental and Social Baseline

This Chapter describes the baseline environmental conditions around the project site for various environmental attributes, viz. physical, biological and socio-economic, within the 10 km radial zone, which is termed as the study area. Topography, soil, water, meteorology, air, noise, and land constitute the physical environment, whereas flora and fauna constitute the biological environment. Demographic details and occupational pattern in the study area constitute socio-economic environment. Baseline environmental conditions are based on the information collected from the various agencies and the secondary data collected from published sources.

Chapter 6: Identification and Analysis of Key Environmental Issues

This chapter details the analysis of the key environmental issues.

Chapter 7: Environmental and Social Impacts

This chapter details the inferences drawn from the environmental impact assessment of the proposed project. It describes the overall impacts of the project activities and underscores the areas of concern, which need mitigation measures.

Chapter 8: Public Consultation and Disclosure Meeting

This Chapter provides an insight into the process & methodology followed for carrying out the public consultation meetings in study area and proceedings of pubic consultations

Chapter 9: Environmental Management Plan and Monitoring Indicators

This Chapter provides mitigation and control measures to attenuate and/or eliminate environmental impacts, which are likely to be caused by the proposed project. An Environmental Management Plan (EMP) has been developed to mitigate the potential adverse impacts and to strengthen the beneficial impacts. This chapter also provides the environmental monitoring plan proposed for the project.

Chapter 10: Cost Estimation for Environmental Mitigation Measures and Monitoring

This chapter concludes on the findings that emerged from the environmental assessment study and summarizes the key points to be addressed to ensure the environmental sustainability of the project during the construction and operation phases.

Chapter 11: Conclusions and Recommendations

This chapter concludes on the findings that emerged from the environmental assessment study and summarizes the key points to be addressed to ensure the environmental sustainability of the project during the construction and operation phases.

2.10. References

List of secondary data used for carrying out EIA study and preparation of EIA report is given at the following table.

Table 10: Reference Used for EIA Study

S. No.	Reference
Government Departments	
1.	Mongla Port Authority
2.	Bangladesh Economic Zone Authority

S. No.	Reference
3.	Department of Public Health and Engineering
4.	Department of Environment
5.	Bangladesh Meteorological Department
6.	Bangladesh Forest Department
7.	Bangladesh Bureau of Statistics
8.	Geological survey of Bangladesh
9.	Bangladesh Water Development Board
10.	Disaster Management Bureau (DMB)
11.	Department of Agriculture Extension
12.	Bangladesh Rice Research Institute
13.	Department of Fisheries
Journals & Books	
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Existing Studies	
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3. Legislative, Regulation and Policy Consideration

3.1. Regulatory Requirements for the Proposed Project

The Government of Bangladesh has framed various laws and regulation for protection and conservation of natural environment. These legislations with applicability to this project are summarized below in the following table.

Table 11: Applicability of Key Environmental Legislation at a Glance

Name	Key Requirement	Applicability	Remarks
Acts/Rules			
Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules 1997 (ECR, 1997) ECA & ECR amendment 2000 ECA & ECR amendment 2002	Mandatory requirement of prior environment clearance for certain category of project for conservation and improvement of environment and control and mitigation of pollution of the environment. Standards are described under ECR, 1997 To ascertain responsibility for compensation in case of damage to ecosystem Restriction on polluting automobiles, sale and production of environmental harmful items.	Applicable. Few project components are Project classified under red category. EIA study required to be undertaken	Site approval certificate is to be obtained from DoE prior carrying out EIA study. EIA study is carried out on basis of ToR approved by DoE.
Environment Court Act, 2000 and subsequent amendments in 2002	To give high priority to environment pollution prevention	Applicable, for all projects have potential of environmental threat	All the developments to be carried oit as per ECA, 1995 & ECR, 1997 and amendments. Regulatory authority is Judiciary and Ministry of Environment & Forest
Bangladesh Wildlife Preservation Act, 1974 and Revision 2008 (Draft)	No person shall damage or destroy any vegetation in any wild life sanctuary & the wild Animals shall not be hunted or captured. For preservation of Wildlife Sanctuaries, parks, reserves.	Not Applicable. Project site is not located within any wildlife sanctuary/national park or any other protected area under this act.	Development activity will not have any interface with wildlife or wild habitat at any stage. Regulatory authority is Ministry of Environment and Forest Bangladesh Wild Life Advisory Board
The Forest Act 1927,Amendment 2000 (Protected, village Forests and Social Forestry)	Declare any forests land or waste land as protected forests. May stop public or private way or watercourse in the interest of preservation of the forest	Not Applicable. No forest land diversion is involved. However,	Permission may be required for felling the trees to construct access road, bridge and laying water supply line.

Name	Key Requirement	Applicability	Remarks
	Declare a reserved forest area as Village Forests Declare an area as Social forests or launch a social forestry programme in Govt. land or private land with permission	permission of cutting trees may be required from them.	
The Private Forests Ordinance Act, 1959	Conservation of private forests and for the afforestation on wastelands.	Applicable as the tree cutting is involved in development of off-site facilities	Tree cutting to be carried out after taking permission from Regional Forest Officer, Forest Department
The Penal Code	Chapter XIV of the Penal Code provides offences affective public health, safety, convenience, decency and morals; Section 277: Falling Water or Public Spring or Reservoir; Section 278: Making Atmosphere Noxious to Health; Section 284: Negligent Conduct with Respect to Poisonous Substance; Section 285: Negligent Conduct with Respect to Fire or Combustible Matter; Section 286: Negligent Conduct with Respect to Explosive Substance. Section 277: whoever voluntarily corrupts or fouls the water of any public spring or reservoir, to render it less fit for the purpose for which it is ordinarily used will be punished under the law. Section 278: whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the Neighbourhood or passing along a public way will get punishment.	Applicable.	It is required to take all the measures proposed and suggested by DoE, Bangladesh during both construction an operation phase to minimize the environmental pollution
The Protection and Conservation of Fish Act, 1950 and The Protection and Conservation of Fish Rules, 1985	Prohibit or regulate the construction, temporary or permanent of weirs, dams, bunds, embankment and other structures	Applicable.	Necessary permission would need to be taken for bridge construction crossing water bodies. Regulatory authority is Ministry of Fishery
The Explosive Act, 1884	To prevent any accident due to explosive storage, use or transportation due to careless handling/management	May be Applicable depending on quantity of fuel storage	Fuel will be stored and used at site for running various construction machinery and equipment
Water Pollution Control	Prevention of water pollution	Applicable from the prospective of	Applicable primarily during construction

Name	Key Requirement	Applicability	Remarks
Ordinance 1970		prevention of pollution	stage (e.g. sewage and equipment washing and maintenance liquid waste discharges at construction camps)
Water Supply and Sanitation Act, 1996	Management and Control of water supply and sanitation in urban areas.	Applicable for all development projects	Regulatory authority is Ministry of Local Government, Rural Development and Cooperatives
The ground Water Management Ordinance 1985	Management of Ground Water Resources. Tube well shall not be dug in nay place without permission from Upzilla parishad.	Applicable. Three nos. tube wells will be dug to develop water supply system during operation phase	Permission should be taken before digging tube wells
Natural Water Bodies Protection Act 2000	the character of water bodies i.e. rivers, canals, tanks, or floodplains identified as water bodies in the master plans or in the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of concerned ministry.	Not applicable. No waterbody identified as water bodies in the master plans will be filled up	Regulatory authority is RAJUK/Town Development Authority/Municipalities
The Embankment and Drainage Act 1952	An Act to consolidate the laws relating to embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water.	Not applicable as project will not interefere with any surface water body and its embankment	Regulatoy authority Ministry of Water Resources and FCD
Wetland Protection Act 2000	Adhere to a formal environmental impact assessment (EIA) process, as set out in EIA guidelines and manuals for water sector projects or related to alteration of natural drainage. No construction of roads if likely to effect the flow of navigable water ways without clearance from concerned authorities Upland flow in water channels to preserve eco-system Protection against degradation and resuscitation of natural water-bodies such as lakes, ponds, beels, khals, tanks, etc.	Not applicable. Site is not low lying area and no water logging is observed at the site	Permission to be taken from the Ministry of Water Resources and DOE

Name	Key Requirement	Applicability	Remarks
	affected by man-made interventions or other causes. Completely stop the filling of publicly-owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Stop unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.		
Antiquities Act 1968	Governs preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites.	Not applicable as no structure of national cultural heritage will be affected due to project development	Regulatory authority is Ministry of cultural Affairs
The Building Construction Act 1952 (with amendments)	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh	Applicable as the project involves development of infrastructure	Regulatory authority is Ministry of Works
The Vehicle Act, 1927 The Motor Vehicles Ordinance, 1983 The Bengal Motor Vehicle Rules, 1940	To regulate vehicular exhaust emissions	Applicable as heavy vehicle movement is involved both during construction and operation phase	Regular maintenance and upkeeping of the vehicles should be carried out. Regulatory authority is Bangladesh Road Transport Authority
The Land Acquisition Act, 1894 The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995, 2004	To provide appropriate compensation for the land acquired	Applicable as the project requires small piece of land acquisition	Regulatory authority is Revenue Department
The Factories Act, 1965 Bangladesh Labour Law, 2006	This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions.	Applicable as the workers will be employed during construction and operation phase of EZ	Regulatory authority is Ministry of labour

Name	Key Requirement	Applicability	Remarks
Policies			
National Environment Policy, 1992	For sustainable development	Applicable for all development projects	Usage of energy efficient building material, fuel etc. should be encouraged
National Environment Management Action Plan 1995	Conservation of natural habitats, bio-diversity, energy, sustainable development and improvement of life of people	Applicable for all development projects	Usage of energy efficient material, green building techniques, reduction of carbon foot prints etc.
National Conservation Stratergy	Sustainable development of Industrial Sector	Applicable for all development projects	Usage of energy efficient material, green building techniques, reduction of carbon foot prints etc.
The National Forest Policy (1994)	conserve the existing forest areas and to increase forest cover of country and increase the reserve forest	Not Applicable, no diversion of forest land is involved	Not applicable
The National Energy Policy, 1995	Protecting the environment by requiring an EIA for any new energy development project, introduction of economically viable and environment friendly technology.	Not Applicable. EIA study is to be carried out	Energy efficient materials and techniques should be explored
The National Water Policy, 2000	To ensure efficient and equitable management of water resources, proper harnessing and development of surface and ground water, availability of water to all concerned and institutional capacity building for water resource management	Applicable. Ground water is required to be withdrawn for fulfilling water requirement during operation phase	Conjunctive use of water should be explored
The National Water Management Plan, 2001	Addresses options for water quality, considerations behind measures to clean up industrial pollution, where effluent discharge monitoring and zoning regulations for new industries are emphasized	Applicable as it is industrial project and will involve generation of effluent and sewage	Installation of effluent treatment facility within the premises
World Bank's Safeguards			
OP 4.01 Environmental Assessment	Ensures sustainability and environmental feasibility of the project. Projects are classified into A, B & C category depending on the nature and extent of the impact.	Triggers	Project classified as Category B considering nature of activities and impacts
OP 4.04 Natural habitats	Ensures conservation of natural habitats and discourages disturbance of nay natural habitat due to project development by recommending adoption of alternative method/route/approach or adopting management measures	Triggered	Applicable for projects lying in close vicinity to eco-sensitive zones like wildlife sanctuary, wetlands under Ramsar convention, national parks bird sanctuary, turtle breeding grounds etc. No such natural habitat is located in close vicinity of the projects. Sundarban reserve forest is located

Name	Key Requirement	Applicability	Remarks
			at 5.0 kms from EZ site and EZ site is located within Ecological critical area of Sundarbans forest and permission from doE is required prior to any development in this area.
OP 4.36 Forests	Ensures that project activities does not disturbs/interfere with the forest, forest dwellers activities, fauna and flora of the forest. Prevents and discourages deforestation and impacts on rights of forest dependant people.	Not Triggered	No diversion of forest land is involved
OP 4.12 Involuntary Resettlement	Ensures minimal involuntary resettlement by considering feasible alternatives project design, assisting displaced people to improve their former living standard.	Triggers	Should be carried out as per the Law of land and RAP for the project. Few project Affected person are there.
OP 4.10 Indigenous people	Ensures protection of the dignity, right and cultural uniqueness of indigenous people and ensures they receive social and economic benefits	Not Triggers	No indigenous group of people will be affected
OP 4.11 Physical Cultural Resources	Ensures preservation of property of cultural and religious importance, heritage and property of natural importance and enhancement of cultural properties	Not Triggers	No property of cultural and religious importance, heritage and property of natural importance will be impacted
Private Sector Development Support Project			
Environment Management Framework	Describes all the mandatory environmental and social clearances and purpose of the same required to be taken before development of the project	Triggers	EIA report is prepared referring to the guidelines mentioned in EMF
Social Management framework	Enhances positive social development outcomes of PSDSP with economic activities undertaken in the EZ, mitigating adverse social impacts, ensures participation of stakeholdersand compliance to GoB policies	Triggers	EIA report is prepared referring to the guidelines mentioned in SMF

3.2. Procedure for Obtaining Environmental Clearance from DoE, Bangladesh

Bangladesh has very simple administrative framework regarding environmental aspect. It has strong interface between local government and federal Government. Department of Environment is

responsible for grant of environmental clearance to a project. In addition to three are other ministries to deal with specific area of importance to the country like Forests, Water.

According to the Section 12 of the Environment Conservation Act 1995 no project will be established or undertaken without obtaining permission, 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 Environment Conservation Rules 1997 require obtaining site and environmental clearance from the Department of Environment. According to the Rule 7 (1) of the Environment Conservation Rules 1997; for the purpose of issuance of Environmental Clearance Certificate (ECC), every projects, in consideration of their site and impact on the environment and will be classified into the four categories, i.e. green, orange A, orange B and red. Development of off-site facilities for economic zone will fall under red category. Thus EIA study is required to be carried out for the project. The present EIA study has been conducted for the proposed project complying with the ToR issued vide Memo No. 03. 761. 018. 00. 00. 66. 2013 - 946, dated 30th March, 2015 and applicable World Bank guidelines. Public consultation has also been conducted to discuss the environmental issues associated with the project. Proceedings of public consultation have also been included in the report. A schematic representation of the various steps involved in obtaining the Environment Clearance certificate from DoEB for red category projects is given in Figure below.

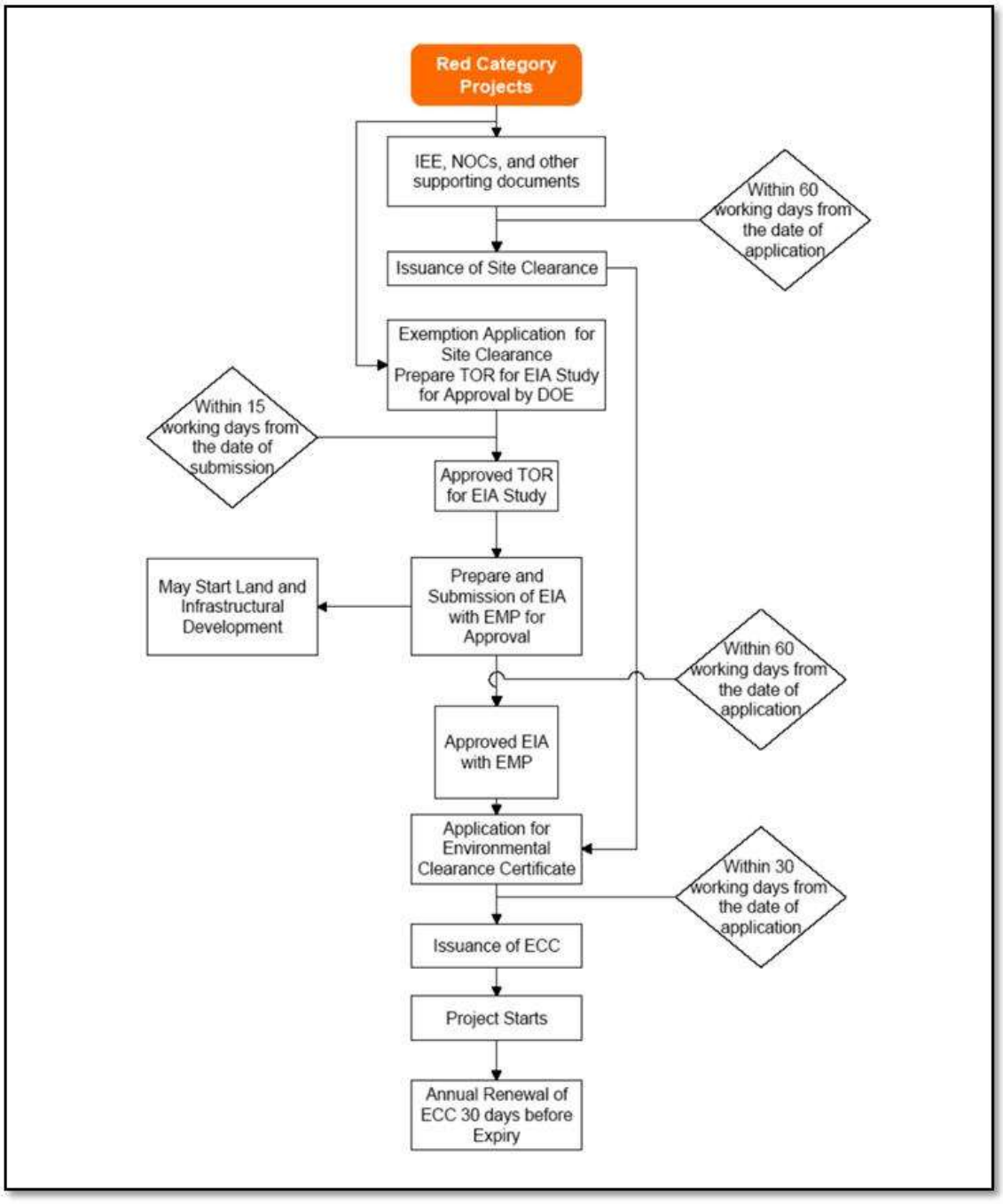


Figure 4: Steps for Obtaining Environment Clearance from DoEB

4. Project Description

4.1. Project Introduction

The proposed project involves development of EZ land and associated off-site facilities for the upcoming Mongla EZ. The off-site development will include the following:

- Development of boundary wall of 4 kms around the economic zone
- Construction of Administration building
- Access road of 350 m from existing Mongla Port Road
- 35 m bridge over Ghana Road to connect the proposed access road and EZ
- External power supply from existing Mongla substation to EZ
- External water supply line from Manik Nagar to EZ

The area of the upcoming Mongla EZ is about 83 ha. EZ will have following components:

- Economic Processing Zone (EPZ), (It is proposed to have textile, food processing and light engineering industries. This area will be developed by prospective developer and with the aim targeting non-polluting industries.)
- Domestic processing area,
- Commercial area and
- Non processing area. The off-site components (administrative buildings) will be part of non-processing areas.

The other off-site facilities will be developed outside the EZ land area and largely on govt. land except the private land for water pumping station. The details of all components are provided at the master plan. The map showing the EZ site and location of proposed off-site facilities are shown at Figures below. The proposed site has already been approved by DoEB for development of EZ.

Figure 5: Master Plan of Proposed Mongla EZ

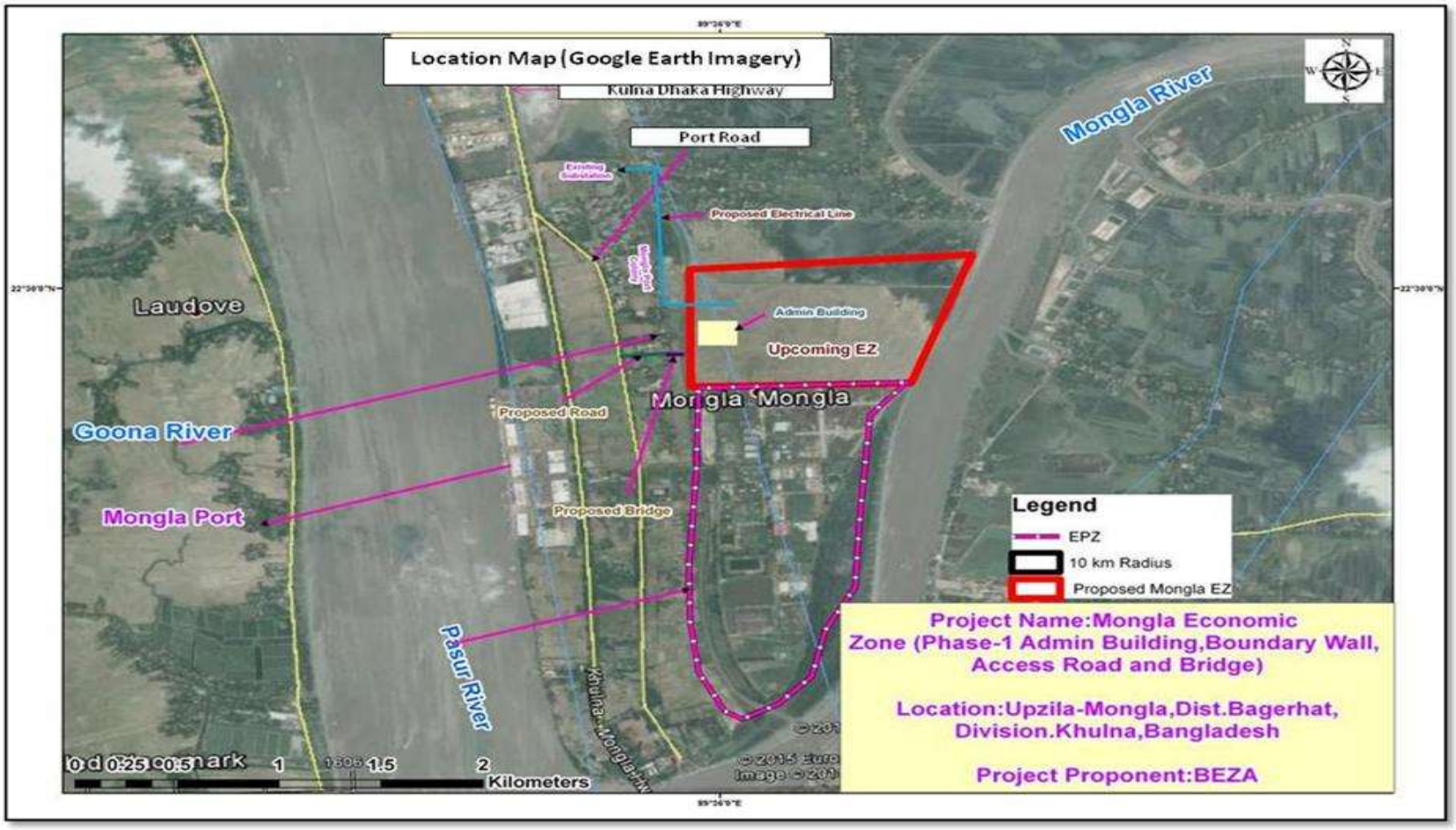


Figure 6: Location of Economic Zone and proposed off-site facilities

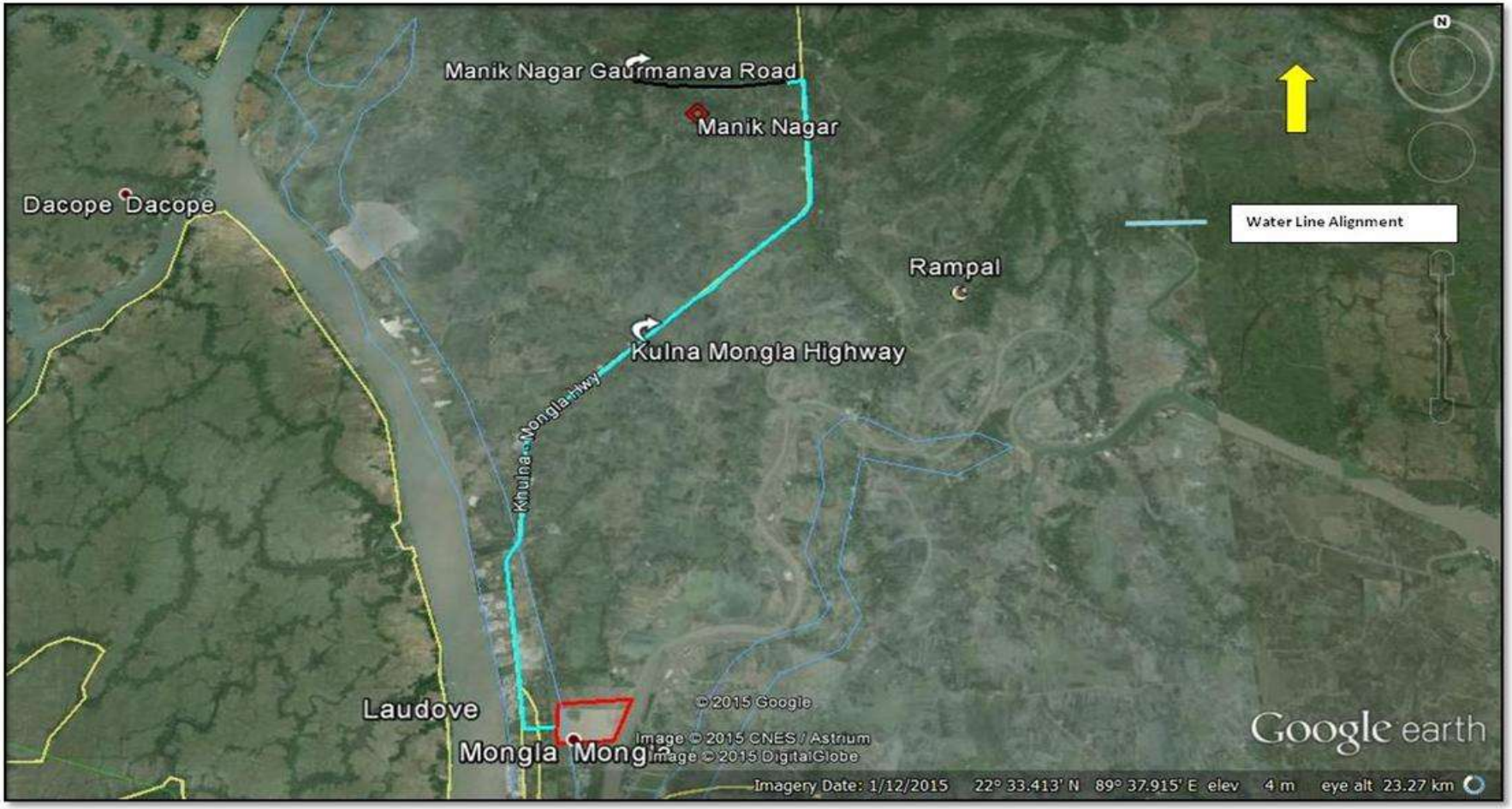


Figure 7: Location of EZ and Water Supply Alignment

4.2. Project Objective and Options

The project is aimed to develop economic zone of international standards with the support of the word bank. The EIA study is also being undertaken with the intent of integrating best environmental management practices in the project design.

BEZA, the overall agency responsible for establishment of EZs in all the potential areas of Bangladesh including the backward and undeveloped regions, has identified four potential sites, i.e. Anwara, Mirsheroi, Sherpur and Mongla, for development of EZs. These areas has been identified considering factors such as land use, land ownership, accessibility & connectivity, linkage to economically important towns/cities, infrastructure availability and engineering, environmental and social feasibility of the site.

The proposed project site (about 83 ha.) identified for the upcoming Mongla EZ and is a continuous section of land. This proposed land site in consideration is Khas land (Government land) and initially belonged to Mongla Port Authority. The proposed land site does not lie within any city Corporation, Municipality and Cantonment Board Area as per requirement of sub-section 3 of section 5 of Economic Zone Act, 2010. The land has now been transferred to BEZA by Mongla Port Authority.

A site suitability analysis was carried out for the development of EZ for assessing environment and social feasibility of the proposed project. As per the analysis, both limitations and benefits are associated with the land for developing EZ at the proposed site location. However, identified weakness and threats can be overcome by adopting alternative technologies and preventive measures.

Identified strength and weakness of the site as carried out by BEZA are given in the following table.

Table 12: Strength and Weakness of Site (as per BEZA)

Parameters	Strength	Weakness
Location, Contiguity & surroundings	• continuous stretch of land measuring 83 ha which is sufficient for development of EZ • does not lies within any city Corporation, Municipality and Cantonment Board Area as per requirement of sub-section 3 of section 5 of Economic Zone Act, 2010 • close proximity to Mongla Port, providing strategic advantage in terms of accessibility to various international markets for trade • close proximity to Pasur & Mongla River and also well-developed inland water transport • Agro based and marine culture industry can flourish due to strong backward linkages	• Region prone to flooding due to presence of Pasur river • threats of cyclones associated due to the close proximity to Bay of Bengal (55 km from site)
Accessibility	• Mongla Port road is at distance of 350 m • Kulna Dhaka Highway is at distance of 600 m • Jessore airport is at distance of 105 km and an unfinished Rampal Airport is at a distance of 22 km • Airport is proposed at Mongla • Kulna railway station at 38 km • Construction of Multi-purpose Padma Bridge started will provide road & rail connectivity to link SW of country to northern and eastern	• As of now, there is no direct access through public road • As of now, the proposed project site is accessible through Mongla EPZ via narrow mud (kachha) road

Parameters	Strength	Weakness
	regions. • A railway line proposed to be developed by Govt. Of Bangladesh to link Kulna, Mongla port, EPZ and EZ • Proposed access road and bridge on Gona river will make site directly accessible from Mongla port road/Kulna Dhaka highway • Well-developed inland water transport	
Proximity to urban hubs & industrial areas	• located adjacent to existing EPZ which can act as supplier/vendor base for upcoming industries in EZ for textile, leather, light engineering and IT hardware and investors are well versed with Mongla as an investment destination • presence of prominent sectors including food products, leather, footwear, ship building, basic metals, jute, wooden furniture, pharmaceuticals, LPG, clay and cement in Kulna division • The proposed project site is conveniently located • Dhaka - 158 km, Jessore-85 km, Mongla town-1.7 km, Kulna-35 km, Border of India-145 km, Chittagong-225 km, Bagerhat district-26 km	• Competition from existing Kulna, Dhaka and Chittagong industrial area
Available Infrastructure Facility	• Site elevation raised to 6 ft. from the sand dredged from Pasur river and is therefore 1.5-2 m above HFL • Existing Mongla EPZ road, Mongla port road and Kulna Dhaka highway • Mongla substation at 1 km distance in NNW direction	• As of now, there are no water supply/power connection and so sewage connection • HT and LT line of EPZ crossing the site, LT line to be re-routed • LT line exists on LHS of the proposed access road, which need to be protected while construction
Availability of Raw Material	• Strong production of cash crops such as jute, cotton, rice, etc. • Fishing is a major activity in the region, hence availability of raw material • Large nos. of unskilled and semi-skilled labour available	• Rivers are saline, ground water to be taken from Manik nagar at distance of approximately 21 km through underground pipeline • Shortage of skilled labour • Shortage of power availability
Eco-sensitivity and threat to bio-diversity	• No significant flora and fauna at site • No eco-sensitivity associated with the site	• Sundarban forest exist at distance of 5 km from site which is fragile eco-system and Ez site falls within Ecological critical area of Sundarbans forest, thus prior permission is required from DoE in this area and also development may have impact on ecology of Sundarbans • Cutting of trees (app. 40 nos.) to construct the proposed approach road and the bridge

Parameters	Strength	Weakness
		• Cutting of approx. 669 trees for laying down water pipeline • Filling up of small pond to construct pump house at 2 locations
Quality of life & Employment generation	• Creation of large nos. of direct and indirect jobs for skilled, semi-skilled and un-skilled labour • Enhanced infrastructure facilities	• Unavailability of adequate skilled labour • Seasonal aqua culture and agriculture practice at site • Small land acquisition for constructing pump house at one location and for laying power supply line

The land involvement for associated off-site facilities is minimal and is detailed in respective off-site details in the following sections in this report.

4.3. Interventions under selected options and Project Activities

Mongla site has been selected for development of economic zone. Scope of the proposed project is to develop EZ and off-site facilities for upcoming EZ zone. These EZ facilities will be developed by BEZA. The EZ area will be developed by prospective developer who will also undertake detailed planning for the same. Proposed off-site facilities will help in improving the infrastructure of the area. Proposed interventions at the selected site are given below:

- Development of EZ consisting of processing and non-processing areas.
- Development of boundary wall of 4 kms around the economic zone
- Construction of Administration building
- Access road of 15 m width and 350 m length from existing Mongla Port Road to the EZ site
- 35 m bridge over Ghana Road to connect the proposed access road and EZ
- External power supply from existing Mongla substation to EZ
- External water supply line from Manik Nagar to EZ

4.4. Existing Infrastructure in and around the Project Site

The site has no infrastructure development at present and requires development for power, water, access roads and drainage. The project site has been raised to the level of 6 ft. (above highest flood level) by Mongla Port Authority from the dredged sand from Mongla and Pasur River (to make these rivers navigable). The site elevation of the proposed project site at present is 1.5-2.0 m above HFL of Mongla and Pasur Rivers. The proposed project site is surrounded by a mix of agricultural land, industrial facilities (EPZ) and small habitations. Surroundings details of project site are given in following table. Photographs of the infrastructure at the proposed EZ site and proposed off-site facility locations are given in Figure below.

Table 13: Existing Features surrounding the project site

Direction	Features
North	Barirdanga Village
East	Mongla River
South	EPZ. (Mongla Town and Old Mongla Port Colony beyond EPZ)
West	Gona River (very small river)
SW	Beyond EPZ, and Port Colony, River Pasur & Mongla Port

Small road from EPZ to EZ

Entry to EZ from the road

View of project site

View of EPZ Boundary Wall from Project

View of EPZ from Project Site

Site	
	
Area used by nearby villagers for aquaculture and agriculture	
	
Area used as agriculture by nearby villagers	
	
Mongla River	

Gona River (View from proposed approach road)

Gona river (view from site)

Proposed approach road

HH/shops to be affected along proposed approach road

Trees to be affected along proposed approach road

Proposed alignment for bridge over Gona river

Proposed location for Pump House 1

Proposed location for Pump House 2

Proposed Location for Pump House 3

Proposed alignment of underground water pipeline (all along within existing ROW of the road)

Figure 8: Photographs of the project site

Some utilities exist at the proposed EZ site and proposed off-site infrastructure facility locations. These utilities may be required to be shifted as per the project planning. Details are given below:

Two HT lines for BEZA and Mongla Port are located on the peripheral area of the EZ but these will not be shifted. The LT line for Mongla Port colony passes from middle of the site and is required to be shifted. This line will be shifted by developer of EZ. Replacement should be done immediately after removing the LT line.

LT line also exists in the left hand side of the proposed approach road which may also require to be shifted. Shifting will be carried out by contractor. Replacement to be done immediately after removing the line

4.5. Project Activities and Area Statement

The proposed project site is filled to the level of 6 ft. (1.8 m) w.r.t surrounding area by Mongla Port Authority by dredged sand from Pasur river (to make Pasur river navigable) raising the ground level of the site.Elevation of site varied from 3-6 m. Site however will require levelling to achieve finished level of app. 6 m above mean sea level after development of EZ. Ground level of EZ site will be 1.5-2.0 m above average HFL of Pasur River (4.45 m).

The development activities for EZ would include the facilities for sewage handling and treatment, industrial waste management, area electrification, internal road development and other EZ developmental activities as per the master plan shown at Figure below. The detailed planning for EZ development would be undertaken by prospective developer.

Planning for EZ development

Developer will be appointed as per the guidelines mentioned in EZ Act, 2010. Preliminary planning has been made for the economic zone on the basis of market and pre-feasibility study. As per the current planning, land use pattern of the EZ site is given in table below. Light engineering, food processing and readymade garment industry are planned to be proposed within EZ. After appointment of developer, developer will explore other options as per the investor's interest and there may be changes in the planning. Developer will carry out separate EIA study as per revised planning and will obtain separate approval from DoE, Bangladesh. Developer will carry out separate EIA study as per revised planning and will obtain separate approval from DoE, Bangladesh if required. Other developments like internal storm water drainage, power distribution, water distribution network, plotting, water treatment plant etc. will be carried out by developer.

Table 14: Preliminary Land Use Planning for the Economic Zone

Land Use Pattern	In Hectare	In%
Processing **Area**		
Industrial Sector		
Food Processing	14.99	18.06%
Textile	28.44	34.26%
Light Engineering	4.99	6.02%
Total Industrial Area	48.42	58.34%
Specialized Infrastructure		
Warehouse	0.94	1.13%
Truck lay bay	1.53	1.84%
Q.A & Q.C lab	1.14	1.37%
R&D facility	1.28	1.54%
Training centre	1.04	1.25%
Total Specialized Infrastructure	5.92	7.14%
Public amenities	1.53	1.85%
Utility	2.01	2.42%
Road	10.83	13.05%
Green & open space	9.75	11.75%
Total processing area	78.47	94.54%
Non-Processing Area		
Entrance plaza	0.62	0.75%
Admin block	0.96	1.16%
Guest house	0.32	0.39%
Investor club	0.45	0.54%
Crèche	0.18	0.21%
Residential	0.55	0.66%
Retail	0.12	0.14%
Place of worship	0.16	0.19%
Road	0.36	0.44%

Land Use Pattern	In Hectare	In%
Green & open space	0.82	0.99%
Total non-processing area	4.53	5.46%
Grand Total	83.0	100.00%

Development of Off-site facilities

The BEZA would undertake the off-site facility developments which are detailed at following table.

Table 15: Details of Off-site facilities

S. No.	Proposed Infrastructure	Details
1	Boundary Wall	A compound wall all along the EZ boundary to a height of 2.1 m above NGL is proposed to be constructed and provided with 0.9 m height barbed wire fencing on top. The total length of the compound wall is estimated to be 4000 m. Area covered by boundary wall will be 400 sq. m.
2	Approach Road	An access road will be constructed to give access to the EZ. Access road of length 350m will be constructed. Access road will have ROW of 15 m. Area covered by approach road will be 5250 sq. m. This access road will pass through port commercial colony and will provide direct access to EZ site from port road through a bridge. 25-30 trees & 8 Households will be affected for construction of the road. U shaped drain will be constructed on both side of the road. Plantation will also be carried out on both side of the road. Space will be left on both side of the road to accommodate telecom cables and street light cable. Alignment of the access road and the bridge is attached as Figure. Cross section of access road & finished road level of access road are given in Figures.
3	Bridge	A bridge of 36 m length will be constructed on Gona river to connect approach road and the EZ site. Area covered by bridge will be 540 sq m. Bridge consists of 3 spans each of 12 m and 4 pillars. Neither of the pillars will be constructed on Gona river. 2 pillars will be towards approach road other 2 towards the project site. 10-15 trees and some weeds are required to be removed for constructing the bridge. Bridge alignment details and cross section are given in Figures.
4	Administration building	Administration building will be constructed within EZ site. Building will have ground coverage of 3600 sq. m and built up area of 1680 sq. m. It will consist of 3 floors (G+2). Site plan of the administration building is given in Figure.

5	Electrical supply system	It is planned to build a new 33 kV dedicated power transmission line from Mongla substation to EZ site for catering to the needs of industries occupying the EZ along with 33/11 KV substation with in EZ. The system parameters are as follows: Transmission line - 33 kV Number of phases - 3 System frequency - 50 Hz Consumer supply voltage 33 kV /11kV/415/240 volt As peak demand may vary for each facility in EZ, a diversity factor, which relates peak demand to rated load demand or calculated demand, is utilized in computation of maximum demand. A simultaneous factor of 40 - 70% is normally considered. Power losses generally occur in the distribution network depending upon the type of conductors and equipment installed. As this is a complete loss to the system, it is generally kept below 10% of the total load. Map showing alignment of power supply line is given in Figure.
6	Water supply system	Water pumping station for potable and non-potable water is required for pumping from the underground storage sump to respective ELSR. It is planned to build three new bore wells cum pumping stations at village Manik Nagar to draw the ground water along with pumping main length of app. 21 km to the proposed EZ. It is also planned to construct an underground service reservoir to store the water within EZ. The water supply scheme including distribution is planned based on the peak flow, minimum residual pressure and pipe material. Map showing alignment of water supply line is given in Figure. Out of three locations, first location is private land and is used for agriculture. This land is required to be purchased and the process of land acquisition is started. Second and third location is khas land (Govt. Land) and is small ponds. Near-by villagers practice aquaculture in these ponds. These ponds are required to be filled for construction of the pump houses. An underground pipeline is to be laid connecting these three pump house and then the EZ site. For laying pipeline, approximately 669 trees (Sirish, Mahagony, Murguka, Palms, Banana and Papaya plantation along the road side) are required to be removed. The pipeline would be laid along the road and within ROW of the existing road.

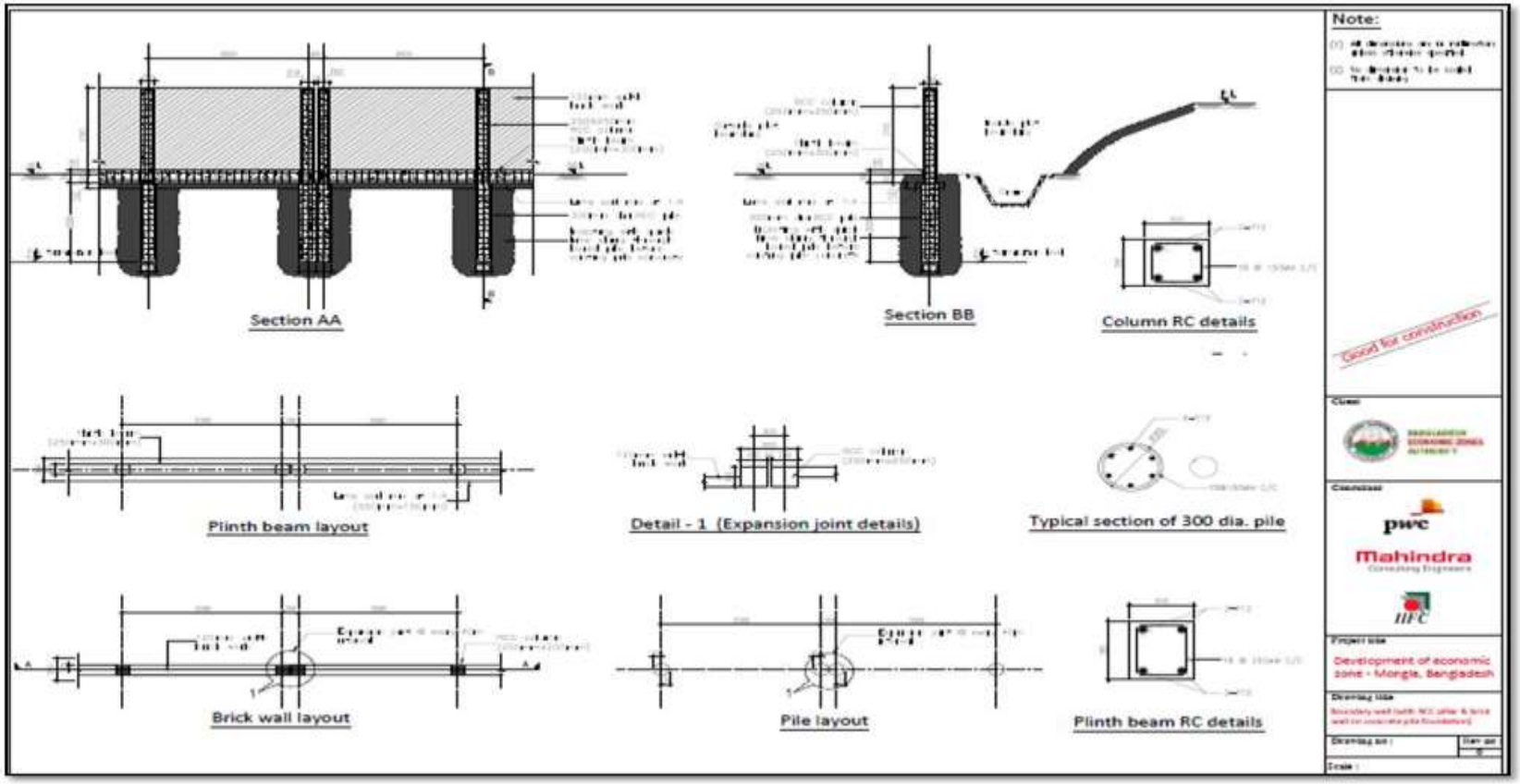


Figure 9: Section of the proposed boundary wall

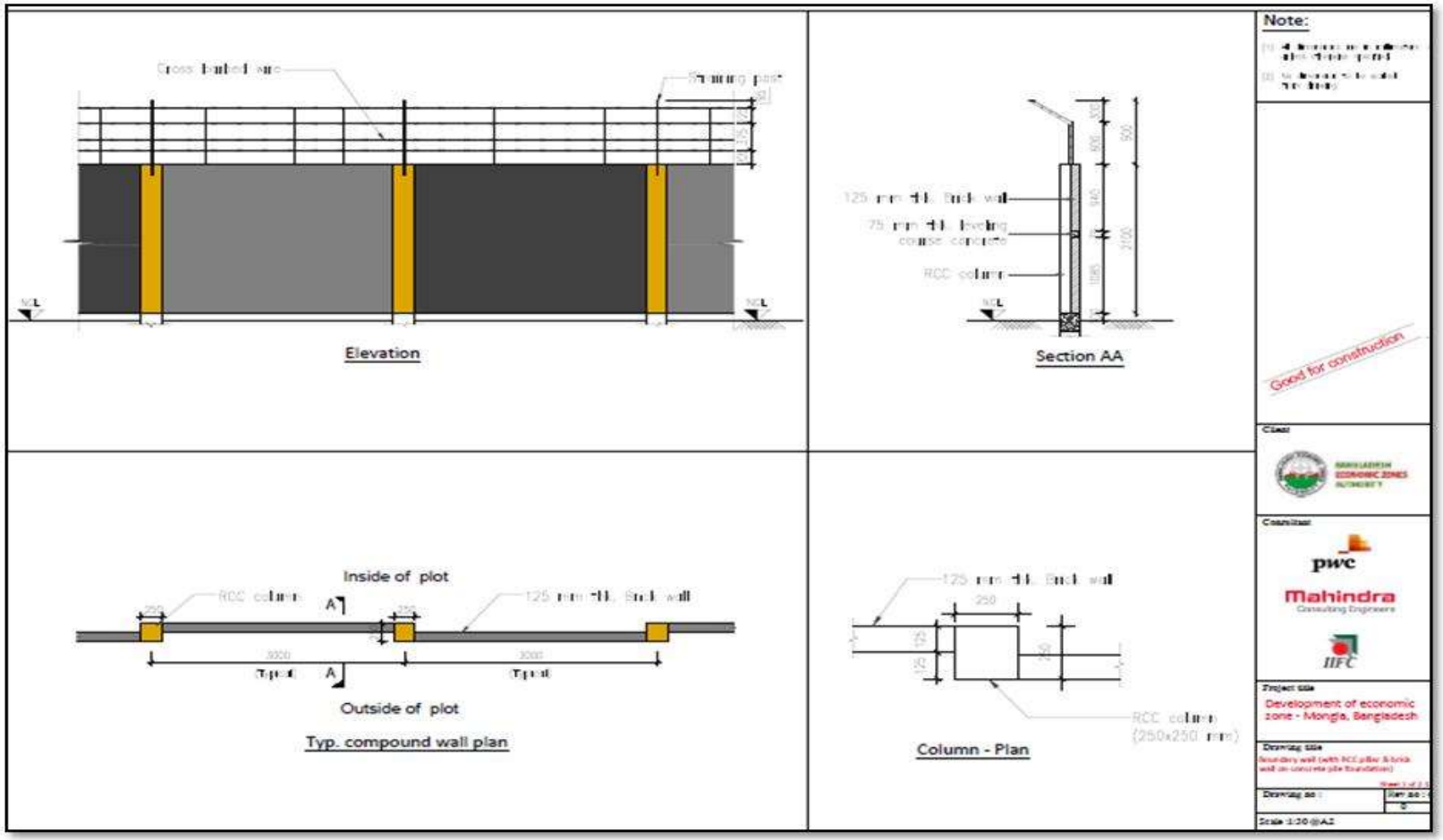


Figure 10: Elevation of the proposed boundary wall

Figure 11: Alignment of access road and bridge

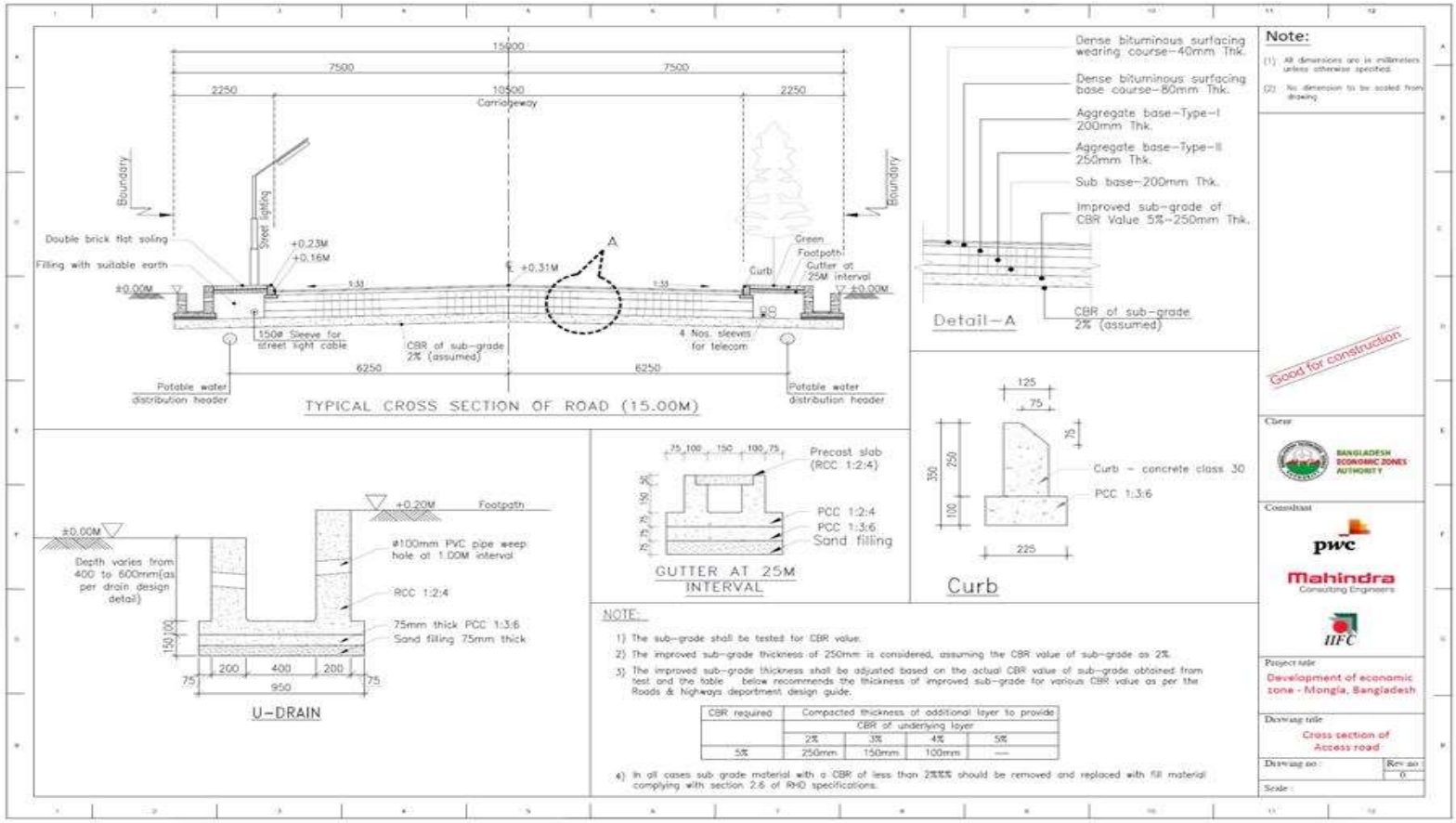


Figure 12: Typical cross-section of the access road

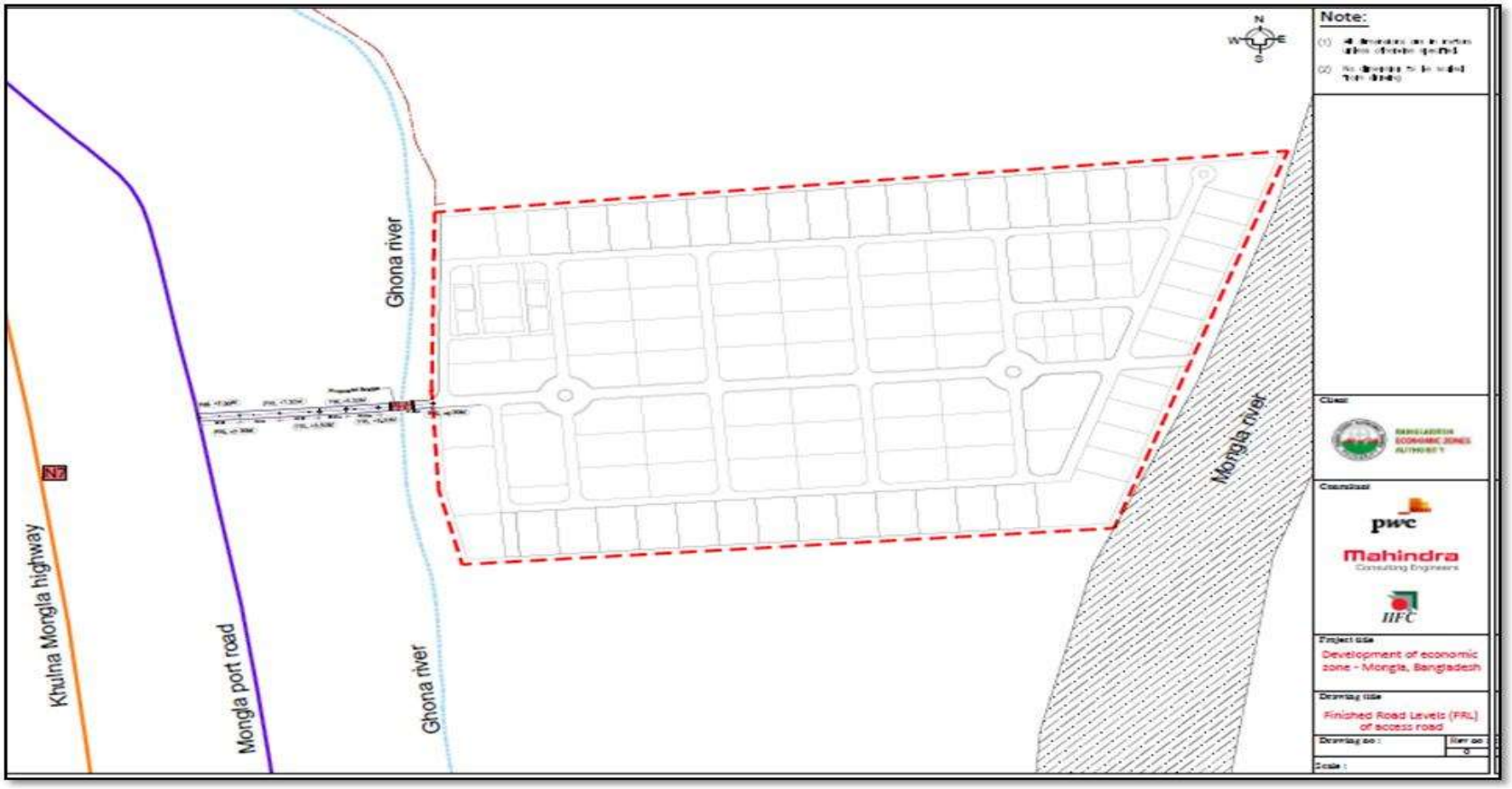


Figure 13: Cross section of finished road level

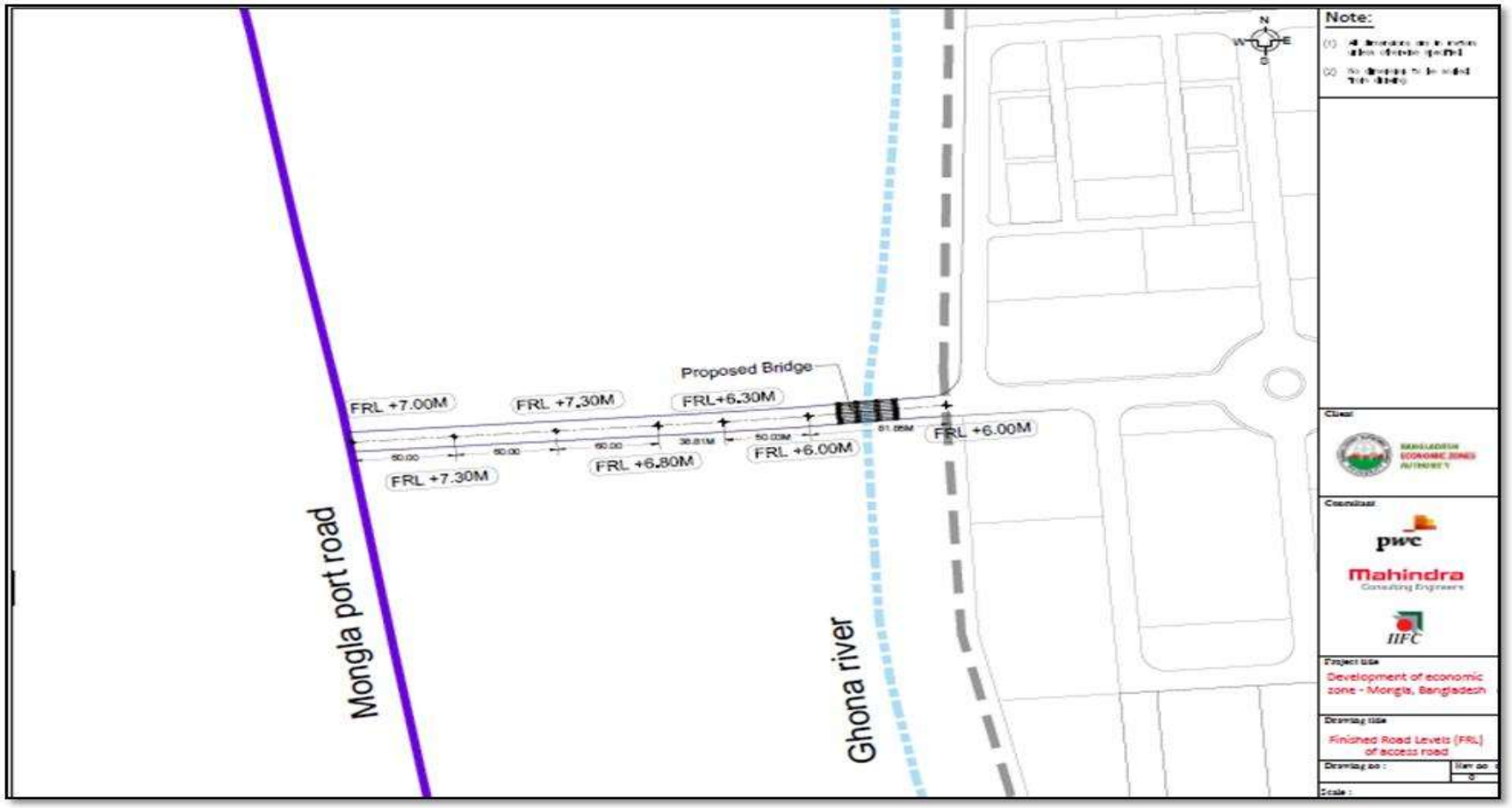


Figure 14: Cross section of finished road level

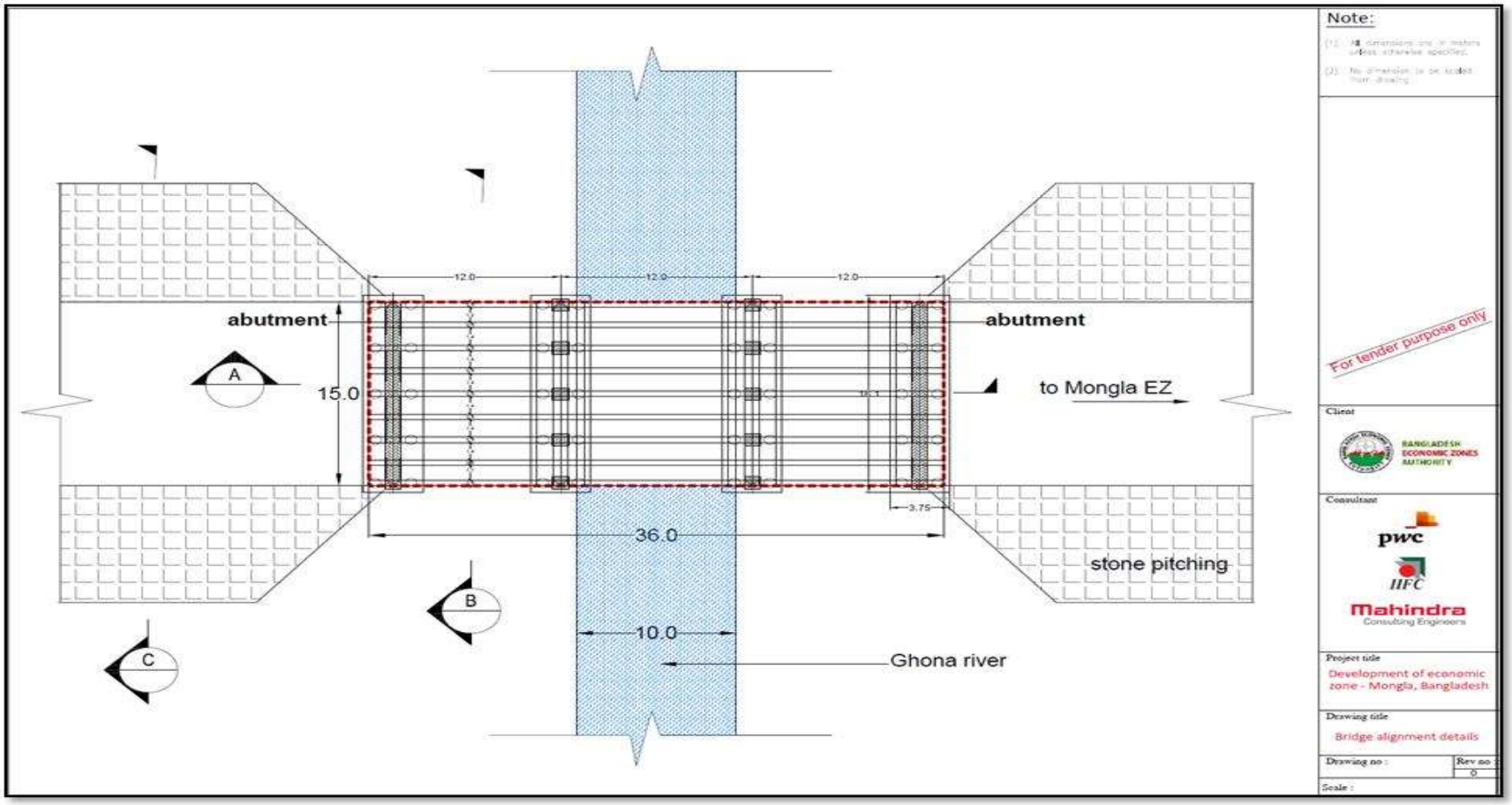


Figure 15: Bridge alignment details

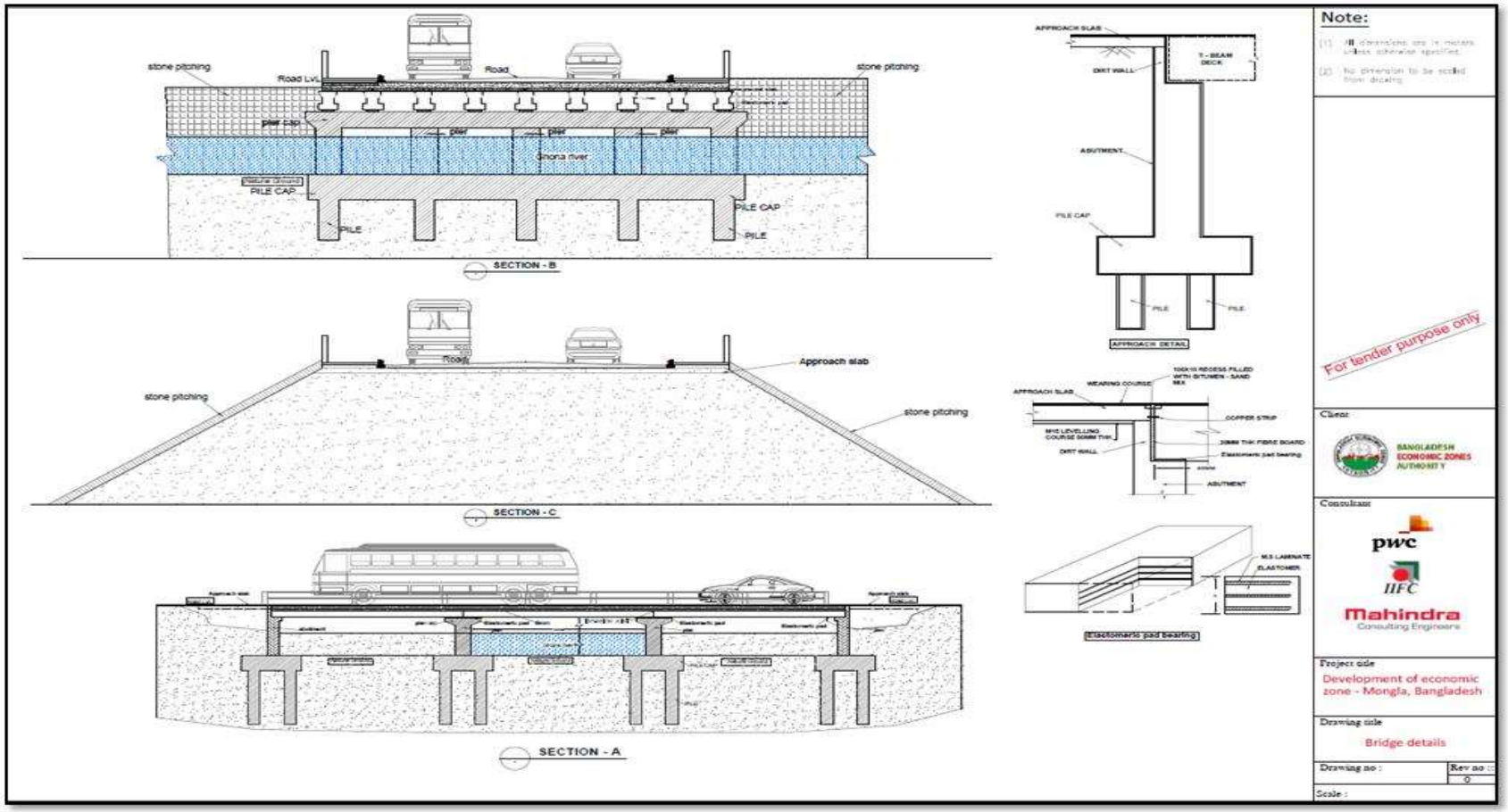


Figure 16: Bridge details

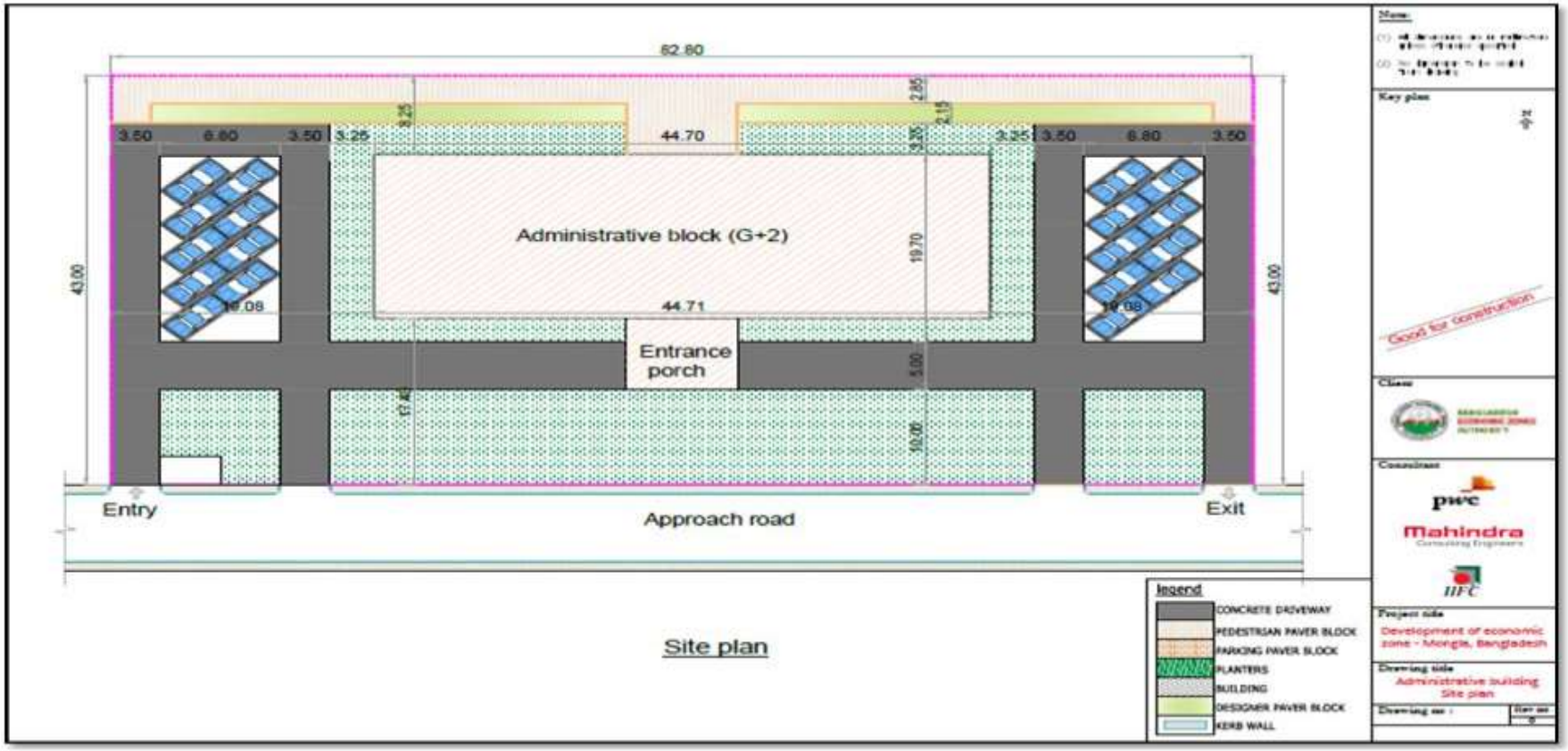


Figure 17: Site plan of administration building

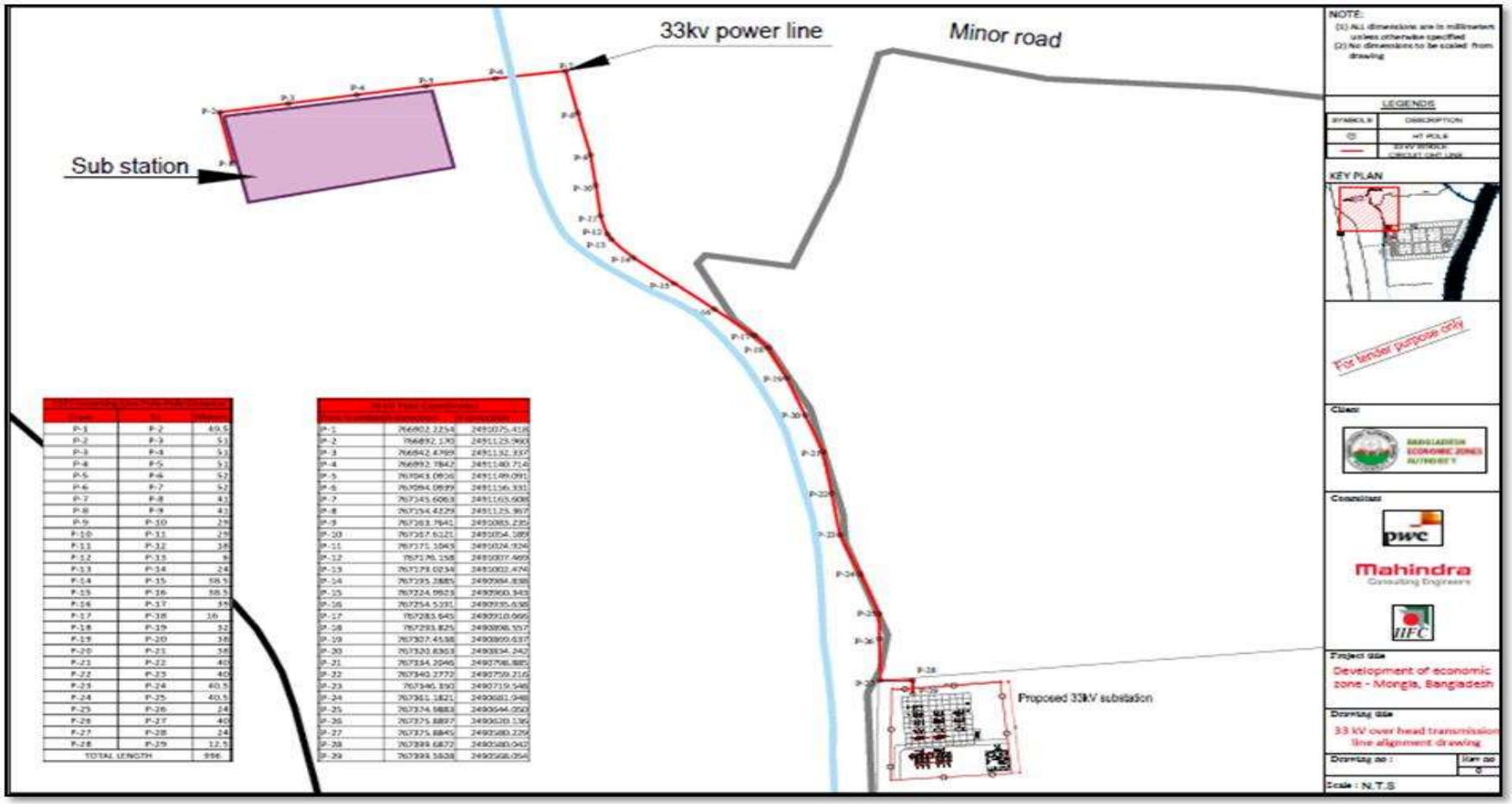


Figure 18: Alignment of Power Supply Line

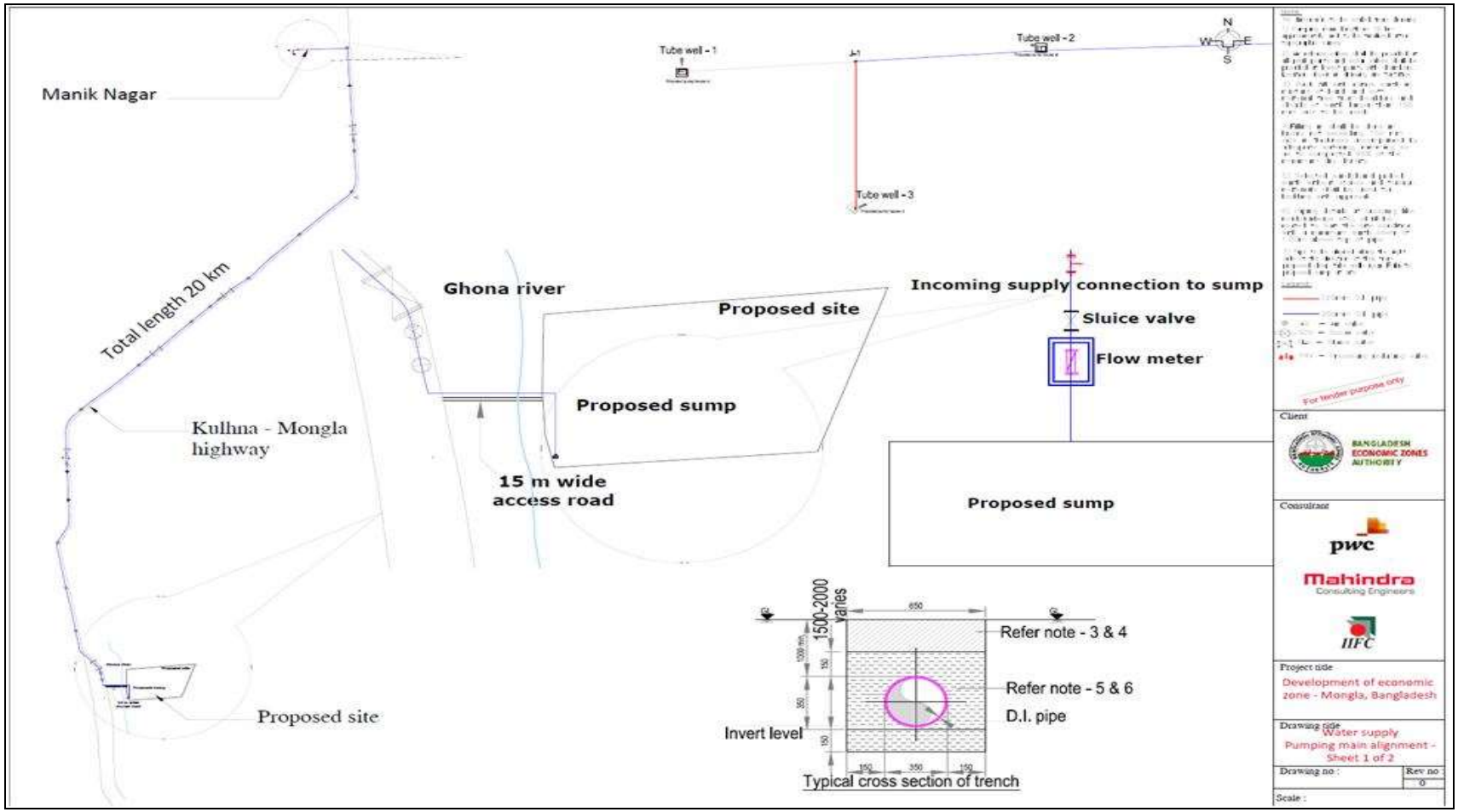


Figure 19: Alignment of Water Supply Line

4.6. Project Schedule

Following table presents the implementation schedule of the off-site infrastructure details at the proposed Mongla EZ site.

Table 16: Implementation Schedule of Off-site Infrastructural Details

S.No	Offsite infrastructure	Duration in months from start
1	Access road	2
2	Bridge	9
3	Boundary wall	6
4	Admin building	12
5	Water supply network	6
6	Power distribution	9

BEZA targets to start the work from May / June 15. The EZ development activities could be undertaken by the prospective developer following the off-site infrastructure development.

4.7. Resources and Utilities Demand

Construction Materials Sourcing

Construction material like steel, cement, concrete, bricks, aggregates etc. will be required for each of the proposed off-site facilities and EZ development. Since the planning has been carried out for offsite development, the detail provided below pertains to off-site facilities. The EZ development requirement though will remain similar in nature but these details for EZ shall be available after the master developer is appointed and his plan is finalized. Raw material requirement for the off-site facilities is given in the following table.

Table 17: Construction Material Requirement for Off-site facilities

S. No.	Material	Quantity
Boundary Wall		
1.	Concrete	535.77 cum
2.	Bricks	7900.2 sq. m
3.	Steel	74865.41 kg
4.	Cement	18377.39 sq. m
5.	Cement Paint	18377 sq. m
6.	Barbed wire	4305.0 sq. m
Access Road		
1.	Sand	1950 cum
2.	Hydrated lime	1312.5 cum
3.	Shoulder filling	506.415 cum
4.	Sub base	735 cum
5.	Aggregate base type II	918.75 cum
6.	Aggregate base type I	735 cum
7.	Bituminous prime coat	3675 sq. m
8.	Bituminous tack coat	7350 cum
9.	Dense bituminous	441 cum
10.	Concrete class 10	15.75 cum
11.	Concrete class 30	21.875 cum
12.	Road marking-thermoplastic material	70 sq. m
Drain of Access Road		
1.	Sand	52.2 cum

S. No.	Material	Quantity
2.	Mass concrete	52.2 cum
3.	RCC	69.55 cum
4.	Concrete	197.32 cum
5.	Steel	18508.7 kg
Administration Building		
1.	Sand	1098 cum
2.	Mass concrete	139.20 cum
3.	Polyethene sheet	84.5 kg
4.	RCC	777.0 cum
5.	Concrete	256 cum
6.	Steel	174674.30 kg
7.	Bricks (1.5 brick thickness)	557.00 cum
8.	Bricks (1 brick)	213 sqm
9.	Cement sand (6 mm thick plaster)	2514 sqm
10.	Cement sand (12 mm thick plaster)	4092.00 sqm
11.	Cement sand (12 mm thick plaster)	1178.00 sqm
12.	Plastic emulsion paint	6606.0 sqm
13.	Weather Coat Paint	589 sqm
14.	Textured Paint	589 sq. m
15.	Paint for door & windows	165.50 sqm
16.	Polish for door & windows	156.00 sqm
Bridge		
1.	Sand	14.0 sqm
2.	Mass concrete	38.0 cum
3.	RCC	642.0 cum
4.	Concrete	405 cum
5.	Concrete	135cum
6.	Brick work (i brick width)	18 cum
7.	Cement sand (12mm thick)	144 sqm

These materials are available locally or from the nearby area.

Water

Water requirement during construction phase is estimated to be app. 50 KLD, which includes Domestic water requirement of construction workers. For storing rain water, temporary rain water harvesting ponds can be constructed at the site. Water for construction shall be sourced from rain water harvesting ponds, EPZ supply or Mongla Port Authority water supply. The total water requirement for operational phase is estimated at about 3.5 MLD. (Refer Table 18 for demand estimation). The water requirement for operation phase will be sourced from Manik Nagar through underground pipeline. The details about this pipeline already included under the off-site facilities above.

Table 18: Estimated Water Demand

Processing area							**In Cum/day**					
1	Food processing	31.77	1.00	800	1729	70.00	900.44	77.81	97.82	1076.07	1037.55	38.51
2	Shipyard	5.28	1.00	800	287	36.00	76.88	12.92	8.98	98.78	92.38	6.39
3	Apparel /RMG	70.27	1.00	800	3825	36.00	1024.21	172.13	119.63	1315.96	1230.76	85.20
4	Light engineering	12.34	1.00	800	672	36.00	179.84	30.24	21.01	231.08	216.12	14.97
5	Warehouse	2.32	1.00	800	126	36.00	83.41	5.67	8.91	97.99	95.18	2.81
6	Truck lay bay	3.78	1.00	800	206	36.00	55.13	9.27	6.44	70.83	66.25	4.59
7	Q.A & Q.C lab	2.82	1.00	800	153	36.00	41.07	6.89	4.80	52.75	49.34	3.41
8	R&D facility	3.15	1.00	800	172	36.00	45.96	7.74	5.37	59.07	55.24	3.83
9	Training center	2.57	1.00	800	140	45.00		6.30	0.63	6.93	3.81	3.12
10	Public amenities	3.79	1.00			36.00		55.19	5.52	60.71	33.39	27.32
11	Utility	4.96	1.00		40.00	45.00		1.80	0.18	1.98	1.09	0.89
12	Road	26.77	1.00			1.80		19.51	1.95	21.46		21.46
13	Green & open space	24.10	1.00			1.80		17.56	1.76	19.32		19.32
	Total processing area	**193.91**			**7350.00**		**2406.92**	**423.01**	**282.99**	**3112.92**	**2881.11**	**231.82**

	Non processing area											
14	Commercial	4.19	2.00	150.00	3009	15.00		45.14	4.51	49.65	27.31	22.34
15	Residential	3.26	1.50	200.00	1751	135.00		236.39	23.64	260.02	182.02	78.01
16	Polyclinic	0.00	1.00	1000.00	0	340.00		0.00	0.00	0.00	0.00	0.00
17	School	0.44			476	45.00		21.42	2.14	23.56	12.96	10.60
18	Places of worship	0.39			476	45.00		21.42	2.14	23.56	12.96	10.60
19	Utilities	0.00				45.00		0.00	0.00	0.00	0.00	0.00
20	Road	0.89				1.80		0.65	0.07	0.72		0.72
21	Greenery and open space	2.02				1.80		1.48	0.15	1.62		1.62
	Total non-processing area	11.19			5712.00		0.00	326.49	32.65	359.14	235.24	123.89
	Total	**205.10**			13062.00		**2406.92**	**749.49**	**315.64**	**3472.06**	**3116.35**	**355.71**

Power Requirement

Power demand during construction phase is insignificant. Power required during operation phase is estimated to be 19.8 MVA. Source of power will be PGCL substation located at Mongla at about 1 km distance from EZ site in NW direction. A substation of capacity 33/11 KV is proposed at the EZ site for power distribution within the EZ site during operation phase. Power demand calculation is given in table below.

Table 19: Power Demand Estimation

Processing area								
Industrial area								
Food processing	12.86			300.00	50%	70%	1.10	4009.90
Shipyard	2.14			300.00	50%	70%	1.10	665.74
Apparel /RMG	28.45			250.00	50%	70%	1.10	7773.44
Light engineering	5.00			350.00	50%	70%	1.10	1749.57
Warehouse	2.32			239.20	40%	50%	1.10	454.44
Truck laybay	1.53			239.20	30%	50%	1.10	275.62
Q.A & Q.C lab	1.14			239.20	40%	50%	1.10	223.76
R&D facility	1.28			239.20	50%	50%	1.10	271.01
Training center	1.04			239.20	40%	50%	1.10	54.68
Public amenities	1.53			478.40	30%	50%	1.10	121.01
Utility	2.01			478.40	20%	40%	1.10	84.50
Road	10.84			239.20	10%	40%	1.10	114.06
Green & open space	9.76			119.60	10%	40%	1.10	51.34
Total processing area	78.50							15.85
Non processing area								0.00
Commercial	1.70	2.00	3396 4.79	0.18	60%	70%	1.10	2815.10
Residential	1.32	1.50	19768 .11	0.14	60%	60%	1.10	1123.50
Polyclinic	0.00	1.00	0.00	0.14	40%	40%	1.10	0.00
School	0.18		0.00	179.40	30%	40%	1.10	4.20
Places of worship	0.16			119.60	30%	40%	1.10	2.47
Utilities	0.00			478.40	20%	40%	1.10	0.00
Road	0.36			239.20	10%	40%	1.10	3.81
Greenery and open space	0.82			119.60	10%	40%	1.10	4.31
Total non-processing area	4.53							3.95
Total	83.04							19.80

4.8. Map and Survey Information

Project Location

The upcoming Mongla EZ is proposed to be located adjacent to existing Mongla EPZ at Kamardanga Mouza in Mongla Upzila, Bagerhat district, Kulna Division, Bangladesh. Mongla upzila map showing location of the proposed project site is shown. The project surrounding is also shown.

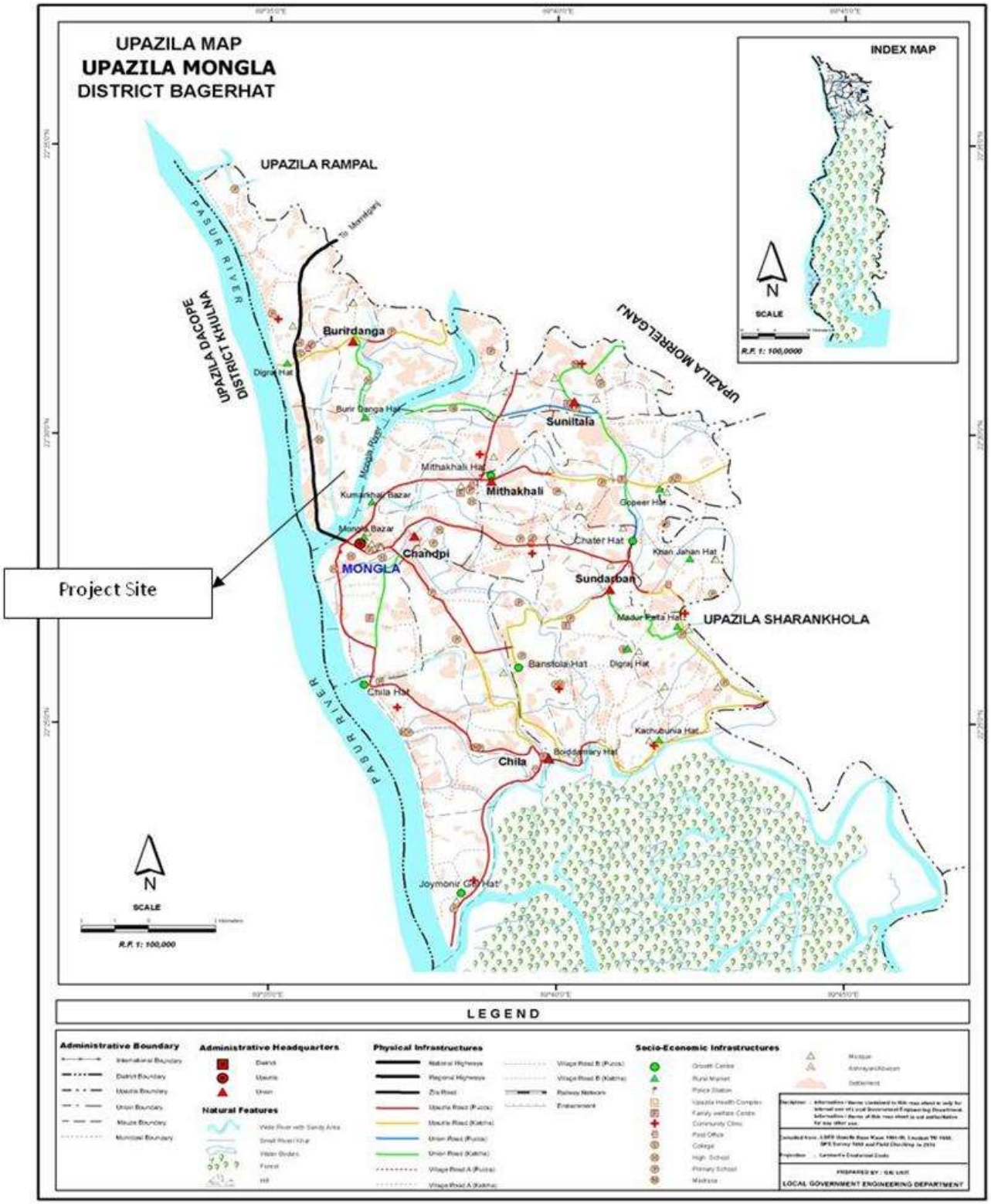


Figure 20: EZ location on Mongla Upzila Map

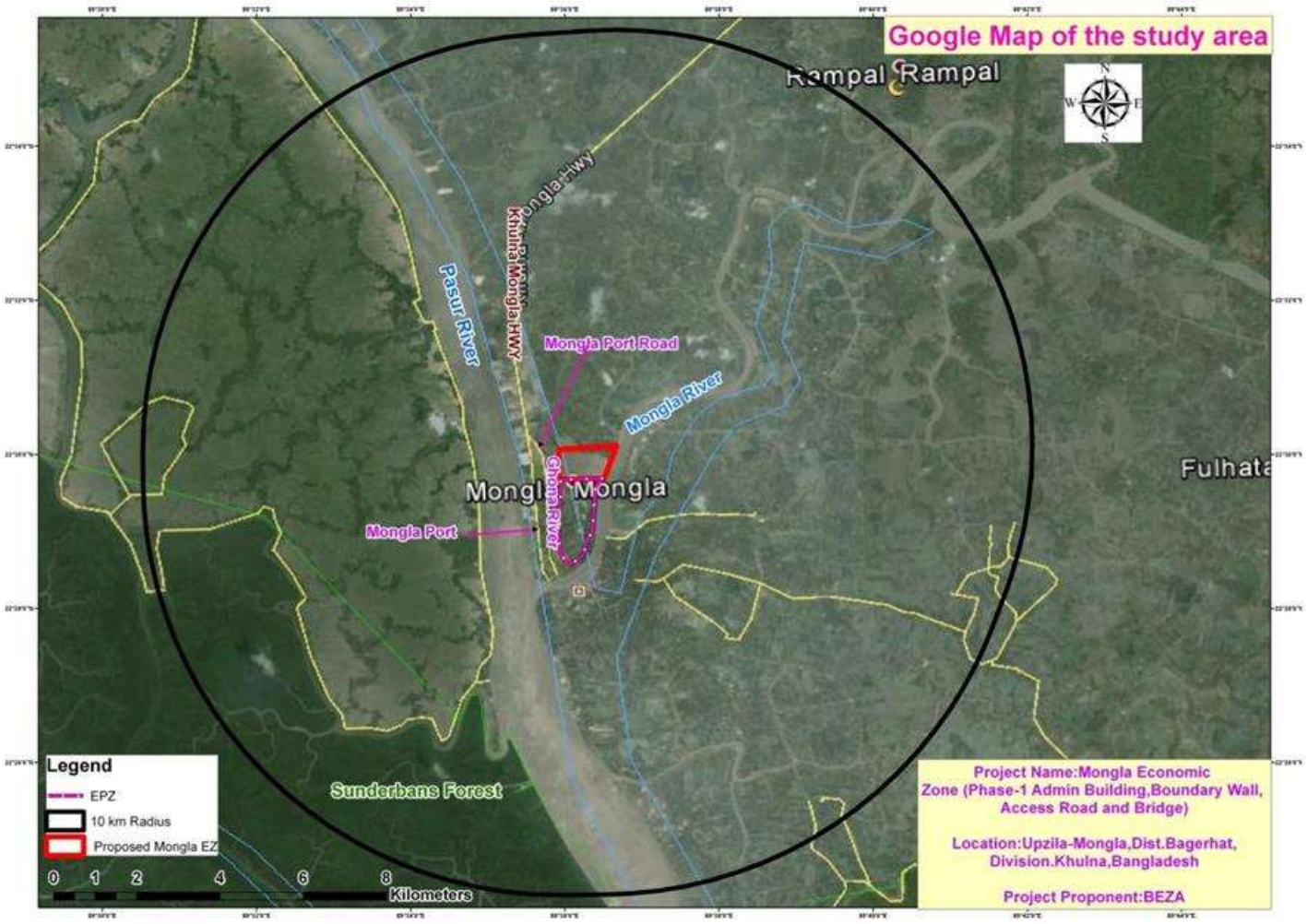


Figure 21: Project site and surroundings within 10 km radius

Topography of the Project Site

The proposed project site is generally flat and poorly drained. The proposed project site is filled to the level of 6 ft. (1.8 m) w.r.t surrounding area by Mongla Port Authority by dredged sand from Pasur river (to make Pasur river navigable) raising the ground level of the site. Finished level of site will be app. 6 m above mean sea level after development of EZ. Ground level of EZ site will be 1.5-2.0 m above average HFL of Pasur River (4.45 m).

Contour map of the project site and area under 10 km radius is given in Figure below. Elevation of the site at present varies from 3-6 m above the mean sea level. The elevation within the 10 km radius area varies from 1 m to 11 m.

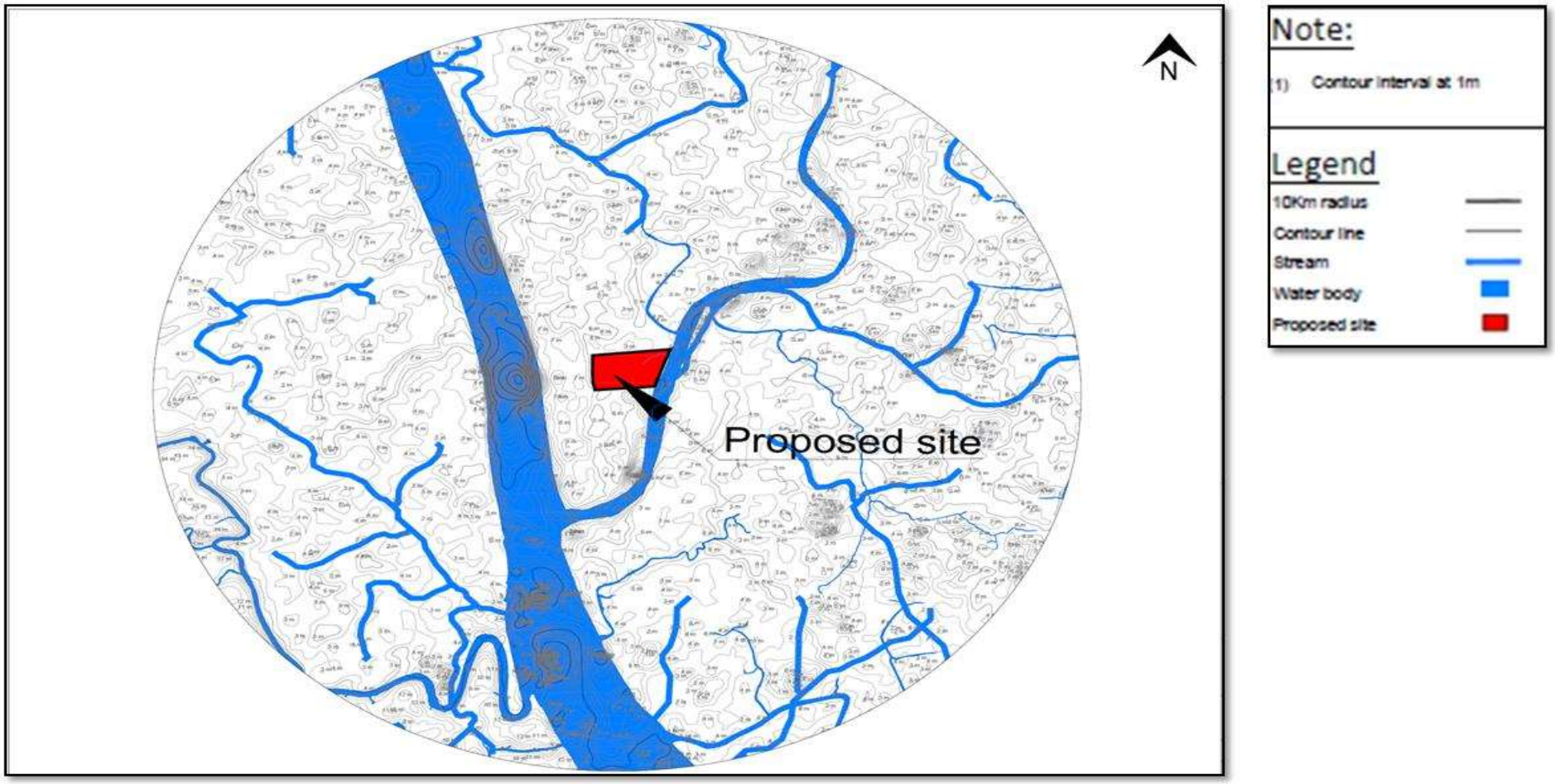


Figure 22: Contour Map of the Proposed EZ

Figure 23: Topography of the Site

Eco Sensitivity

Sundarban reserve forest is mangrove forest located at about 5.0 km distance in SW direction from proposed project site.

As per Ref No. pa ba ma/4/7/89/99/263 in 1993 under ECA, 1995, 10 kms radius area around Sundarbans RF is declared under ecological critical area for the purpose of protection of protection of Sundarbans forest.

The Mongla EZ site is at 5 kms distance from Sundarbans forest and thus falls in the ecological critical area.

As indicated in previous section proposed EZ is located next to already permitted EPZ and is with the provision and operation of non-polluting industry. There are existing industrial developments & habitat area between EZ site and Sundarban forest. BEPZA industrial area is next to proposed EZ site and other industries including polluting industries including cement & petroleum industry which are considered to be highly polluting in nature.

The proposed EZ project is unlikely to cause any impact on Sundarbans. The provision has been made for treatment of any sewage/process effluent by every industry. All requisite control for any air pollution also suggested considering the nature of industry and environment protection measures are proposed in following sections. Thus no significant impact on Sundarbans is anticipated due to proposed EZ. Also the developer will comply with the additional measures proposed by DoE for environment protection while development and operation of EZ.

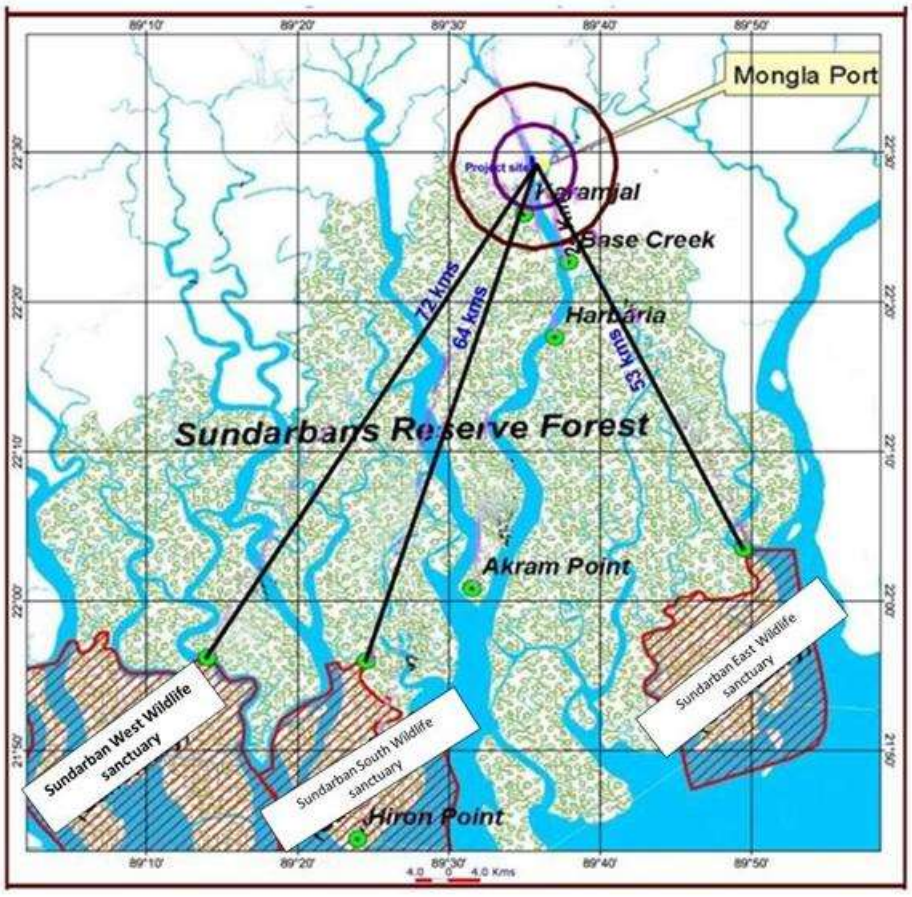


Figure 24: Location of Reserve Forest and Wildlife sanctuaries w.r.t EZ site

Figure 25: Photographs of Sundarbans Forest

Geology

The area is covered by paludal deposit comprised by Holocene River alluvium, meander, inter-stream and swamp deposit with 16,000 m thick alluvium, meander, inter-stream and swamp deposit with 16,000 m thick sequence of quaternary sediments (Alam et al., 1990 and USGS-Bangladesh Gas Assessment Team, 2001). Geological map of the Bangladesh is given in Figure below.

Lithology shows that the area comprises of clay on the upper part and sand in the deep. The upper surface layer consists of clay, the intermediate layer of mainly fine sand.

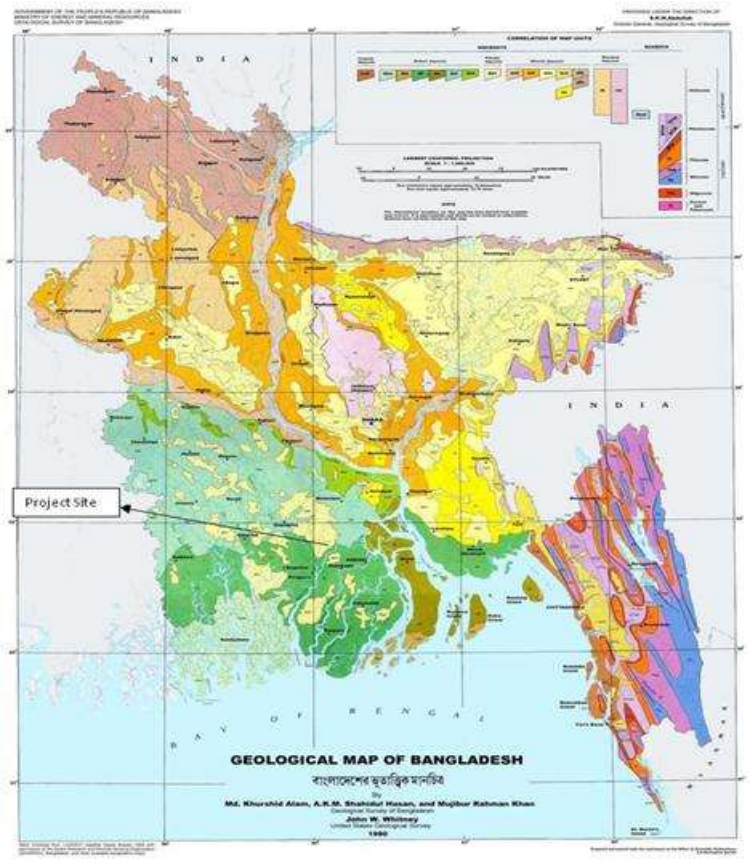


Figure 26: Geological Map of Bangladesh

4.9. Transportation Options for the EZ

The EZ has options of road, rail, air and water ways transportation. Road and water ways are located next to the EZ. However rail and air transportation options are available at distance. The details of

available options are given in the following section. Current traffic and estimated traffic generation from EZ is also given in this section.

Road Transportation System and Traffic Assessment

Site surroundings has well developed road network. Map showing the connectivity of the site through roads with major towns is given in given in Figure.

Traffic Survey and Estimated Traffic from EZ

A traffic survey has been carried out by CEGIS at Kulna Mongla Expressway near Babu Bazar & Bagha Bazar which is app. 6.5 km & 12.0 km in North direction respectively from Mongla Economic zone site. Traffic survey data in PCU is given in table below.

Table 20: Traffic on Kulna Mongla Expressway at Babu Bazar and Bagha Bazar

Location	8.30 AM to 9.30 AM		12.30 PM to 1.30 PM		4.30 PM to 5.30 PM	
	April, 2014	June, 2014	April, 2014	June, 2014	April, 2014	June, 2014
Babu Bazar	30	13	23	21	24	25
Bagha Bazar	330	299	376	429	389	493

Source: CEGIS

Estimation of the traffic to be generated from EZ site at Mongla has been made. It is estimated approx. 4304 PCU will be generated from the EZ site after development. PCU calculations for the project are given in table below.

Rail & Air Transportation System for Project Site

Nearest airport is Jessore airport at distance of 105 km in NNW direction from site. An unfinished Rampal airport is at 22 km from site in NNE direction. Nearest Railway station is Kulna Railway station which is at distance of 38 km in North direction from site. A railway line is also under proposal of Govt. of Bangladesh to connect Kulna, Mongla Port, existing EPZ and upcoming Economic zone.

Water Transportation System

Inland water transportation system is well developed. Both Pasur and Mongla River are navigable. Pasur River is main water communication system in the area. Mongla port falls within the study area. The river is very deep (8-11m) and navigable throughout the year and large marine ships can easily enter the Mongla seaport through from Akram point. Pasur is an important river route through which Kulna-Barisal steamboats and other vessels ply. Few local boat points exist in Mongla, Dighraj, Biddarbaon and Kaigar Dashkati in the nearby areas.

Figure 27: Connectivity of the site with major towns and cities via roads

Table 21: Estimated Traffic Generation from EZ, Mongla Site

Description	Total Area		Total population for demand calculation	Type	Buses							Goods Vehicles				Slow Moving Vehicles			Total No. of Vehicles	Total PCUs / day	ratio of the 30th highest hourly traffic volume over one	ratio of heavy directional- peak hour (30th highest)	planning peak hour traffic volume (pcu/hour)	No. of lanes in one direction
	in Acres	in %			Standard bus	Other Bus	Mini Bus	Van	cars	Two wheeler	Auto rickshaw	Truck	MAV	LCV	Tractor	Cycles	Cart	Cycle Rickshaw						
CATEGORY A				PCU Value	3	3	1.5	1	1	0.5	1	3	4.5	1.5	4.5	0.5	8	2			0.1	0.6		
A. Industries				No. of Passenger	50	35	20	14	4	2	3	1	1	1	1	1	3	2						
					20.00%	5.00%	15.00%	5.00%	35.00%	5.00%	8.00%	40.00%	30.00%	10.00%	10.00%	3.00%		4.00%						
Food processing	37.05	24%	4033		16	6	30	14	353	101	108	7.41	5.56	1.85	1.85	121	0	81	846.67	917.35			55.04	0.03
					35.00%	5.00%	15.00%	5.00%	20.00%	5.00%	8.00%	40.00%	30.00%	10.00%	10.00%	3.00%		4.00%						
Apparel / RMG	70.27	46.43%	7,650.00		54	11	57	27	383	191	204	14.05	10.54	3.51	3.51	230	0	153	1341.62	1521.68			91.30	0.05
					20.00%	5.00%	15.00%	5.00%	35.00%	5.00%	8.00%	40.00%	30.00%	10.00%	10.00%	3.00%		4.00%						
Light engineering	12.34	8.15%	1,343.00		5	2	10	5	118	34	36	2.47	1.85	0.62	0.62	40	0	27	282.55	305.44			18.33	0.01
					28.00%	5.00%	15.00%	5.00%	20.00%	10.00%	8.00%					5.00%		4.00%						
Warehouse	2.32	1.53%	10.00		0	0	0	0	1	1	0	0.00	0.00	0.00	0.00	1	0	0	3.00	2.00			0.12	0.00
					28.00%	5.00%	25.00%	5.00%	20.00%	10.00%		70%	10%	10%	10.00%	3.00%		4.00%						
Truck laybay	3.78	2.50%	206.00		1	0	3	1	10	10	0	1.32	0.19	0.19	0.19	6	0	4	36.89	40.45			2.43	0.00
					20.00%	5.00%	25.00%	5.00%	30.00%	10.00%		10%	50%	30%	10.00%	2.00%		3.00%						
QA & QC lab	2.82	0.02	1,842.00		7	3	23	7	138	92	0	0.14	0.71	0.42	0.14	37	0	28	336.41	334.86			20.09	0.01
					22.00%		15.00%		35.00%	20.00%			80%	20%		4.00%		4.00%						
R & D facility	3.15	0.02	1,372.00		6	0	10	0	120	137	0	0.00	1.26	0.32	0.00	55	0	27	356.58	309.14			18.55	0.01
					30.00%	5.00%	20.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Training center	2.57	0.02	420.00		3	1	4	3	21	21	0	0.00	1.25	0.00	0.00	8	0	6	68.29	74.28			4.46	0.00
					30.00%	5.00%	20.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Public amenities	3.79	0.03	619.00		4	1	6	4	31	31	0	0.00	1.90	0.00	0.00	12	0	9	99.90	107.03			6.42	0.00
					30.00%	5.00%	20.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Utility	4.96	0.03	540.00		3	1	5	4	27	27	0	0.00	2.48	0.00	0.00	11	0	8	88.48	96.66			5.80	0.00
Total Category A	143.05	94.53%	21249.00																					
Category B																								
					20.00%	5.00%	30.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Commercial	4.19	2.77%	1,825.00		7	3	27	13	91	91	0	0.00	2.10	0.00	0.00	37	0	27	298.10	301.93			18.12	0.01
					20.00%	5.00%	30.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Residential	3.26	0.02	1,420.00		6	2	21	10	71	71	0	0.00	1.63	0.00	0.00	28	0	21	231.63	235.34			14.12	0.01
					22.00%		15.00%		35.00%	20.00%			80%	20%		4.00%		4.00%						
School	0.44	0.00	192.00		1	0	1	0	17	19	0	0.00	0.18	0.04	0.00	8	0	4	50.22	43.86			2.63	0.00
					35.00%		30.00%		20.00%	10.00%			100%			2.00%		3.00%						
place of worship	0.39	0.00	85.00		1	0	1	0	4	4	0	0.00	0.20	0.00	0.00	1	0	1	13.20	14.38			0.86	0.00
					20.00%	5.00%	30.00%	10.00%	20.00%	10.00%			100%			2.00%		3.00%						
Total category B	8.28	5.47%	3522.00																					
GRAND TOTAL	151.33	100.00%	24771.00		114.00	30.00	198.00	88.00	1,385.00	830.00	348.00	25.40	29.86	6.95	6.31	596.00	-	396.00	4053.52	4304.39			258.26358	0.14348

4.10. Cost of the Project

The indicative preliminary cost for development of economic zone is 1911.6 million BDT. The total estimated cost of the proposed off-site facilities is about 4932 lakh taka that includes the construction cost of access road, bridge, boundary wall, administration building, external water supply system, external power supply system and land development. Details of cost of each component are given in table below. The cost of EZ development would be estimated by prospective developer on a later stage.

Table 22: Cost of the Development of Proposed Off-site Facilities

S. No.	Description of work	Amount in Lakh Taka
1	Access Road	309
2	Bridge	463
3	Boundary Wall	380
4	Administration Building	558
5	External Water Supply System	1922
6	External Power Supply System	800
7	Land Development	500
Total		**4932**

5. Description of Environment (Environment and Social Baseline)

5.1. Prelude

The environmental status around the proposed project site is analysed for valued environmental components viz., air, water, land, noise, soil, and ecology and socio-economic in a 10 km radial radius around the site. The baseline provides the basis for assessment of impact (likely changes in the baseline conditions) due to the proposed interventions (EZ development project).

5.2. Site Description and Its Environs

The site and surrounding details have already been presented under chapter 4. The study area considered as 10 KM radius around the EZ site. The project activity areas are considered as core area and remaining study area as buffer zone. Environment setting of 10 km radius area around EZ site is given in fugure below. Map showing environmental profile of area within 100 m of water supply and electrical alignment is given in figures below

Table 23: Environmental Setting

Location	Port Road (350 m, West) Kulna Dhaka Highway (600 m ,West) Latitude: 22° 29.838' N Longitude: 89° 36.246' E
Site Elevation	Mainly flat with elevation of 3-6 m amsl
Nearest Airport	Jessore (105 km, NNW)
Nearest Railway Station	Kulna Railway Station (38 km, North)
Nearest Port	Mongla Port (780 m, SW)
Climatic conditions	Avg. wind speed– 1.7 m/s Monthly Min. Temp. – 12.2°C Monthly Max. Temp. – 36.5°C Annual Avg. Rainfall – 1947 mm Monthly Average Humidity – 70-90%
Seismic Zone	Zone I
Forests / National Parks	Sundarban Reserve Forest (5.0 km, SW)
Archaeologically important places/monuments	None within 5 km zone

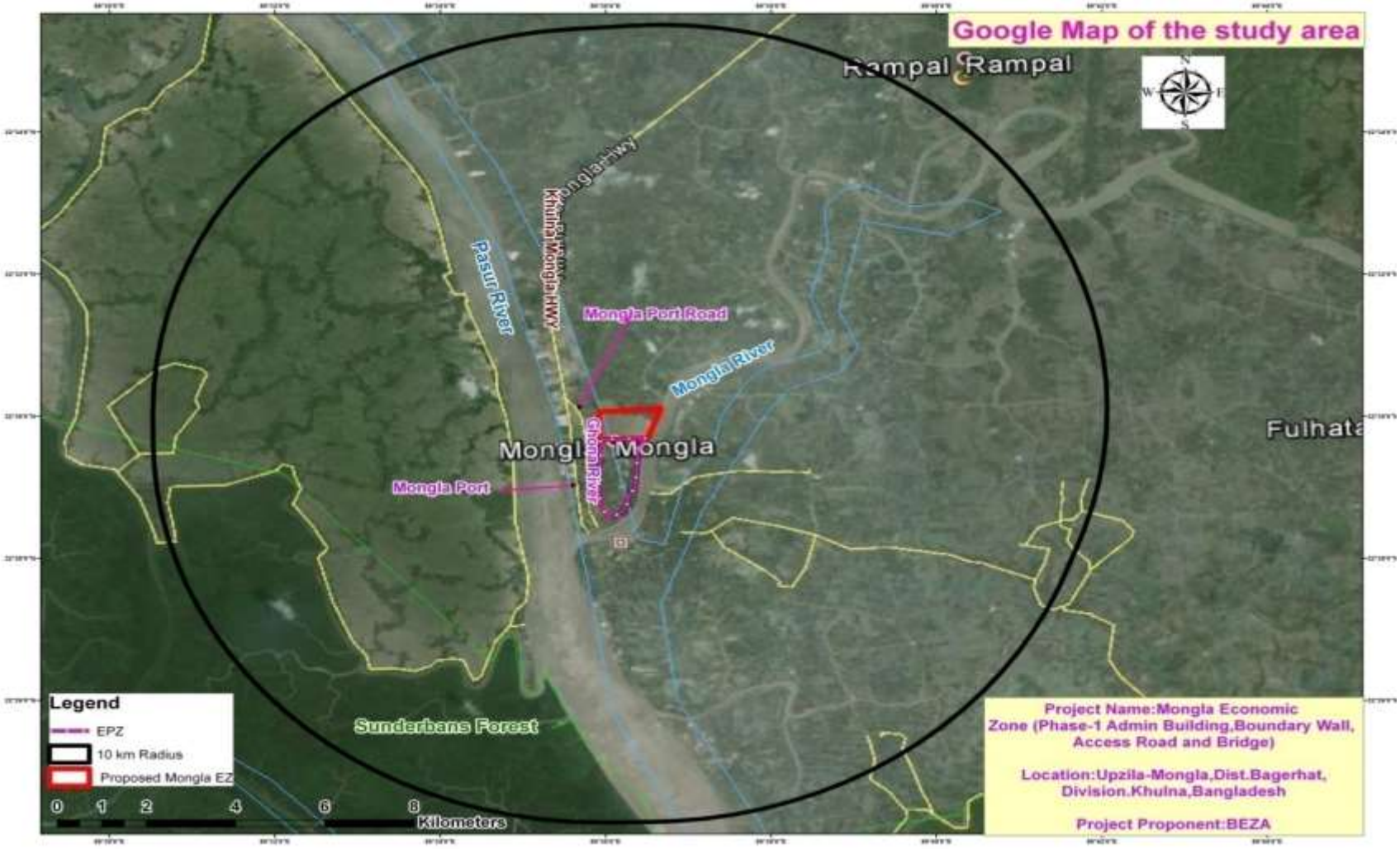


Figure 28: Map Showing Environmental Settings within 10 km Radius of Project Site

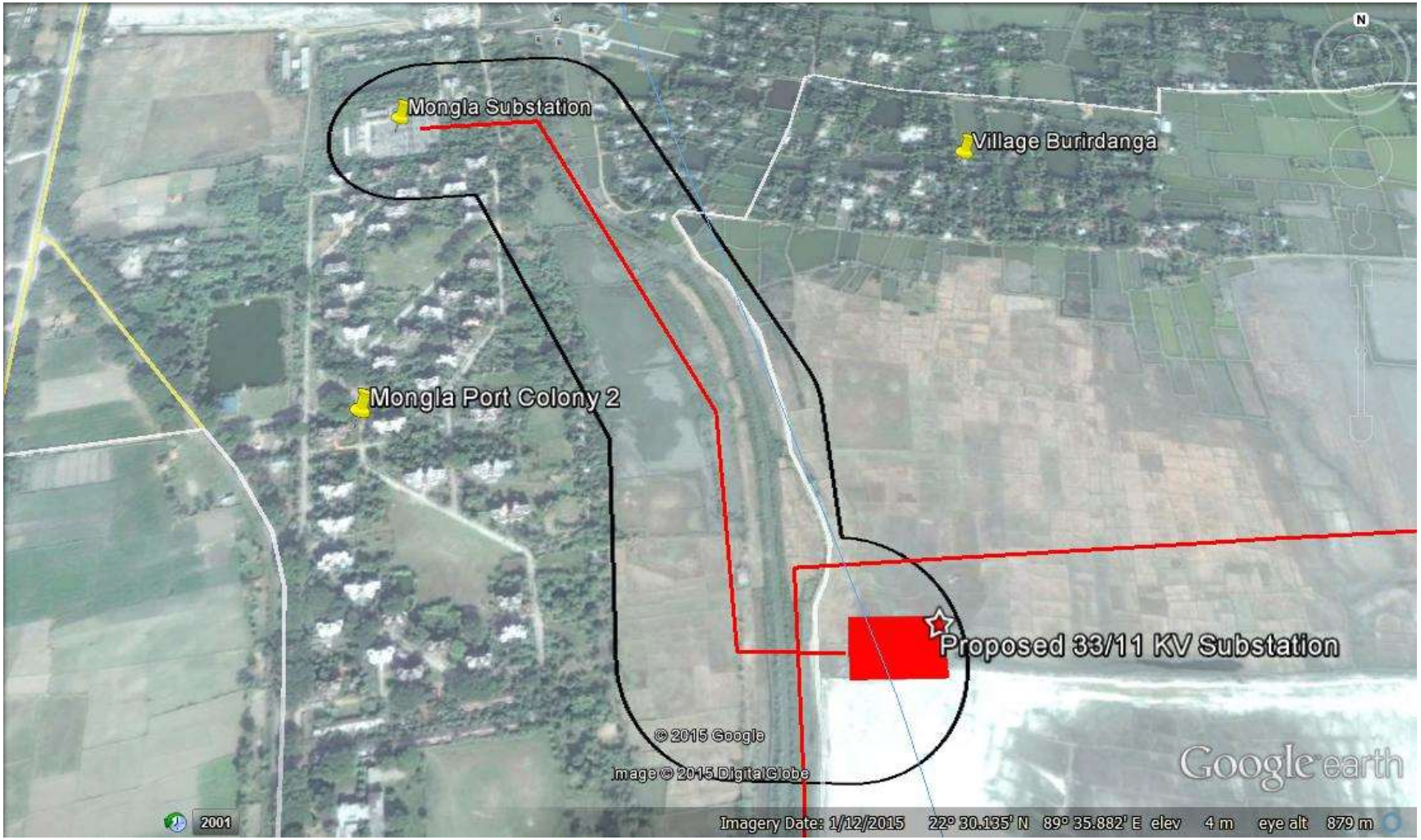
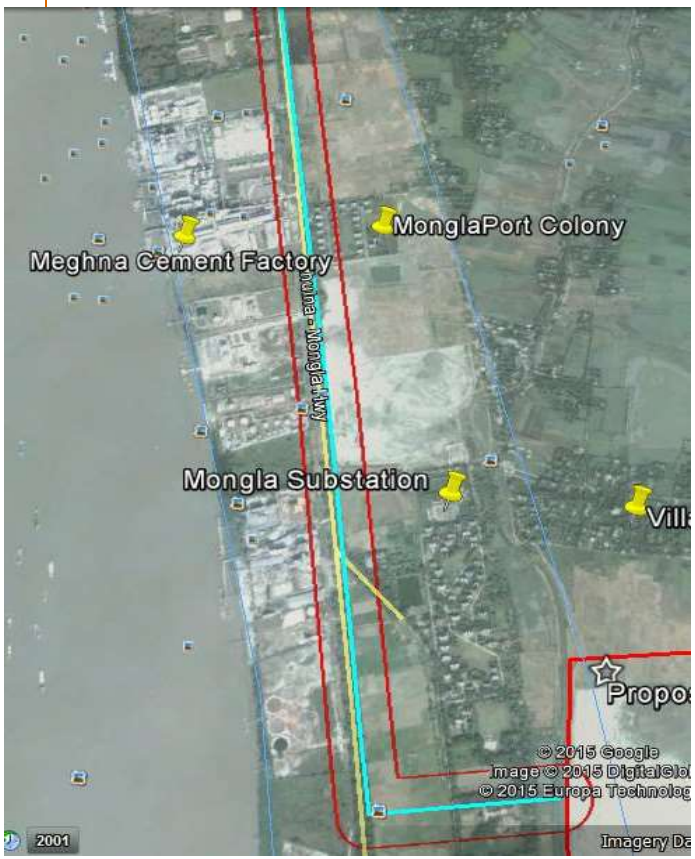
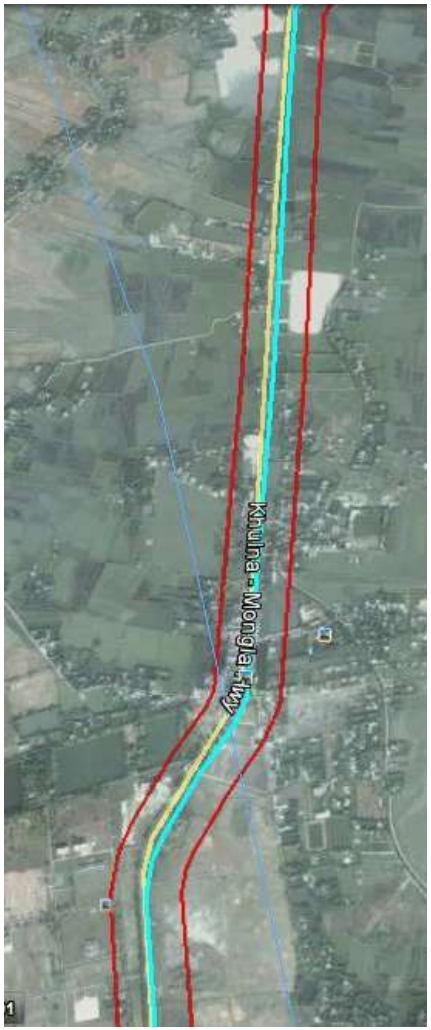


Figure 29: Environmental Profile Map Showing Environmental Settings within 100 m of Electrical Alignment


Meghna Cement Factory
MonglaPort Colony
Mongla Substation
Kulna - Mongla Hwy
© 2015 Google
© 2015 Europa Technolog
2001


Kulna - Mongla Hwy


Kulna Mongla Highway
Kulna Mongla Highway

Figure 30: Environmental Profile Map Showing Environmental Settings within 100 m of Water Supply Line Alignment

5.3. Baseline Data Collection and Monitoring Stations

The present EIA Report has been prepared based on the Primary field investigations / assessment, and secondary data from data collected from Department of Public Health and Engineering (DPHE), Mongla Port Authority, BEPZA, DoEB and published journals, and books, public consultation and site observations. Data on noise levels, air quality, water quality and soil quality is available for the area from the reports of Mongla Port Authority & CEGIS. Locations of the monitoring stations is given in the Figure below

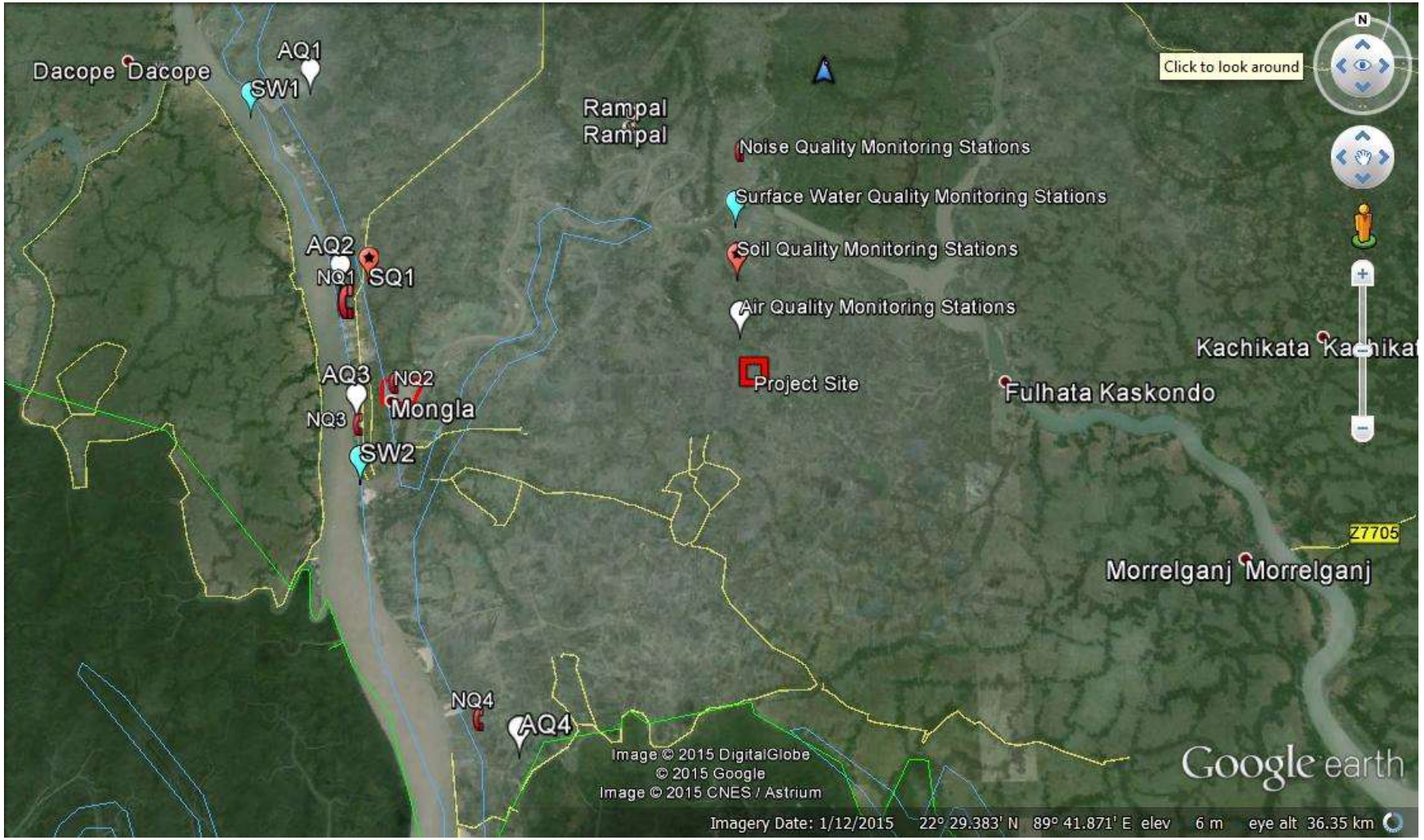


Figure 31: Map Showing Location of Environment Monitoring Station

5.4. Meteorology

The project area lies in the South-central climate zone of the country and shows tropical monsoon climate with three prominent seasons – summer (Pre-monsoon) - March to May; Rainy season (monsoon) - June to October; and winter season - November to February. Climate region map of Bangladesh is given in Figure. Seasonal variation of rainfall, temperature, and humidity is the noteworthy aspect of the climate. The rainy season is hot and humid, and characterized by heavy rainfall, tropical depression and cyclone. The winter is predominately cool and dry. The summer is hot and dry interrupted by occasional heavy rainfall. Gentle north/north-westerly winds with occasional violent thunderstorms called northwester during summer and southerly wind with occasional cyclonic storm during monsoon are prominent wind characteristics of the region. Meteorological condition has been established using data on different metrological parameters accumulated from nearby Mongla station of the Bangladesh Meteorological Department. Summary of the analysis of metrological parameters are given in the following sections.

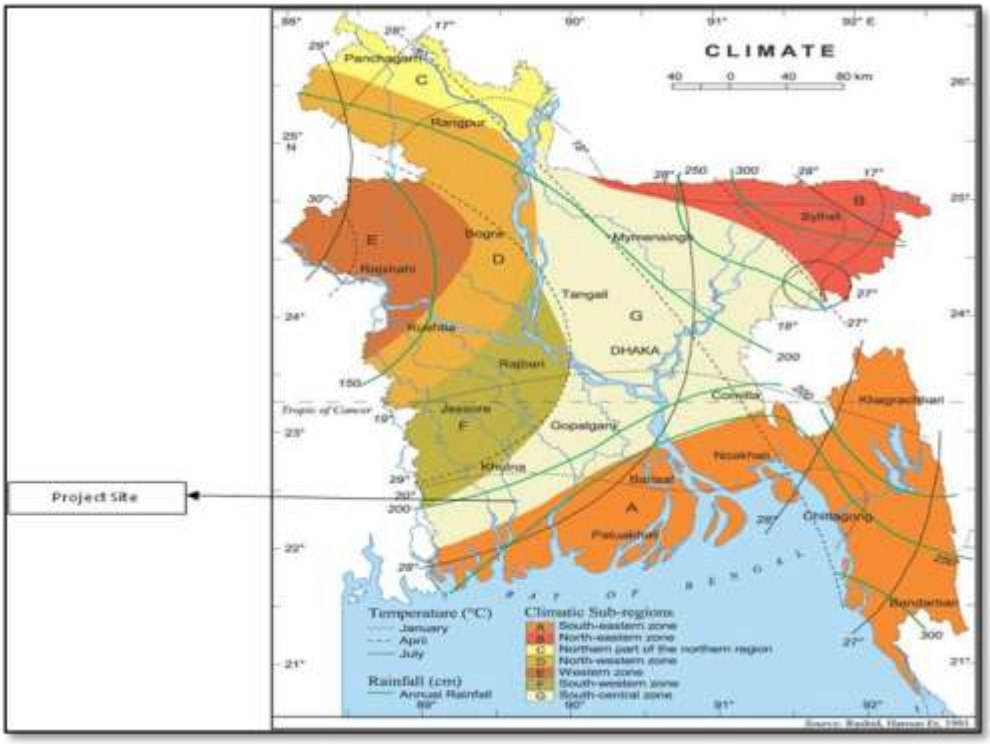


Figure 32: Climate Region Map of Bangladesh

Temperature

Seasonal variation of the temperature is distinct but does not vary largely. Monthly maximum temperature varies from 23.3° to 36.5° C while April is the warmest month and the monthly minimum temperature varies in the range of 12.2° to 27.8°C while January is the coldest month. The highest maximum temperature ever recorded within the last 20 years is 36.57°C during May 1995 and the lowest ever recorded minimum temperature is 12.21°C during January, 2003.

5.5. Humidity

Average relative humidity in the project area varies seasonally from 70% to 90%. June, July and August are the most humid months (80 % to 90 %) while during January to March it remains lowest (20% to 30%).

5.6. Rainfall

Rainy season is very prominent in this region like other coastal areas of the country. The annual average rainfall is1946 mm/yr as per last 18 years recorded data of Mongla weather station. Since 1991, maximum monthly rainfall ever recorded is 983 mm in the month of June during 2002 and little or no rain during December. Average Monthly Normal Rainfall for Mongla is given in Table & Figure below.

Table 24: Average Normal Rainfall of Mongla

S. No.	Month	Rainfall (mm)
1	January	16.9
2	February	35.9
3	March	58.1
4	April	72.4
5	May	180.9
6	June	323.8
7	July	342.7
8	August	344.4
9	September	313.0
10	October	149.9
11	November	48.0
12	December	1.6

Source: BMD

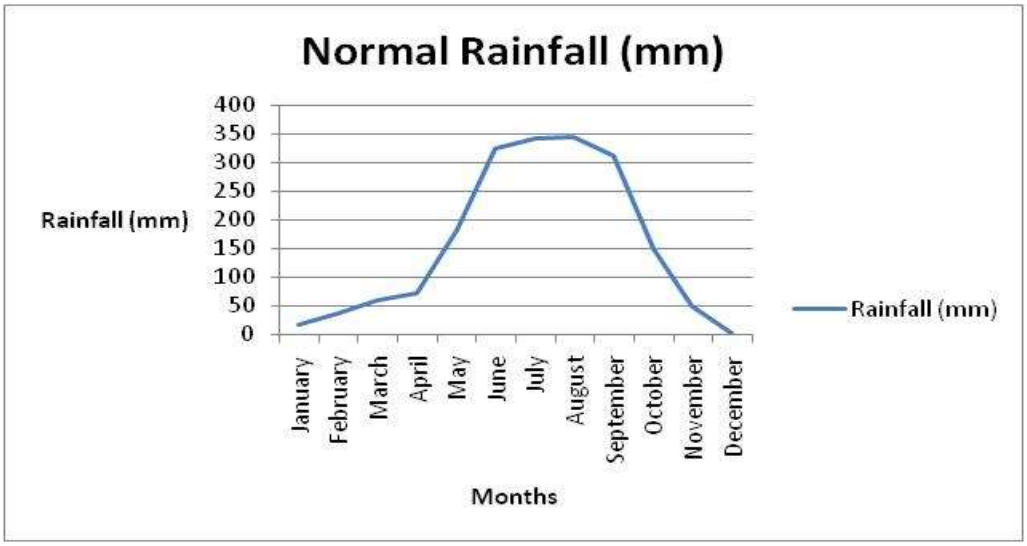


Figure 33: Normal Rainfall of Mongla

5.7. Evaporation

Evaporation data for Khulna region has been taken from BRRI study. Monthly evaporation data for Khulna region is given below. Maximum evaporation occurs in month of May.

Table 25: Data on Evaporation for Khulna Region

January	69.8
February	88.6
March	121.3
April	136.4
May	144.0
June	125.5
July	108.7
August	101.8
September	100.9
October	92.8
November	84.2
December	74.1

Source: BRRI

The monthly average evaporation in Mongla varies from 3 to 5 mm/day in a year. The monthly maximum average evaporation occurs in the month of July and it is 16 mm/ day (CEGIS).

5.8. Winds

Like the country's wind characteristics, the region is characterized by Southerly wind from the Bay of Bengal during monsoon and Northwesterly wind from Himalaya during winter. As per BMD, monthly average maximum wind speed in Mongla weather station varies from 300-750 km/day. The average wind speed is 1.7 m/s. Windrose diagram for Kulna region (data from BMD website) is given in Figures below.

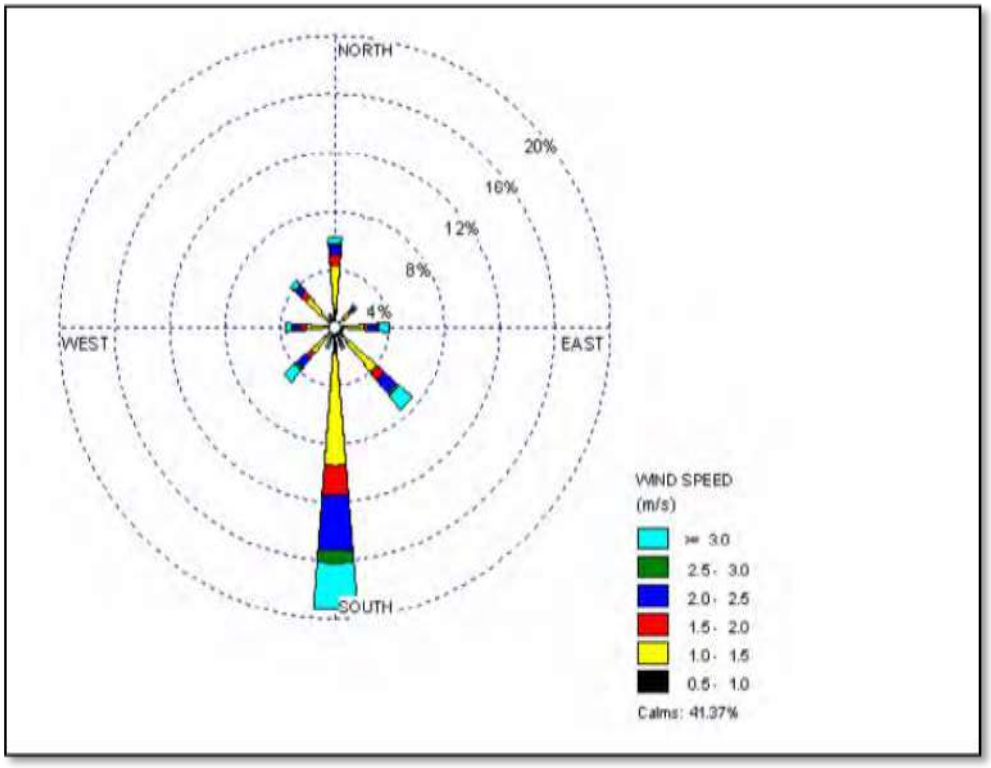


Figure 34: Windrose for Kulna-Annual

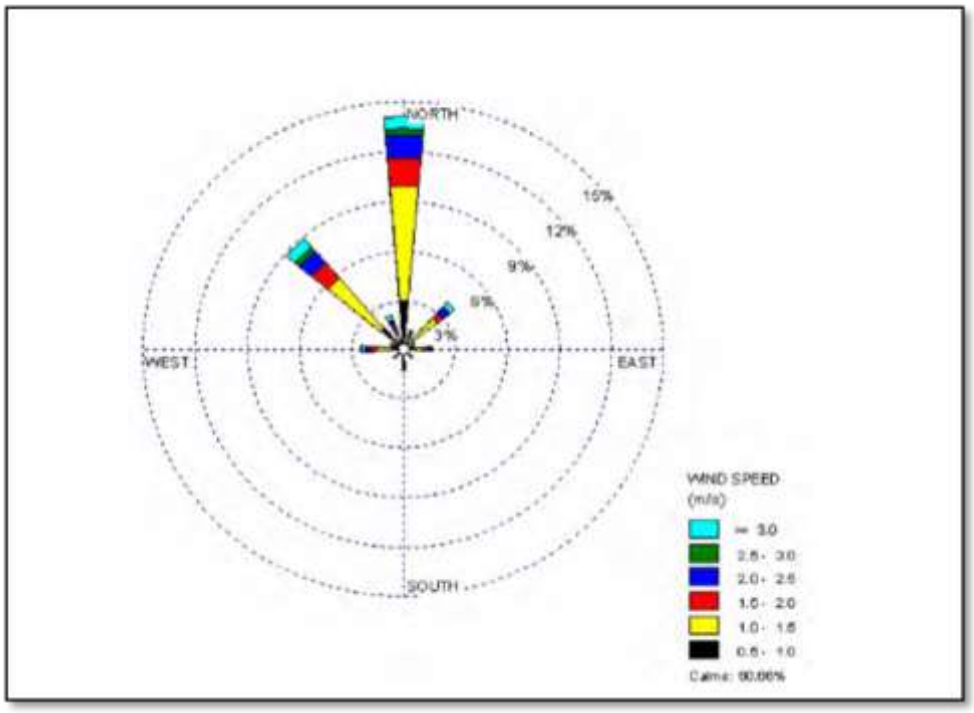


Figure 35: Windrose for Kulna-November to February

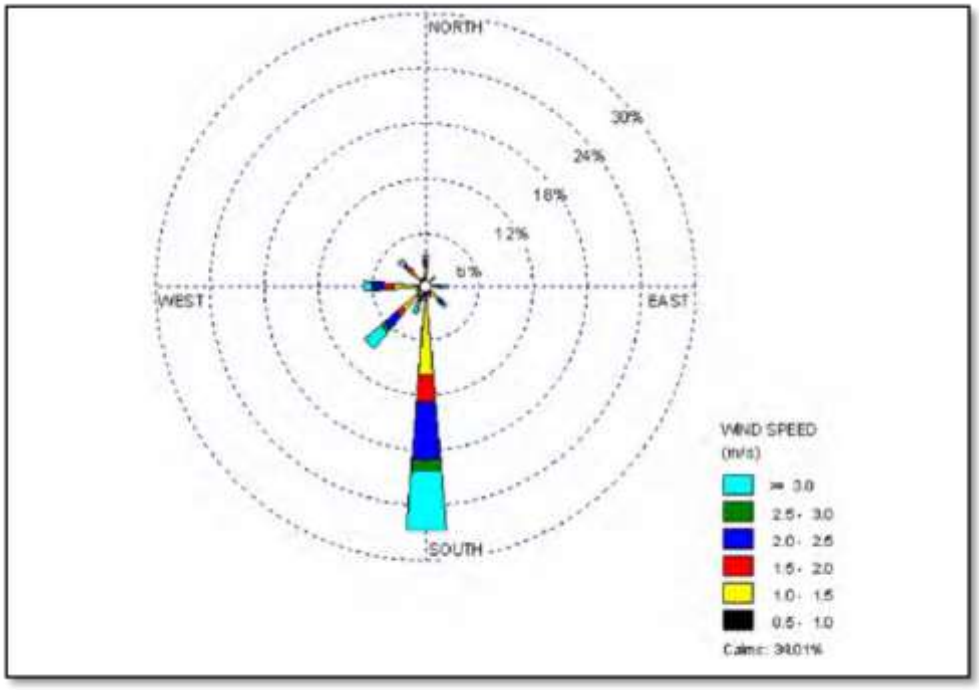


Figure 36: Windrose for Kulna-March to April

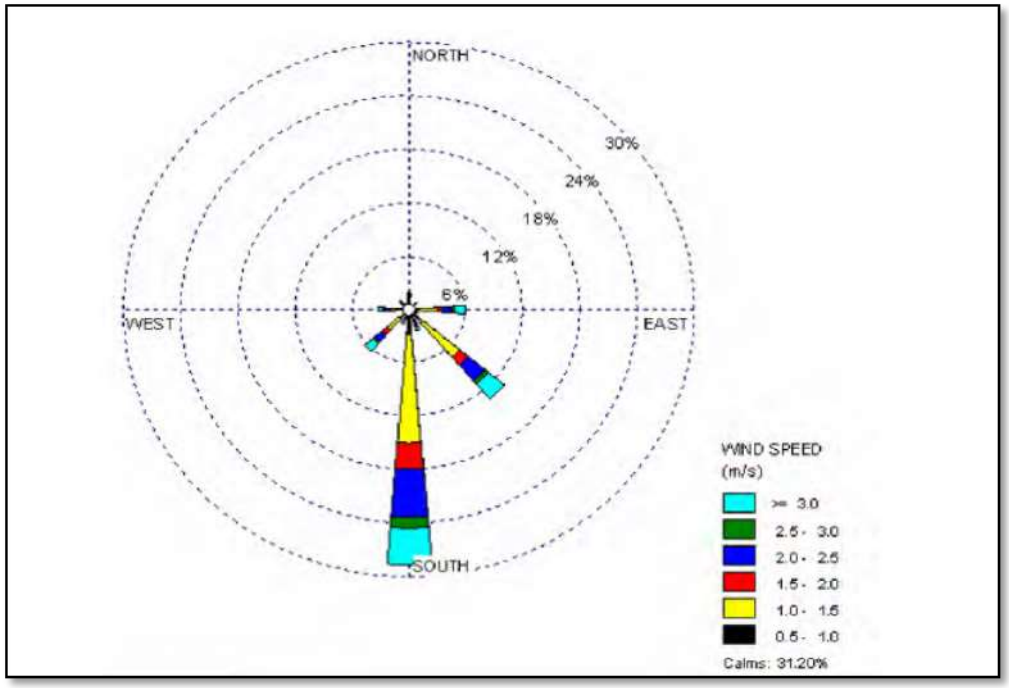


Figure 37: Windrose for Kulna-May to October

5.9. Sunshine Hours

The monthly average sun-shine hour in Mongla varies from 4 to 9 hour/day in a year. In general, maximum sun-shine hour of 12 hour in a day is found in May.

5.10. Air Environment

Project site is surrounded by the small settlements, Industries (within & outside EPZ), Port and agriculture land. Major source of air pollution in this area is industrial activities. Major polluting

industries are cement, brick kilns and petroleum industries. Other activities which add to the air pollution are vehicular movement, movement of cargo/vessels (especially carrying coal) dredging and filling activities. Air quality monitoring has been carried out by CEGIS at various locations. Data for Harbaria, Mongla Port area and village Bajua is given below. Harbaria point & Mongla port is Southern to the project site, i.e. in down wind direction, whereas Bajua & near Rampal TPP is North to the direction of project site, i.e. down wind direction.

Table 26: Ambient Air Quality in the Study Area

Location of Monitoring	Wind Direction	Pollutants	April, 2014	July, 2014	DOE Standards (ECR, 2005)	IFC/WB Standards
Units: (µg/cum)						
Near Rampal TPP (AQ1)	Upwind direction	$PM_{2.5}$	35	39	65	75
		PM_{10}	77	86	150	150
		SPM	117	113	200	NF
		SO_2	19	24	365	125
		NO_x	23	26	100	200
		CO	190	205	1000	NF
		O_3	27	24	157	160
Bajua (AQ2)	Upwind direction	$PM_{2.5}$	47	49	65	75
		PM_{10}	119	127	150	150
		SPM	297	266	200	NF
		SO_2	28	31	365	125
		NO_x	41	39	100	200
		CO	230	217	1000	NF
		O_3	49	38	157	160
Mongla Port Area (AQ3)	Downwind direction	$PM_{2.5}$	47	55	65	75
		PM_{10}	139	174	150	150
		SPM	288	303	200	NF
		SO_2	27	28	365	125
		NO_x	44	39	100	200
		CO	230	320	1000	NF
		O_3	57	52	157	160
Harbaria (AQ4)	Downwind direction	$PM_{2.5}$	19	22	65	75
		PM_{10}	41	39	150	150
		SPM	111	117	200	NF
		SO_2	9	10	365	125
		NO_x	19	22	100	200
		CO	65	58	1000	NF
		O_3	13	12	157	160

Source: CEGIS

The time in preparing the "Base Line Information Chart" is April, 2014 and July, 2014

Particulate Matter (PM_{10}):

PM_{10} within study area varies from 41 to 139 µg/m3. Value of PM_{10} is within the specified limit as per DoE. Highest level of PM_{10} is observed at Mongla port area due to dredging activities, plying of vehicles and cargos.

Particulate Matter ($PM_{2.5}$):

$PM_{2.5}$ levels were found ranging from 19 to 47 µg/m3. Value of $PM_{2.5}$ is within the specified limits as per DoE. The highest mean $PM_{2.5}$ levels were found at the port and Bajua village.

Sulphur Dioxide (SO_2):

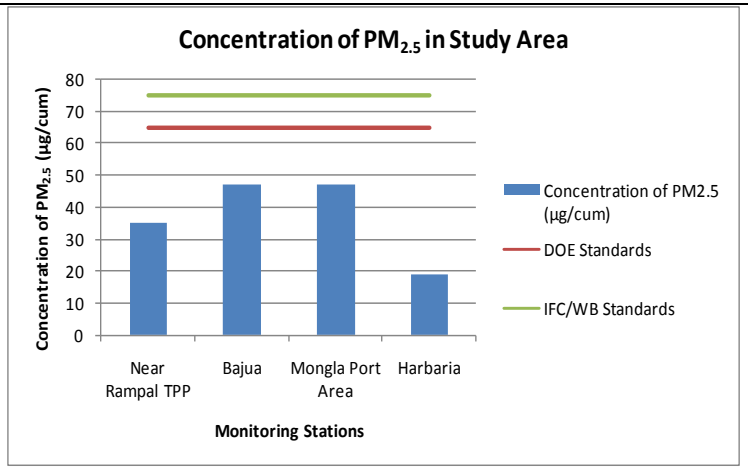
Value of SO_2 is much lower than the prescribed limits of DoE. SO_2 levels were found ranging from 9 to 28 µg/m3. The highest levels of SO_2 were found at Bajua village followed by Port area. The main source of SO_2 emission is from industrial and vehicular sources.

Oxides of Nitrogen (NO_x):

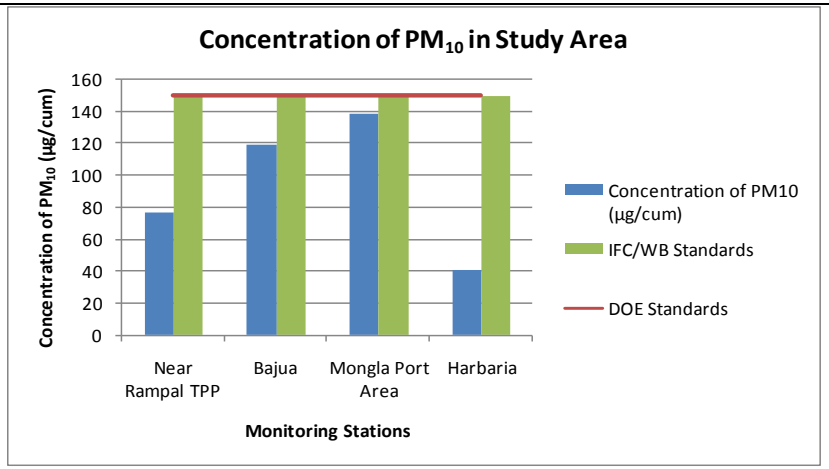
Value of NO_x is much lower than the prescribed limits of DoE. NO_x levels were found ranging from 23 to 44 µg/m3. The highest levels of NO_x were found at Mongla Port.

Carbon Monoxide (CO) & Ozone (O_3)

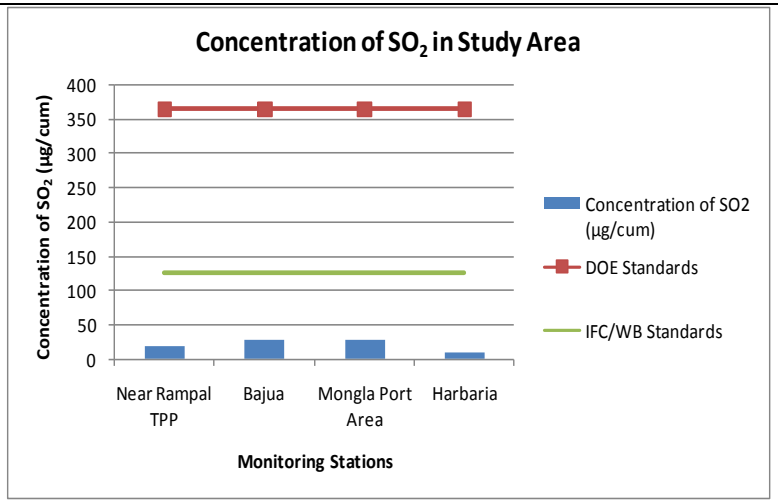
CO and O_3 concentrations are also very low. CO concentration ranges from 65 µg/m3 to 230 µg/m3 while of O3 vary from 13-49 µg/m3.

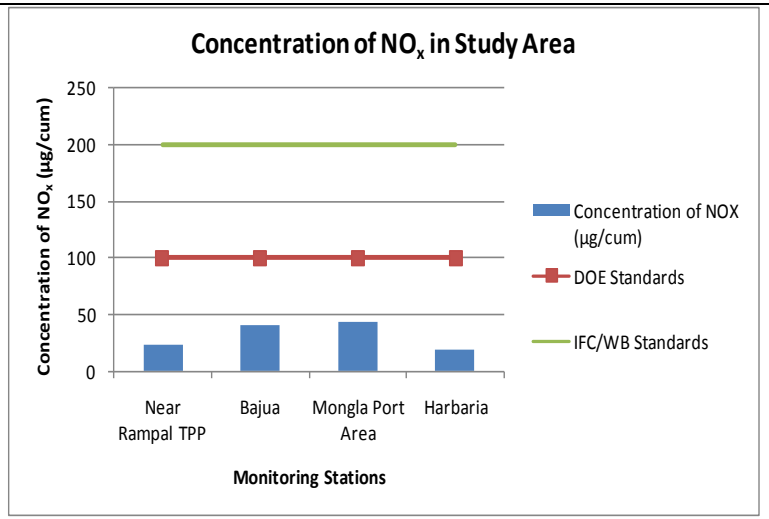


Comparison of PM $_{2.5}$ conc. with DOE and WB standards



Comparison of PM $_{10}$ conc. with DOE and WB standards





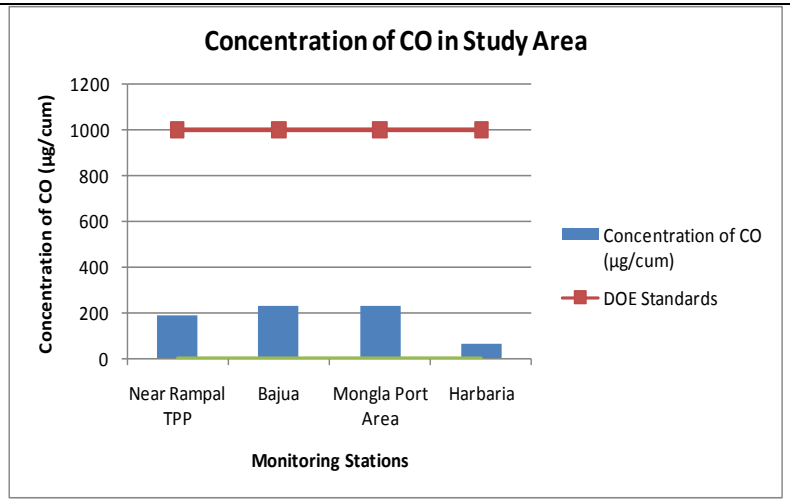
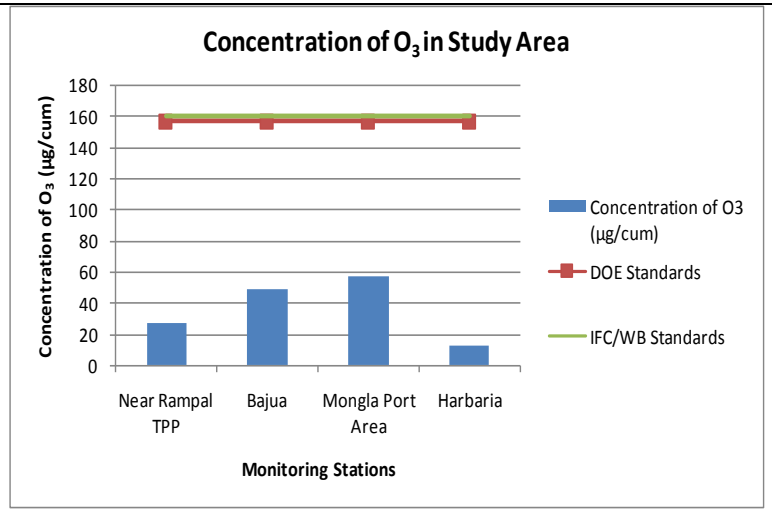
Comparison of SO_2 conc. with DOE and WB standards	Comparison of NO_X conc. with DOE and WB standards
	
Comparison of CO conc. with DOE and WB standards	**Comparison of O_3 conc. with DOE and WB standards**

Figure 38: Graphical representation of Ambient Air Quality in the Study Area

5.11. Noise Environment

Noise level monitoring has been carried out by CEGIS at various locations in the Study area in month of April & June, 2014. Noise levels at village Bajua, economic zone, Mongla port and Harbaria point, Sundarbans is given below in Table and Figure below.

Table 27: Ambient Noise Quality in the Study Area

			Morning	Afternoon	Evening	Average	Morning	Afternoon	Evening	Average	
1.	Village Bajua	Residential	62.69	57.19	53.39	57.76	54.61	51.14	51.90	52.55	50
2.	Project Site	Industrial	54.2	51.3	42.8	49.4	55.2	54.1	44.8	51.4	75
3.	Mongla Port	Industrial	69.38	54.55	59.79	61.24	54.75	54.20	52.58	53.84	75
4.	Herbaria, Sundarban	Sensitive	39.24	41.98	42.51	41.2	59.25	60.52	48.62	56.13	45.0

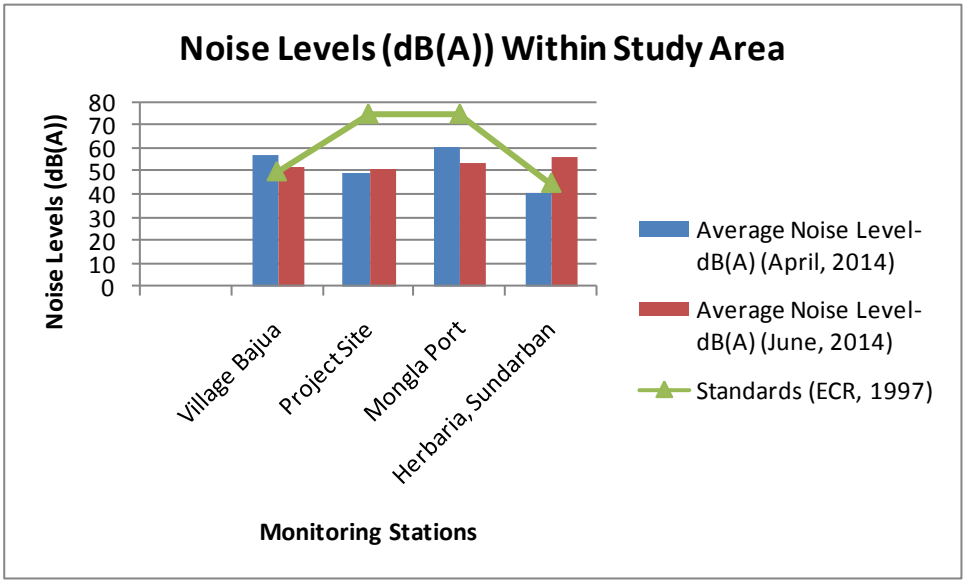


Figure 39: Graphical Representation of Noise Environment

5.12. Water Resources

Surface Water System

Pasur is the major river flowing in the study area. The flow of the Pasur River is dominated by the Atai and Bhairab rivers. The wet season brings extra volume of water from the Ganges through Gorai-Nabaganga-Atai into the system. According to the most recent study of river phenomenon over the past 38 years establishes the increased sediment rates due to upstream river diversions specifically through Farakka Barrage in India. Mongla a tributary of Pasur river, flowing adjacent to East end of the EZ drains

into Pasur River south of EZ near Mongla Port. Gona (a small river) also a tributary of river Mongla flowing west end of EZ drains into Mongla River beyond EPZ.

The water level hydrograph of river Pasur at Mongla station shows the variation of maximum and minimum monthly water level. The water level of the Pasur river rises from January-February to till July-August then recedes up to December-January. A typical hydrograph of Pasur River based on water level data of Mongla station is given in Figure below. As per the data of 25 years (1990-2014) from Mongla port authority, highest water level observed in Pasur river is 4.96 m in year 2009 and lowest water lever observed is -0.37 m. The water level of Pasur River brings the variation in water level of Mongla and Gona rivers as well through tidal effect.

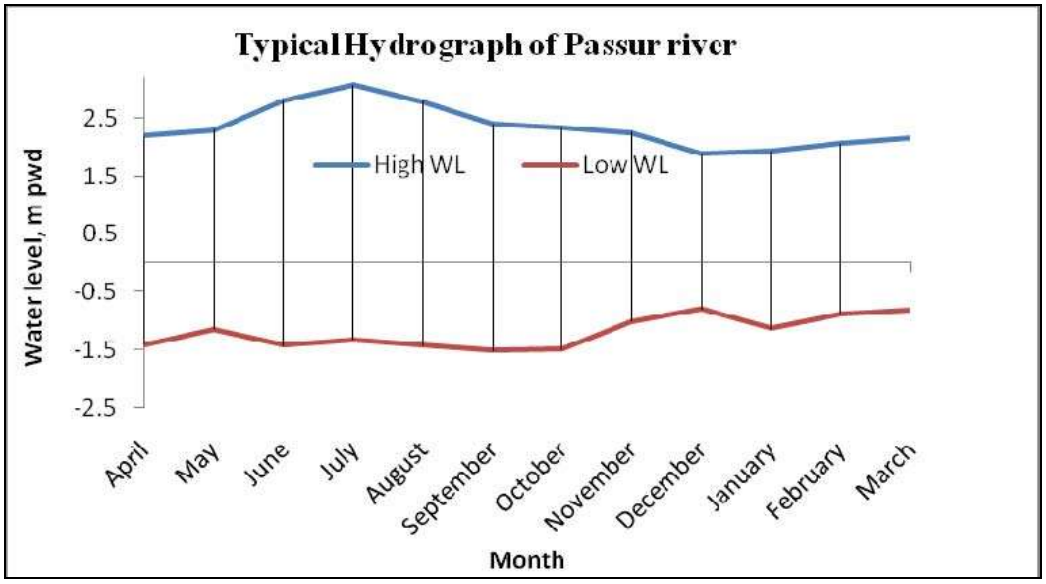


Figure 40: Typical hydrograph of Pasur River

Tropical Cyclones

Project site is located in SW part of the coastal areas of Bangladesh. Numbers of cyclones have struck this area in past and has cause severe damages at few times. As per the cyclone risk zone map of coastal area of Bangladesh, project site is located in the wind risk zone of Bangladesh where no tidal surge is recorded. Cyclone risk zone and track map of Bangladesh is given in Figures below. Sixteen cyclones are recorded in last 25 years that had hit the coastal areas of Bangladesh. Most recent devastating cyclone is Aila which had hit this area in 2009. Mongla was severely affected by the cyclone as the storm water entered into the project site overtopping the bank of Pasur River. The area got inundated during the storm. Of the major cyclones that had hit the Bangladesh coast is given in Table below.

Table 28: List of major cyclones of Bangladesh

30th October, 1960	211	4.6-6.1
30th May, 1961	160	6.1-8.8
28th May, 1963	203	4.2-5.2
11th May, 1965	160	6.1-7.6
15th December, 1965	211	4.6-6.1
1st November, 1966	146	4.6-9.1
23rd October, 1970	163	3.0-4.9
12th November, 1970	224	6.1-9.1
25th May, 1985	154	3.0-4.9
29th November, 1988	160	3.0-4.0
29th April, 1991	225	6.0-7.5
2nd May, 1994	210	2.0-3.0
25th November, 1995	140	2.0-3.0
19th May, 1997	220	3.1-4.2
2nd December, 2005 (Baaz)	--	--

14th May, 2007, (Akash)	--	--
15th November, 2007 (Sidr)	240	Up to 10
26th October, 2008 (Rashmi)	--	--
17th April, 2009 (Bijli)	--	--
25th May, 2009 (Aila)	120	3.0
16th May, 2013 (Viyaru)	--	--

Source: Banglaesh Disaster Knowledge Network & BMD

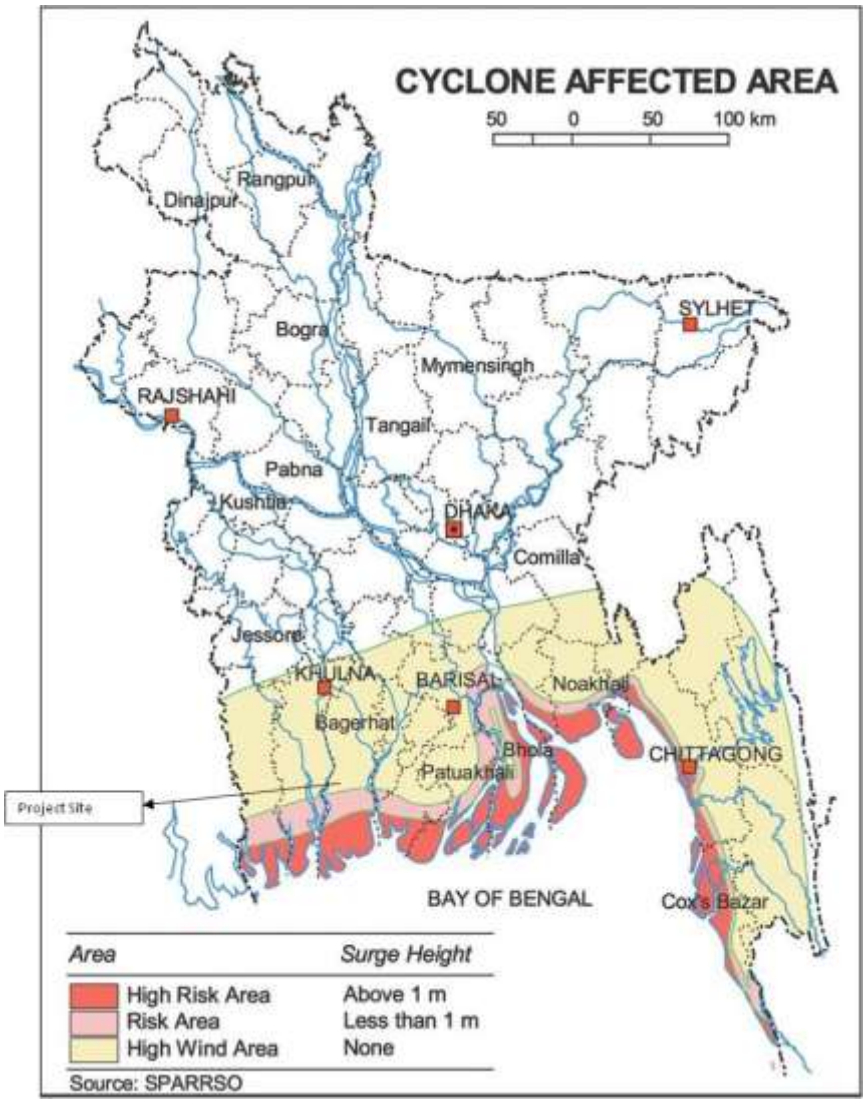


Figure 41: Cyclone Risk Zone Map

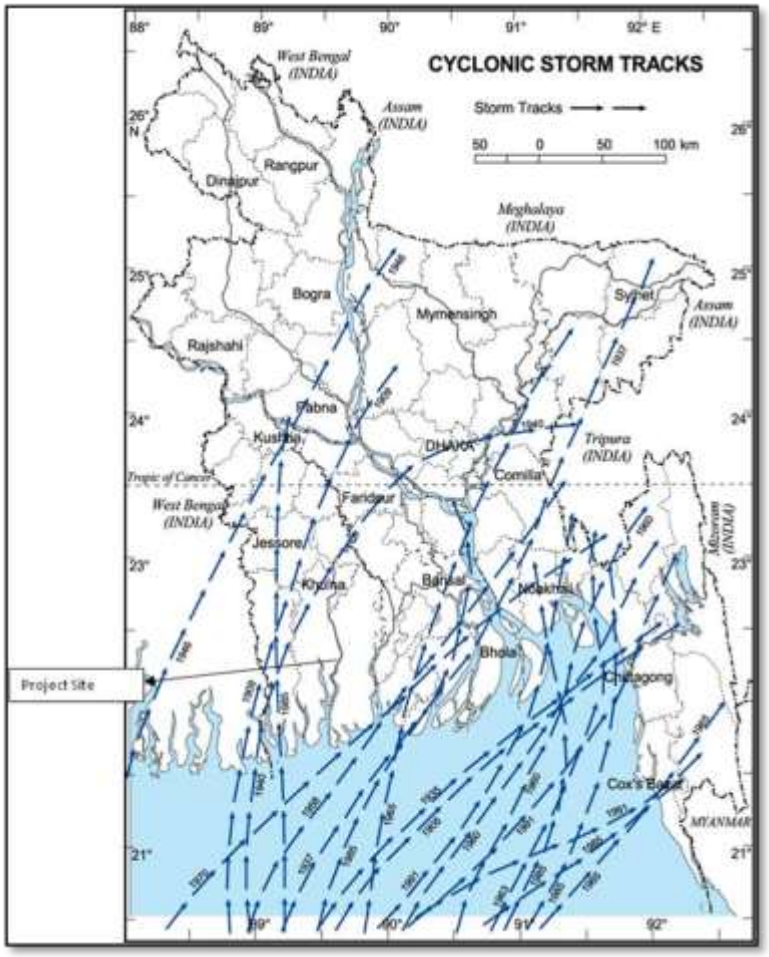


Figure 42: Cyclone Storm Track Map

Tidal Flooding

Mongla River and Gona rivers about the site being tributary to the Pasur River, the area is prone for flooding. As a flood protection measure, Mongla EZ has constructed a clay bund along Mongla River. However a semi-diurnal tide occurs in Pasur River which enters inland through numerous creeks. EZ site is 900 m away from Pasur River. There are various developments between EZ site and Pasur River like Mongla port, industries, Naval Base, Kulna Mongla highway etc. Elevation of these developments is more than 20 ft (6 m) which is above average HFL level of Pasur River (4.45 m). This will prevent the water to enter EZ site during floods.

A solid compound wall all along the EZ boundary to a height of 2.1 m (7 ft.) above NGL is proposed to be constructed and provided with 0.9 m (3 ft.) height barbed wire fencing on top which will further protect the site from flooding and water intrusion. Project site does not inundate during high tides.

Clay Bund at Mongla	Elevated Site

Figure 43: Photographs Showing Clay bund at Mongla and Filled Site of EZ Figure 43:

Tornado

It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also there are severe local seasonal storms, popularly known as nor'westers (kalbaishakhi). Severe nor'westers is generally associated with tornadoes. Tornadoes are embedded within a mother thundercloud, and moves along the direction of the squall of the mother storm. The frequency of devastating nor'westers usually reaches the maximum in April, while a few occur in May, and the minimum in March. Nor'westers and tornadoes are more frequent in the afternoon. Nor'westers may occur in late February due to early withdrawal of winter from Bangladesh. The occasional occurrence of nor'westers in early June is due to the delay in the onset of the southwest monsoon over the region (Karmakar, 1989). List of the nor'westers and tornadoes is given in Table below.

Table 29: List of Tornadoes had hit the Bangladesh

14th April, 1969	Demra (Dhaka)
17th April, 1973	Manikganj (Dhaka)
10th April, 1974	Faridpur
11th April, 1974	Bogra
9th May, 1976	Narayanganj
1st April, 1977	Faridpur
26th April, 1989	Saturia (Manikganj)
14th May, 1993	Southern Bangladesh
13th May, 1996	Tangail
4th May, 2003	Brahmanbaria
21st March, 2005	Gaibandha

Source: Bangladesh Disaster Knowledge Network

Floods

Floods are the most significant natural hazard in the country causing extensive damage to human life and property. The country lies on the downstream part of three major river basins: Brahmaputra, Ganges and Meghna and thus is frequently flooded. There have been many destructive floods in Bangladesh, including very severe floods of 1987, 1988 and 1998. The 1988 flood set a new record for flooded area, while 1998 flood was unprecedented with its long duration. The flood damage potential in Bangladesh is increasing due to the possible causes of climate change, urban concentration in the three river basins, encroaching of settlements into flood prone areas, and overreliance on the safety provided by flood control works such as levees, reservoirs. There are two types of floods which occur in Bangladesh: annual floods (barsha) that inundate up to 20% of the land area; and low frequency floods of high magnitude that inundate more than 35% of the area (bonna). The major floods that occurred in 1954, 1955, 1974, 1984, 1987, 1988, 1993, 1998, 1999, 2000 and 2007 have been very destructive and caused serious threat to lives and economy. In the context of human exposure in flood hazard zones, nearly 19,279,960 people are present in these zones and Bangladesh ranks 1st among 162 nations. Similarly, the modelled amount of GDP in seismically hazardous zones puts Bangladesh 3rd among 162 countries. Flood hazard map of the Bangladesh is shown in Figure below.

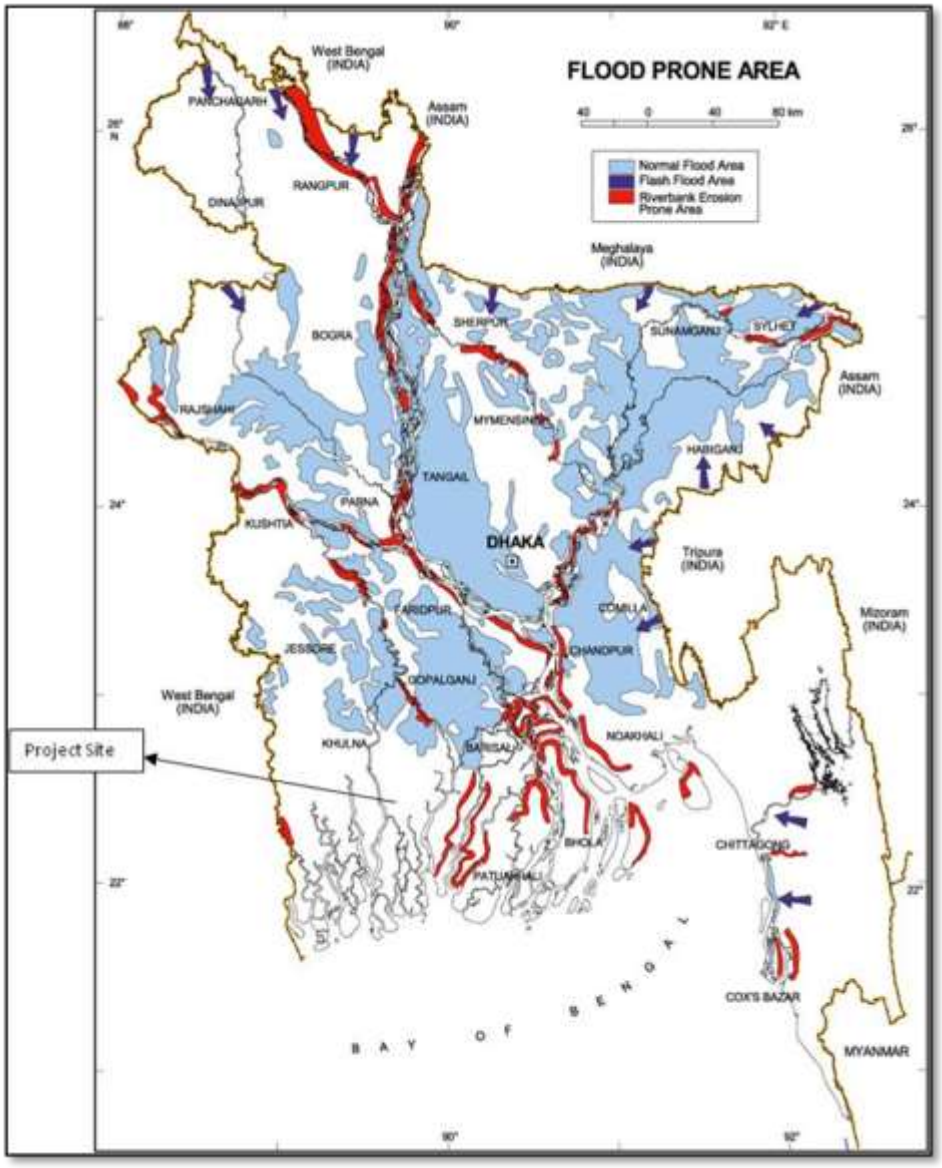


Figure 44: Flood Prone Area Map

Salinity

Water of project area rivers (Pasur and Mongla River) is highly saline as they carry large amount of sediments from upstream and influenced by tidal effect. Pasur River meets the Bay of Bengal crossing Sundarbans forest. Both these rivers remain saline throughout the river. Salinity varies depending upon input of fresh water. Source of fresh water is mainly rains and run-off flow from nearby areas. Salinity values are reduced during monsoon season in these rivers but are not fit for domestic purpose even in monsoon. Salinity level has been tested by CEGIs along River Pasur at different locations and at Pasur Mongla confluence.

Table 30: Salinity in River Pasur

1.	Right Bank of Pasur river near Rampal TPP	10.0	2.5
2.	Left Bank of Pasur river near Rampal TPP	9.5	4.0
3.	Middle of Pasur river near Rampal TPP	10.0	0.0

4.	Pasur and Mongla Confluence	10.0	9.5
5.	Pasur river at Harbaria point of Sundarban	12.0	10.0
6.	Pasur river at Hiron point at Sundarban	23.0	19.5

Salinity in Pasur River varies from 9.5 to 23.0 ppt during April, 2014 and 0.0 to 19.5 ppt during June, 2014. Salinity lowers in June, 2014 due to rains.

Ground water in Shallow aquifers in Mongla region is also saline. Ground water in the area is saline due to sea water intrusion and flowing of Pasur and Mongla River. Ground water is fresh in deeper aquifers, i.e. at depth of 180-220 m.

Ground water quality has been tested by CEGIS near Rampal TPP which is at app. 9 km from EZ site. Ground water samples are withdrawn from well of depth 600 ft. (app. 180 m) As per CEGIS report salinity of ground water salinity varies from 0.0-0.5 ppt.

Drainage of Study Area

The drainage map of the study area is given in Figure below. As can be seen, the Pasur River which falls into the Bay of Bengal flowing down of the Mongla port, through Sundarban is the major river in the study area. The behavior of project area rivers (Mongla and Gona) depends on the behaviour of Pasur river, therefore this section covers in details the aspect related to Pasur River. The river is navigable throughout the year and ships can approach with the maximum allowable draught of 6 to 6.5m easily up to Mongla Port. The Pasur is an important river route through which Indian vessels under transit agreement, clinker carrying vessels, LPG carrying vessels, fuel carrying vessels, maritime transportation vessels of approaching and departing Mongla Port, barges, Kulna-Barisal steamboats and other vessels ply round the year. The river is about 460 m wide at Rupsha, about 790 m wide at Bajiyan and about 2.44 km wide at the confluence of the Pasur-Sibsha. The total length of the river is about 142 km. The Pasur and all its distributaries are tidal channels and is the main river to control drainage system of the total study and project area. Small tributaries and canals that finally join the river Pasur drain the area. The river Pasur flows in Southern direction. Pasur River would be the main navigational channel for transportation of the construction materials and imported coal. The general features of Pasur at different location of its longitudinal profile are presented in the following table. HFL Data for Pasur River is attached as Annexure III. Hydrographic chart of Pasur River is shown in Figure below.

Table 31: General Characteristics of the Pasur River

1	Outfall	Bay of Bengal
	Geographical location	Akram Point
2	River flow path	Batiaghata, Dacope, Kulna, Mongla and Bagerhat
3	Physical settings of river	
	Length	51 km
	Width	850 m at Kulna
	Depth	8 m at Mongla
	Catchment area	425 sq. km
4	Discharge	
5	Seasonal/Perennial	Perennial
6	Minimum discharge month	February
7	Minimum of monthly minimum discharge (February)	6000 cum/s
8	Minimum depth in dry season	6-6.5 m at Mongla
9	Maximum discharge month	August
10	Maximum of monthly maximum discharge	22500 cum/s
11	Maximum depth in wet season	8 m at Mongla
12	Tidal	Yes
13	Flooding pattern during normal flood	Tidal flood (tidal inundation, storm surge)

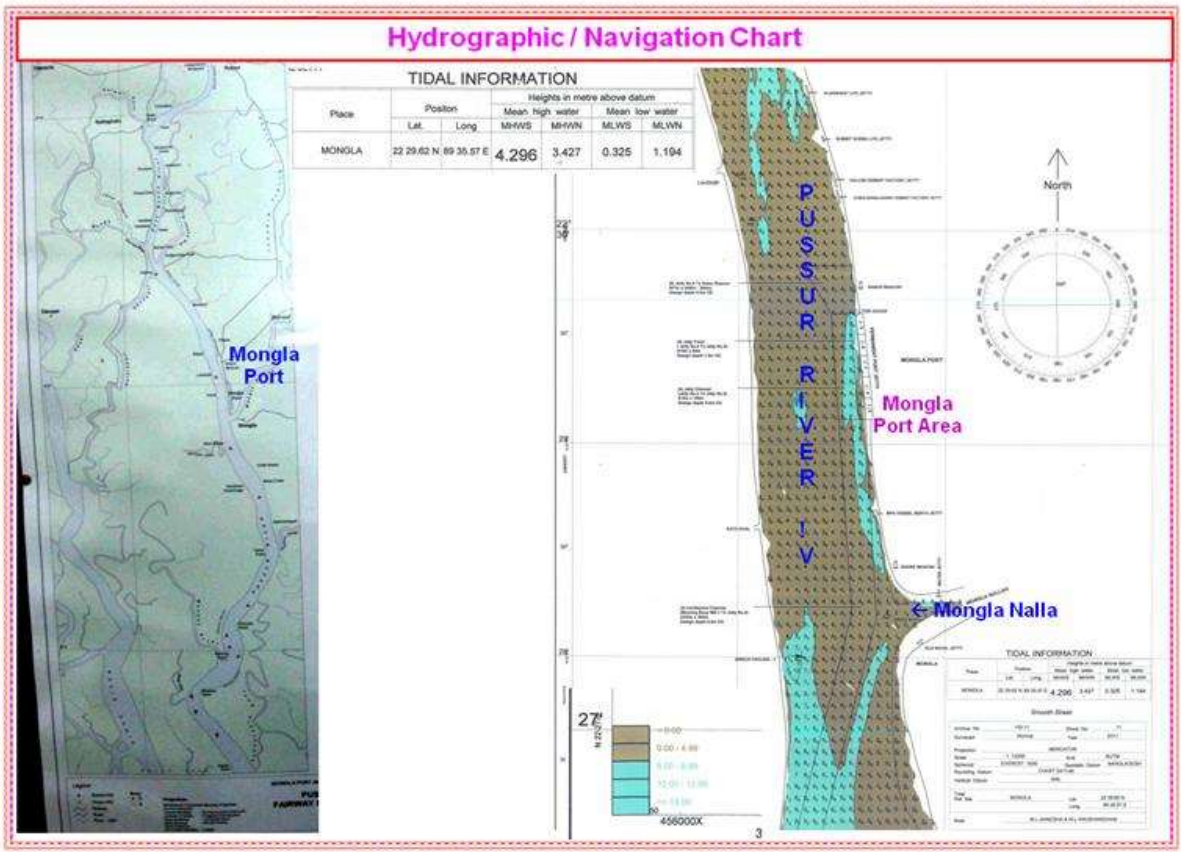


Figure 45: Hydrographic Chart of Pasur River

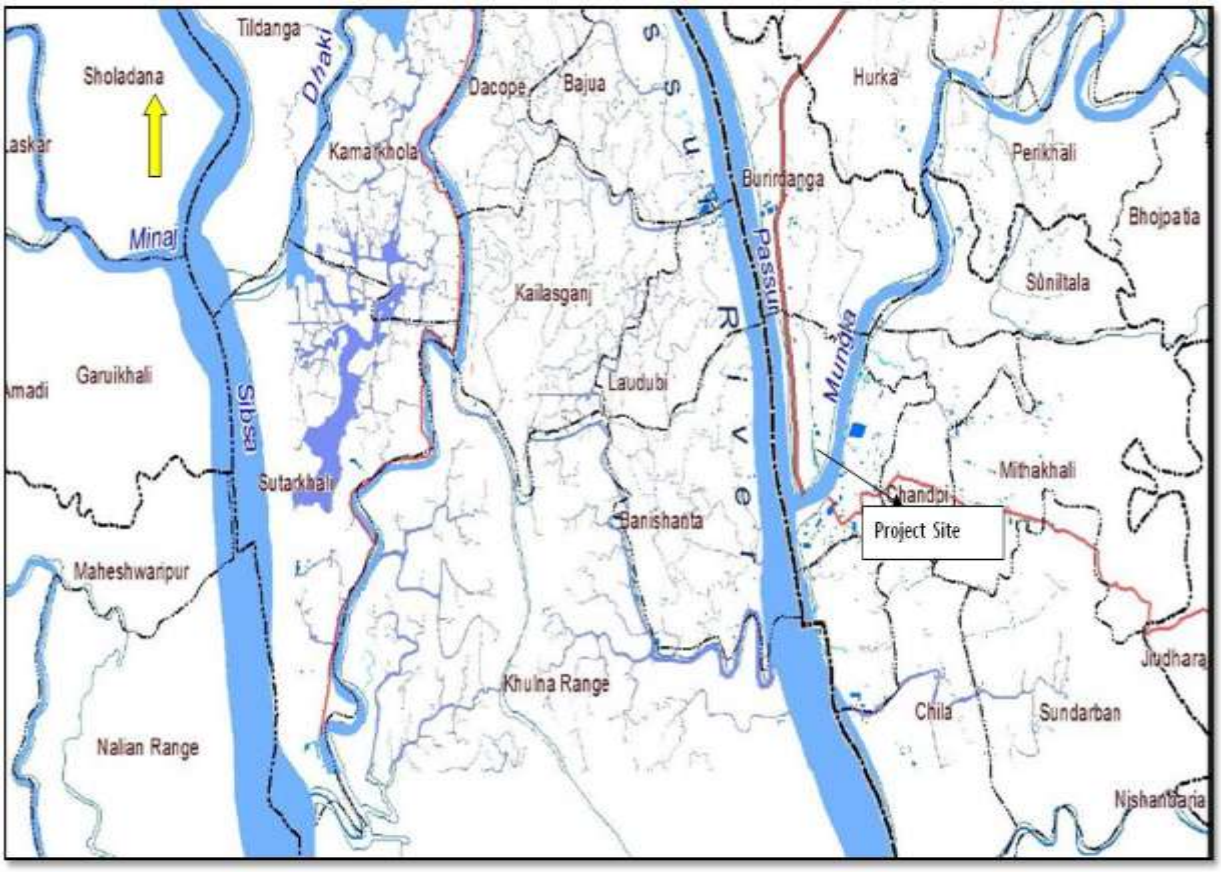


Figure 46: Drainage map of the project site and he surroundings

Drainage Congestion and Water Logging

The project area is well drained and no instances of drainage congestion are observed. Water logging in low lying area is reported in rainy season during rainy season. Project site is at higher elevation than nearby areas due to filling no such situation is anticipated at project site. Some water logging is expected at site during monsoon season which would need to be channelled through proper drainage system at site.

Erosion and Sedimentation

Site has been filled to level of 6 ft. w.r.t surrounding area by Mongla Port Authority from dredged material of Pasur River. No significant soil erosion is anticipated at the site. Erosion and accretion is observed along the bank of the Pasur River. Map showing the potential zones of erosion along the rivers in Bangladesh is given below in Figure below.

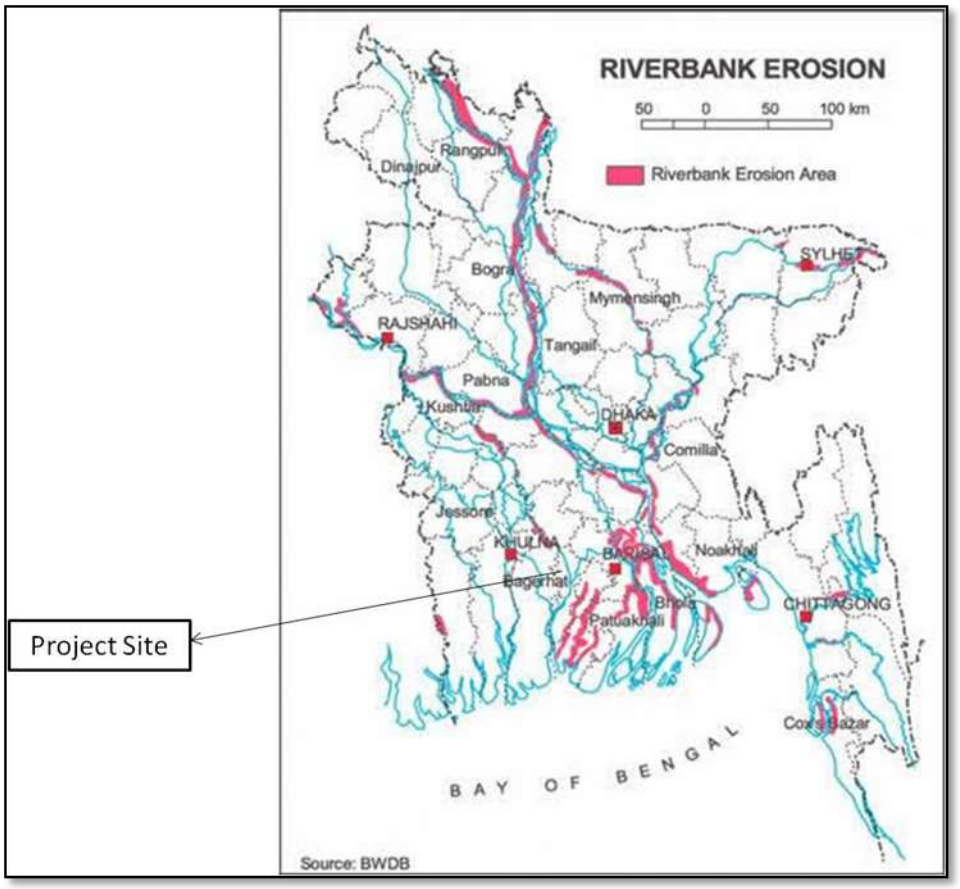


Figure 47: Map showing river bank erosion of Bangladesh

Source: http://www.livingwiththejamuna.com/essayintroduction.html

River Morphology

River Pasur and Mongla are morphologically stable. The change in river course since 1955 is presented in the following Figures**.**

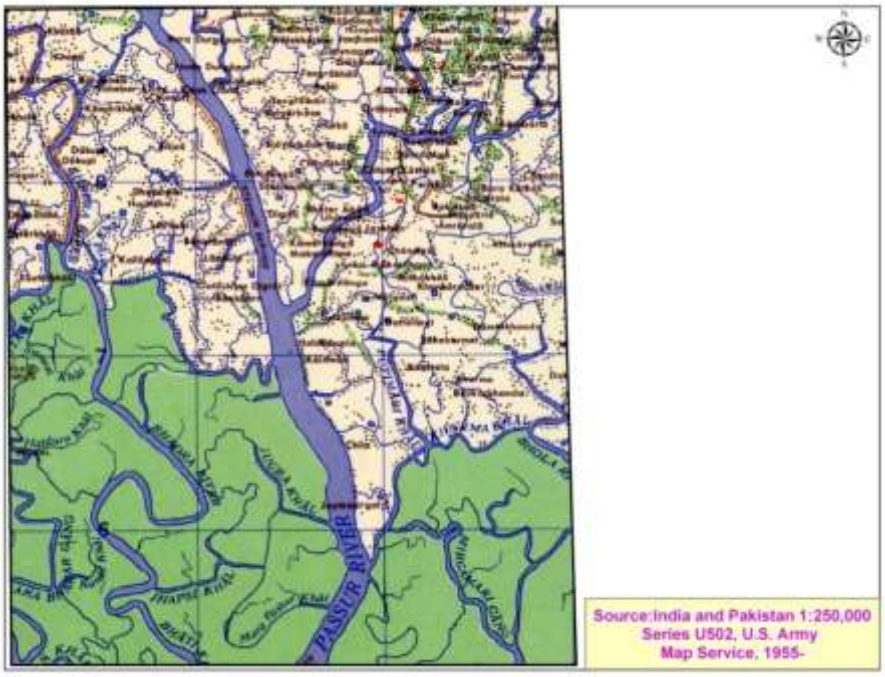


Figure 48: Toposheet Map (1955) showing course of Pasur and Mongla River

Figure 49: Google Image (2001) showing course of Pasur and Mongla River

Figure 50: Google Image (2009) showing course of Pasur and Mongla River

Figure 51: Google Image (2013) showing course of Pasur and Mongla River

Navigation

Both Mongla and Pasur River are navigable throughout the year. Navigation in Mongla River also includes localized transportation of men and material from one bank to other. Major navigation takes place in Pasur River. Nearest Mongla port, the second largest seaport in country, consists of shore based facilities and a sheltered anchorage in the Pasur river. Navigation depth in Pasur River varies from 4 m (Near Mongla Port) to 35 m (Near Tinkona Dweep). Depth availability of Pasur River is depicted in the Figure below.

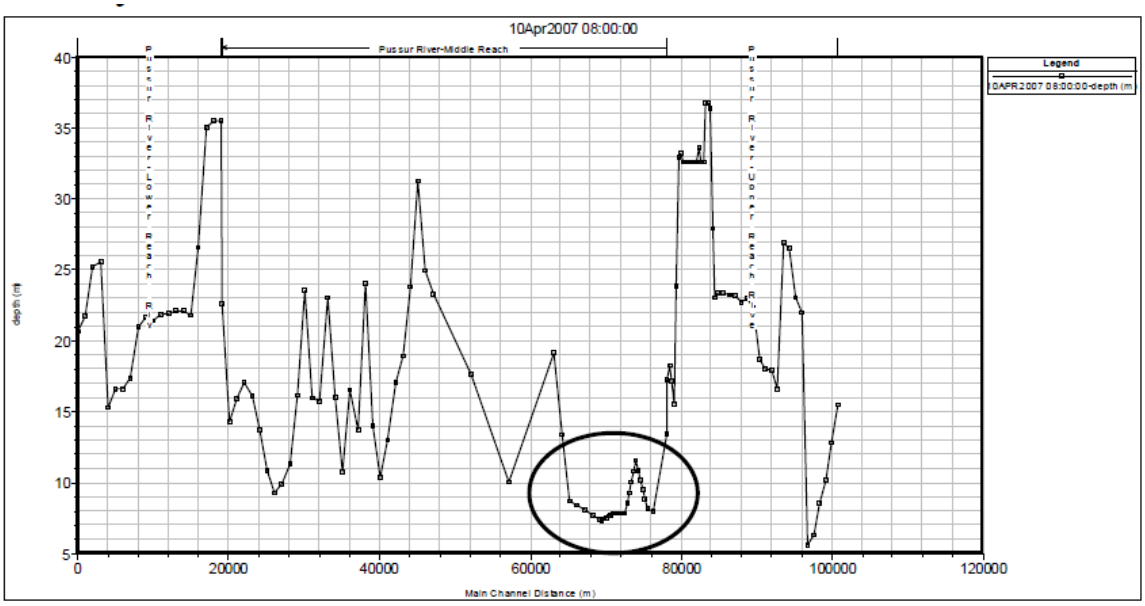


Figure 52: Depth Availability for Navigation in Pasur River

Source: Sarker T., UNESCO

Adequate navigation facilities are also available from Mongla Port Fairway Buoy (MPFWB) to Mongla Port Jetty. With the capacity of handling 6.5 million tons in a year, at present, Mongla Port handles 1.6 million tons of cargo yearly. The average turnaround time (in day) for a bulk cargo is 5.5 and 2.5 for a container cargo. In 2009-2010 fiscal years, the port handled 153 numbers of vessels. At present, Mongla port operates five general cargo/container berths, seven river mooring berths, and fourteen anchorage berths. In addition, there are seven specialized private berths. The port has cargo-handling equipment of different capacity including dockside, mobile crawler, truck mounted forklift truck, prime mover, trailer cargo handling, etc. At present there are four transit sheds having an area of 19628 sq. m, two warehouse of 19,630 sq. m, and open dumps of 3,00,000 sq. m available for cargo storage. Moreover, three container yards of 35,754 sq. m are also available. However, no facility for coal cargo handling prevails in the port at present. Maintenance of draught is the main challenge for Mongla port. Presently, maximum allowable draught at jetty is 6.5 m. Vessels having 6.0 m. to 6.5 m. draught can take berth at port jetty. Navigation Channel demarcated by Mongla Port Authority is shown in Figure below.

The tides of the Pasur River are important for navigation as it determines the possibility of crossing the shallow outer bar at the entrance. The approximate range of the tide observed at Mongla station is between 1.2 m to 3.5 m and the tidal amplitude is around 3.25m (Observation of Mongla Port Authority). The tide is semi-diurnal in nature. Tidal motion dominates during pre-monsoon and post monsoon period. However, fresh water from the river plays a very important role, especially during monsoon. During storms and cyclones, the short waves and storm surges are important morphologic factors.

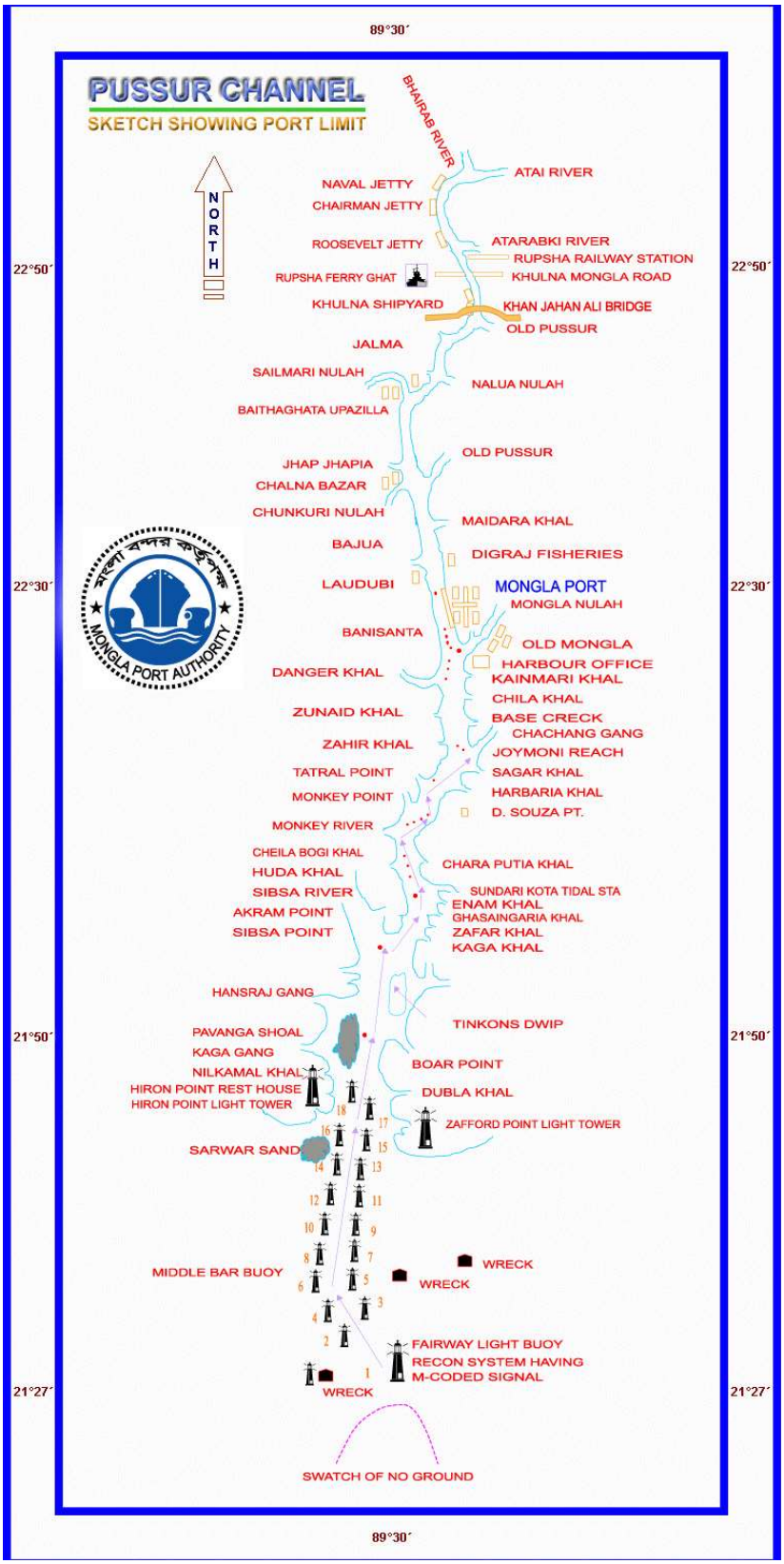


Figure 53: Navigation Channel in Pasur River

Source: Mongla Port Authority

Surface Water Quality

As per the DPHE, water of river Pasur and Mongla is saline throughout the year and is comparatively less saline during months of monsoon. Salinity levels along the Pasur river system vary according to the volume of fresh water entering the system. As per the IUCN report, 2006, salinity level varies from 10-29 ppt throughout the year. Nearby cement industry located in Mongla area discharges it waste into Pasur River which increases the pollution level in river Pasur. Surface water quality monitoring is carried out by CEGIS every six monthly in Pasur river. Data of surface water quality at Pasur River near Rampal TPP (upstream of project site) and near the river Pasur and Mongla confluence (downstream) is given in the Table below. As per the data collected by CEGIS, pH varies from 6.79 to 7.36 in both these locations which are within standards (6.5-8.5) of ECR, 1997 for inland surface water quality. Presence of BOD and low DO indicates the pollution level of the river. Department of Environment, Bangladesh also carried out water quality analysis of Pasur River in 2010. These results also shows similar pattern as above.

Table 32: Surface Water Quality Data Upstream and Downstream of Project Site

Parameters	Units	Middle of Pasur River Near Rampal TPP April, 2014 (SW1)	Pasur river Near Confluence of Mongla and Pasur river April, 2014 (SW2)	Middle of Pasur River Near Rampal TPP July, 2014 (SW1)	Pasur river Near Confluence of Mongla and Pasur river July, 2014 (SW2)
pH	-	7.36	7.27	6.89	6.79
Temperature	^{o}C	30.9	28.7	31.0	29.9
Salinity	ppt	10.0	10.0	0.0	9.5
DO	mg/l	6.5	5.3	7.1	6.2
BOD	mg/l	3.8	2.3	3.3	2.2

Table 33: Water Quality of Pasur River at Mongla Port (2010)

				µS/cm	**mg/l**	**mg/l**	**NTU**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
1	7 Jan	27.4	7.74	3010	879	36	68.7	1565	1510	55	5.1	0.8	55	1.6
2	7 Jan	27.1	7.72	3020	878.8	36	68.5	1570	1510	60	5.1	0.8	55	1.6
3	7 Jan	27.8	7.71	3030	879	36	68.8	1565	1510	55	5.1	0.8	55	1.6
1	11 Feb	29.8	7.66	4380	1262	36	182	2390	2180	210	4.7	1	76	2.3
2	11 Feb	29.2	7.63	4380	1268	36	178	2390	2190	200	4.7	1	76	2.3
3	11 Feb	29.1	7.65	4380	1263	36	179	2380	2180	200	4.7	1	76	2.3
1	9 Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	6.7
2	9 Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	6.7
3	9 Mar	32.1	7.55	11780	2946.4	38	177	6090	5890	200	4.7	1.2	76	6.7
1	17 Apr	32.6	7.59	25300	8273	36	185.6	129.50	12700	250	4.6	0.7	136	15.5
2	17 Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	138	15.5
3	17 Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5
1	5 May	31.6	7.59	29200	9480	36	198.6	14900	14600	300	4.5	1.2	177	17.6
2	5 May	32.9	7.54	29200	9470	36	198.6	14900	14600	300	4.4	1.2	177	17.6
3	5 May	33.2	7.57	29200	9470	36	199.6	14900	14600	300	4.5	1.2	177	17.6
1	13 Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	13 Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	13 Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1 Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1 Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1 Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5 Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5 Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5 Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8 Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8 Sep	31.6	7.76	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8 Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12 Oct	30.6	7.79	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-

				µS/cm	**mg/l**	**mg/l**	**NTU**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
2	12 Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
3	12 Oct	30.6	7.78	290	25.6	36	62.6	192	145	47	5.6	0.7	22	-
1	5 Nov	24.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
2	5 Nov	26.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
3	5 Nov	25.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
1	12 Dec	21.5	7.72	520	62.6	36	72.6	320	260	60	5.1	0.9	25	-
2	12 Dec	20.9	7.71	520	62.6	36	72.6	320	260	60	5.1	0.9	25	-
3	12 Dec	21.1	7.72	520	62.6	36	72.6	320	260	60	5.1	0.9	25	-

Source: DoE, 2010

River Mongla

River Gona

Pasur River

Figure 54: Photographs of Rivers in Study Area

5.13. Ground Water system

Shallow water aquifers in this region of Bangladesh are Saline. Average static water level in shallow aquifers in Manik nagar and project site varies from 1-2 mbgl. These aquifers are saline due to sea water intrusion. With the cyclone Aila in 2009, most of the shallow water aquifers became saline. Fresh water is available in the study area in deep water aquifers of depth varying from 660-997 ft. DPHE supplies water in the Mongla by withdrawing ground water from Foyla haat village located in Rampal Upzila. Mongla port and Economic Processing Zone is also withdrawing water from the same area to fulfil their daily water demand. As per the DPHE, pH of the water is recorded as 8.3, chloride is 428 mg/l, hardness is 196 mg/l, iron is 1.87 mg/l, TDS is 750 mg/l, turbidity is 5 NTU and Arsenic is 0.006 mg/l in this water withdrawal area. The presence of coliform (Feacal) in the water is noted as nil. The detailed aquifers study details are not yet available for the water withdrawal area. However lithology of area is developed by DPHE and shows availability of enough water underground. Ground water test reports by DPHE are attached as Annexure IV. Aquifer test details of the ground water aquifers in the area is attached as Annexure V.

5.14. Land Resources

Archaeological Resources

There is no archaeological resource present within 10 km radius area of the project site. Archaeological resources present in the Bagerhat district are given below

Shatt-Gumbad Mosque, Nine Dome Mosque, and Singara Masjid: They are located at app. 22 km in NNE direction from EZ site and 12 km from point of ground water withdrawal in manic Nagar. All other proposed off-site facilities are more than distance of 15 km.

Ronvijoypur Mosque & Khan Jehan Mausoleum: It is located at app. 30 km in North direction from EZ site. All proposed off-site facilities are more than distance of 20 km.

Chunakhola Masjid: Located at app. 23 km in NE direction from EZ site and 11.0 km from point of ground water withdrawal. All other proposed off-site facilities are more than distance of 15 km.

Kodla Math: Located at app. 31 km in NE direction from EZ site and 18.0 km from point of ground water withdrawal. All other proposed off-site facilities are more than distance of 20 km.

Other sites are Sona Mosque, Seven Domed Mosque, Ten Domed Mosque, One Domed Mosque, Pacha Dighee, Ghora Dighee, Kuthibari, Durgapur Shiva Math & Shiva temple: None of these are located within 5 km radius area of project site.

Land Types

Land types are classified depending upon the depth of inundation during monsoon season due to normal flooding in an average year. SRDI has made the land type classification into five types, i.e. High land (Above flood level), Medium highland (Flooding depth 0-90 cm), Medium lowland (Flooding depth 90-180 cm), Lowland (Flooding depth 90-270 cm) and very lowland (Flooding depth >270 cm). Land type classification based on flooding during Monson Season by SRDI is given below in following Table:

Table 34: Land Type Classification

F0	Highland	0-30 cm	Non flooded to intermittent
F1	Medium Highland	30-90 cm	Seasonal
F2	Medium Lowland	90-180 cm	Seasonal
F3	Lowland	180-270 cm	Seasonal, but remains wet in early dry season
F4	Very Lowland	> 270 cm	Seasonal but remains wet in most of the dry season

Source: SRDI

As per the classification, project site will be covered under highland and study area will fall under both high land and medium highland type

Soil Texture

Soil Investigation has been carried out by BEZA through Consultancy Research & Testing Services, Department of Civil Engineering, Kulna University of Engineering & Technology, Kulna during August 2014 for Boundary wall & Access Bridge and the same is considered for study of geotechnical characteristics. Six boreholes up to the depth of 50 ft. from the existing ground level were drilled. Based on the information obtained from subsoil investigation both in the field and laboratory, it is observed that the sub soil dominantly consists of clay soils all through the depth of the boring. Sample Bore log data is depicted in following figures.

	
Filled sand	Clayey soil in areas which are not filled with river sand

Figure 55: Photographs Showing Soil Profile of Area

Appendix A: BORE LOGS

Project : Construction of Administration Building at Proposed Bangladesh Economic Zone, Buridanga Union (No. 2), Mongla, Bagerhat		CRTS Civil, KUET, Khulna.
Client : Project Director (Additional Secretary), Bangladesh Economic Zone Authority, Office of the Prime Minister, Dhaka	Engineer	Start : 08-07-2014
Location : Mongla EPZ, Mongla, Bagerhat		End : 08-07-2014
Bore hole number : *BH1*	G.W.T. : 2' - 3"	Sample

Depth (ft.)	Strata Encountered	Bore Log	SPT Value	Blow number 10 20 30	DS	US	Remark
0	Filled material						
5			2				
10	Clayey silt Gray		9				
15			4				
20			3				
25			5				
30			4				
35			4				
40			4				
45			3				
50			5				
60	Silty sand with clay Gray		8				
70			17				
80			23				
90	Silty sand Gray		26				
100			40				

DISTURBED: SAND: CLAY: FILLED MATERIAL:
UNDISTURBED: SILT: CLAYEY: SILTY: SANDY:

Figure 56: Bore log data- Near Administration Building

Based on the information obtained from sub-soil investigation at the location of administration building, the sub-soil predominantly consist of clayey Silt from the existing ground surface to the depth of 60 ft. overlying on the competent soil predominantly consisting of silt sand extending to the bottom of the boring, which should be considered while selecting a suitable type of foundation to support the structure.

Appendix A: BORE LOGS

BORE LOG

Project: Construction of Bridge on Ghona River, Burirdanga, Mongla, Bagerhat, Bangladesh	**CRTS Civil, KUET, Khulna.**
Client: Project Director (Additional Secretary), Office of the Prime minister, Bangladesh	**Start: 16-07-2014**
Location: Burirdanga, Mongla, Bagerhat	Engineer — **End: 16-07-2014**
Bore Hole Number : 01	**G.W.T. +1.5 ft.**

Depth (ft)	Strata Encountered	Bore Log	SPT Value	Blow number (6 12 18 24 30 36 42 48)	Sample US	Sample DS	Remark
0 – 5	Silty Clay, Gray		2				
10	Sandy Silt with Clay, Gray		2				
15	Clayey Silt, Gray		2		Miss		
20	Clayey Silt little Sand, Gray		3				
25			3				
30	Clayey Silt, Gray		2				
35			3				
40			4				
45			3				
50			4				
60	Clayey Silt trace Sand, Gray		11				
70	Sandy Silt with Clay, Gray		20				
80			22				
90	Silty Sand, Gray		35				
100			36				

UNDISTURBED: SAND: LITTLE SAND: SANDY
DISTURBED: SILT: CLAYEY: CLAY:

Figure 57: Bore log data- Bridge

Based on the information obtained from sub-soil investigation at the location of the proposed bridge both in the field and laboratory, it may be concluded that the sub-soil consists of predominantly clayey silts of soft-stiff consistency up to the depth of 60 ft. from the existing ground surface overlying on the soil layer consisting of silt sand of medium to dense compactness extending up to the bottom of the borings, which should be considered while selecting a suitable type of foundation for the construction of bridge on Gona River.

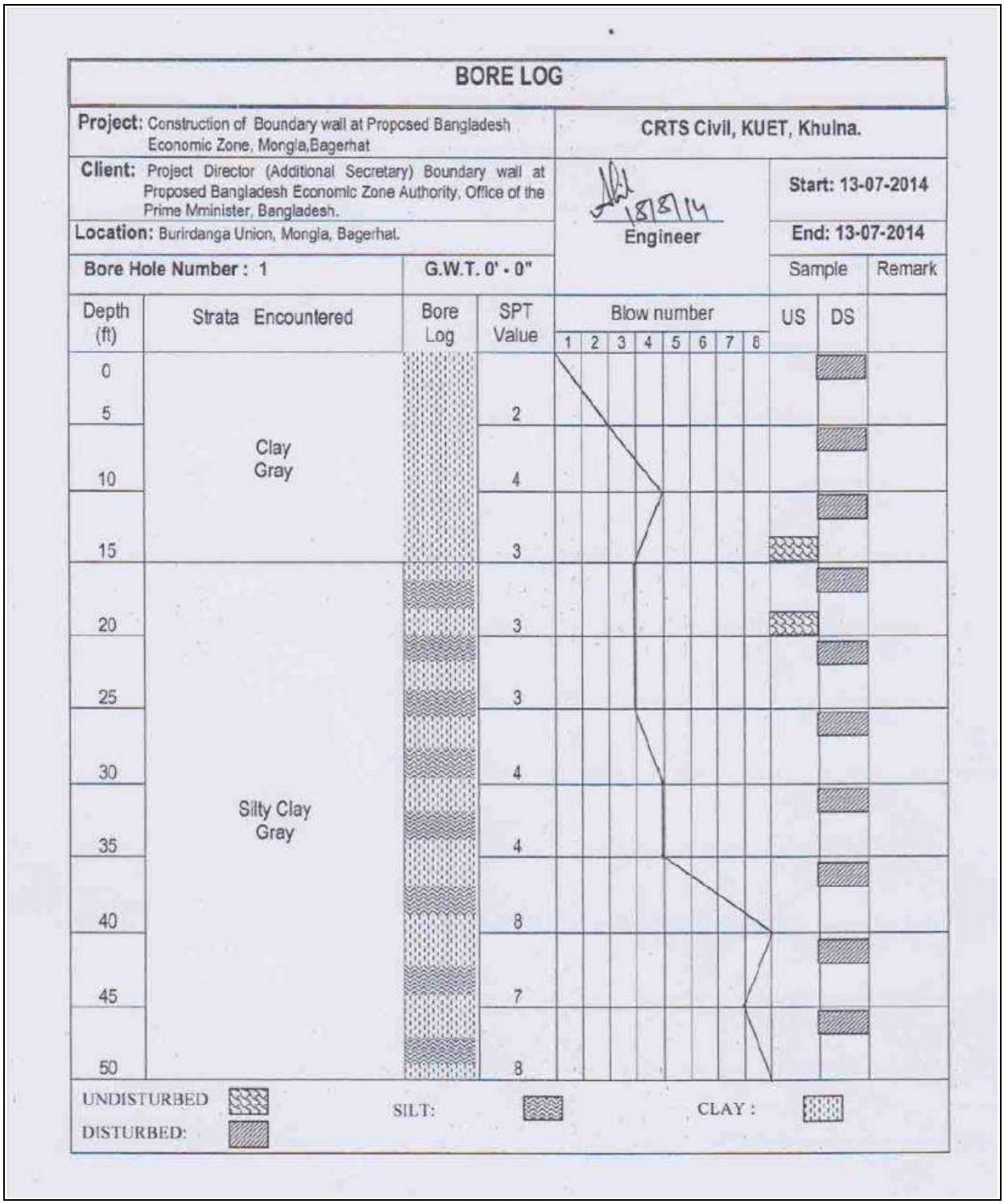


Figure 58: Bore log data- Boundary wall

Based on the information obtained from sub-soil investigation at the location of boundary wall both in the field and laboratory, it may be concluded that the sub-soil dominantly consists of Clay soils all through the depth of the boring, which should be considered while selecting a suitable type of foundation to support the wall.

Physio chemical quality test has also been conducted by CEGIS at Kapalirmet, Buridmial (SQ1) which is app. 3.5 km from project site in North direction.

Table 35: Physio-chemical analysis of Soil Quality (April, 2014)

S. No.	Parameters	Soil Quality Results (SQ1)	Analysis
Top Soil (0-15 cm)			
1	EC (ds/m)	4.8	Slightly saline
2	pH	7.0	Neutral
3	OM (%)	3.0	Medium
4	N (%)	0.2	Low
5	K (%)	1.5	Very high
6	Ca (meq/100g)	18.2	Very high
7	Mg (meq/100g)	15.3	Very high
8	Na (meq/100g)	12.0	--
9	P (µg/gm)	3.2	Very low
10	S (µg/gm)	545.2	Very high
11	B (µg/gm)	1.2	Very high
12	Fe (µg/gm)	37.3	Very high
13	Mn (µg/gm)	3.8	Very high
1	Zn (µg/gm)	2.0	High
15	Lead-Pb (µg/gm)	12.5	-
16	Chloride (Cl^-) (µg/gm)	3741.9	-
Subsurface soil (15-30cm)			
17	EC (ds/m)	11.1	Moderately saline
18	pH	7.2	Neutral
19	OM (%)	2.6	Medium
20	N (%)	0.2	Low
21	K (%)	1.5	Very high
22	Ca (meq/100g)	11.7	Very high
23	Mg (meq/100g)	7.1	Very high
24	Na (meq/100g)	8.5	-
25	P (µg/gm)	3.8	Very low
26	S (µg/gm)	341.4	Very high
27	B (µg/gm)	0.86	Very high
28	Fe (µg/gm)	140.2	Very high
29	Mn (µg/gm)	3.7	High

S. No.	Parameters	Soil Quality Results (SQ1)	Analysis
30	Zn (µg/gm)	0.94	Medium
31	Lead-Pb (µg/gm)	0.0	-
32	Chloride (Cl^-) (µg/gm)	2217.4	-
Substratum (30-45cm)			
33	EC (ds/m)	10.8	Moderately saline
34	pH	7.3	Neutral
35	OM (%)	2.8	Medium
36	N (%)	0.15	Low
37	K (%)	1.5	Very high
38	Ca (meq/100g)	12.9	Very high
39	Mg (meq/100g)	10.4	Very high
40	Na (meq/100g)	8.5	-
41	P (µg/gm)	3.4	Very low
42	S (µg/gm)	345.1	Very high
43	B (µg/gm)	1.4	Very high
44	Fe (µg/gm)	120.3	Very high
45	Mn (µg/gm)	2.9	Optimum
46	Zn (µg/gm)	0.88	Medium
47	Lead-Pb (µg/gm)	0.0	-
48	Chloride (Cl^-) (µg/gm)	180.16	-

Source: CEGIS

Soil quality/fertility is an important factor for crop production. In general, organic matter content of the soil is pretty low in the coastal regions of Bangladesh. The monitoring study area comprises the Agro-Ecological Zone-13 (Ganges Tidal Flood Plain) (BARC, 2012). So, the analysis report of soils of monitoring land was compared to the AEZ physic-chemical properties of soil to understand the variation of the soil fertility status of monitoring land. Texture of the soil in the area is clay and clay loamy. Soil are saline and salinity level varies from 4.8 to 11.7 ds/m which indicates soil are slightly too moderately saline. pH varies from 7-7.3 which indicates soil at this location is neutral to slightly basic in nature. Content of organic matter varies from m 2.6-3.0% which is medium as per BARC, 2012. Lead is also present in soil of this region.

Land Use

Land use land cover study has been carried out for the site and the area within 30 km radius of the project site. Major portion of the EZ site is covered with sand dredged from Pasur river. Area along the Gona river has some naturally grown vegetation consisting of trees, shrubs, weeds and grasses. This area is planned to be left as green buffer. Some of the area at site is not filled and is used for agriculture and aquaculture by nearby villagers. Four major land use class has been identified in the 30 km study area, i.e. Water body & stream, Forest, Agriculture/Aquaculture and settlements. Major area within the study area is covered by agriculture/aquaculture followed by Sundarban reserve forest. Land use map of the study area (area within 30 km radius of project site) is shown in the figures & table below.

Table 36: Land use Details for the 30-km radius area around the proposed project site

Settlements	43791.90	15%

Agriculture & Aqua culture	128137.32	45%
Water body & streams	20400.11	7%
Forest area (Sunderban)	90706.62	32%
Total area	**32668.56**	**100%**

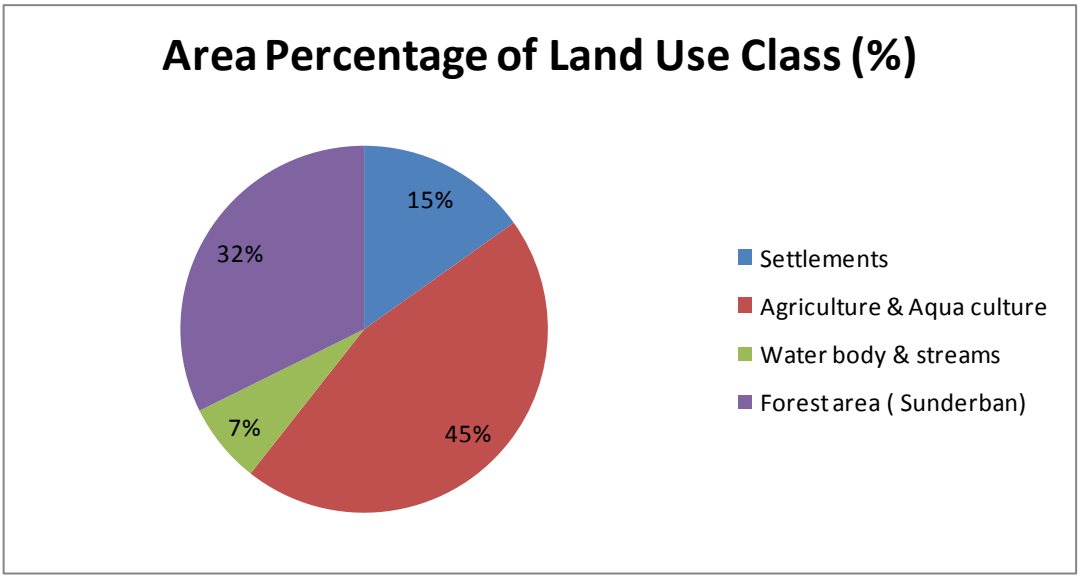


Figure 59: Area under Each land Use Class

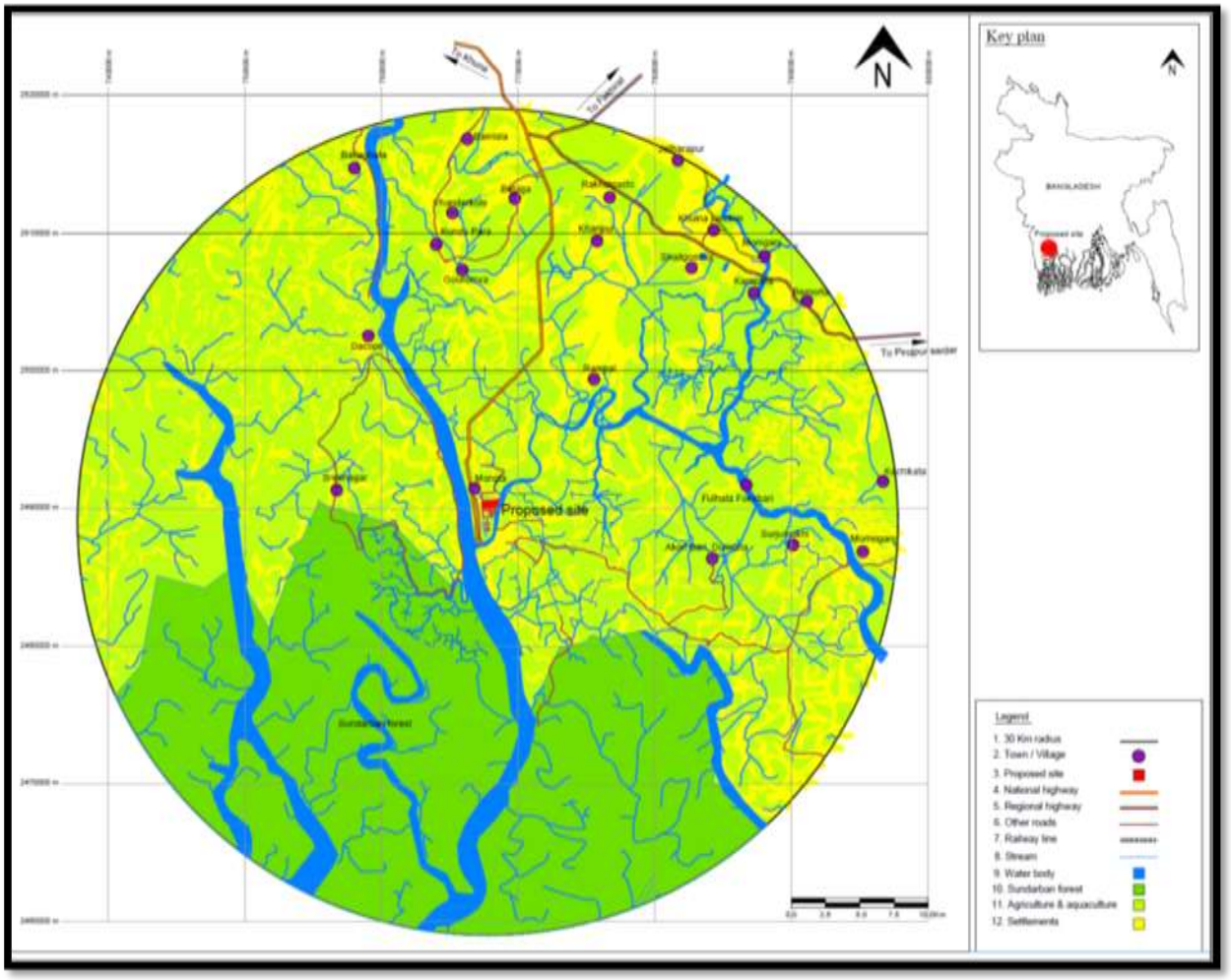


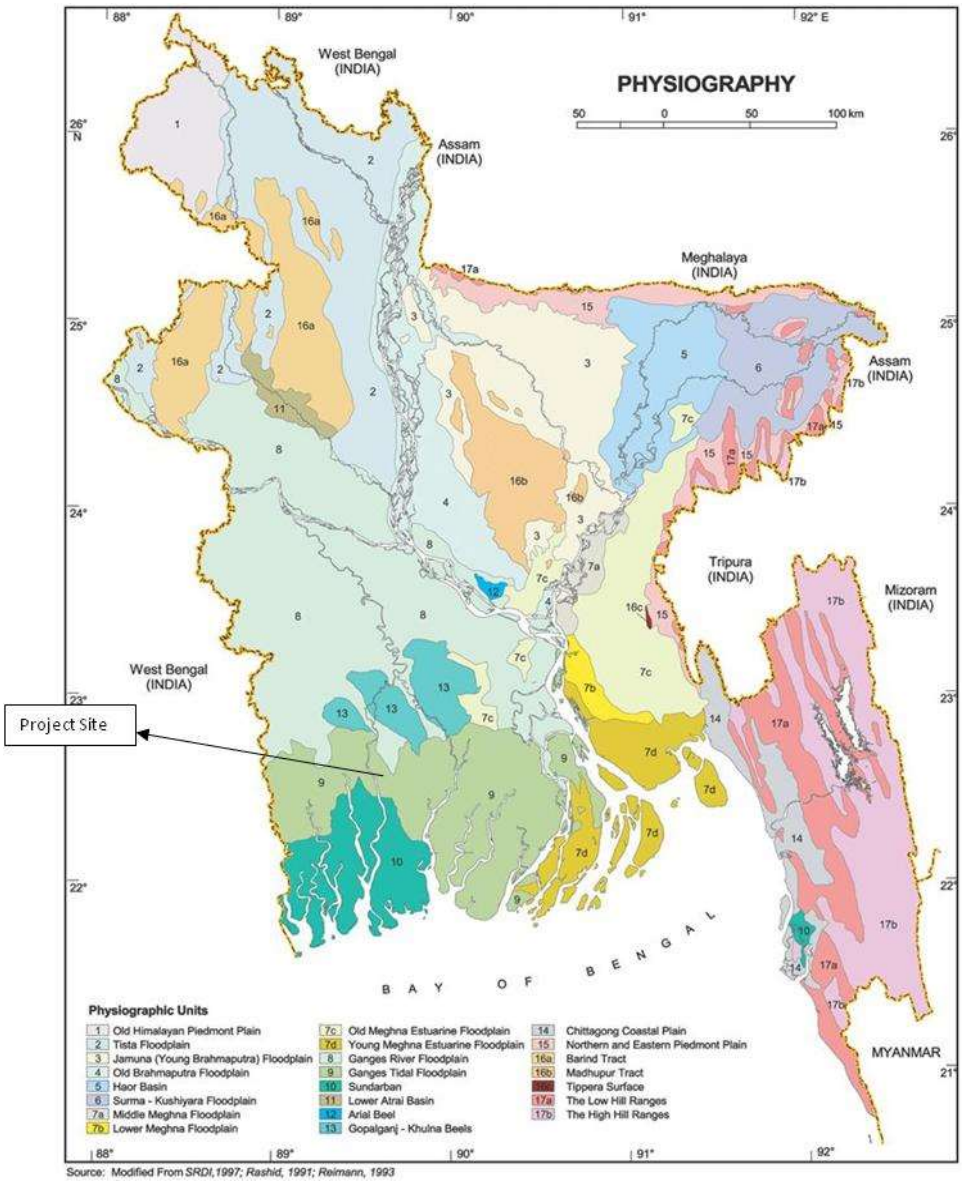
Figure 60: Land Use Map of the Study Area (30 km Radial Zone)

Topography

Bangladesh is the largest deltaic region in the world with most of its parts, at low elevations. It is a riverine country criss-crossed by innumerable rivers, rivulets and their tributaries. It is divided into five physical regions- the Ganges Delta proper to the southwest, the Paradelta to the northeast, and the southeast undulating Chittagong region.

Ganges total flood plains is the tidal landscape has a low ridge and a basin relief crossed by many tidal rivers and creeks. Local differences in height are generally less than 1 m compared with 2-3 m on the Ganges floodplain. Physiographic map of Bangladesh is given in Figure below.

The proposed project site is generally flat and poorly drained. Proposed project site is filled to the level of 6 ft. (1.8 m) w.r.t surrounding area by Mongla Port Authority by dredged sand from Pasur river (to make Pasur river navigable) raising the ground level of the site. Finished level of site will be app. 6 m above mean sea level after development of EZ. Ground level of EZ site will be 1.5-2.0 m above average HFL of Pasur River (4.45 m). Elevation of the site is 3-6 m above the sea level. The elevation within the 10 km radius area varies from 1 m to 11 m.



Source: Modified From *SRDI,1997; Rashid, 1991; Reimann, 1993*

Figure 61: Physiographic Map of Bangladesh

Seismicity

In the earthquake zoning map of 1993, 26 percent of Bangladesh falls in high risk, 38 percent moderate and 36 percent in low risk zone in terms of earthquake vulnerability. The distribution of recorded earthquakes indicate a major clustering of seismicity around the Dauki Fault and scattering of other events along other major fault systems of Bangladesh. The magnitude of the earthquakes are moderate (4-6) and majority of them are shallow depth.

As per tectonic classification, the area falls under Faridpur trough of Western platform flank which is adjacent to the hinge line.Tectonically this area is inactive and no apparent major structure like fault or fold exists in the region that might be geologically significant (Sir William Halcrow and Partners ltd., 1993). List of the major earthquake that hit Bangladesh are listed in following table.

Table 37: List of Major Earthquake Affected Bangladesh

10 January, 1869	Cachar Earthquake	7.5
14 July, 1885	Bengal Earthquake	7.0
12 June, 1897	Great Indian Earthquake	8.7
8 July, 1918	Srimongal Earthquake	7.6
2 July, 1930	Dhubri Earthquake	7.1
15 January, 1934	Bihar-Nepal Earthquake	8.3
15 August, 1950	Assam Earthquake	8.5

Source: Bangladesh Disaster Knowledge Network

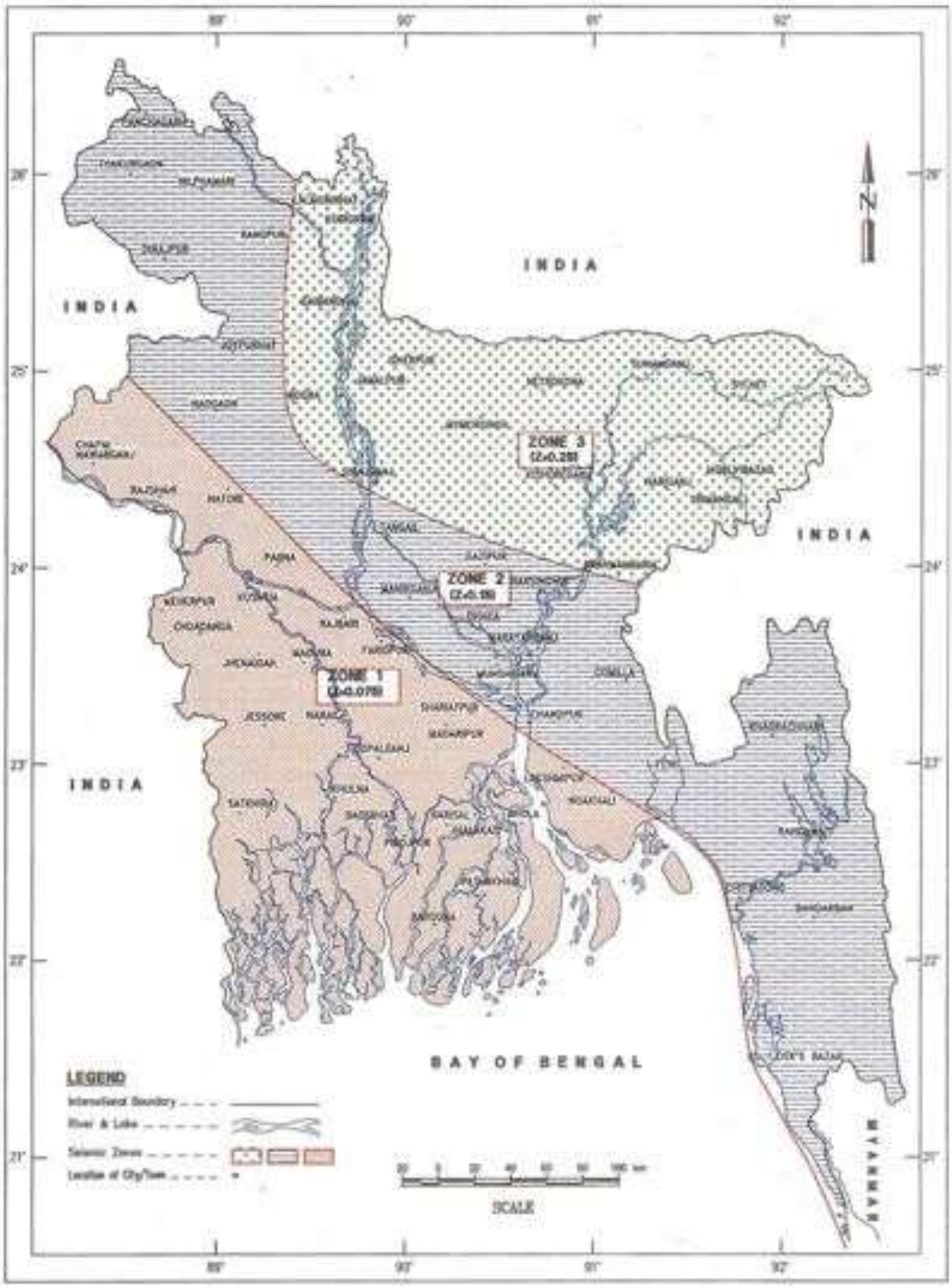


Figure 62: Seismic zone map of Bangladesh

5.15. Agriculture Resources

As per the land use land cover study of 30 km radius of the project site, approx. 45% of the area is covered under agriculture land. No agriculture or aquaculture activity takes place at the site presently. Earlier agriculture and aquaculture were carried out by people of village Burirdanga and have taken land on lease from Mongla Port Authority.

Farming Practice

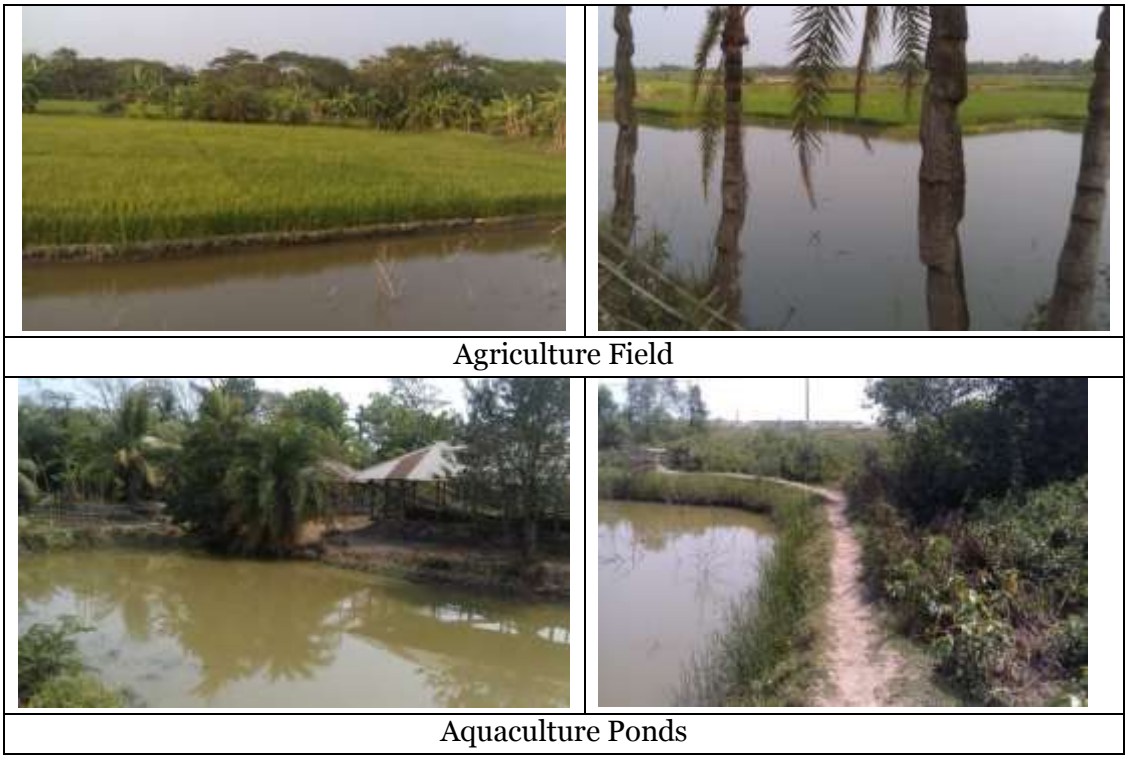
Agriculture

Farmers practice agriculture in this region for 3 seasons, i.e. Rabi, Kharif I and Kharif II. Source of irrigation in this region are storm water are natural beels, ponds etc. There are 2 rivers and 11 dighee in Mongla Upzila. Major crops of the region are rice, vegetable, fruits, jute and pulses.

Aquaculture:

Farmers of Bagerhat district used both natural and hatchery post larvae (PL) in their farms. 60% of farmers of Mongla used hatchery produced PL. Post larvae were collected either from arat (Business establishment with storage facilities for selling and purchasing) of PL mockams (Business centre, place where located a number of arats). Farmers carry PL in aluminium pots to the fields.). Shrimp farming is not very old practice in Bagerhat district. This became popular only after 1995 and maximum between 2001-2004.

The culture period was typically four months for bagda and six to seven months for golda. Hatcheries PL are stocked mainly in May to June for prawn and from late March for bagda. The average stocking density of shrimp PL golda and bagda was 24.16 and 12.16 thousand/ha in the farms. Varieties of feeds such as cooked rice, fishmeal, oilcake and snail muscle were used for shrimp culture. Mainly virus disease was responsible for the great loss of shrimp in this area. About 46.34% of the surveyed farms faced a huge damage due to WSBV. The average bagda and golda production was 350.37 kg and 428.08 kg/ha/year. Long term sustainability of shrimp farming facing problems due to lack of money, poor supply of good quality PL, lack of technical knowledge, higher production costs and poor institutional support (Chandra K.J., Chowdhury A. R. & Das D.R., 2010).



Agriculture Field

Aquaculture Ponds

Figure 63: Photographs Showing Agriculture Fields and Aquaculture Ponds

Cropping Pattern and Intensity

Major portion of the land within study area is under agriculture. Agriculture land comprise of fallow and agriculture land areas, seasonal gher and aquaculture ponds. There are three cropping seasons, i.e. Kharif-I, Kharif-II and Rabi. Major agriculture pattern in study area is Fallow-T.Aman (Local), local fruits (water melon and Bangi) and B.Aus. Major crops of each cropping season are as follows:

- In Kharif-I-B.Aus, Jute and vegetables
- In Kharif-II-T.Aman and fallow land
- In Rabi season: Boro (HYV), vegetables, fruits and pulses

Crop Calendar

Raising of seedling starts in the area in mid-August to mid-September depending on rainfall and salinity. Sowing of B.Aus generally starts from March and continues till late April. Boro (HYV) crops are transplanted during late December to late January. The seeds of water melon/Bangi are generally sown in December–January just after recession of water from the field. T.Aman (Local) crops are harvested during December whereas the harvesting of B.Aus is generally done during mid-July to mid-August. Some vegetables are very sensitive to temperature. Therefore, the time of sowing and harvesting of vegetables vary.

Table 38: Crop Calendar of the Area

	Start	**End**	**Start**	**End**	**Start**	**End**
T.Aman (local)	Early July	Early Aug	Early-Aug	Mid-Sep	Early-Dec	Late-Dec
B.Aus	-	-	Late-Mar	Late- Apr	Mid-Jul	Mid-Aug
Boro (HYV)	Mid-Nov	Mid-Dec	Late Dec	Late Jan	Late Aril	Late-May
Vegetables (W)	Early Nov	Dec	Nov	Dec	Jan	May
Vegetables (S)	June	July	-	-	Aug	Oct
W.melon/Bangi	-	-	Mid-Dec	Mid-Jan	Mar	June
Pulses	-	-	Mid-Nov	Mid-Dec	March	April
Jute			Late Mar	April	Late July	Mid Aug

Source:DAE, Rampal

Cropped Area

As per the land use land cover study of 30 km radius of the project site, approx. 45% of the area is covered under agriculture land. No significant agriculture land area will be used for development of proposed off-site facilities. Only 0.166 acres of agriculture land will be purchased/acquired for development of pump house for water supply system

Crop Production, Damage and Constraints of Crop Production

Farmers of Bagerhat district produce food crops, cash crops, fruits, vegetables, livestock and poultry, fish, timber and fuel wood. Majority of household also have poultry, livestock and produce poultry and livestock produce for daily consumption and selling. As per BBS statistics, 2008 permanent cropped area in Mongla upzila is 1246 ha, temporary cropped area is 19296 ha, permanent fallow area is 970 ha. Out of 12987 ha is single cropped, 6352 ha is double cropped, and 957 ha are triple cropped (BBS).

Major crops of the area are: Paddy, wheat, jute, sugar cane, potato, banana, onion, garlic etc. are main crops of this district. Major constraints of agriculture in the study area is availability of arable land, crop damage, seasonal flooding of land, water logging, soil salinity and availability of high quality seeds and fertilizers.

5.16. Livestock and Poultry

Livestock and poultry, being an essential sector of integrated farming system, play an important role in the economy of the study area. Livestock provide significant draft power for cultivation, threshing and crushing of oil seeds. Cow dung is used as a source of manure and fuel. Meat, milk and eggs are used for human consumption and a ready source of funds. Most of the households raise poultry and livestock, a practice that significantly reduce the poverty by generating employment and income.

Figure 64: Photographs Showing Livestock & Polutry in the area

Feed and Fodder Shortage

The owners of the livestock population are facing problems in respect of availability of fodder and feeds during the month from March to December due to shortage of grazing fields. In dry and Kharif-I seasons, the lands are generally submerged with saline water especially in the project area and major portion of the study areas. During Kharif-II season, the fields are covered with T. Aman (Local). Rice straw is the main fodder for cattle. Bran of wheat and rice, oil cakes, powder of cereal crops etc. are the other common fodders, but the availability of these feed in these areas is rare. Shortage of grazing area 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 to the poultry.

Livestock/Poultry Diseases

Most common livestock diseases found in the study area are foot and mouth disease (FMD), Anthrax, Diarrhea, PPR etc. The got/cyst in head is common disease of goat. Major poultry diseases are Duck Plague, Paralysis, New Castle, Fowl pox, and Dysentery etc. The most vulnerable period is between July to October (rainy season) months for spreading diseases to livestock and poultry populations. The duck plague generally occurs in summer.

5.17. Fisheries

Introduction

Fisheries resources of the study area are rich and diversified. Study area consists of rivers, aquaculture ponds, beels and Khals. Details of the fisheries of the study are is given in sections below

Habitat Description

Fish habitats of the area are creeks, Khal, rivers, aquaculture ponds, natural ponds and beels. Water in these bodies varies from fresh to brackish. Both natural and cultured fisheries exist in the study area. Culture fish habitats are generally for shrimps culture.

Fish Migration

The dynamic network of Pasur river systems of this area connects fresh water fish habitats with brackish water habitats and maintains biological balance of the major groups of fishes. It offers the route for fish migration for both anadromus and catadromus fishes. The fishes use the Sundarbans as a nursery, breeding and feeding ground and return to the sea or freshwater. Fishes like Khorsula (*Mugil corsula*), Gulsha Tengra, Rui, Catla, Shol, Taki, Pungus Tengra, Shing, Magur, Koi, Puti, Datina (*Pomadasys spp.*), Bagda (*Penaeus monodon*) etc are very common in these areas. A number of fish species spend most of their life stages outside the Sundarbans but come to breed here. These types of fishes are Gulsha Tengra, Poma, Phesa (*Setipinna spp.*), Pungus, Golda, Topshi (*Polynemus paradiseus*), Parsha, Chamua Chingri, etc. depending on ichthyoplankton concentration due to reduced salinity. Marine fishes like Ghagot (*Tachysurus jella*), Apula (*Osteogeneisus militaris*), Lakhya (*Polynemus indicus*) and Tailla (*Polynemus Tetradactylus*) are also present in this area. Fishes that use the Sundarbans as both nursery and spawning ground are Gulsha Tengra, and some other species. Many marine fishes come to the Sundarbans only for feeding as this area is rich in food organisms. This type of fishes are Chaka Chingri, Chali Chingri, Motka Chingri, Tiger Chingri, Gura Chingri (*Leander stylifera*), Begi Ilish (*Tenualosa ilisha*), Rupchanda, Gang Thurina, Boiragi, Potka, Shapla Pata, Kamot, Tulardati (*Silago domina*), Pokki, Pankha, Baim, Churi (*Lepturacunthas savale*), Lottya (*Harpadon neherius*), Kaldi, Korina, etc. The juveniles of many marine species of prawns and fishes e.g. Chaka Chingri (*Penaeus indicus*), Gura Chingri (*Leander stylifera*) and various sciaenid and ribbon fish (Churi Mach) migrate into the lower zone of the estuary during the winter and summer months to feed and then return to the sea with the onset of the monsoon. Some other fishes like Koral (*Lates calcarifer*), Jaba, Kawn, Chitra, Chapli Chela, Tarial, Borial, Crab, Renua (mus skeeper- *Boleophthalmus spp*), etc. spend most of their life stages in the Sundarbans. Many threatened and endangered species also live in these area e.g. Khorsula (critically endangered), Pungus (endangered) etc.

Fish Biodiversity, Production and Effort

Study area has two main rivers and various small ponds. Area has rich and diversified fisheries. Total fish production of Bagerhat district is 99779 metric ton. Out of the total fish production in Bagerhat district, 4762 MT is produced from river, 13605 MT from Sundarban wetlands, 17 MT from Beel, 7608 MT from flood plains, 13143 MT from ponds, 3848 MT from seasonal cultured water body and 56796 MT from shrimp/prawn farms.

Fish habitats vary from fresh water to brackish to saline. Pasur River is also home to Ganges Dolphin (*Platanista gangetica*). Fresh water dolphins are endangered species as per Bangladesh Wildlife Act 2010. However, Dolphin is not found in Mongla or Gona River. Pasur River is habitat for wide variety of fishes, Irrawaddy dolphin and estuarine crocodiles also. People practice shrimps (Bagda pona/Penaeus monodon & Goda pona Macrobrachium resenberil) and crab (especially mud crab/Scylla serrata) cultivation in the study area. Crabs are collected from inter-tidal creeks, khals, mangrove area and rivers. Some of the native fish varieties in the region are Paisha (*Liza Persia*), Taposhi (*Polynemus paradisous*), Vatki (*Lates calcarifer*), Datina (*Sparus datina*), Vhola (*Barilius Bole*), Illish (*Hilsa ilisha*), Tilapia

(*Tilapia mossambica*), Nilotica (*Oreochromis niloticus*), Pangus (*Pangasius sutchi*) & African Magur (*Clarias gariepinus*). Detail of fisheries in this area is given in section ecosystem tables below.

Fisheries Management, Problem and Issues

Project activities will not directly interface with fisheries activities and hence is not likely to disturb any fisheries. Project authorities will ensure that no obstruction is caused during construction and operation phase of project for movement of fisherman. Any additional measures require will be taken care by project authority with guidance of fisheries department to manage fisheries.

5.18. Ecological Resources

Bio-ecological zone

The baseline ecological surveys were carried out, based on various secondary sources (Forest Department Data, Scientific Studies and previous similar studies) which are further validated from through field observations and interaction with local people. Present biological assessment was carried out for core zone (at the economic zone site and offsite facilities areas) and buffer zone (10 km surrounding the core zone area).

Core Zone –Ecological assessment

Economic zone site & Administration Building:

Upcoming economic zone is located at Mongla Upzila of Bagerat District and is devoid of any plantation. It is filled with the sand dredged from Pasur River to height of 6 ft. by Mongla Port Authority. Fertile top soil is still available at large area of economic zone. Some agriculture and aquaculture activities were taken up by nearby villagers within the zone in the past but these activities have been discontinued now. Administration building will be constructed within the economic zone site.

Vegetation along Gona River

Vegetation in filled area


Vegetation in non-filled area

Figure 65: Photographs Showing Vegetation at EZ Site

Access Road & Bridge

Proposed access road to connect site with the Mongla port road, crosses through Mongla port commercial colony. Trees of Sirish, Palm, banana, Papaya, Mango, Mahagony, Dumur, Baroi, Tamaring, Black berry, Kewda, Geuwa etc are present all along the proposed road. LT line (LHS), urthan (kachha) houses and shops also exist along the proposed road. Bridge is to be constructed over Gona River to connect the access road and site such that no pillar will be constructed on the river. Trees of Kewda, Dumur, Mahagony, Baroi, and Gewa are existing along the bridge alignment that may require to be removed. Approx. 30-40 trees will require to be fallen for construction of access road and bridge.




Vegetation along access road

Vegetation in bridge alignment

Figure 66: Photographs Showing Vegetation along the Proposed Access Road and Bridge Alignment

Water pipeline

Water is proposed to be taken from the Manik nagar by digging three nos. of tube wells. Underground pipeline will be laid along the roads. Plantation of banana and papaya exists all along the proposed road which are likely to be affected. Trees of palms, mahagony and Dumur etc. also exist along the road which may be affected.

Vegetation along water pipeline alignment

Figure 67: Photographs Showing Vegetation at EZ Site

Table 39: Nos. of Trees to be fell down for laying Underground Water Pipeline

Fruit bearing				
Banana	240	190	129	559
Coconut	2	1	0	3
Dates(Palm)0	0	1	5	6
Guava	0	1	1	2
Sajna	1	2	4	7
Papaya	0	5	0	5
Jackfruit	4	8	0	12
Boroi	2	0	0	2
Mango	3	0	0	3
Babla	0	1	0	1
Bengal almond	4	0	0	4
Total	**256**	**209**	**139**	**604**
Non fruit bearing				
Arjun	1	0	0	1
Champal	0	3	4	7
Shirish	10	25	9	44
Eucalyptus	0	0	1	1
Gewa	4	0	0	4

Moahogany	0	0	7	7
Neem	1	0	0	1
Total	**16**	**28**	**21**	**65**

Electrical system

Electrical supply will be taken from the Mongla substation. HT line will be passing through the agriculture fields. Major agriculture crop in the affected area is rice (Aman & Aus depending on season) and vegetables.

Buffer Zone: Ecological Assessment

Buffer area of 10 km is considered for studying the ecology around the project site. Study area has all terrestrial, auatic and wetland ecosystem. The river system of the area is rich in aquatic flora and fauna. Substantial fishing activities are carried out in these rivers. Major area in the study area comprises of the Sundarban forest and agriculture activities. Agriculture activities include both the crop cultivation and aquaculture. Aquaculture ponds can be seen everywhere in the study area and people practice aquaculture throughout the year along with the agriculture. Sundarban reserve forest exists at app 5 km from economic zone site and is rich in both flora and fauna. An assessment on the ecology has been made for the study area from the available secondary data.

Common Flora and Fauna in buffer zone

In general brackish water ecosystem is dominant in the study area. Villages having high elevation, low todal flushing and low salinity show brackish to fresh water ecosystem. Fresh water ponds comprise of the plants like: water lily, water hyacinth, *Pistia stratiotes, Lemna minor* etc. Source of fresh water ponds is only rainwater in the study area. Study area is divided in two parts sunadrban areas and other areas. Sundarban areas flora and fauna is given separately following the other area flora and fauna details.

Flora

Major trees recorded during the visits are papaya, banana, palms, coconut, ladyfinger, tomato, mahagony, jack fruit, water melon, cucumber, Neem, Bamboo, Castor, Hibiscus, Rongi, Sisoo, Sapota, Lime, Baroi, Jujubi, Arjun, Mango, Peyara, Safeda (*Manilkara zapota),* Akashmoni (*Accacia*), Golpata etc. List of the plants found in study areas are given in the following table.

Table 40: Species Composition of the Plants found in study area

Species Name	Local Name	Family
Acacia moniliformes	Akashmoni	Leguminosae
Aegle marmelos	Bel	Rutaceae
Albizia richardiana	Chambol	Leguminosae
Albizia saman	Sirish/Rendi Koroi	Leguminosae
Anona squamosa	Ata	Anonaceae
Areca catechu	Supari	Palmae
Avecenia alba	Baen	Aviceniaceae
Azadirachta indica	Neem	Meliaceae
Borassus flabeliffer	Taal	Palmae
Carica papaya	Pepey	Caricaceae
Citrus medica	Kagoji Lebu	Rutaceae
Cocos nucifera	Narikel	Palmae
Cordia dichotoma	Bohal	Boraginaceae

Species Name	Local Name	Family
Diospyrus pregrina	Deshi Gab	Ebenaceae
Dyospyros blancoi	Bilati Gab	Ebnaceae
Excoecaria agallocha	Gewa	Euphorbiaceae
Feronia lemonia	Kaotbel	Rutaceae
Ficus religiosa	Aswath	Moraceae
Ficus sp	Zeer Bat	Moraceae
Gardenia augusta	Gondhoraj	Rubiaceae
Hibiscus rosa sinensis	Jaba	Malvaceae
Hibiscus	Bola	Malvaceae
Herritiera fomes	Sundari	Sterculiaceae
Ixora coccinea	Rangan	Rubiaceae
Mangifera indica	Aam	Anacardiaceae
Manilkara zapota	Safeda	Zapotaceae
Mimusops elengii	Bakul	Zapotaceae
Moringa oleifera	Sazna	Moringaceae
Musa sp	Kola	Musaceae
Nypa fruticans	Gol	Palmae
Phoenix sylvestris	Khejur	Palmae
Phylanthus acidus	Naul/Orboroi	Euphorbiaceae
Pongamia sp	Koroj	Leguminosae
Psidium guajava	Peyara	Myrtaceae
Punica granatum	Dalim	Lythraceae
Quisqualis indica	Madhabilata	Combrataceae
Sonneratia apetala	Kewda	Lyrthaceae
Spondius pinnata	Amra	Anacardiaceae
Swietenia mehagoni	Mehogani	Meliaceae
Syzygium cumini	Jaam	Myrtaceae
Syzygium samarengense	Jamrul	Myrtaceae
Tamarindus indica	Tentul	Leguminosae
Terminalia catapa	Kathbadam	Combrataceae
Zizyphus mauritiana	Kul	Rhamnaceae

	
Coconut (Cocos nucifera)	Eucalyptus
	
Neem (Azadhirachta indica)	Mango (Mangifera indica)
	
Boroi Tree (Albizia procera)	Pseudo Ashoka (Polyalthia longifolia)

Figure 68: Photographs Showing Vegetation in Buffer Zone

Avifauna Brids like Crane, Kingsfisher, House sparrow, Crow, Parrot, Myna, Eagle, black drongo etc. were spotted during the site visit at the site and in the settlement areas around the project site within 10 km radius from project site. Due to presence of various waterbodies and aquaculture ponds, water dependent birds are found to be present in the area. Presence of trees, bushes, shrubs provide favorable nesting requirement for the avifauna of the area. Local birds present in the study area are listed in following table. As per local discussions, it is found that few migratory birds visit this area during winter season. Most of the migratory birds are saline water dependent and rest near the Gher & Beel.

Table 41: Avifauna of Study Area

S. No.	Species Name	Local Name	Family
1.	Accipiter badius	Shikra	Shikra
2.	Acridotheres fuscus	Jungle Myna	Jhuti Shalik
3.	Acridotheres tristis	Common Myna	Bhat Shalik

S. No.	Species Name	Local Name	Family
4.	Actitis hvpoleucos	Common Sandpiper	Chah Pakhi
5.	Aegithina tiphia	Common Iora	Pati Fatikjal
6.	Alcedo atthis	Common Kingfisher	Pati Machranga
7.	Amaurornis phoenicurus	White-breasted Waterhen	Dholabook Dahuk
8.	Ardeola grayii	Indian Pond Heron	Deshi Kanibok
9.	Athene brama	Spotted Owlet	Khuruley Pencha
10.	Bubulcus ibis	Cattle Egret	Go Boga
11.	Butorides striatus	Little Heron	Choto Bok
12.	Casmerodius albus	Great Egret	Jattha Bok
13.	Centropus bengalensis	Lesser Coucal	Kana Kukka
14.	Copsychus saularis	Oriental Magpie-Robin	Udoi Doel
15.	Cypsiurus balasiensis	Asian Palm Swift	Ashio Talbatashi
16.	Dendrocygna bicolor	Fulvous Whistling-Duck	Boro Sarali
17.	Dendrocitta vagabunda	Rufous Treepie	Khoira Harichacha
18.	Dendrocygna javanica	Lesser Whistling Duck	Choto Sarali
19.	Dendrocopos macei	Fulvos breasted woodpecker	Kathkurali
20.	Dicrurus macrocercus	Black Drongo	Kala Fingey
21.	Dinopium benghalense	Black ramped Frameback	
22.	Egretta garzetta	Little Egret	Choto Boga
23.	Eudynamys scolopacea	Asian Koel	Kokil
24.	Gallinula chloropus	Common Moorhen	Jolmurgi
25.	Halcyon smyrnensis	White-throated Kingfisher	Dholagola Machranga
26.	Haliastur Indus	Brahminy Kite	Shonkho Chil
27.	Ixobrychus cinnamomeus	Cinnamon Bittern	Nolkhoka
28.	Ixobrychus sinensis	Yellow Bittern	
29.	Ketupa zeylonensis	Brown fish owl	Bhutum pecha
30.	Lanus schach	Long-tailed Shrike	Lenja Latora
31.	Macronous gularis	Striped Tit Babbler	
32.	Megalaima haemacephala	Coppersmith Barbet	Choto Boshonto Bauri
33.	Merops orientalis	Green Bee Eater	Suichora
34.	Motacilla maderaspatensis	White-browed Wagtail	
35.	Nectarinia asiatica	Purple Sunbird	Durgo Tuntuni
36.	Netapus coromandelianus	Cotton pygmy goose	Bali Hansh
37.	Oriolus xanthornus	Black-hooded Oriole	Kalamatha Benebou

S. No.	Species Name	Local Name	Family
38.	Orthotomus sutorius	Common Tailorbird	Pati Tuntuni
39.	Passer domesticus	House Sparrow	Charui
40.	Phalacrocorax niger	Little Cormorant	Choto Pankouri
41.	Porzana fusca	Ruddy-breasted Crake	Ranga Ulti
42.	Porphyrio porphyrio	Purple Swamphen	Kalim
43.	Pycnonotus cafer	Red Vented Bulbul	Bulbuli
44.	Rhipidura albicollis	White-throated Fantail	Dholagola Chatighurani
45.	Sterna albifrons	Little tern	Choto Gangchil
46.	Streptopelia chinensis	Spotted Dove	Tila Ghughu
47.	Streptopelia tranquebarica	Red Collared Dove	Penchi Ghughu
48.	Sturnus contra	Asian pied starling	Go Shalik
49.	Tachybaptus ruficollis	Little Grebe	Choto Duburi
50.	Todiramphus chloris	Collared Kingfisher	Dholaghar Machranga
51.	Treron bicincta	Orange-breasted Green Pigeon	
52.	Tyto abba	Barn owl	
53.	Upupa epops	Hoopoe	Hudhud
54.	Vanells indicus	Red-wattled Lapwing	Lal Hotiti

Butterfly

Presence of butterfly was found in the settlement areas, fields, road side plantation and at bank of river. Some of the common butterfly reported in that area is listed in following table.

Table 42: Butterfly in the Study Area

Local Name	Species Name
Orchard Swallowtail	Papilio aegeus
Foscus Swallowtail	Papilio fuscus
Checkered Swalotail	Papilio demoleus
Small Grass-yellow	Eurema smilax
Evening Brown	Melanitis leda
Chocolate Argus	Junonia hedonia
Common Crow	Euploea core
Orange Tiger	Danaus genutia
Monarch	Danaus plexippus
Swamp Tiger	Danaus affinis
Blue Tiger	Tirumala hamata
Purple Copper	Paralucia spinifera
Spotted Pea-blue	Euchrysops cnejus

Local Name	Species Name
Dainty Grass-blue	Zizula hylax
Papuan Grass-yellow	Eurema blanda

Mammals & Reptiles

Cows, goats, dogs, cats, mule, horse, monkey are found in the study area during the visit. No wild fauna was found in study area other than sundarban areas. Apart from the mammals, reptiles like chameleon, garden lizard were also observed during the visit.

Road side vegetation & Storm water ponds Ecology:

Road side plantation is mostly planted. Area closer to Gona River & Mongla river show presence of Gewa (Excoecaria agallocha) and Kewda (Sonneratia apetala) trees in more numbers. Whereas areas near Pasur river show more of Kewda and Ura. These are naturally grown over the years. Ponds along the road side are reported to have water lily, water hyacinth (*Eichhornia crassipes*), Topa pana (*Pistia stratoites*) etc. Above mentioned birds and butterfly are also found to be present along the road side.

Agriculture fields and Aquaculture ponds Ecology

Crops recorded during the visit are varieties of the rice, beetlenut, coconut, beetle leaf, vegetable and fruits. Aquaculture ponds are both fresh and brackish water. Aquatic species found in the aquaculture ponds are water snakes, Ruhi, Catla, Cheetal, Baal, Shoyal, Kangla, Karfu, Mirka, Mrigal, Pabdo, Safila, Mocha, Tengda, Aaiyr, Pooti, Seeng, Magur, Chingri (shrimps) etc. Few of the birds like house sparrow, black drongo, parrots, bulbul etc. were found in agriculture fields. Some of the cattle like cow and goats were found to be grazing in fallow lands.

River Ecology

Mongla River, Pasur River and river Gona are present within the study area. Apart from this various storm water ponds, khal and beel area present within the study area. All of these water bodies support aquatic life. List of the fishes present in these waters is given in following table.

The species composition of fishes in the study area is still rich in its diversity and is believed to have about 120 species. Among the brackish water fishes; Hilsa, Parsha, Tapashi, Bhetki, Tulardandi, etc. are abundant in the study area. The tapashi, bhola, amadi (bairagi) fishes are presently available in the confluence of the Mongla Pasur river. Golda and Bagda post larvae (PL) are still abundant in the Pasur River and its tributaries. The puti, kholisha, taki, baila, shing, etc. are the main species of the beels and floodplains of the study area. It is also estimated that exotic carp species are available in the culture system in the study area. In addition, species of tilapia are also cultured in the study area. Pasur River is home to Ganges Dolphin (*Platanista gangetica*). Platanista gangetica is an endangered species as per Bangladesh Wildlife Act 2010. Pasur River is habitat for Irrawaddy dolphin and estuarine crocodiles also.

Table 43: Fish species present within river of study area

S. No.	Scientific Name	Local Name	Common English Name
1.	Acanthopagrus Berda	Sada Datina	Sea Bream
2.	Acanthopagrus Latus	Datina	Yellow Sea Bream
3.	Acentrogobius Caninus	Baila	Tropical Sand Goby
4.	Aila coila	Kajoli	Gangetic Aila
5.	Apocryptes bato	Chiring	Prawn
6.	Brachygobius nunus	Nuna baila	Goby
7.	Catla catla	Catla	Katla
8.	Cirrhinus mrigela	Mirka	Mrigel
9.	Clupisoma naziri	Muri Bacha	Indus Garua

S. No.	Scientific Name	Local Name	Common English Name
10.	Ctenopharyngodon idellus	Grass carp	Grass carp
11.	Cyprinus carpio	Carpio	Common carp
12.	Garra gotyla	Ghor Poia	Gotyla
13.	Hypopthlmichthes molitrix	Silver carp	Silver carp
14.	Labeo boga	Bhangon	Boga Labio
15.	Labeo calbasu	Calbaus	Black Rui
16.	Labeo rohita	Rui	Rohu
17.	Lates calcarifer	Koral	Sea Bass
18.	Lepidosephalus Guntia	Gutum	Guntia Loach
19.	Liza parsia	Parse	Gold spot Mullet
20.	M. gulio	Guillya	Long whiskered cat fish
21.	Macrognathus Aculatus	Baim	Tire-track Spiny eel
22.	Mastacembalus Armatus	Sal baim	Tire-track Spiny Eel
23.	Monopterus Cuchia	Kuicha	Cuchia
24.	Mugil cephalus	Bhangon	Flathead Mullet
25.	Mystus gulio	Nona tengra	Catfish
26.	Mystus tengara	Bajari tengra	Tengra Mystus
27.	Nandas nandas	Meni	Mud perch
28.	Oreochromis Niloticus	Tilapia	Tilapia
29.	Plotosus canius	Gang Magur	Canine Catfish
30.	Polynemus Paradiseus	Tapsi	Paradise Threadfin
31.	Pama pama	Poa	Jew fish
32.	Rhinomugil Corsula	Bata	Mullet
33.	Rita rita	Rita	Rita
34.	Sillaginopsis Panijus	Tular Dandi	Flathead Silage
35.	Tenualosa ilisha	Ilish	Hilsha
36.	Thrssa mystex	Faisha	Anchovy
37.	Trypauchen Vagina	Sada chewa	Burrowing goby

The study area is also influenced with these practices particularly the culture of mangrove mud crab, Scylla serrata, and harvesting of crabs from nature. The natural crabs are collected from inter-tidal creeks, khals, mangrove area and rivers using local traps and Estuarine Set Beg Net (ESBN).

Various mangroves species are also found to be located near river banks which includes *Excoecaria agallocha, Sonneratia apetala*, Ura, *Acanthus ilicifolius* (Hargoza), Pakor, Amur (*Amoora cucullata*), Golpata (*Nypa fruticans),* Sundri etc. Apart from the mangroves along the river banks, phyto and zoo planktons present in the water bodies in study area are given in following table.

Table 44: Phytoplanktons and Zooplanktons species present in the waterbody of study area

Class	Genus	Phylum	Class	Genus
Chlorophyceae	Closterium sp Hydrodictyon sp Chlorella sp	Arthropoda	Crustacea	Merocyclops sp Mesocyclops sp. Cyclops sp. Diaptomus sp. Bosmina sp. Diaphasomqa sp Praunus sp. Mysidella sp. Epinebalia sp. Tigriospus sp. Oxyurostylis sp. Anatanis sp
Cyanophyceae	Lyngbya sp Oscillatoria sp Schizothrix sp Calothrix sp Spriulina sp Microcolens sp			
Bacillariophyceae	Gyrsigma sp Navicula sp Cyclotella sp Coscinodiscus sp			

Source: CEGIS & Mamun Md. M., Sarower Md. G, Ali Md. A., Rahman S.M.B., Huq K.A., 2009

Mangroves forest/Wetland (Sundarbans):

Sundarban is the largest mangrove wetland in the world. It covers an area of about 1mha, of which 60% is located in Bangladesh and the remaining western portion, comprising 40%, lies in India. They protect our coast from heavy wind, tidal waves, coastal erosion and sea water intrusion, generate substantial quantities of fishery resources and provide many useful forestry products. The Sundarban ecosystem supports rich fisheries diversity. This ecosystem support 27 families and 53 species of pelagic fish, 49 families, 124 species of demersal fish, 5 families and 24 species of shrimps, 3 families and 7 species of crabs, 8 species of lobster. A total 334 plants, 165 algal, 13 special orchids, 17 fern, 87 monocotyledon and 230 dicotyledon belonging to 245 genera and 75 families from the sundarbans and adjacent area are found available. The principal tree species is Sundry (*Heritiera fomes*) which covers about 73% to total landmass and the second species is Gewa (*Excoecaria agallocha*) which covers about 16% of total forest area. The plant species include 35 legumes, 29 grasses, 19 sedges, and 18 euphorbias. Of the 50 true mangrove plant species recorded throughout the globe, the Sundarbans alone contain 35 species.

The magnificent among the animals on land is Royal Bengal Tiger, Spotted deer, barking deer and wild boars are there in plenty. Besides those jungle cats, fishing cat, civet cat, monkey, bengal fox, jackle, water monitor, monitor lizard and snakes are important faunal spp. Moreover, abundant of the Sundarbans are purple heron, pond heron, cattle egret, little egret, open billed stork, smaller adjutant stork, brahmini kite, spotted dove, rose ringed parakeet, crow pheasant, wood pecker, bee eater, drongo, pide myna, jungle myna, bulbul, tailor bird, magpie robin, sparrow etc., Otherwise, recorded that wild Buffalo, 2 species of deer, javan rhinoceros extinct and presently 2 species of amphibians, 14 species of reptiles 25 species of birds and 5 species of mammals are considered as endangered species (M R Rahman and M Asaduzzaman, 2010).

The Sundarbans (21°30'- 22°30'N, 89°12'-90°18'E) are a World Heritage Site which consists of three wildlife sanctuaries (Sundarbans West, East and South) lying on disjunction deltaic islands in the Sundarbans Forest Division of Kulna District, close to the border with India and just west of the main outflow of the Ganges, Brahmaputra and Meghna rivers. Sundarban wild life sanctuaries are located more than 20 Km from the site (refer chapter 4 for details). The Sundarbans are divided in 3 ecological zones on different degrees of salinity.

1. Oligohaline zone
2. Mesohaline zone
3. Polyhaline zone

The Sundarbans mangrove forest extends from the Harinbhanga-Raimangal-Kalindi river system in the west and Baleswar River in the east. The Bangladesh Sundarbans now covers an area of about 5,950 km2, of which 4143 km square are landmass and remaining 18707 km square are under water bodies in forms of rivers, canals and creeks (M R Rahman and M Asaduzzaman, 2010). About 62% of the forest lies in the administrative districts of Bagerhat, Kulna and Satkhira in Bangladesh. This mangrove tract constitutes 44% of the total forest area in Bangladesh and contributes about 50% of the total revenue derived from the forestry sector (Tamang, 1982).

Of total area of Bangladesh Sundarbans, 139,699ha of the Bangladesh Sundarbans are protected as follows: Sundarbans West Wildlife Sanctuary with 71,502 ha; Sundarbans East Wildlife Sanctuary with 31,226ha; and Sundarbans South Wildlife Sanctuary with 36,970ha. Sundarbans National Park (133,010ha), a World Heritage Site, lies to the west in India. The mangrove of the Sundarbans is unique compared to the non-deltaic coastal mangrove forests. For instance, unlike in the cases of the other mangrove of the world, the Rhizophoraceae is of only minor importance and the dominant species are the Sundri (*Heritiera fomes*) of the Sterculiaceae family, from which the Sundarbans takes its name, and the Gewa (*Exeoeearia agalloeha*) of the Euphorbiaceae family. Other dominant plant species include the Pasur (*Xyloearpus mekongensis*), Ohundal (*Xyloearpus granatum*), Kankra (*Bruguiera gymnorrhiza*), Keora (*Sonneratia apetala*), Baen (*Avieennia officinalis*), Golpatta (*Nypa fruticans*) and Goran (*Ceriops decandra*) (BWDB, 2001). This mangrove tract is also both diverse and complex in terms of faunal riches. Moreover, it is now the only refuge left for the national pride of Bangladesh: the Bengal tiger (*Panthera tigris*). In addition, its waterways and canals are richest fish-nurseries in the region. Despite the combination of high tidal flow velocity, heavy silt load and low light penetration, a remarkable diversity of finfish and shellfish exists inside the Sundarbans forest and in the adjacent marine zone of the northern Bay of Bengal. These are mainly of marine origin, but several freshwater species are able to take advantage of low salinity and freshwater conditions in the northern part of the forest.

Fisheries of Sundarbans:

The fish habitats in the Sundarbans area are mostly brackish in nature. The fisheries resources in this area are rich and diversified. This is the largest shrimp producing area of Bangladesh and is established as an important sector for earning foreign currency for the nation. The dynamic network of river systems of this area connects fresh water fish habitats with brackish water habitats and maintains biological balance of the major groups of fishes. The fishes use the Sundarbans as a nursery, breeding and feeding ground and return to the sea or freshwater. Fishes like Khorsula (*Mugil corsula*), Gulsha Tengra, Rui, Catla, Shol, Taki, Pungus Tengra, Shing, Magur, Koi, Puti, Datina (*Pomadasys* spp.), Bagda (*Penaeus monodon*) etc are very common in these areas. A number of fish species spend most of their life stages outside the Sundarbans but come to breed here. These types of fishes are Gulsha Tengra, Poma, Phesa (*Setipinna spp.*), Pungus, Golda, Topshi (*Polynemus paradiseus*), Parsha, Chamua Chingri, etc. depending on ichthyoplankton concentration due to reduced salinity. Marine fishes like Ghagot (*Tachysurus jella*), Apula (*Osteogeneisus militaris*), Lakhya (*Polynemus indicus*) and Tailla (*Polynemus Tetradactylus*) are also present in this area. Fishes that use the Sundarbans as both nursery and spawning ground are Gulsha Tengra, and some other species. Many marine fishes come to the Sundarbans only for feeding as this area is rich in food organisms. This type of fishes are Chaka Chingri, Chali Chingri, Motka Chingri, Tiger Chingri, Gura Chingri (*Leander stylifera*), Begi Ilish (*Tenualosa ilisha*), Rupchanda, Gang Thurina, Boiragi, Potka, Shapla Pata, Kamot, Tulardati (*Silago domina*), Pokki, Pankha, Baim, Churi (*Lepturacunthas savale*), Lottya (*Harpadon neherius),* Kaldi, Korina, etc. The juveniles of many marine species of prawns and fishes e.g. Chaka Chingri (Penaeus indicus), Gura Chingri (*Leander stylifera*) and various sciaenid and ribbon fish (Churi Mach) migrate into the lower zone of the estuary during the winter and summer months to feed and then return to the sea with the onset of the monsoon. Some other fishes like Koral (*Lates calcarifer*), Jaba, Kawn, Chitra, Chapli Chela, Tarial, Borial, Crab, Renua (mus skeeper- *Boleophthalmus* spp), etc. spend most of their life stages in the Sundarbans. Many threatened and endangered species also live in these area e.g. Khorsula (critically endangered), Pungus (endangered) etc.

There are two common fish habitats in Sundarbans- i) rivers and canals, ii) tidal flood plain. According to the FRSS (2009-2010), the total fish production of the Sundarbans is 8,109 MT. This production comes from the shrimp farms, rivers, estuaries, mangroves, ponds etc. There are 291 species exist in Sundarbans areas. Out of these 210 are whitefish, 24 Shrimps, 14 crabs and 43 mollusks. Brackish water

fish are dominating in the Sundarbans area and the adjoining tidal floodplains. List of some available fish species are given in the following in Table.

Table 45: Indicative Fish Species Diversity of Sundarban

S. No.	Scientific Name	Common Name
1.	Lates calcarifer	Bhetki
2.	Liza parsia	Parsha
3.	Polynemous paradiseous	Topsha
4.	Silago domina	Tular danti
5.	Raiamas bola	Bhol
6.	Mystus cavasius	Gulsha Tengra
7.	Glossogobius giuris	Baila
8.	Setipinna phasa	Phesa
9.	Gudusia chapra	Chapila
10.	Trypauchen vagina	Lal cheua
11.	Aorichthyes aor	Ayir
12.	Penaeus indicus	Chaka chingri
13.	Tenualosa ilisha	Hilsha
14.	Metapenaeus monoceros	Harina chingri
15.	Penaeus monodon	Bagda
16.	Macrobrachium Rosenbergii	Golda
17.	Puntius gonionotus	Sharpunti
18.	Puntius ticto	Tit puti
19.	Puntius chola	Chola punti
20.	Channa punctatus	Taki
21.	Channa striatus	Shole
22.	Wallago attu	Boal
23.	Heteropneustes fossilis	Shing
24.	Clupisoma gharua	Gharua
25.	Eutropichthyes vacha	Bacha
26.	Rita rita	Rita
27.	Mystus tengara	Tengra
28.	Mystus vittatus	Bujuri
29.	Mastacembelus pancalus	Chirka baim
30.	Mastacembelus armatus	Shail baim
31.	Mastacembelus aculeatus	Tara baim
32.	Lepidocephalus guntea	Gutum
33.	Leander styliferus	Icha
34.	Anabas testudineus	Koi

S. No.	Scientific Name	Common Name
35.	Colisa fasciatus	Kholisha
36.	Colisa sota	Boicha
37.	Chanda nama	Nama Chanda
38.	Chanda baculis	Chanda
39.	Glossogobius giuris	Baila
40.	Pangasius sutchi	Pangus
41.	Labeo gonius	Ghoinya
42.	Labeo rohita	Rui
43.	Catla catla	Catla
44.	Cirrhinus mrigala	Mrigal
45.	Hypophthalmichthys molitrix	Silver Carp
46.	Ctenopharyngodon idella	Grass Carp
47.	Cyprinus carpio	Carpio
48.	Puntius gonionotus	Sharpunti
49.	Telapia mossambica	Telapia

Source: Mandal B., Mukherjee A., Sarkar S., Banerjee S., 2012

Table 46: List of birds in Sundarbans

English Name	Scientific Name	Relative abundance	Status	IUCN Global Status
Blue-Breasted Quail	Coturnix Chinensis	UC	R	Least Concern(LC)
Red Junglefowl	Gallus Gallus	VC	R	LC
Lesser Whistling-Duck	Dendrocygna Javanica	R	R	LC
Cotton Pygmy-Goose	Nettapus Coromandelianus	R	R	LC
Gadwall	Anas Strepera	UC	M	LC
Spot-Billed Duck	Anas Poecilorhyncha	R	R	LC
Red-Crested Pochard	Netta Rufina	R	M	LC
Tufted Duck	Aythya Fuligula	UC	M	LC
Eurasian Wryneck	Jynx Torquilla	R	M	LC
Speckled Piculet	Picumnus Innominatus	UC	R	LC
Grey-Capped Pygmy Woodpecker	Dendrocopos Canicapillus	C	R	LC
Fulvous-Breasted Woodpecker	Dendrocopos Macei	VC	R	LC
Rufous Woodpecker	Celeus Brachyurus	C	R	LC
Greater Yellownape	Picus Flavinucha	UC	R	LC
Streak-Breasted Woodpecker	Picus Viridanus	R	R	LC
Streak-Throated Woodpecker	Picus Xanthopygaeus	UC	R	LC
Grey-Headed Woodpecker	Picus Canus	UC	R	LC
Common Flameback	Dinopium Javanense	UC	R	LC

English Name	Scientific Name	Relative abundance	Status	IUCN Global Status
Black-Rumped Flameback	Dinopium Benghalense	VC	R	LC
Greater Flameback	Chrysocolaptes Lucidus	VC	R	LC
Lineated Barbet	Megalaima Lineata	C	R	LC
Coppersmith Barbet	Megalaima Haemacephala	UC	R	LC
Common Hoopoe	Upupa Epops	C	R	LC
Indian Roller	Coracias Benghalensis	UC	RM	LC
Dollarbird	Eurystomus Orientalis	R	RM	LC
Common Kingfisher	Alcedo Atthis	VC	R	LC
Blue-Eared Kingfisher	Alcedo Meninting	UC	R	LC
Brown-Winged Kingfisher	Pelargopsis Amauroptera	VC	R	Near Threatened
Ruddy Kingfisher	Halcyon Coromanda	UC	R	LC
White-Throated Kingfisher	Halcyon Smyrnensis	VC	R	LC
Black-Capped Kingfisher	Halcyon Pileata	VC	R	LC
Collared Kingfisher	Todiramphus Chloris	VC	R	LC
Pied Kingfisher	Ceryle Rudis	R	R	LC
Greater Sand Plover	Charadrius Leschenaultii	C	M	LC
Grey-Headed Lapwing	Vanellus Cinereus	R	M	LC
Red-Wattled Lapwing	Vanellus Indicus	VC	R	LC
Small Pratincole	Glareola Lactea	R	R	LC
Pallas's Gull	Larus Ichthyaetus	R	M	LC
Brown-Headed Gull	Larus Brunnicephalus	VC	M	LC
Black-Headed Gull	Larus Ridibundus	UC	M	LC
Gull-Billed Tern	Gelochelidon Nilotica	VC	M	LC
Caspian Tern	Sterna Caspia	R	M	LC
Great Crested Tern	Sterna Bergii	R	M	LC
Common Tern	Sterna Hirundo	UC	M	LC
Little Tern	Sterna Albifrons	VC	M	LC
Whiskered Tern	Chlidonias Hybrida	VC	M	LC
Osprey	Pandion Haliaetus	R	M	LC
Black-Shouldered Kite	Elanus Caeruleus	UC	R	LC
Black Kite	Milvus Migrans	UC	R	LC
Brahminy Kite	Haliastur Indus	VC	R	LC
White-Rumped Vulture	Gyps Bengalensis	R	R	Critically Endangered
White-Bellied Sea Eagle	Haliaeetus Leucogaster	VC	R	LC
Crested Serpent Eagle	Spilornis Cheela	VC	R	LC
Eurasian Marsh Harrier	Circus Aeruginosus	R	M	LC

English Name	Scientific Name	Relative abundance	Status	IUCN Global Status
Pied Harrier	Circus Melanoleucos	R	M	LC
Shikra	Accipiter Badius	VC	R	LC
Greater Spotted Eagle	Aquila Clanga	R	M	f
Changeable Hawk Eagle	Nisaetus Cirrhatus	UC	R	LC
Common Kestrel	Falco Tinnunculus	UC	M	LC
Peregrine Falcon	Falco Peregrinus	R	M	LC
Little Cormorant	Phalacrocorax Niger	R	R	LC
Little Egret	Egretta Garzetta	VC	R	LC
Grey Heron	Ardea Cinerea	R	R	LC
Great Egret	Casmerodius Albus	VC	R	LC
Intermediate Egret	Mesophoyx Intermedia	C	R	LC
Cattle Egret	Bubulcus Ibis	R	R	LC
Indian Pond Heron	Ardeola Grayii	C	R	LC
Little Heron	Butorides Striatus	VC	R	LC
Black-Crowned Night Heron	Nycticorax Nycticorax	R	R	LC
Malayan Night Heron	Gorsachius Melanolophus	R	RM	LC
Cinnamon Bittern	Ixobrychus Cinnamomeus	R	R	LC
Black-Headed Ibis	Threskiornis Melanocephalus	R	R	Near Threatened
Lesser Adjutant	Leptoptilos Javanicus	C	R	Vulnerable
Indian Pitta	Pitta Brachyura	R	R	LC
Mangrove Pitta	Pitta Megarhyncha	R	R	Near Threatened
Golden-Fronted Leafbird	Chloropsis Aurifrons	UC	R	LC
Brown Shrike	Lanius Cristatus	UC	M	LC
Long-Tailed Shrike	Lanius Schach	C	R	LC
Grey-Backed Shrike	Lanius Tephronotus	R	M	LC
Rufous Treepie	Dendrocitta Vagabunda	C	R	LC
House Crow	Corvus Splendens	C	R	LC
Large-Billed Crow	Corvus Macrorhynchos	UC	R	LC
Ashy Woodswallow	Artamus Fuscus	VC	R	LC
Black-Naped Oriole	Oriolus Chinensis	R	M	LC
Black-Hooded Oriole	Oriolus Xanthornus Oriolus Xanthornus	C	R	LC
Large Cuckooshrike	Coracina Macei	VC	R	LC
Black-Winged Cuckooshrike	Coracina Melaschistos	R	M	LC
Small Minivet	Pericrocotus Cinnamomeus	VC	R	LC
Scarlet Minivet	Pericrocotus Flammeus	C	R	LC

English Name	Scientific Name	Relative abundance	Status	IUCN Global Status
Bar-Winged Flycatcher-Shrike	Hemipus Picatus	UC	R	LC
White-Throated Fantail	Rhipidura Albicollis	C	R	LC
Black Drongo	Dicrurus Macrocercus	VC	R	LC
Ashy Drongo	Dicrurus Leucophaeus	C	M	LC
Bronzed Drongo	Dicrurus Aeneus	VC	R	LC
Lesser Racket-Tailed Drongo	Dicrurus Remifer	R	M	LC
Spangled Drongo	Dicrurus Hottentottus	UC	R	LC
Greater Racket-Tailed Drongo	Dicrurus Paradiseus	C	R	LC
Black-Naped Monarch	Hypothymis Azurea	C	R	LC
Common Iora	Aegithina Tiphia	C	R	LC
Blue Rock Thrush	Monticola Solitarius	UC	M	LC
Orange-Headed Thrush	Zoothera Citrina	R	R	LC
Scaly Thrush	Zoothera Dauma	R	M	LC
Dark-Sided Flycatcher	Muscicapa Sibirica	R	M	LC
Red-Throated Flycatcher	Ficedula Parva	C	M	LC
Verditer Flycatcher	Eumyias Thalassinus	UC	M	LC
Blue-Throated Flycatcher	Cyornis Rubeculoides	R	M	LC
Oriental Magpie Robin	Copsychus Saularis	C	R	LC
Black Redstart	Phoenicurus Ochruros	R	M	LC
Common Stonechat	Saxicola Torquata	UC	M	LC
Chestnut-Tailed Starling	Sturnus Malabaricus	C	R	LC
Asian Pied Starling	Sturnus Contra	C	R	LC
Common Myna	Acridotheres Tristis	UC	R	LC
Bank Myna	Acridotheres Ginginianus	C	R	LC
Jungle Myna	Acridotheres Fuscus	VC	R	LC
Velvet-Fronted Nuthatch	Sitta Frontalis	C	R	LC
Great Tit	Parus Major	VC	R	LC
Barn Swallow Hirun	do Rustica	VC	M	LC
Red-Whiskered Bulbul	Pycnonotus Jocosus	C	R	LC
Red-Vented Bulbul	Pycnonotus Cafer	VC	R	LC
Zitting Cisticola	Cisticola Juncidis	VC	R	LC
Yellow-Bellied Prinia	Prinia Flaviventris	R	R	LC
Plain Prinia	Prinia Inornata	R	R	LC
Oriental White-Eye	Zosterops Palpebrosus	UC	R	LC
Blyth's Reed Warbler	Acrocephalus Dumetorum	UC	M	LC
Clamorous Reed Warbler	Acrocephalus Stentoreus	R	M	LC
Common Tailorbird	Orthotomus Sutorius	C	R	LC

English Name	Scientific Name	Relative abundance	Status	IUCN Global Status
Common Chiffchaff	Phylloscopus Collybita	UC	M	LC
Greenish Warbler	Phylloscopus Trochiloides	UC	M	LC
Abbott's Babbler	Malacocincla Abbotti	C	R	LC
Pin Striped Tit Babbler	Macronous Gularis	C	R	LC
Yellow-Eyed Babbler	Chrysomma Sinense	R	R	LC
Striated Babbler	Turdoides Earlei	C	R	LC
Rufous-Winged Bushlark	Mirafra Assamica	C	R	LC
Pale-Billed Flowerpecker	Dicaeum Erythrorhynchos	UC	R	LC
Ruby-Cheeked Sunbird	Anthreptes Singalensis	UC	RM	LC
Purple-Rumped Sunbird	Nectarinia Zeylonica	R	R	LC
Purple Sunbird	Nectarinia Asiatica	VC	R	LC
Crimson Sunbird	Aethopyga Siparaja	UC	R	LC
Forest Wagtail	Dendronanthus Indicus	C	M	LC
White Wagtail	Motacilla Alba	VC	M	LC
White-Browed Wagtail	Motacilla Madaraspatensis	R	R	LC
Citrine Wagtail	Motacilla Citreola	UC	M	LC
Yellow Wagtail	Motacilla Flava	R	M	LC
Grey Wagtail	Motacilla Cinerea	C	M	LC
Paddyfield Pipit	Anthus Rufulus	C	R	LC
Olive-Backed Pipit	Anthus Hodgsoni	UC	M	LC
Baya Weaver	Ploceus Philippinus	VC	R	LC
Scaly-Breasted Munia	*Lonchura Punctulata*	C	R	LC

Source: Khan H, 2005, Sarker S. U & Sarker N H, 1985

Migratory Birds of Sundarbans:

As per the study carried out by Chowdhury S., 2013 et. al. on shore birds of Bangladesh Sundarban, 17 species of migratory birds were observed in Sundarbans. List of the migratory birds found in Sundarbans is given below.

Table 47: Migratory Birds of Sundarbans

S. No.	English Name	Scientific Name
1.	Pin-tailed Snipe	Gallinago stenura
2.	Great Thick-knee	Esacus recurvirostris
3.	Eurasian Oystercatcher	Haematopus ostralegus
4.	Pacific Golden Plover	Pluvialis fulva
5.	Grey Plover	Pluvialis squatarola
6.	Kentish Plover	Charadrius alexandrinus
7.	Lesser Sand Plover	Charadrius mongolus
8.	Greater Sand Plover	Charadrius leschenaultii
9.	Bar-tailed Godwit	Limosa lapponica

S. No.	English Name	Scientific Name
10.	Whimbrel	Numenius phaeopus
11.	Eurasian Curlew	Numenius arquata NT
12.	Common Redshank	Tringa totanus
13.	Common Greenshank	Tringa nebularia
14.	Terek Sandpiper	Xenus cinereus
15.	Common Sandpiper	Actitis hypoleucos
16.	Ruddy Turnstone	Arenaria interpres
17.	Sanderling	Calidris alba
18.	Red-necked Stint	Calidris ruficollis
19.	Little Stint	Calidris minutes
20.	Curlew Sandpiper	Calidris ferruginea

Source: Chowdhury S., Diyan Md. A. A., Zockler C., Foysal Md.& Lemke H. W., 2013

Ecosystem Service and Function

Presence of rich flora and fauna of sundarban and river system and trees plantation provides good ecobalance situation currently for maintaining the climatic situation of the area. Since project development is on smaller area which is unlikley to affect this ecobalance system.

5.19. Socio Economic

Socio Economic Condition

Project site falls under Mongla Upzila of Bagerhat District, Kulna Division. Mongla Upazila with an area of 1,461.22 km², borders Rampal Upazila on the north, the Bay of Bengal on the south, Morrelganj and Sarankhola Upazilas on the east and Dacope Upazila on the west. Mongla became a police station on the 19th September, 1976 and was upgraded to an upazila on the 14th September, 1983.

Mongla (Town) stands on the river Pasur. It is the second biggest seaport of the country. It consists of 9 wards and 13 mahallas. Mongla municipality was established in 1991. The area of the town is 17.79 km². The town has a population of 60561; male 57.27%, female 42.73%. The density of population is 2943 per km². The literacy rate among the town's people is 53.6%. The town has one dakbungalow.

Site of Economic Zone is bounded by Upazila Rampal in the north, Mongla EPZ on the south, the Mongla River in the east and the Pasur & Ghona river/Mongla Port Authority on the west and lies at a distance 105 km from Jessore airport, 397 km from Dhaka city and 664 km from Chittagong port. The nearest city is Mongla Port city which is approximately 6 Km away from the project site.

Demographic Profile

As per the Census, 2011, population of Mongla Upzila is 1,36,588, out of which 71,492 are male and 65,096 are female. Population of Mongla during Census 2001 was 1,49,030 and during 1991 was 1,37,947. Decline in population from 2001 to 2011 is observed, which may be due to the Aila cyclone, 2009 and migration. Density of the Mongla upzila is 93.5 person/sq km. Average household size of the Mongla Upzila is 4.02 as per 2011 census. Sex ratio in the area is 110 which shows that male outnumbers female population. Demographic profile of Mongla Upzila & Bagerat District is given below.

Table 48: Demographic profile of Mongla Upzila & Bagerat District

Population (Enumerated)				
Both Sex	1,36,588	1,49,030	14,76,090	15,49,031
Male	71,492	80,819	7,40,138	8,04,143
Female	65,096	68,211	7,35,952	7,44,888

Urban	39,837	56,746	1,10,651	1,24,919
Other Urban	0	0	84,680	81,635
Rural	96,751	92,284	12,80,759	13,42,477
Annual Growth Rate	--0.85	0.78	--0.47	0.79
Sex Ratio				
Total	110	119	101	108
Urban	119	125	106	116
Other Urban	0	0	100	105
Rural	106	115	100	107
Househld (HH)				
Total	32,383	31,015	3,54,223	3,23,505
Urban	8,927	12,399	25,979	26,442
Other Urban	0	0	20,047	17,219
Rural	23,456	18,616	3,08,197	2,79,844
Average HH Size				
Total	4.02	4.76	4.13	4.74
Urban	4.16	4.68	4.07	4.70
Other Urban	0.0	0.0	4.18	4.72
Rural	3.97	4.81	4.13	4.75
Area sq km	1461.20	1461.22	3959.11	3959.11
Area sq. Mile	564.17	564.18	1528.62	1528.62
Density per sq. Km	93	102	373	391
Density per sq. mile	242	264	966	1013
Urbanization (%)	29.17	38.08	13.23	13.33
Literacy (%)				
Both sex	57.2	56.1	59.0	58.7
Male	56.7	44.3	59.5	47.5
Female	56.7	40.9	56.1	43.3
School Attendance (5 to 24 years) (%)				
Both sex	56.7	42.6	57.7	45.4
Male	56.7	44.3	59.5	47.5
Female	56.7	40.9	56.1	43.3
Population (Adjusted)				
Both sex	1,42,358	1,56,516	15,34,012	16,20,281
Male	74,523	84,888	7,69,203	8,41,173
Female	67,835	71,628	7,64,809	7,79,108
Geographic Unit				
Upazila/Thana	-	-	9	9
Union	6	6	76	75
Mauza	28	30	697	720
Village	83	77	1048	1031
Paurashava	1	1	3	3
Paura Ward	9	9	27	27
Paura Mahalla	13	13	56	56

Ethenicity and Religion

As per the SIA study, PAHs who will be losing business units/dwelling units at Mongla EZ and agriculture land (partially) at Maniknagar are Muslim. No indigenous or special ethnic minority people are found in the project affected area. A total 58 people (hereinafter called Project Affected People-PAPs) will be affected from 10 households. This includes 43 PAPs at the approach road at Mongla and 15 PAPs at the proposed pumping station at Maniknagar

Mongla Upzila

All the people in the area belong to the same etheniticity, i.e. Bengali but belong to different religion. Of the total population of Mongla Upzila, i.e. 136588, 102298 are muslim, 29426 are hindu, 4837 are Christian, 21 are Buddhist and 6 people belong to other religion. There are 178 mosques, 26 Eid-Gah, 36 temples & 16 Church in Mongla Upzila.

Project site is located in ward No. 7 of Mongla Upzila. In Ward No. 7 of mongla upzila, total population is 7032 out of which 5320 are muslim which is majority, 1068 are hindus, 644 are Christians. Statistics show that it is muslim dominated area. There are various mosque and temples in the study area. In village Burirdanga which is at 300 m from project site in North direction has 1 mosque and 4 temples.

Quality of Life Indicators

Employment opportunity and availability of manpower

As per the SIA study, Out of the 58 PAPs, only 20 (34.48%) are working. Out of these, five are working in the agriculture sector (self-employed; 3 and daily labourer:2),and 14 are working in the service sector(self-employment:3, wage employment:7 & daily labourer: 5).

Mongla Upzila

Most of the people in the study area are involved in aquaculture activities, especially shrimp cultivation. Some of the people from nearest village Buridanga are employed at Bangladesh Economic Processing Zone & at Mongla Port also for semi-skilled to unskilled work. Very few other options of employment are available in the area. Few people are doing small business like cycle repair, rope making, own small shops etc to earn their livelihood. Female in the study are willing to work and some of them are involved in aquaculture practices, jobs in EPZ etc. The labours get the chance to work only for 4-5 days in a week. In shrimp farming they never have the opportunity to work for more than 5 to 6 hours in a day. There is lack of job opportunities. Discussion with students revealed that they have to migtare to cities to get jobs as no jobs are available in the village and nearby areas. According to them, upcoming economic zone may generate skilled jobs opportunity for them.

Education

Over 90% of the PAPs are literate with around 60%of the PAPs having secondary level education, while 17% having primary education. Around 12% of the PAPs are graduates. In addition, one PAP is a diploma holder. It has been also revealed from the survey that, out of the 13 children, only four are attending school (two male and two female).

Mongla Upzila

Rate of students attending school is very less in the study area also. Most of the children at early age are involved for earning livelihood for the families. Literacy rate of the Mongla upzila is 57.2% which is relatively low. Huge nos. of student quit after completing their primary education as the high and secondary schools are located at far-off locations in unions, towns and cities. Village Burirdanga is nearest village to the EZ site and is located at 300 m in North direction from EZ site. There are 2 schools in village Burirdanga.

Educational institutions in Bagerhat District: The total numbers of educational institutions are Government College 2, Non-government college 38, Government high school 5, Non-government high school 287, Junior school 33, Mentally retarded school 1, Government primary school 603, Registered primary school 511, Madrasa 352, Satellite school 14 and Community school 9.

Industries & Commercial Area: There are 5 growth centres, 19 Hat/bazaars, 228 poultry farms, 5 dairy farms, 4 nursery and 5 decorator service provider in Mongla Upzila.

Population Migration

As per discussion with local people, it is found that youth of age between 16-40 move out of the area to towns, cities & abroad to get jobs. Seasonal migration is also observed in the area.

Vulnerability to Natural Disaster

Being located near to Sea and rivers, number of threats is anticipated to be associated with the site. Alia cyclone happened in 2009 has cause huge losses to life, property and natural resources of this area. Cyclone shelters are provided at 3 locations in Mongla town, one in village Kapalirmet Buridimal and one

in village Burirdanga. These all are close to the economic zone site. Cyclone shelters are also provided at various other locations in study area. In total there are 21 cyclone shelters in Mongla Upzila.

Income and Poverty

According to the SIA study, the average monthly income of head of PAHs works out to be BDT 17,721 (as per the data provided by the PAHs). The monthly income of the head varies from below BDT 2500 to above BDT 21,000.

Mongla Upzila

Large nos. of people are unemployed in the study area. People are engaged in jobs, small business, agriculture and aquaculture in the study area. People practicing aquaculture work only for 5-6 hrs in a day. Land is taken on lease by people for practicing agriculture, residing and for small business from Mongla Port Authority.

Gender and Women

As per the SIA study, total 58 PAPs, 51.72% (30 nos.) are male and 48.27% are female (28 nos.). Further, the population distributed over age shows that about 60.34% PAPs are in the working age group (20- 64 yrs.).

Mongla Upzila

Female population in Mongla upzila is 65,096 are female which is 47.658% of total population. Sex ratio in the area is 110 which show that male outnumbers female population.

Infrastructure

The structure of business units/dwelling units of eight PAHs at the approach road are Kutcha: walls and roofs are made up of asbestos sheet & 'Golpatta'; floor of six houses is made up of mud and the floor of two houses is partially cemented. The house structure of the two PAHs at the pumping station is pucca. The houses are single floor and have a separate kitchen. Out of these 8 householders, 6 are lease holders and 2 are tenants.

SIA revealed that electric network (50%) and solar energy (40%) are the most commonly used source for lighting. Out of the eight PAHs at the approach road, 4 are depending on solar energy; two are depending on kerosene and remaining two has electricity connection for lightening. The two PAHs at the pumping station have electric connection.

Regarding drinking water, the PAHs at the approach road are purchasing water (27 liter @ BDT 10) locally as there is no tap water available within the area. For other household purpose, pond and tube well is the main for water.

Regarding the sanitation facilities, only 2 PAHs have pucca toilets. Six PAHs are using slab based toilets and two are using the community toilet at the nearby market.

Mongla Upzila

Out of the total 31912 households in upzila, 80.5% of the HH are kachha house and only 6.1 % is pukka households. Rest of them are semi-pukka and Jhopri. Out of the total households only 6.6% have an access to tap water supply, 4.4% through tube well and rest other sources like ponds, private water tanker suppliers etc. Only 44.9% of the HH have electrical connection. Out of the total HH, 80.4% are self-owned. Communication infrastructure is not proper. Site is not accessible through any public road till now but the proposed access road and bridge will connect the site to existing Mongla port road which inturns connect to Kulna Dhaka highway making the site accessible. There are 2 fuel filling stations, 1 fire brigade station, 4 police station/camps, 3 Union land office, 1 Sub-registry office, 1 BOP and 1 cyber cafe in Mongla Upzila

Common Property Resources

Development of proposed off-site infrastructure does not involve shifting of any common property resource in the area. LT lines passing through the site will required to be shifted before development.

Conflict of Interest and Law and Order Situation

No conflict of interest is associated with the EZ site or development of any other off-site facility.

Historical, Cultural and Archaeological sites

There is no archaeological resource present within 10 km radius area of the project site.

6. Identification and Analysis of Key Environmental Issues

6.1. Environmental Sensitivity Investigation

Environmental impact assessment has been carried out considering the impacts of proposed interventions with associated activities on important components of the environment and society. Firstly, all of the environmental components sensitive to proposed activities were identified during reconnaissance field visit based on expert observation, local people's perception and worldwide practice of EIA. The scoping process, followed to identify the environment and social sensitive features included professional judgments of the multi-disciplinary EIA team members and public consultation. The preliminarily identified environmental and social sensitive components are listed in sections below.

6.2. Environmental Asset

Environmental assets identified in the study area are listed below:

1. Air Quality of the area
2. Noise level of the area
3. Transportation system of the area
4. Fisheries of the study area
5. Ecosystem of study area
    a. River Gona, Mongla and Pasur- Fishes, Crocodiles, Dolphins and other aquatic fauna
    b. Sundarban Reserve Forest: Mangroves and Fauna
    c. Agriculture land and Aquaculture pond

Identified environmental assets of the project are likely to be impacted due to development of the off-site facilities at all the pre-construction, construction and operation stages of the project. Project activities which may have an impact on the environmental assets and the associated impacts are listed below**.** The detailed impact identification and mitigation measures are given at Chapter 7.

Table 49: Environmental Assets of the project area

S. No.	Environmental Assets	Impact	Related Project Activity
Pre-Construction & Construction Phase			
1	Air Quality of Study Area	Degradation	Site clearance/ preparation Construction activities Excavation Exhaust from construction vehicles/machinery
2	Noise Level of Study Area	Increase in Noise levels	Construction activities Movement of construction vehicles/machinery

S. No.	Environmental Assets	Impact	Related Project Activity
3	Transportation System	Traffic congestion	Increased nos. of vehicles carrying construction raw material and construction debris
4	Fisheries of Study Area	Filing up of the aquaculture ponds/small water bodies Increased sedimentation of water body	Construction of two nos. of pump house on the khas land which is small water body Increase in run-off from construction/excavated site
5	Eco-system of Study area: River Gona, Mongla and Pasur	Increased sedimentation of water body	Increase in run-off from construction/excavated site
6	Eco-system of Study area: Agriculture and Aquaculture activity	Loss of agriculture & aquaculture land	Land acquisition for laying water pipeline but this is insignificant in nature
Operation Phase (For Off-site Developments Only)			
1	Air Quality of Study Area	Air pollution	Industrial emissions and movement of vehicular access
2	Noise Level of Study Area	Increase in Noise levels	Increased traffic movement and industrial operations
3	Transportation System	Traffic congestion	Increased nos. of vehicles carrying industrial raw materials and workers for existing roads. Though it is unlikely to occur as the existing road has enough carrying capacity
4	Fisheries of Study Area	Improvement	Setting up of aquaculture based industries
5	Eco-system of Study area: River Gona, Mongla and Pasur	Degradation of Water Quality & Aquatic ecology	Discharge of effluents from the industries proposed to be located in economic zone
6	Eco-system of Study area: Sundarbans (Mangroves and Fauna)	Insignificant impact	Air emissions from the industries and vehicular emissions are likely to create air pollution. However, it is unlikely to reach Sundarban area due to distance from the site.
7	Eco-system of Study area: Agriculture and Aquaculture	Improvement of agriculture and aquaculture production	Setting up of agriculture & aquaculture based industries

6.3. Environmental Hotspot

EZ site and site for proposed off-site facilities lies in Mongla Upzila of Kulna Division which is app. 5 Km from Sundarban forests and more than 50 Km from notified Sundarban wild life sanctuaries (shown in figure below). Thus no notified environmental sensitive hotspot exists within 10 km of the EZ site.

As per Ref No. pa ba ma/4/7/89/99/263 in 1993 under ECA, 1995, 10 kms radius area around Sundarbans RF is declared under ecological critical area for the purpose of protection of protection of Sundarbans forest. EZ site is at 5 kms distance from Sundarbans forest and thus falls in the ecological critical area. Any activity under this area requires prior permission from DoE. Thus any discharge or emission or activity which can affect the bio-diversity may be restricted by the department. As indicated in previous section proposed EZ is located next to already permitted EPZ and with the provision and operation of non-polluting industry. The proposed BEZA project is unlikely to cause any impact on Sundarbans. The provision has been made for treatment of any sewage/process effluent by every industry. All requisite control for any air pollution also suggested considering the nature of industry and environment protection measures are proposed. Thus no significant impact on Sundarbans is anticipated due to proposed EZ. Also the developer will comply with the additional measures proposed by DoE for environment protection while development and operation of EZ.

Pasur river flows at distance of 900 m from EZ site in east direction. Pasur river has rich variety of species and also the dolphins. Thus industries should strictly be instructed that no effluent or waste should be allowed to discharge in Pasur. All industries should meet zero discharge and if not the disposal should be as per the norms of DoEB.

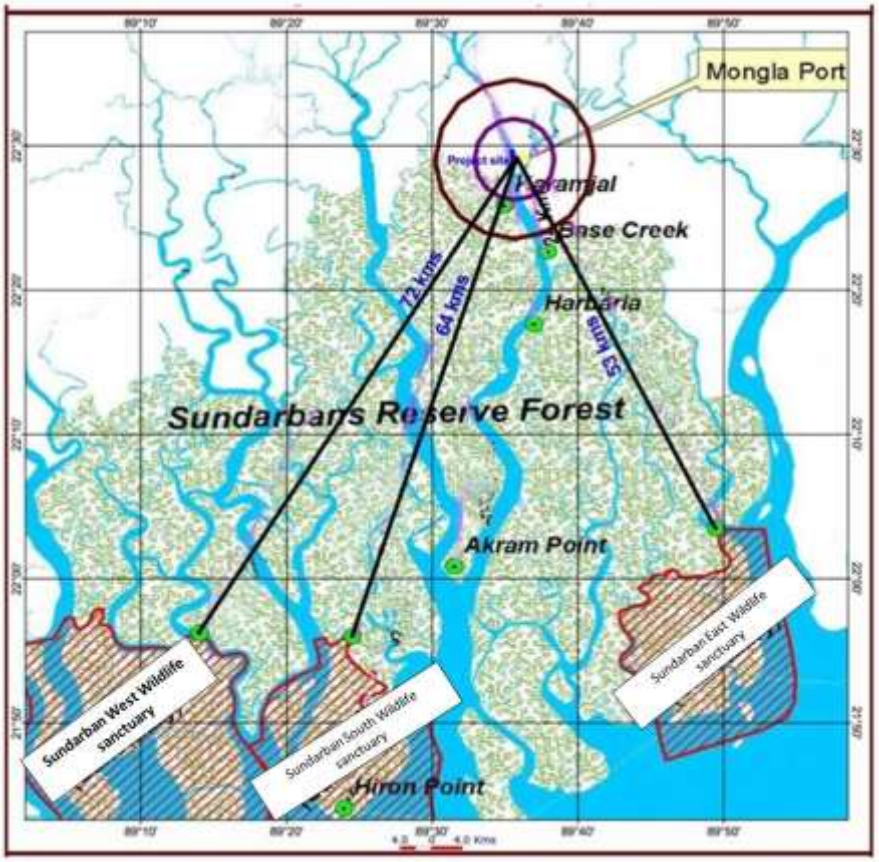


Figure 69: Map Showing Location of Sundarban Reserve Forest and three wildlife sanctuaries w.r.t proposed project site

No eco-sensitive zone is located within 10 km area of the upcoming EZ site.

6.4. Likely Beneficial Impacts

The project involves development of EZ and off-site facilities. These off-site developments will make the site accessible and suitable for setting up of the industries. Development of the off-site infrastructure will

attract the investors for setting up of the industries in the upcoming economic zone. Vicinity of the site to existing EPZ, Mongla port and Kulna Dhaka highway and developed inland water transportation system further adds to economic development of the area. The likely benefits from the proposed development are listed as below :

1. Rapid Economic development (including enhancement and diversification of Industries, Enhancement of investments)
2. Large scale direct and indirect employment generation
3. Development of infrastructure facilities
4. Technological enhancement for management of environmental management (like water treatment, waste management, environmental monitoring)

6.5. Community Recommendations

As per SIA study, 8 HHs and 2 agriculture land owners will be impacted directly due to project development. 8 HHs will be relocated and the agriculture land measuring 0.166 acres will be acquired for development of proposed off-site facilities.

Focused group discussions were carried out with the directly impacted people, i.e. people of village Burirdanga, residents of Mongla port colony and Mongla commercial colony to discuss their view on the project development, the benefits and the negative impact of the project on their life and their expectations from the project.

As per the discussion it was found that people are in favour of development of the economic zone project. According to them, after development of economic zone, there could be significant infrastructure development in this area which will improve their quality of life. Also it was found that large nos. of people are unemployed and are engaged in aquaculture activities. People are hoping to get employment from the upcoming EZ project. Shop owners of Mongla commercial complex said that construction of access road and coming up of economic zone will be highly beneficial for them.

It was enquired during FGD, if people are facing any health related issues due to operation of industries in EPZ zone and the cement industries in Mongla Port area. People said that there is no pollution issues involved with the existing industries.

People also suggested that agro based and aquaculture industries should come up in this region so as it could be beneficial for people engaged in aquaculture activity.

6.6. Alternate Analysis

Various sites have been identified by BEZA or development of economic zone. Pre-feasibility study for various sites has been carried out to analyze suitability of site for EZ development by BEZA. As per pre-feasibility study it was found that Mongla is most potential zone for development of EZ. Sites considered for development of the economic zone other than Mongla are listed below:

- Area of app. 7500 acres in Mirsharai upzila, Chittagong Ditrict
- Area of app. 353 acres in Sherpur, Maulvi Bazar
- Area of app. 1390 acres in Anwara, Chittagong

These sites are analyzed on basis of location, accessibility, potential for industrial growth, availability of raw material, infrastructural development, availability of man-power, vulnerability to natural and man-made disasters, availability of the basic amanties and utilities for industrial development. After analysis ranking has been done for these sites. As per ranking Mongla is most preferred site for development of EZ. Weakness and

strengths of the Mongla as site for development of EZ is discussed in section 4.2 of Chapter 4. Factors responsible for selection of Mongla as site for development of economic zone are given below:

1. Contiguous stretch of Government Land
2. Located outside city Corporation, Municipality and Cantonment Board Area
3. Close proximity to Mongla Port
4. Close proximity to EPZ
5. Close proximity to Pasur & Mongla river and also well-developed inland water transport
6. Close vicinity to Mongla port road & Kulna Dhaka highway
7. Proposed railway line connecting Kulna and Mongla port, proposed EPZ & EZ
8. Well-developed inland water transport
9. Availability of electricity & raw material for industries
10. No eco-sensitivity associated with the project
11. Availability of large nos. of un-skilled and semi-skilled labour

Alternative options are considered for selection of construction material and technologies of construction. Options considered are for construction of compound wall and administrative building as given below:

The soil investigation report necessitates minimum 30 m depth of pile foundation for administration building and minimum 8 m depth of pile foundation for compound wall. Considering the soil conditions, the nature of utilization, the following alternate technology has been suggested for successful ground modification / improvement which will be determined depending upon the difficult soils, liquefaction potential, slope stability, bearing capacity and settlement, and seepage instability. The ground improvement include loading conditions and allowable deformations for the facility, as well as an assessment of the impacts of natural hazards, such as floods, earthquakes or hurricanes, and the performance required during these events.

- Unsliced Lime slurry filling on the pile bore before casting pile concrete for a depth of 2m instead of providing pile for a depth of minimum 6 m for compound wall
- Soil stabilization through lime injection at the bottom of the foundation for administration building.
- The above measures have brought down the project cost substantially apart from reduction in wastes of natural resources for the heavier foundation structure.

Environmental and Social Impacts

6.7. Introduction

Environmental impacts assessment was carried out considering present environmental setting of the project area, and nature and extent of the proposed activities. Proposed project involves development of EZ and off-site facilities for upcoming Economic Zone at Mongla. Potential environmental impacts associated with EZ and each of the proposed off-site facility is classified as: (i) impacts during design and construction phase and ii) impacts during operation phase/Post-construction phase. Sensitive environmental and social components were identified during the site visits and qualitative and quantitative techniques have been applied for direct and indirect assessment of impacts on the identified environmental and social sensitive components. Impacts are classified as being insignificant, minor, moderate and major.

Some of the important impacts associated with the proposed EZ and off-site facilities for economic zone will be associated with land use (land acquisition), land stability (soil erosion), soil compaction and contamination, water availability, water quality of river/stream/canal, ground water contamination, waste and wastewater disposal, ambient air quality, ambient noise levels, vegetation, tree cutting (including social forestry tree), fauna (terrestrial and aquatic), drainage pattern, hydrology, socio economic, places of social/cultural importance (religious structures, community structure), construction material sourcing and occupational health and safety.

In Mongla the probable type of industries will be light engineering, food processing and readymade garments. These

industries will not generate significant waste except domestic effluent. As such there will be no effect/impact on the Sunderban reserve forest, due to the implementation of Mongla EZ

However adequate mitigation measures are devised to mitigate/minimise all likely environmental impacts and the same have been presented below along with the impacts.

During the field study, consultations were also held within study area including local people and Govt. authorities like DPHE, Mongla Port Authority, BEPZA. Outcome of these consultations were used in impact assessment and devising mitigation measures.

6.8. Impact Identification

During the site visit, various environment and socially sensitive features were identified which may potentially be impacted by the project at various stages. Identified impacts of the project activities on the environment and social components are given below along with the activities associated.

Table 50: Impact Matrix for Proposed Off-site Infrastructure

S. No.	Activities	Impacts	Negative Impact		Positive Impact		Not Applicable
			Short Term	Long Term	Short Term	Long Term	
A	**Pre-Construction Phase**						
i	Land Acquisition for access road and water supply system	• Displacement of people • Diversion of agricultural land (ROW purpose only) • Impact on livelihood		√ √ √			

S. No.	Activities	Impacts	Negative Impact		Positive Impact		Not Applicable
			Short Term	Long Term	Short Term	Long Term	
		• Shifting of Utilities					
ii	Site Preparation	Removal of Vegetation. Loss of tree cover and Impact on aesthetic aspects	√ √				
B	**Construction Phase**						
i	Development of EZ and Construction of Boundary wall, Access Road, bridge, electrical & water supply system and administration building	Loss of Top soil		√			
		Soil contamination due to spillage of material	√				
		Surface water contamination	√				
		Air pollution	√				
		Noise pollution	√				
		Increase in traffic	√				
		Un pleasant view	√				
		Impact on Health & safety	√				
		Social impact	√			√	
		Felling of Trees		√			
C	**Operational Phase- Offsite Infrastructure**						
i	Development of Off-site Infrastructure, i.e. Boundary wall, BT access road, bridge, water supply system, electrical supply line and administration building	Air Quality Improvement				√	
		Economic Development				√	
		Accessibility				√	
		Availability of drinking water				√	
		Improved drainage				√	
		Electrification of the area				√	
		Improved health and sanitation facilities				√	
		Increased Run-off		√			
		Generation of Employment				√	
		Natural drainage pattern	√				
D	**Operational Phase- Economic Zone**						
i	Operation of Industries	• Air pollution • Noise pollution • Potential for river water pollution from industrial waste discharges • Ground water depletion • Rain water harvesting • Health & Safety • Employment Generation	√ √	√ √ √		√ √	

S. No.	Activities	Impacts	Negative Impact		Positive Impact		Not Applicable
			Short Term	Long Term	Short Term	Long Term	
		• Potential for land contamination from industrial waste disposal					
ii	Green Buffer development around each industrial plot	• Improved Ecology • Air Quality Improvement • Aesthetics				√ √ √	

6.9. Impact on Air Environment

Pre-construction Phase

Pre-construction phase will involve site clearance activity for development of EZ, access road and pump houses for water supply system. Clearance of site will involve removal of vegetation and land levelling activities. These activities will lead to dust generation. But these emissions will be limited to the site only and have impact for short duration only during clearance activity. To minimize the dust generation, water should be sprinkled regularly at the site and low sulphur diesel should be used in land levelling equipments to control the SO_2 emissions.

Construction Phase

The proposed project involves construction activities like site development (land filling, earth work), civil construction, construction material handling and stocking, and construction vehicle movement will generate fugitive dust and vehicular emissions. However, these ground sourced generation will be limited to the construction site and the impact will be short duration that too during construction activities only. The likely emission from construction vehicle, machinery, and generators is likely to be insignificant as the pollutant emission activities (point and area sources) will be limited within the project boundary and the activities will be short term (only for construction period). However, this impact may further be minimized by adopting following mitigation measures.

Mitigation Measures

- Sprinkling of water at construction site and haul roads
- Covering the scaffolding (in case of administration building) to reduce the dust emission in outside environment
- Provision of face mask to workers to minimize inhalation of dust particles
- Construction vehicles and machinery should be regularly serviced and check for pollution control
- Low sulphur diesel should be used for running construction equipment and vehicles
- Adequate parking space should be provided for the construction vehicles so as to prevent idling of the vehicles and the emissions generating from them
- Vehicles carrying construction material and debris should be covered with tarpaulin cover
- Raw materials, excavated soil and other debris should be stored under covered sheds
- Green buffer should be developed all along the EZ boundary
- Plantation should be carried out along the both side of access road

Operation Phase

Offsite Facilities: Development of BT access road will reduce the dust emissions that results from movement on the earthen roads. No adverse impact is anticipated on air quality during operation phase due to development of off-site infrastructure.

EZ operation: Post development of the economic zone & setting up of industries, there could be some impacts on the air quality of the area. Industrial development will involve generation of emissions, and increased vehicular movements. These altogether may have overall negative impact on the air quality of the site and the nearby areas. The industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing.

Significant air emissions result from light-engineering industries. These are particulate matter, sulphur dioxide, metals and other criteria pollutants like ozone, oxides of nitrogen and carbon monoxide. Lead may be generated in some of the processes.

Air emissions from food processing industry will contain some volatile organic compounds but do not contain any hazardous compounds. These industries emit low process-air emissions. Most processes uses electrical power and rarely emit harmful compounds to environment. But air emissions from water treatment plant of these industries are a major concern. Mal odour from these water detoriate the air quality and disturbs the living condition in the area. No significant air emissions is generated from readymade garment industries.

Mitigation Measures

- Provision shall be made for peripheral green belt all along the EZ boundary. The green belt shall be thicker on East and west side (Mongla river, Gona river and village side). Green belt shall have minimum of three rows of local variety of tree. Tree species shall be selected such that first inside row is of smaller height, middle row of tree is of medium height and last row of tree is of higher height so that green belt formed appears like a canopy.
- Development of thick green belt (10 m) and organized greens within each industrial plots
- Power Generators should be provided with stacks of adequate height (higher than nearest building) to allow enough dispersion of emission.
- Process emission if any shall be control with the installation of adequate air pollution control systems
- No red category industries should be allowed within industrial zone
- All industries should obtain clearance from DoE, Bangladesh as applicable . Air pollution control measures shall be adopted by respective industries in line with DOE permission
- Air pollution monitoring should be carried out quarterly by all industries to check the air pollution level.
- Preference of usage of clean fuel like LPG, low sulphur diesel should be explored
- Energy conservation should be adopted by opting the alternate energy options like solar power.
- Odour should be managed at the site using odour suppressant and planting fragnant flowering trees.

6.10. Impact on Noise Environment

Pre-construction and Construction Phase

Pre-construction phase will involve site clearance activity for development of access road and pump houses for water supply system. Clearance of site will involve removal of vegetation and land levelling activities. Operation of different machineries and equipments for construction activities, running of heavy load traffic for construction materials transportation, and regular traffic movement may generate noise during construction period. The produced noise may have impact on existing acoustic environment of rural category defined in ECR, 1997. Local inhabitants may feel disturbed due to noise from line sources (traffic movement).

Mitigation Measures:

Machinery to be used should comply with the noise standards prescribed by DoE.

- DG set shall be aquoustic treated
- Workers shall be given PPE (ear plugs)
- No noise generating activity shall be carried out in the night.
- No construction activities to be undertaken during night hours to prevent any disturbance to nearby residents and labours in labour camps.
- Acoustic enclosures should be provided with DG sets and machinery to control the noise levels at construction site.
- Temporary noise barriers should be provided near the high noise generating areas

Operation Phase

After construction of the road and upcoming economic zone, traffic in the area will increase significantly which will increase the noise level of the area. Operation of water pumps during operation phase of economic zone may also increase the local noise level. Following mitigation measures should be taken to prevent noise pollution during operation phase

Mitigation Measures

- Pumps should be fitted in close room, preferably acoustic enclosure to reduce the noise generation
- Avenue plantation should be developed along both the side of access road which will act as noise buffer
- Green buffer of 10 m should be developed all along the project boundary. Green buffer should compose of the 2-3 rows of plants of variable height and thick canopy so as to form continuous barrier. This will help in reducing the noise level significantly.
- Apart from these after development of economic zone, noise will be generated from the construction aof individual industries, operation within in industrial units, running DG sets in each units and traffic movement within EZ zone. Following mitigation measures are required to be taken to minimize noise pollution:
- Mitigation Measures
- All industries should obtain clearance from DoEB before establishing industrial unit and should comply with all the conditions mentioned in the letter of environment clearance
- All industries should install the new machiney of modern make which complies with the noise standards prescribed by DoEB in ECA, 1995.
- Acoustic treatment and temporary noise barrier should be provided in area generating higher noise levsls
- Job rotations should be practiced for workers in industry to prevent prolonged exposure to high noise level as it may lead to deafness, fatigue, head ache, nausea and drowsiness
- Honking should be prohibited within the economic zone

6.11. Impacts on Water Resources

Pre-Construction and Construction Phase

Impacts on Ground & Surface Water Resources:

Significant quantity of water will be required for various construction activities & domestic purpose. Source of water for these activities will be the ground water, either through BEPZA or Mongla Port water supply system. Excess withdrawal of ground water may lead to depletion of aquifers. Shallow water aquifers in the area are saline and fresh water is available at the depth of 210-270 m (700-900 ft). Measures should be taken to minimize the water extraction by reducing water consumption and wastage. Mitigation measures are given below.

Mitigation Measures

- Best management practices will be required to be adopted to minimize water wastage and water loss. Best management practices to be adopted are given below:
- Temporary storm water drains and rain water harvesting ponds should be constructed so as to store rain water for construction activities.
- Water for curing can be saved by carrying out curing in early morning or late evening and covering structures with gunny bag so as the moisture can be restored for longer time.
- Regular inspections at site to monitor leakages in water storage tanks
- Creating awareness among construction workers about the importance of water conservation
- Adoption of the advance technologies and machinery which helps in minimizing water requirement for construction
- Storing the curing run-off and waste from other construction activity and using the same for sprinkling.
- Covering the water storage tanks at site to prevent evaporation losses.
- Impact on Surface Water Quality
- Run-off from the construction site may carry the higher quantity of sediments and oil which may pollute the surface water and impact the aquatic life. Thus measures are required to be taken to minimize the surface water pollution

Mitigation Measures

- To avoid excavation activities during rains
- To prevent piling up of excavated soil, raw material and construction debris at site by proper management and disposal
- Minimize run-off by using sprays for curing
- Maintaining appropriate flow of water sprinklers at site
- Construction of storm water drains along with sedimentation tanks with sand bags as partition as barrier for direct flow of run off to river.
- Collection & Reusing of curing over flow, tyre wash water etc within the site
- Construction of adequate nos. of toilets and proper sanitation system to prevent open defecation along the river banks/water supply lines
- Construction of soak pits/septic tanks to dispose-off the domestic waste water generated from labour camps to prevent disposal of sewage in surface water bodies
- Proper collection, management and disposal of construction and municipal waste from site to prevent mixing of the waste in run-off and entering the water bodies
- No debris/construction material should enter the aquaculture ponds and other waterbody in the area

Impacts on Ground Water Quality

Ground water is saline in shallow aquifers of the study area. No significant impacts are anticipated on the ground water quality due to development of the off-site facilities for economic zone. Following measures should be taken to prevent any ground water contamination

Impacts on Drainage Pattern & Hydrology

Site has been raised with the sand dredged from Pasur River and is grey in colour by 6 ft w.r.t surrounding area. The proposed site will be required to be levelled due to iterative sand filling at different times. Finished level of site will be 6 m above mean sea level after development of EZ. The ground level of the EZ will be around 1.50 to 2.0 m above the average High Flood Level (HFL) of Pasur River (4.45 m). Storm water from the site will be drained into Gona and Mongla River through

peripheral drains developed along the EZ site. Gona (small stream) and Mongla River finally drains into Pasur river. Pasur river is at distance of 900 m from project site in West direction.

Mongla River abuts site in East direction and Gona River abuts site in West direction. Clay bund is constructed along Mongla river which prevents flooding of nearby areas. Storm water from the site is drained through these rivers. No significant impact on drainage is anticipated with development of the off-site development except access road. For drainage of storm water from access road, masonry drains will constructed on both side of the roads. These drains will carry run-off from the nearby areas also and will be connected to the Gona River. These drains will help in preventing the local flooding during heavy rains.

After development of the economic zone, natural drainage pattern of the site may be altered. Natural drainage pattern should be maintained. Run-off from the site is estimated to be 8614 cum/day presently. Site is adjacent to the Gona and Pasur River. Run-off from site presently is drained into these rivers. Run-off from the site will increase after development of the economic zone. To manage the storm water from the site, after development of the economic zone, storm water collection network and storage system should be provided at the site. Storm water should be collected, treated and stored within the site and should be used for meeting daily water demand as per the availability.

Mitigation Measures

- Natural drainage pattern should be maintained. Assessment shall be made of catchment area Garland drains shall be constructed based on the assessment of catchment area (frequency, and storage area).
- Development of peripheral drains to drain out storm water from EZ site
- Storm water drain shall have the provision of di-siltation before discharge to river.

Operation Phase

Impacts on Ground & Surface Water Resources:

Expected population for administration building is 112 Nos. Water requirement of 5.04 KLD has been calculated for administration building during operation phase considering criteria of 45 LPCD for staff members. This demand can be fulfilled by withdrawing water through water supply system developed for the project.

It is estimated app. 4 MLD of water will be required during operation phase *after development of economic zone at Mongla*. This water is proposed to be taken from Manik Nagar which is at app 20-21 km distance from the site as shallow ground water aquifers in study area are saline. Mongla Port Authority and BEPZA are also withdrawing water from nearby areas of Manik Nagar for app. 10 years. Withdrawal of huge amount of water may deplete the ground water aquifers of the area. Following Measures should be taken to minimize the impacts on water resources

Mitigation Measures

- Feasibility shall be explored by BEZA of installing the desalination plant for the use of surface water.
- Rain water harvesting system and storage should be developed to minimize ground water construction
- Adoption of best management practices to prevent water wastage and minimize water loss
- Usage of water conservation fixtures to minimize water consumption
- Installation of leakage detection system to minimize the water loss
- Ground water aquifer assessment studies may be undertaken to assess the ground water potential. Pizometer shall be installed to monitor variation in ground water level in the area.

Impacts on Surface Water Quality

Industries are likely to generate domestic and industrial effluent. Liquid waste which can be generated from light engineering industries will include waste acid, waste alkali, grease, used/spent oil, liquid

metal, spent solvents etc. Wastewater is not generated in significant amount from these industries. Majorly domestic and cleaning waste is likely to be generated. No significant liquid waste is generated from readymade garment industry.

Food processing industries similarly generate both liquid and solid waste. Concern with wastewater from the food processing industry is high BOD levels, high TSS, excessive nutrient loading like nitrogen and phosphorus compounds and pathogens. This water is to be treated essentially to achieve DoEB standards to prevent the soil, water and air quality pollution. Discharge of wastewater in soil will degrade its fertility and increase the toxicity which will make it unsuitable or growth of plants and survival of micro/macro organisms. If this water is discharge into water system, will pollute the water quality and have potential to threat the aquatic life.

Uncontrolled discharge of this effleunt to river may severally pollute the river water quality.

The pollution thus discharged to Mongla/gona river may be carried away to Sunderban area through Pasur river and effect area ecology substantially. Run-off may significantly increase post development of economic zone. It is required to manage storm water which will be generated from EZ site post development. Measures should also be taken to prevent contamination of storm water with any industrial pollutant. Following measures should be adopted during operation phase to minimize impacts of development of Economic zone on water quality:

Mitigation Measures

- Each industry should obtain consent of DoE Bangladesh before construction and operation and should comply to the conditions laid by them
- Each industry should treat the effluent and sewage generated by them so as to achieve zero discharge and no untreated effluent should be discharged into any water body
- Provision shall be made for Common Effluent Treatment Plant (CETP) if required.
- Common STP (in modules) should be constructed within the EZ to treat sewage from residential and commercial areas
- Each industry should practice rain water harvesting to minimize the water consumption and reduce run-off from the site
- Proper management of waste should be done to prevent any contact between the waste and storm water
- Storm water drains should be lined separate from effluent drains
- Storm water system should be inspected & cleaned before monsoon every year
- Peripheral drain shall also be lined and shall not be connected to internal storm water drainage system.
- The top soil shall be preserved and used for covering the sand layer at EZ site. Vegetation turffing shall be made at the side slops of the EZ areas to prevent erosion and siltation in the river.
- River water quality shall be monitored periodically.
- Impacts on Ground Water Quality
- No impact on ground water quality is anticipated during operation phase due to off-site developments.
- After development of economic zone there may be some ground water pollution due to industrial activities. Following measures should be taken to minimize the ground water pollution.
- Mitigation Measures
- Each industry should treat the effluents and sewage and should not discharge into ground.
- No leachate, waste water and waste material should be stored in pervious unlined area/pond.
- Ground water quality shall be monitored periodically.

6.12. Impacts on Land resources

Pre-construction and Construction Phase

Impact on Land Use

EZ site is spread over an area of 83 ha and off-site facilities development also requires significant land area. Efforts has been made to minimize the change in land use and acquisition of agriculture land by making use of Government/Khas land.

Land required for development of EZ belonged to Mongla Port Authority. The land has now been transferred to Bangladesh Economic Zone Authority (BEZA) for development of economic zone. Administration building will be developed within the economic zone site. Economic zone will be developed after appointing the developer by BEZA and obtaining permission from DoEB.

Land ownership of access road is with Mongla Port Authority (MPA). Some of the kachha houses and shops are located along the proposed access road. 8 of these households will be impacted due to development of 15 m access road. These areas are allocated for the establishment of commercial units. Accordingly, MPA has provided alternative piece of land to eight persons to undertake small business, who pay an annual rent of BDT 4.05/sq. Gauge/annum. As per MPA, BEZA can now develop the access road and can use the road as access for their site. Land for constructing electrical supply system belongs to Govt. of Bangladesh and the system will be developed with consent of GoB.

Water supply will be taken from Manik Nagar, which is app 21 km from the EZ site. For development of water supply system, 3 pump houses will be constructed. Out of three, one location is private land and rest are Khas land (Govt. Land). Land will be required for construction of pump house. Private land will be purchased/acquired for development of the pump house. The private piece of land (0.166 acres) belongs to two farmers (0.083 acres each). Also 669 nos. of trees (planted and natural trees) along the Manik Nagar Gaurmanava road will be impacted. Water pipeline will be laid along the Kulna Dhaka Highway and Manik Nagar Gaurmanava Road which is Govt. Land. After laying the pipeline, roads will be restored to their original state. Only a small piece of agriculture land will be diverted for development of pump house. No significant change in land use is associated with the project development.

Mitigation Measures

- The alignment of the approach road was repositioned in such a way that the small business units at the beginning of the road, as well as the structures at the end of the road and at the right-hand side would not be affected. This realignment has helped in minimising the number of displaced business units/houses at the approach from eighteen to eight.
- Affected families will be relocated in the nearby areas in consultation with Mongla Port Authority
- In the matter regarding the removal and replanting of plants, mainly banana trees, from the route marked for laying the water supply pipeline, it was decided to remove the earth manually, rather than using a JCB excavator/digger.
- Compensation to the agricultural land loossers will be provided as determined by DC, compensation under law (CUL) or replacement costs, whichever is greater will be paid by DC office. Top up equal to the difference between CUL and replacement costs will be paid from the project.

Impact on Topography & Geology

No impact on topography & Geology is anticipated due to development of EZ and of-site infrastructure for economic zone. Economic zone site is already filled to level of 6 ft. w.r.t surrounding areas. Finished level of site after levelling will be 6 m which is well above the HFL level thus no more raising of land is required. Excavation made for laying pipeline and constructing towers will be filled back to same level. Thus no impacts on topography are anticipated due to project development.

Impact on Top Soil and Soil Quality

Development of the structures, construction of the road & laying of the pipeline may disturb the soil profile of the area. EZ site is filled with the dredged sand from Pasur river. The top Thus no loss of valuable top soil will occur during construction of administration building and boundary wall. Borrow earth shall be required for road embankment and EZ land. The borrow earth shall be sourced with the consent of land owner. The preserved top soil shall be used at EZ site. Electrical supply system will

require construction of the towers, laying of HT lines and construction of substation. Tower will be constructed along the Gona river and substation will be constructed within EZ site. No significant impact on soil quality is anticipated due to electrical supply system.

For water supply system, three pump houses will be constructed. One pump house out of 3 will be constructed on agriculture land. Top soil should be removed from agriculture land (to be acquired) and will be used for landscaping or spread on other agriculture fields. Pipeline will be laid along the road, thus no significant impact on soil quality is anticipated.

Storage of raw material, fuel and construction debris may contaminate the soil thus measures should be taken to prevent the soil pollution. Mitigation measures to be adopted are mentioned below. Contractors are required to take all the proposed mitigation measures. PMC and BEZA will ensure that all the proposed mitigation measures are being incorporated in the bid document issued to the contractor and the implementation of the same during construction.

Mitigation Measures

- No piling of raw material at site
- Raw material will be stored under covered sheds and paved surface
- Fuel storage area should be paved
- Adoption of best management practices to prevent any spillage of raw materials
- Construction debris should be stored under covered sheds and paved surface and should be disposed off regularly to designated sites
- Waste from labour camps can be segregated at site. Food waste/wet waste should be composted in pits within the camp site. Recyclable waste should be sold to the authorized dealers and the remaining should be disposed off at designated sites through local agencies responsible for waste management in the area.

Impact on landscape and scenic beauty

EZ site is devoid of any vegetation and is raised at level of 6 ft. Only levelling will be required prior to construction of the site. All construction activities for administration building & boundary wall will be carried out within economic zone and will not cause any impact on landscape and scenic beauty. A green buffer of 10 m (minimum three rows of trees) will be developed all around the project site which will enhance the scenic beauty of the area

Constructions activities involved in construction of access road, electrical supply and water supply system may change the visual landscape of the project area. Site clearance activities, gathering of equipment and construction materials, machinery and camp establishment on green field site may reduce the scenic beauty. Nevertheless, the impact is for a short duration, and reversible as the project plan includes landscape planning, green belt development as well.

Operation Phase

Impact on Soil Quality

No impact due to off-site developments is anticipated on soil quality of the project site during operation phase.

After development of economic zone, disposal of industrial domestic and process waste may contaminate land and soil quality of the area. . The impact can be significant and long term in case of uncontrolled discharges. Improper disposal of waste (hazardous and non-hazardous waste) may degrade soil, water, noise, air quality and ecology of the area. As per the preliminary planning, it is planned that industries like light engineering, readymade garment manufacturing and food processing will come up in the EZ zone. These industries are not heavily polluting like tanneries, distelleries etc but generate significant waste both hazardous and non-hazardous in nature, which can pollute the environment if not managed properly. Nature of the waste which can be generated from these industries is dicussed below.

Waste to be generated from the light engineering industries can be solid and liquid in nature. Solid waste will include packaging waste, metal pieces, damaged electrodes, ends of coils, wires and spools, flux

cored electrodes, greased clothes/cotton, damaged rods, burnt rods, scrap flux, slag (residue from flux reaction and composed of metal and non-metal oxides), Dross (oxidized metal expelled during thermal cutting and gouging operations), metal dust, dust collected in filter ventilation systems/air pollution control devices, floor sweepings, coal ash (if coal used as fuel), solid waste recovered from treatment of wastewater like sludge etc.

Solid waste from the food processing industries includes both organic and packaging waste. Organic waste, that is, the rinds, seeds, skin, and bones from raw materials, results from processing operations. Inorganic wastes typically include excessive packaging items that are, plastic, glass, and metal. Solid waste from readymade garment factorymajorly composed of resins, fabric, apparel, dye, discarded machinery and fibers. These waste required to be collected and disposed off periodically. Lub oil/waste oil is generated from the machineries as hazardous waste. Mitigation measures are required to be adopted to prevent soil pollution of the area.

Mitigation Measures

- Provision shall be made for proper storage and disposal of industrial waste by receptive industries.
- Common waste storage areas shall be designated for industrial domestic waste.
- Waste should be segregated at source into hazardous and non hazardous waste. Further the waste should be segregated into recyclable and rejected waste. Recyclable waste should be sent to authorized vendors for recycling and rejected waste should be disposed off as per the norms specified by DoEB for the particular waste.
- Industrial waste generated should be stored on sealed surfaces and should be disposed off as per guidelines of DoE, Bangladesh.
- No chemical/hazardous raw material should be allowed to spill over the land and should be operated in covered systems
- Excessive packaging should be reduced and recyclable products such as aluminum, glass, and high-density polyethylene (HDPE) are being used where applicable.
- Organic waste should be resold to value addition industries or can be feeded to live stock.
- Advanced wastewater treatment should be adopted by industries
- Use of advanced techniques to control specific portions of the manufacturing process to reduce wastes and increase productivity.
- Use of radiation to kill pathogenic microorganisms.
- Reduction or total elimination of effluent from the manufacturing process

At present no common hazardous waste handling and disposal unit exists in Bangladesh. Industries thus have to install the incenerators in the unit to dispose hazardous waste. The incinerator further should use the clean fuel and required air quality management measures should be adopted.

A site for disposal of hazardous waste can be identified within the EZ and it should be developed as per the norms of DoEB and upcoming Hazardous Waste Management rules of Bangladesh.

Impact on Land Use

No impact due to off-site developments is anticipated on land use of the study area during operation phase. Development of economic zone will attract more infrastructural development around the project site to facilitate industrial growth which may alter the land use of area. Some of the developments wll include, construction of roads, housing facilitiy, commercial areas including hotels, hospital, restraunts, schools etc, small scale industries etc. This will help in development of the area significantly.

6.13. Impacts on Agriculture resources

Pre-construction and construction Phase

No agriculture land is proposed to be acquired for development of proposed off-site activities as well the economic zone except 0.166 acres of land for development of pump house & water supply system. That land will either be purchased/acquired by the BEZA. Thus no significant impact on agriculture activities/resources is anticipated due to the project development.

Operation phase

No impact on agriculture resources is anticipated from off-site infrastructure during operation phase. Some agro based or aquaculture based industries may come up in proposed economic zone. These industries will have positive impacts favouring the growth of agriculture and aqua culture.

6.14. Impacts on Fisheries

Pre-construction and construction phase

No impacts on fisheries due to off-site developments are anticipated during the pre-construction phase. No significant impact on fisheries is anticipated during construction of the proposed off-site developments.

For withdrawing ground water three pump rooms are proposed to be constructed. Two out of three pump are located on Khas land. Both khas land are small pond excavated by local people and they use it for minor aquaculture activities. Filling up of these ponds will impact the aquatic life in the ponds thus the small fisheries.

Construction work including land filling by dredging, sand lifting, site clearance and physical construction of plant setup, may have impacts on open water fish habitats, fish diversity and hence to some extent on capture fisheries production. The project adopts waste management plan, so impact on fish habitat due to waste discharge would be minimum.

Operation Phase

No impact on fisheries is anticipated during operation phase due to the proposed off-site developments. After development of economic zone, some of the aquaculture based industries may come up. This will help in boosting the aquaculture activities & fisheries development in the region.

The fisheries may get severely impacted if untreated industrial effluent or hazardous waste is discharged to river. Therefore effluent management system shall be implemented strictly. Fish kill may happen due to contamination of water due to discharge of untreated effluent. Effluent may contain toxic compmenents like heavy metals etc which leads to fish poisoning and may lead to large scale fish death. Also fishes contaminated with these pollutants if consumed may affect the consumer health (birds/biger fishes/humans).

Mitigation Measures

- Adoption of adequate wastewater and industrial effluent management technology so no untreated sewage is discharged into surface waterbody
- Industrial, municipal and hazardous waste should be managed such that no waste is dumped or disposed in surface water body

6.15. Impacts on Eco-system

Pre-construction and construction Phase

There is no vegetation at the economic zone site. No vegetation removal will be required for construction of administration building, electrical substation and boundary wall. No agriculture or aquaculture activity is reported at the site thus no impact on crop and aquatic eco-system is anticipated due to off-site development.

For construction of access road and the bridge, it is required to fell app. 30-40 trees and some bushes. These trees and bushes provide habitat to birds, insects, reptiles and small mammals like squirrel etc. For laying the water pipeline app 671 trees will required to be fell for water pipeline. Details of the trees to fell are given below.

Table 51: Trees to be affected for Laying Water Pipeline

Name of tree	Small	Medium	Large	Total
Fruit bearing				
Banana	240	190	129	559
Coconut	2	1	0	3
Dates(Palm)0	0	1	5	6
Guava	0	1	1	2
Sajna	1	2	4	7
Papaya	0	5	0	5
Jackfruit	4	8	0	12
Boroi	2	0	0	2
Mango	3	0	0	3
Babla	0	1	0	1
Bengal almond	4	0	0	4
Total	**256**	**209**	**139**	**604**
Non fruit bearing				
Arjun	1	0	0	1
Champal	0	3	4	7
Shirish	10	25	9	44
Eucalyptus	0	0	1	1
Gewa	4	0	0	4
Moahogany	0	0	7	7
Neem	1	0	0	1
Total	**16**	**28**	**21**	**65**

Cutting of the trees will disturb the eco-system and the habitat of the dependant organisms.

Development of off-site development does not require any dredging activity thus no impact on the aquatic life of rivers is anticipated due to project development. Project is located at app. 5 km distance from Sundarbans reserve forest. All the construction activities are site specific and will have negligible impact on Sundarbans ecosystem.

Mitigation Measures:

- Twice the nos. of trees to be fell should be planted as compensatory plantation in affected areas to minimize the impact on the eco-system.
- No waste shall be discharged in water bodies.

Operation Phase

Green buffer of 10 m all around the project site will include most of the native plant species, which will significantly improve the ecology of the area. This green buffer will provide habitat for the avifauna, reptiles and small mammals and will enhance ecology of the area. Plantation should also be carried out

along the both side of access road. Twice the number of trees fell (for access road, bridge and water pipeline) should be planted.

Post development of the economic zone & setting up of industries, there could be some impacts on the ecosystem of the area. Sundarbans reserve forest is within 5 km radius area from EZ site and thus EZ site falls within Ecological critical area of Sundarbans forest. Sundarbans has fragile eco-system with rich bio-diversity and unique flora and fauna. Industrial development will involve generation of emissions, effluents and increased vehicular movements. These altogether may have overall negative impact on the eco-system of the site and the nearby areas as the air pollutant will impact the existing vegetation and avifauna in the area.

But the industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution as described above are taken there will be no significant impact on the eco-system of the area.

Mitigation Measures:

- Periodic monitoring shall be carried out as per the monitoring plan for air, water, noise and soil and ensure that no impact
- No waste shall be discharged in water bodies.
- Tree survival rate shall be monitored
- Implementation of proposed mitigation measures and proposed environment management plan

6.16. Impacts on Socio-Economy

Pre-construction and construction Phase

Loss of Livelihood & Displacement of Families

A 15 m wide access road will be developed to connect the project site with Mongla port road. The road will be constructed in place of existing 6 m road. Habitations, small shops and Mongla commercial colony exists along both side of the road. 8 HHs will require be displacing and rehabilitating for construction of the road. Land to these HHs is given on lease by Mongla Port Authority. Nos. of affected people are 43 HHs will be losing the structures. Another section of land will be identified in close vicinity on Mongla port land to rehabilitate the displaced HHs. But the livelihood of these HHs will be impacted. Out of the 8 HHs, 6 HHs are lease holders and 2 are tenants. Loss of livelihood of these two HHs will be equivalent to the rents from the tenants.

Out of these 8 Hhs, 3 are wood/log seller, one has small business, one has garage, one is farmer, one is working in tailoring shop and one owns a shop.

For construction of water pump houses in Manik Nagar, it is required to acquire/purchase private land of app. 0.166 acres. The land belongs to two farmers of the Manik Nagar village. This will have impact on livelihood of the both farmers but not significant as only 0.083 acres will be acquired from each farmer which is a small piece of land. Affected nos. of familes at Manik Nagar are 2 and affected nos. of people are 15. The issue has been addressed in SIA and will be dealt as per the applicable laws of land, Act of resettlement and rehabilitation and Social Management Framework of PSDSP to minimize the impact on livelihood of the affected people. In total 10 HHs/58 people are affected due to project development. Details of the project affected families are given below.

Table 52: Detail of Project Affected Families

PAF	Unit	Quantity
PAHs losing structures using for housing and business purposes	Households	8
PAHs losing agriculture land	Households	2
Total Project Affected Households(PAHs)	Households	10
Total Project Affected Persons(PAHs) in the 10 households	Persons	58

Table 53: Type of Impacts of PAHs/PAPs

Loss Category	Impact Category	Reason
Loss of business units/dwelling units	Major	The 8 business units (43 people) will be displaced due the widening of the approach road from 6 m to 15m
Loss of agriculture land	Minor	Only a portion of the agriculture land (2 PAHs & 15 PAPs) will be affected
Loss of Trees	Minor	Around 669 trees will be affected. The trees will be removed and replanted. Majority of trees are banana trees

Table 54: Extent of Income Loss of Leaseholders

S. No.	Name of leaseholder	Occupation type	Ownership of business	Yearly Income (in BDT)	% of loss without rehabilitation support	Loss of income during resettlement period**	% of loss with rehabilitation support
1	Md.Ruhul Amin	Wood/Log selling	Own	1,80,000	100	30,000	16.7
2	Md.Abed Bepari	Wood/Log selling	Own	2,40,000	100	40,000	16.7
3	Md.Mostofa Howldar	Wood/Log selling	Own	1,80,000	100	30,000	16.7
4	Md. Kazi Abdul Kalam*	Business	Own	8400	100	1,400	16.7
5	Md.Al Amin Sheikh	Motorcycle garage	Own	2,40,000	100	40,000	16.7
6	Rupali Begam	Farmer	Lease	30,000	100	5,000	16.7
7	Abdul Khaleque	Working in a Tailoring shop	Wage	6000	100	1,000	16.7
8	Abdul Alim Howldar	Shopkeeper	Own	1,44,000	100	24,000	16.7

* Income has been calculated as per the rent received from the tenants

**Considering the time period for resettlement for the land owners as 1 month

Table 55: Extent of Loss of Tenants

Md.Rony Sikdar**	Rickshaw van driver	Wage	96,000	8.3
Moshiur Rahman**	Small Laundry shop	Own	1,20,000	8.3

Table 56: Extent of Loss Due to Land Acquistion

1	Azmal Hossein	1.41	0.08	1.125	1.58	0.090	6%
2	Abul Kalam Samsud din	1.87	0.08	1.125	2.10	0.090	4%

Table 57: Extent of Loss of livelihood income from the acquired land

Azmal Hossein	1.41	Own	46	1	Rice White Fish Prawn	1400 200 100	0.029 0.027 0.090	0.08	0.008	6%
Abul Kalam Samsudd in	1.875	Own	40	3	Rice White Fish Prawn	1680 400 60	0.035 0.055 0.054	0.08	0.006	4%

8 HHs out of 2 HHs will be displaced from their original location and will be relocated into another land. The land required for the relocation of PAPs has been estimated at around 0.1 acres. The estimation has been done based in SIA on the foot print of the area occupied by each affected person, details are given below.

Table 58: Detail of displacement and relocation

1	Md.Ruhul Amin	Leaseholder	Kutcha	23	750	760	0.02
2	Md.Abed Bepari	Leaseholder	Kutcha	25	875	990	0.02
3	Md.Mosta fa Howldar	Leaseholder	Kutcha	10	400	418	0.01
4	Md. Kazi Abdul Kalam (tenant-Md. Rony Sikdar)	Leaseholder	Kutcha	NA 3 month-tenant	500	429	0.01
5	Md.Al Amin Sheikh	Leaseholder	Kutcha	22	400	360	0.01
6	Rupali Begam	Leaseholder	Kutcha	30	225	604	0.01
7	Abdul Khaleque (tenant-Moshiur Rahman)	Leaseholder	Kutcha	NA 15 yrs for tenant	384	459	0.01
8	Abdul Alim Howldar	Leaseholder	Kutcha	16	500	518	0.01
Total						**4448**	**0.10**

Detailed resettlement action plan for the project is attached as annexure VI

Impact on Health, Aesthetics and Hygeine

Construction activities lead to generation of dust, unpleasant view, obstruction in access of public properties due to excavation etc which may impact the society significantly. Adequate waste management plan, air, soil, noise and water pollution controls are required to be adopted to prevent any impact on society. Also various health hazards are associated with construction activity which may significantly impact the workers if not taken care.

During operation phase also there are various hazards associated with industrial operations. Thus BEZA should ensure that during operation phase industries take adequate health and safety measures for their employee. There should also be provision of development of helath centre within the EZ site.

Impact on Infrastructure& Utilities

No sensitive feature like religious structures, school, hospital etc are located along the proposed access road. Approx 30-40 trees planted along the proposed access road may require to be removed during construction. No impact is anticipated on social sensitive receptors due to construction of access road. Water pipeline will be laid along the Manik Nagar Gaurmanava road and Kulna Dhaka highway. Approx 669 trees (both planted and natural) will required to be removed for laying water pipeline along Nagar Gaurmanava road. Majorly agriculture fields and aquaculture ponds are located along the Kulna Dhaka highway in alignment of proposed water supply line. No sensitive features have been recorded along the proposed water supply alignment.

Some utilities exist at the proposed EZ site and proposed off-site infrastructure facility locations. These utilities may be required to be shifted as per the project planning. Details are given below:

Two HT lines for BEZA and Mongla Port are located on the peripheral area of the EZ but these will not be shifted. The LT line for Mongla Port colony passes from middle of the site and is required to be shifted.

This line will be shifted by developer of EZ. Replacement should be done immediately after removing the line.

LT line also exists in the left hand side of the proposed approach road which may also require to be shifted. Shifting will be carried out by contractor. Replacement should be done immediately after removing the line

Water availability in the Mongla area is a challenge. Transportation and connectivity of the nearby city, i.e. Mongla city is also through the boat. Thus after development of the EZ will creat further pressure on the existing resources as there is chance of people to migrate from nearby areas for getting employment. The local authority of the area may therefore take adequate step for developing long term development plan for this area after setting up of EZ and enhancing the basic facility in the area.

Impact on Demographic structure

The demographic profile of Burirdanga UP and Mongla Port Pourashva would not undergo any changes during the construction phase of the EZ, because the inflow of daily labourers would be mainly be from Burirdanga UP and Mongla Port Pourashva or from some other nearby areas. However, during the commissioning phase, a large number of inward migrations are expected. The inward migration along with the infrastructure development in Burirdanga UP and Mongla Port Pourashva may lead to changes in the demographic profile of both Burirdanga UP and Mongla Port Pourashva.

Generation of Employmenet

Employment opportunities will be ensured through three channels (i) direct employment for unskilled labour, (ii) indirect employment to the local community; and (iii) employment of women workers. Direct employment includes site clearance, excavation, loading and offloading of materials and deliveries, mason and construction works. Further, the construction labour force will be requiring food and other items, which is expected to be supplied by the local eateries, retail shops and the local community. The local community members can take advantage of these opportunities. Employment generation benefits improve the quality of life of the labourers and enhance their productivity and living standards. Employment generation, both direct and indirect, through Mongla EZ will have a tremendous impact on human development and poverty reduction in theMongla area.

Furthermore, as an enhancement measure, it is recommended that equal employment opportunities should be given to women in the EZ, especially those who are now unemployed or are working in the service sector as daily wage workers. These recommendations should be included as a requirement in the contract to be prepared by BEZA for the construction works related to the proposed EZ. EZs further create an important avenue for young women to become part of the formal economy at better wages compared to agriculture and domestic services. Employment opportunities within the EZ will increase their employability and position in the household. In addition, Mongla EZ is expected to assist women in changing their occupation pattern and accessing better job opportunities and wages. But the child labour should not be encouraged in the area. Thus BEZA should make strict rules fo industries and contractor for not employing child labour and there should be imposition of heavy fine, if anybody is found guilty.

Enhancement of Tourism

The immigration of workforce coming from outside to the EZ will also boost the tourism sector in Mongla area since it is adjacent to the Sunder bans which is a major attraction for tourists. Enhanced tourism will mainly lead to increased business for the boat owners as well as the boat workers in that area.

Skill Enhancement of Local people

As the both skilled and un-skilled labour will be requied during both construction and operation phase of the EZ, but Mongla and nearby area lack the skilled labour due to low literacy rate. BEZA should similar to BEPZA should provide the skill enhancement training to locals to carry out specific tasks and enhance the skill of local people so that they can be given employement.

Mitigation measures are required to be taken to minimize the impact of projects on the society and they are given below:

Mitigation Measures

- Provision of proper training to all workers for handling the construction equipment
- Provision of cautionary and guiding signage in local and English language indicating the hazard associated with the site
- Employment should be provided preferable to local & affected people
- Entry to the fuel storage area and construction equipment rooms should be restricted and should be allowed for trained personnel
- Wastewater from the toilet should be disposed off in septic tanks and soak pits and should not be allowed to accumulate at labour camp site or construction site
- Dustbins should be provided at labour camps for collection of waste and waste should be regularly disposed off through the concerned agency
- Temporary storm water drainage system should also be provided at camp site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies
- Arrangement of fire-fighting should be made at site and workers should be trained to use the system in case of fire
- Provision of personal protective equipment like safety jackets, helmets, gumboots, gloves, face mask, ear buds, goggles, safety shoes etc as per requirement and nature of job in which they are involved
- Job rotation should be carried out for workers exposed to high noise and dust areas
- Provision of First aid facility at the site and the labour camp
- Labour camps should be located at neat and clean location with no water logging issues
- Proper sanitation facility including toilets, bathing facility and washing facility should be provided at site and at labour camps for workers
- Clean drinking water supply should be provided to labour
- Crèche facility should be provided for kids if female workers are employed
- Regular inspection for hygiene and safety in labour camps should be done
- Compensation should be given to the people as per the policy for the planted tress
- Construction debris should not be allowed to enter into aquaculture ponds located along the road
- Entrance to any road/structure should not be blocked for laying pipeline and construction of access road
- A major segment of the population on the area is unemployed. Construction activity will provide employment to huge nos. of people including skilled, unskilled and non-skilled workers. This will improve the quality of life of people.
- In order to rehabilitate the PAPs, the business/dwelling units of the PAPs may be moved 30 feet backwards from their current location. Shifting them back is easy as the land available behind the dwelling units also belongs to the Mongla Port Authority. Shifting them backwards should consider the future plans for expsnsion of roads without disturbing PAPs in future. Further shifting these PAPs backward shall not affect any other person or shall have any impact on their livelihood.
- Financial assistance shall also be given to the PAPs for shifting movable busniness/dwelling units backwards
- To minimise the removal of plants along the route decided for laying the water supply pipeline, excavation should be carried out manually rather than using a JCB excavator/digger. This will help in minimising the cutting down of trees to a large extent.
- Replacement and relocation of utilities (if shifted) should be carried out immediately after removal.

Operation Phase

Development of off-facilities will improve the infrastructure of the area and will facilitate local people. Development of economic zone and setting up of industries will provide significant direct and indirect employment for the local people. This will significantly improve the quality of life of people.

The investments required in the commissioning of Mongla EZ will directly enhance the local economy of the area by increasing cash flow which in turn will increase the purchasing power of the local population. Increased cash flow will create more employment opportunities for the local communities in Burirdanga UP and Mongla Port Pourashva

Employment opportunities are expected to increase throughout the region during the construction and commissioning phases. Around 65% percent of employable population in Burirdanga UP and Mongla Port Pourashva will have access to better opportunities during the construction and commissioning phases of the Mongla EZ.

Post development of the economic zone & setting up of industries, there could be some impacts on the Socio-economic conditions of the area. Industrial development will involve generation of emissions, effluents, waste and increased vehicular movements. These altogether may have overall negative impact on the health of the people and aesthetics of area. But the industries proposed as per the pre-feasibility study are light engineering, food processing and readymade garment manufacturing. These industries are not heavily polluting. If appropriate measures for preventing air, water, soil and noise pollution are taken there will be no significant impact on the society

7. Public Consultation and Disclosure

7.1. Introduction

Public consultation is one of the key components of the environmental assessment. The EA team conducted public consultations in project and study area. The approach involved a mix of conventional as well as participatory/ rapid rural appraisal (PRA/ RRA), focus group discussions (FGD) and one-to-one interviews. Accordingly, as first step, the literature and secondary data was reviewed. Local people and concerned Govt. officials were consulted. Public consultations were held during the site visit in March, 2014.

The public consultations were conducted with the following objectives: (i) to intrude awareness of the stakeholders about the project and to collect their opinion, suggestions for planning and designing of the project (ii) to identify the need and concern of the public, (iii) to assess cultural patterns and behaviour of local communities. Stakeholder consultation, was targeted at people/communities who may – directly or indirectly, positively or negatively- be affected by the outcomes of a project. The consultations were conducted at two different tiers of stakeholders: local people and Government Officials. Stakeholders concerns are summarised in the following two parts: (i) consultations with Government officials and (ii) consultation with local people

7.2. Approach and Methodology of Pubic Consultation and Disclosure Meeting

Consultations were conducted on informal and interview based. No questionnaire/ brochures were supplied to the participants. The discussions were primarily focused on receiving maximum inputs from the participants regarding their acceptability and environmental concerns arising out of the project. Consultation was started with the short description of the upcoming EZ projects and proposed off-site developments for EZ project. The objectives, proposed developments and the possible impacts of the project and the connectivity links of the study area with the project were also explained. The study team recorded their perceptions, demands and recommendations, about the project.

7.3. Location of Public Consultation Meetings

Locations where focused group discussion and consultations were taken up are given in Table below.

Table 59: Location of Stakeholder Consultation

Location	Proposed Development	Remarks	Date
Village Burirdanga (the only village in close proximity of the EZ)	Administration building, electrical substation and boundary wall within EZ site	Nearest village located at 400 m in North direction.	22.03.2015
Mongla Port Commercial Colony	Access Road and Bridge	On both side along the proposed access road	22.04.2015
Mongla Port Authority	Development of all off-site infrastructure for upcoming EZ	--	21.04.2015

Location	Proposed Development	Remarks	Date
Bangladesh Economic Processing Zone Authority	Development of all off-site infrastructure for upcoming EZ	--	21.04.2015
Department of Public Health and Engineering Department	Water Supply System	--	21.04.2015

7.4. Pubic Consultation and Disclosure Meetings

Discussions carried out during public consultation meeting, response of local people and government officials and conclusions are given below. Photographs of public consultation are also presented in this report. Attendance sheet of the participants of Public consultation held at village Burirdanga is attached as Annexure VII & VII.

Table 60: Proceedings of Public Consultation and Disclosure Meetings

S. No.	Village	Villagers comment	Conclusion
1	Burirdanga	• We don't expect from environmental impact explained to us from the proposed EZ. • We want development of this project as people will get good job opportunity. Most of people in village are educated and work in EPZ. All females are also interested in working if they get opportunity. • Deejan Chaudhary a vetinary doctor said that in 1975 their lands were acquired by Port and they have lost all their land and have not got any good compensation and since then they are poor. Now we expect Govt. will provide us employment. • Source of drinking water in our village is pond water, we use it for daily purpose and sweet water is purchased from Mongla port authority. We expect to get water supply in our village with development of EZ project • Water Diseases are very common here and are increasing a lot due to usage of collected rain water for domestic purpose. Villagers should be given water supply from BEZA. • Most of the people working here are labour and practice aquaculture or work in BEZA industries. People involved in aquaculture work only for 5-6 hrs in a day. Earnings are also not sufficient for livelihood. Thus jobs should be provided to us after development of EZ • BEPZA give employment to people	People are aware about the upcoming EZ project. Source of information is surveys carried out by SIA team and newspapers. Majority of people have positive attitude towards the project People expect employment generation for them from upcoming EZ project People also expect infrastructure development such as good roads, water supply, power supply in their area after coming up of EZ zone People expects overall development of the area after development of EZ project People expects coming up of less polluting industries so as no pollution related problems are observed in the area.

S. No.	Village	Villagers comment	Conclusion
		upto 40 yrs of age so BEZA should do something for people of age more than 40 also • BEZA shall promote less polluting industries in this area	
2	Mongla Commercial Colony and Affected households (kachha houses/shops along access road opposite to Mongla commercial colony)	All the people consulted here expressed no concern from likely impacts from the project. **Business man having shops in Commercial Complex:** **Mr. Jahidul Islam-0171423535, Grocer.** He is happy that good road will be constructed and EZ will come up. Their business will enhance **Mohammad Sohail- 01914004099- R/o Port colony** but owns mobile recharge shop in commercial complex. He said project should come up as it will help in development of the area and improvement of our business. **Houses & shops located along road, opposite commercial complex:** **Mr. Mohammad Al. Amin-0173600946** Affected HH and Tyre puncture shop. He does not want to be relocated at other location. He is ready to move back. Shop land is given by port to him on lease basis. He does not have any other problem with project **Mr. Abdul Alim Howlader-01716951480** He may be affected in future. He has no problem with project. He expects to get water supply in their area with upcoming BEZA project. He also does not want to relocate and ready to be shifted back. **Residents of Mongla Port Colony:** **Mr. Abdus Sattar-01772919161- Retired official from Mongla Port Authority** He said project should come up. We don't have any environmental and social problem with BEPZA. BEPZA has maintained zone well and expect same from BEZA.	People have positive attitude towards the project and expects overall development of the area due to project Affected HHs/shops are not willing to relocate. They insist if they can shift backwards remaining in the same road. They expect BEZA to maintain the area well.
3	Manik Nagar Area	Discussion was carried out with Fishermen, farmers, students and labours regarding the impact of ground water extraction from Manik Nagar area for EZ project. Most of them are educated till Higher secondar level. People are well aware about the planning and also aware about the existing BEPZA and MPA pipelines in Foilar Hatt region. People extract water from shallow aquifers for domestic and irrigation purpose. Water level is 1-2 mbgl. Water is saline but they are using the same water. They have not	People are using water from shallow aquifers thus no significant impact is anticipated on people due to BEZA water pipeline as BEZA will withdraw water from deep aquifers only. Additionally rain water harvesting at Manik nagar Area should be practiced as enhancement measure to recharge deep water aquifers.

S. No.	Village	Villagers comment	Conclusion
		seen and faced any water shortage due to existing pipeline of MPA and BEPZA as they extract water from deep aquifers. Similarly they do not have any objections with BEZA project as well but that should not interfere with shallow water aquifers.	
4	Mongla Port Authority	**Mr. Md. Faruqul Islam, Chief Hydrographer and Md. Maksudu Rehman, Sr. Hydrographer - Discuss about the hydrology and flooding of the Mongla & Pasur river.** They informed Pasur river floods every year during monsoon but Mongla floods very rarely. A clay bund has been constructed for Mongla river by BEZA . HFL & hydrological data of Pasur river was given by them. It was confirmed that, due to filling activity at site, site is well above the highest flood level and proposed boundary wall will protect the site from annual flooding. **Er. S.K. Sowkat Ali, Deputy Chief Engineer, Civil.** He said the project location is suitable for EZ an also informed that there is proposed railway alignment from Khulna area to port and EPZ & EZ area which will increase the accessibility of site and will facilitate transportation of raw material	Data on hydrology and drainage of the area has been obtained from Mongla Port Authority. According to Mongla Port Authority, site location is suitable for development of EZ from HFL prospective as well.
5	Bangladesh Economic Processing Zone Authority	**Sr. XEN, Civil- Mr. Anamul Haque** Discussion was carried out to identify environmental and social issues associated with site and how they manage these issues. BEPZA informed a proper environment and social issues management system exists in BEPZA to handle issues. Regular inspections are carried out by BEPZA to check the compliance of industries to conditions laid by DoE, Bangladesh. Social and environment issues are checked before any problem is created by the environment and social management team. They are very strict for industries to comply with all environmental conditions laid by DoE and labour rights. BEPZA also informed a road will be developed parallel to Mongla river along EPZ zone which will enhance the connectivity for both EPZ and EZ site.	As per BEPZA, location of Mongla EZ is appropriate and it will not have any significant environment and social issues, if zone is managed properly. EPZ industries will act as supplier/vendor base for upcoming industries in EZ for textile, leather, light engineering and IT hardware and investors
6	DPHE, Mongla	**Er. Dipak Chandra Talukder, XEN, DPHE, Mongla division, Mongla** He suggested, that Mongla Port Authority and BEPZA are already drawing water from Foyla Haat Region to meet daily demand as water of pasur and Mongla is saline. Both river are saline and have salinity of 2400 ppm in all seasons and 1800-2000 ppm during monsoon. Water level in Foyla is found at greater depth of 250 m.	As per DPHE, alternate options of water usage like usage of surface water after desalination and rain water should be explored by BEZA rather depending completely on ground water.

S. No.	Village	Villagers comment	Conclusion
		BEZA is also planning to draw water from Manik Nagar which is near to Foyla Haat. Though enough water is available in this region with good recharge potential, but It may still lead to depletion of ground water in that region. BEZA should adopt conjunctive use of water. Feasibility of installing desalination plant shall also be explored so as surface water can be used. Rain water harvesting may also be carried out to reduce dependency on ground water. He suggested DPHE should be given this work of O & M of the water pipeline as they have been doing it for port and BEPZA also.	
7	Mongla Port Hospital	**Dr. Ruhul Amin, MBBS, Medical Officer, Mongla Port Hospital.** He informed that hospital is mainly for port usage but in emergency villagers also approach them and pay the fee. Major diseases in the area are water borne diseases, gastric, Hyper tension, asthma, bronchitis etc. There are 5 doctors, 4 diploma holder nurse, 6 trained nurse. It is 25 bedded hospital mainly for Mongla Port people. BEZA may also develop such facility.	Mongla port and BEPZA each has medical centre dedicatedly for people working in these zones. Govt hospital is in Mongla town. People residing in this area have to go to Mongla or Kulna to get medical treatment. Suggested BEZA to develop such facility for the benefit of People.

Discussion with BEPZA

Discussion with DPHE

Discussion with Dr. in Mongla Port Hospital

Discussion with Mongla Port Authority

Discussion with Mongla Port Authority

Discussion with Mongla Port Authority

Discussion in Mongla Port Commercial Colony




Discussion in Village Burirdanga


Discussion in Manik Nagar Area

Figure 70: Photographs of Stakeholders Consultation

8. Environmental Management Plan and monitoring indicators

8.1. Introduction

The Environmental Management Plan (EMP) is the synthesis of all proposed mitigation and monitoring actions, set to a time frame with specific responsibility assigned and follow-up actions defined. EMP is a plan of actions for avoidance, mitigation and management of the negative impacts of the project. Environmental enhancement is also an important component of EMP. A detailed set of mitigation measures have been compiled in view of the likely impacts associated with the proposed off-site development in Mongla EZ.

8.2. The Environmental Management Plan

The EMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation (post-construction) stages of the project. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Minimum disturbance to the native flora and fauna
- Compliance with the air, water, soil and noise quality norms.
- Conservation of water to the extent possible through rain water harvesting, wastewater recycling

8.3. Mitigation Plan

The proposed off-site developments may have some impacts on the environment and society such as change in land use, removal of vegetation, increased dust emissions etc. Health & Safety Plan along with the EMP has been drafted. Details of which are given below. All offsite facilities shall be constructed by BEZA. EMP implementation shall also be BEZA who will intern implement it through contractor.

8.4. Mitigation Plan for Boundary wall & Administration Building

It is planned to construct 4.0 km long 1 m wide and 3 m high boundary wall (2.1 m solid wall & 0.9 m barbed wire) around the upcoming Mongla EZ site of 83 ha and administration building covering an area of 3660 sq m. Ground coverage of administration building is 560 sq m. G + 2 level will be developed so that office space and related facilities will be there on ground and first floor and guest rooms at second floor.

Impacts associated with construction of boundary wall and administration building along with proposed mitigation measures are given below. No impacts are anticipated during operation phase. The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/water pollution; drainage/traffic congestion) as specified in the EMP tabulated below.

Table 61: Environmental Impacts and Mitigation Plan for Development of Boundary Wall & Administration Building

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
Removal of Vegetation	• Vegetation which has been identified & approved to be removed shall only be removed for site clearance	Pre-construction phase	Contractor	BEZA/PMC
Setting up of construction camps/labour camps	• The construction camps should be at least 500 m distance from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. • Location for stockyards for construction materials will be identified at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer • All sites used for camps will be adequately drained. They will not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures • The camps will be located such that the drainage from and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes	Pre-construction phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
	and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis. • The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. • Clean potable drinking water facility should be provided at the site and the water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed • First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2 % alcoholic solution of iodine, bottle containing salvolatile, snakebite lancet, , bottle of potassium permanganate crystals, scissors, Ointment for burns & surgical antiseptic solution • 1 first aid box should be available per 50 labour • A person trained in first-aid treatment shall be made in charge who shall always be readily available during the working hours at the work place • A suitable motor transport shall be kept readily available to carry injured or ill person to the nearest hospital.			

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
Identification of dumping sites for debris	• The dumping sites shall not be located within designated Forest/protected areas • Residential facility or sensitive facilities like hospitals, schools etc shall not be located in downwind direction of the identified dumping sites • Dumping shall not impact natural drainage courses • Dumping sites should be located at least 1 km from sensitive locations • Permission from concerned local body should be taken before finalizing the location • Agriculture lands should be avoided & waste lands should be preferred • Selected site should not support significant vegetation • The area should be sprinkled with water to suppress the dust emissions • Plant species suitable to grow in that conditions should be planted at the time of closure	During Construction	Contractor	BEZA/PMC
Soil Erosion and Sedimentation control	• To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. • Sedimentation tanks should be provided in line with storm water drains to trap the sediments from run-off. Sand bags can be used to trap sediments more effectively	During Construction	Contractor	BEZA/PMC
Disposal of Debris and any waste generated	• Waste from construction camp should be segregated at site. Food/wet waste should be composted in pit at the site, recyclable should be send to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area • Dustbins should be provided at the site and construction camps to prevent littering of waste	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
	• Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold through authorized dealers and reject waste should be sent to the identified debris disposal site • All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. • Utmost care shall be taken to ensure that the Municipal Corporation norms are met for the safe collection, transport and disposal of construction waste and debris.			
Dust Generation	• Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. • Compaction of prepared site to re-strain the fugitive emissions. • Water should be sprayed in the cement and earth mixing sites as well as after compaction.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
	• In high dust areas, workers should be provided and encouraged to use masks. • Regular maintenance, servicing of the vehicles and periodic emission check for equipment and machinery would be carried out in conformity with the Central Motor Vehicles Rules, 1989. • Water will be sprayed on the haul road. • All the vehicles entering the project site will be checked for Pollution-Under-Control Certificates. • Air quality monitoring to be carried out during construction phase to check the pollutants level in the air			
Contamination of surface & ground water	• Construction close to water bodies shall be avoided • Car washing / workshops near water bodies will be avoided. • Avoid excavation during monsoon season • Loosened soil will be stabilized by Contractor through landscaping and developing vegetation, wherever possible, once construction activity is completed at any site. • Sanitation facility with septic tank followed by soak pit will be developed. Common toilets will be constructed on site during construction phase and the waste water would be channelized to the septic tanks and soak pits in order to prevent waste water to enter into the water bodies. • Provision of oil & grease traps upstream of storm water drains • Surface run off due to construction activity will not be discharged in open without treatment.	During Construction	Contractor	BEZA/PMC
Noise from Vehicles, Plants and Equipment	• Construction activities would be carried out in the daytime only. • The construction	Throughout construction		

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
	equipment would be provided with adequate noise control measures and should comply with the noise standards as prescribed by DoE • Regular maintenance of vehicles and equipment would be carried out and corrective action taken in case of any deviation. • Ear muff/ear plug shall be given to the workers working around or operating plant and machinery emitting high noise levels. • DG sets if installed should be provided with acoustic enclosures • Labour working in noise prone area should be provided with ear plugs and job rotation should be practiced to prevent the prolonged exposure of any workers to high noise levels			
Accidents	• Safety officer should be appointed at site to ensure all the safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented.	During Construction	Contractor	BEZA/PMC
Clearing of Construction of Camps & Restoration	• Contractors shall prepare site restoration plans. The plans shall be implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy,.	Post Construction	Contractor	BEZA/PMC
Occupational	• All construction worker	During	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implentation of Mitigation Measures	Supervision & Monitoring
Health & Safety Plan	should wear a safety jacket and other protective equipment like helmet, gloves, gum boots, ear plugs, mask while working at the site • Workers should be made aware about the health issues related with open defecation • Training to workers should be provided for handling the construction equipment and machinery • Training to the workers should be provided to handle the emergency situations like fire, floods etc. • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp • Cautionary signage and notice should be displayed in local language and English at the required places like fuel storage area so that hazards can be avoided. A security guard should be deputed in these areas and entry should be restricted	Construction		
Disaster Management	All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	During Construction	Contractor	BEZA/PMC

8.5. Mitigation Plan for Access Road Construction & Bridge Construction

Another offs-ite development will involve construction of access road from existing Mongla Port Road to upcoming Mongla EZ site. This access road of 350 m length and 15 m width (7.5 m carriage way) will be developed and will connect the site to the existing Mongla Port Road. Access road and site will be connected via bridge of 36 m length and 15 m width. Bridge is being constructed over Gona River.

Impacts associated with construction of access road & bridge along with proposed mitigation measures are given below**.** The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/water pollution; drainage/traffic congestion) as specified in the Environmental Management Plan (EMP) as below.

Table 62: Environmental Impacts and Mitigation Plan for Access Road

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
Pre-Construction					
Removal of Vegetation	• When clearing the site, care shall be taken to keep vegetation clearing at a minimum and only from the RoW • Removal of as little vegetation as possible during the development and re-vegetation of bare areas after the project.	RoW	Pre-Construction	Contractor	BEZA/PMC
Procurement & Setting up of Crushers, Hot-mix plants, other Vehicles, Equipment and Machinery	• Specifications of crushers, hot mix plants and batching plants, other Construction Vehicles, Equipment and Machinery to be procured should comply to the relevant Standards/ norms and with the requirements of the relevant current emission control legislations • Hot mix plants, crushers and batching plants shall be located at distance of app. 1 km from nearest habitation, archaeological site, sensitive areas, forests etc. • Residential facility or sensitive facilities like hospitals, schools etc shall not be located in downwind	Areas in vicinity of construction site	Pre-Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	direction of the identified plant site • Aadequate stack height and emission control devices such as bag house filters, cyclone separators, water scrubbers etc., should be attached with HMP • Impervious platform for storage of bituminous and other liquid hazardous chemical • Pollution control measures for Diesel Generator (DG) set i.e. stack height, acoustic enclosure etc. • Proper lighting arrangement shall be made around plant site if the plants are operated during dark hours. • Provision of readily available first aid kit, fire fighting equipments at the plant site at appropriate location to respond in case of accident. • Periodical monitoring of air quality and noise levels as per conditions stipulated under the statutory clearance from DoE. Whenever the emission exceeds the permissible level				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	the plants should be stopped and necessary repairing works of faults should be done to bring down the emission levels.				
Setting up of construction / labour camps	• Labour/construction camps should be at least 500 m distance from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. • Location for stockyards for construction materials will be identified at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer • All sites used for camps will be adequately drained. They will not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures • The camps will be located such that the drainage from	Areas in vicinity of construction site	Pre-construction phase.	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis. • The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	air, ground or adjacent watercourses takes place. • Clean potable drinking water facility should be provided at the site and the water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed • First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2 % alcoholic solution of iodine, bottle containing salvolatile, snakebite lancet, , bottle of potassium permanganate crystals, scissors, Ointment for burns & surgical antiseptic solution • 1 first aid box should be available per 50 labour • A person trained in first-aid treatment shall be made in charge who shall always be readily available during the working hours at the work place • A suitable motor transport shall be kept readily available to carry				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	injured or ill person to the nearest hospital.				
Identification of debris dumping sites	• The dumping sites shall not be located within designated Forest/protected areas • Residential facility or sensitive facilities like hospitals, schools etc. shall not be located in downwind direction of the identified dumping sites • Dumping shall not impact natural drainage courses • Dumping sites should be located at least 1 km from sensitive locations • Permission from concerned local body should be taken before finalizing the location • Agriculture lands should be avoided & waste lands should be preferred • Selected site should not support significant vegetation • The area should be sprinkled with water to suppress the dust emissions • Plant species suitable to grow in that conditions should be planted at the time of closure	Waste lands in nearby area	Pre-Construction	Contractor	BEZA/PMC
Resettlement & Rehabilitation	• Affected HHs identified as per SIA should be given	Waste lands in nearby area	Pre-Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	compensation and should be relocated as per RAP prior commencement of construction activity				
CONSTRUCTION STAGE					
Land					
Soil Erosion and Sedimentation control	• Contractor should plan the activities so that no naked / loose earth surface is left out before the onset of monsoon. • Top soil from debris disposal sites & along the road side should be stripped and kept under covered shed for plantation • After the construction activity is over, top soil will be utilized for landscaping activity. • To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. • Along sections abutting water bodies, stone pitching needs to be carried out • High embankments should be provided with chutes and drains to minimize soil erosion. • Turfing of low embankments and plantation of grasses and shrubs should be done in slope stabilization. • Soil erosion	Throughout Project Corridor, Service roads and equipment storage sites, etc.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	checking measures as the formation of sediment basins, slope drains, etc, should be carried out. • Construction of Side Slope of Filled Land of 1:2 by suitable soils with proper compaction as per design. Slope surface should be covered by top soils/ cladding materials and grass turfings with suitable grass.				
Contamination of soil	• Impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform will be appropriately provided at construction camp, servicing area and liquid fuel and lubes at storage areas. • Proper management of waste from labour camps and construction site • Proper disposal of wastewater generated from labour camp and construction site	At fuel storage areas – usually at construction camps, temporarily acquired site.	During Construction.	Contractor	BEZA/PMC
Material sources	• Adequate safety precautions shall be ensured during transportation of quarry material from quarries to the construction site. • Vehicles transporting the material shall be	Nearest Quarry Site (Kulna)	During construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	covered to prevent spillage. • No excavation of earth should be carried out prior obtaining permission from DoEB				
Disposal of Debris	• Waste from construction camp should be segregated at site. Food/wet waste should be composted in pit at the site, recyclable should be send to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area • Dustbins should be provided at the site and construction camps to prevent littering of waste • Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold through authorized dealers and reject waste should be sent to the identified debris disposal site • All arrangement for transportation	Identified debris disposal location during preconstruction phase	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Rubbish, debris and bitumen wastes remaining after blacktop works shall be cleaned and disposed off in a safe place. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. • Utmost care shall be taken to ensure that the Municipal Corporation norms are met for the safe collection, transport and disposal of construction waste and debris.				
Air					
Dust Generation	• Vehicles delivering materials should be covered to reduce spills and	Throughout Project Corridor, all access roads,	During Construction Phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	dust blowing off the load. • Clearing and grubbing to be done, just before the start of next activity on that site. • In laying sub-base, water spraying is needed to aid compaction of the material. After the compaction, water spraying should be carried out at regular intervals to limit the dust to below • Every equipments and machinery will be fitted with dust suppression devices such as water sprinklers, dust bags, cyclone etc. as appropriate. • Road surface should be cleaned with air compressor and vacuum cleaners prior to the construction works. Manual labour using brooms should be avoided, if used labour to be provided masks. • The Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants . • Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly	temporarily acquired sites.			

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	maintained and confirm that pollution emission levels comply with the relevant requirements of DoEB • The Contractor will submit PUC certificates for all vehicles/ equipment/ machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'. • Air quality monitoring to be carried out during construction phase to check the pollutants level in the air				
Water					
Loss of water bodies/ surface / ground	• No excavation from the bund of the water bodies. • No earth will be excavated for development of any off-site facility • No debris disposal near any water body. • Prior written permission from authorities is required for use of water for construction activity. • Construction labours to be restricted from polluting the source or misusing the source. • Labour camps will be located away from water bodies.	Near all water bodies	During construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
Drainage and runoff	• The Contractor will always clear all the cross drainage structures and natural drainage before onset of monsoon in order to keep all drainage unblocked Earth, stones, wastes and spoils will be properly disposed off, to avoid blockage of any drainage channel. • All necessary precautions will be taken to construct temporary or permanent devices to prevent inundation or ponding.	Throughout the stretch	During Construction	Contractor	BEZA/PMC
Silting / sedimentation	• Silt fencing shall be provided around water bodies to prevent runoff of sediment from construction site • Sedimentation tanks should be provided inline with the storm water drains to prevent soil loss/eroision	Throughout Project Corridor and at all locations of water bodies	Construction Phase	Contractor	BEZA/PMC
Contamination of water	• Construction close to water bodies shall be avoided • Car washing / workshops near water bodies will be avoided. • Wastewater generated from labour camp and construction sites should not be discharge in waterbodies and should be channelized to septic tanks/soak	Throughout Project Corridor and at all locations of water bodies	Construction Phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	pits • Construction wastewater can be re-used for sprinkling and curing				
Noise					
Noise from Vehicles, Plants and Equipment	• All vehicles and equipment used in construction will be fitted with exhaust silencers. • Noise standard at processing sites, eg. hot mix plant , machinery will be strictly monitored to prevent exceeding of noise standards. • Workers in vicinity of loud noise, shall wear earplugs and working time should be limited as a safety measure. Job rotations should also be carried out to prevent continuous exposure • Construction activities to be taken up during day time only • Servicing of all construction vehicles and machinery should be done for exhaust silences and should be checked and if found defective should be replaced. • No noisy construction activities should be permitted around educational institutions/health centers (silence zones) up to a	Throughout Project Corridor and at all construction sites, hot mix plant etc.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	distance of 100 m from the sensitive receptors. • Monitoring shall be carried out at the construction sites • Environmental Expert will be required to inspect regularly to ensure the compliance of EMP.				
Flora and Fauna					
Loss or damage to vegetation	• Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other that those identified for cutting is minimum. • Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. • Trees identified under the project will be cut only after receiving clearance from the Forest Department • Vegetation only with girth of over 30 cm measured at a height of 1.0 m above the ground will be considered as trees and shall be compensated. • Compensatory plantation should	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	be carried out in the ratio of 1:2 minimum • Pillars of bridge should not be constructed on Gona River so as to prevent any disturbance to aquatic life in Gona river				
Compaction of vegetation	• Construction vehicles, machinery and equipment will move or be stationed in the designated area only (RoW or CoI, as applicable), to prevent compaction of vegetation outside the RoW. • While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses will be avoided.	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC
Loss, damage or disruption to fauna	• Construction workers will be directed not to disrupt or damage the fauna. • Construction vehicles will run along specified access to avoid accidents to cattle.	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC
Socio-Economic Environment					
Accidents	• Safety officer should be appointed at site to ensure all the		During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented.				
Occupational Health & Safety					
Construction Safety	• All construction worker should wear a safety jacket and other protective equipment like helmet, gloves, gum boots, ear plugs, mask while working at the site • All workers employed on mixing asphaltic 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. Stonebreakers will be provided with protective goggles	Entire Project site.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	and clothing and will be seated at sufficiently safe intervals • Workers should be made aware about the health issues related with open defecation • Training to workers should be provided for handling the construction equipment and machinery • Training to the workers should be provided to handle the emergency situations like fire, floods etc. • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp • Cautionary signage and notice should be displayed in local language and English at the required places like fuel storage area so that hazards can be avoided. A security guard should be deputed in these areas and entry should be restricted • A register of all toxic chemicals delivered to the site shall be kept and maintained up to date. The register shall include the trade name, physical properties and characteristics,				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product.				
Disaster Management	• All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	Entire Project site	During Construction	Contractor	BEZA/PMC
Clearing of Construction of Camps & Restoration	• Contractors shall prepare site restoration plans. The plans shall be implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy.	All Workers' Camps		Contractor	BEZA/PMC

8.6. Mitigation Plan for Power Supply

It is planned to build a new 33 kV dedicated power transmission line from Mongla substation to EZ site for catering to the needs of industries occupying the EZ along with 33/11 KV substation with in EZ. Laying of electrical transmission may involve various environmental and social issues. Mitigation Plan has been prepared addressing all the potential issues. Mitigation measures proposed are given below.

Table 63: Environmental Impacts and Mitigation Plan for Power Supply

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
Pre-Construction					
Fixing the alignment	• Alignment should not pass through residential areas • Transmission line should not disrupt any aquatic habitat • Riparian vegetation should not removed for construction of the tower, alignment should be shifted, if required	RoW	Pre-Construction	Contractor	BEZA/PMC
Setting up of construction / labour camps	• Labour/construction camps should be at least 500 m distance from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. • Location for stockyards for construction materials will be identified at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer • All sites used for camps will be adequately drained. They will not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections	Areas in vicinity of construction site	Pre-construction phase.	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	of water unless such water surface can be subjected to mosquito control measures • The camps will be located such that the drainage from and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis.				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	• The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. • Clean potable drinking water facility should be provided at the site and the water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed • First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2 % alcoholic solution of iodine, bottle containing salvolatile, snakebite lancet, , bottle of potassium permanganate crystals, scissors, Ointment for burns & surgical antiseptic solution • 1 first aid box should be available per 50 labour • A person trained in first-aid treatment shall be made in charge who shall				

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	always be readily available during the working hours at the work place • A suitable motor transport shall be kept readily available to carry injured or ill person to the nearest hospital.				
CONSTRUCTION STAGE					
Land					
Soil Erosion and Sedimentation control	• Contractor should plan the activities so that no naked / loose earth surface is left out before the onset of monsoon. • Soil excavated for construction of tower should be filled back to same • To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation.	Throughout Project Corridor, Service roads and equipment storage sites, etc.	During Construction	Contractor	BEZA/PMC
Contamination of soil	• Impervious platform and oil and grease trap for collection of spillage from construction equipment vehicle maintenance platform will be appropriately provided at construction camp, servicing area and liquid fuel and lubes at storage areas. • Proper management of waste from labour camps and construction site • Proper disposal of wastewater	At fuel storage areas – usually at construction camps, temporarily acquired site.	During Construction.	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	generated from labour camp and construction site				
Material sources	• Adequate safety precautions shall be ensured during transportation of quarry material from quarries to the construction site. • Vehicles transporting the material shall be covered to prevent spillage.	Nearest Source Station	During construction	Contractor	BEZA/PMC
Disposal of Debris	• Waste from construction camp should be segregated at site. Food/wet waste should be composted in pit at the site, recyclable should be send to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area • Dustbins should be provided at the site and construction camps to prevent littering of waste • Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold	Identified debris disposal location during preconstruction phase	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	through authorized dealers and reject waste should be sent to the identified debris disposal site • All arrangement for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. • Utmost care shall be taken to ensure that the Municipal Corporation norms are met for the safe collection, transport and disposal of construction waste and debris.				
Air					
Dust Generation	• Vehicles delivering materials should be covered to reduce spills and	Throughout Project Corridor, all access roads,	During Construction Phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	dust blowing off the load. • Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of DoEB • The Contractor will submit PUC certificates for all vehicles/ equipment/ machinery used for the project. Monitoring results will also be submitted to PMC/PIU through the 'Engineer'. • Air quality monitoring to be carried out during construction phase to check the pollutants level in the air	temporarily acquired sites.			
Water					
Loss of water bodies/ surface / ground	• No excavation from the bund of the water bodies. • No debris disposal near any water body. • Prior written permission from authorities is required for use of water for construction activity. • Construction labours to be restricted from polluting the source or misusing the source.	Near all water bodies	During construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	• Labour camps will be located away from water bodies.				
Contamination of water	• Construction close to water bodies shall be avoided • Car washing / workshops near water bodies will be avoided. • Wastewater generated from labour camp and construction sites should not be discharge in waterbodies and should be channelized to septic tanks/soak pits • Construction wastewater can be re-used for sprinkling and curing	Throughout Project Corridor and at all locations of water bodies	Construction Phase	Contractor	BEZA/PMC
Noise					
Noise from Vehicles, Plants and Equipment	• All vehicles and equipment used in construction will be fitted with exhaust silencers. • Noise standard at processing sites, should be strictly monitored to prevent exceeding of noise standards. • Workers in vicinity of loud noise, shall wear earplugs and working time should be limited as a safety measure. Job	Throughout Project Corridor and at all construction sites, hot mix plant etc.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	rotations should also be carried out to prevent continuous exposure • Construction activities to be taken up during day time only • Servicing of all construction vehicles and machinery should be done for exhaust silences and should be checked and if found defective should be replaced. • No noisy construction activities should be permitted around educational institutions/health centers (silence zones) up to a distance of 100 m from the sensitive receptors. • Monitoring shall be carried out at the construction sites • Environmental Expert will be required to inspect regularly to ensure the compliance of EMP.				
Flora and Fauna					
Loss or damage to vegetation	• Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other that those identified for cutting is	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	minimum. • Vegetation only with girth of over 30 cm measured at a height of 1.0 m above the ground will be considered as trees and shall be compensated. • Compensatory plantation should be carried out in the ratio of 1:2 minimum				
Compaction of vegetation	• Construction vehicles, machinery and equipment will move or be stationed in the designated area only (RoW or CoI, as applicable), to prevent compaction of vegetation outside the RoW. • While operating on temporarily acquired land for traffic detours, storage, material handling or any other construction related or incidental activities, it will be ensured that the trampling of soil and damage to naturally occurring herbs and grasses will be avoided.	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC
Loss, damage or disruption to fauna	• Construction workers will be directed not to disrupt or damage the fauna. • Construction vehicles will run along specified access to avoid accidents to cattle.	Throughout Project Corridor	During Construction Phase	Contractor	BEZA/PMC
Socio-Economic Environment					
Accidents	• Safety officer		During	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	should be appointed at site to ensure all the safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented.		Construction		
Occupational Health & Safety					
Construction Safety	• All construction worker should wear a safety jacket and other protective equipment like helmet, gloves, gum boots, ear plugs, mask while working at the site • Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. Stonebreakers will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals • Workers should be made aware about the health issues	Entire Project site.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	related with open defecation • Training to workers should be provided for handling the construction equipment and machinery • Training to the workers should be provided to handle the emergency situations like fire, floods etc. • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp • Cautionary signage and notice should be displayed in local language and English at the required places like fuel storage area so that hazards can be avoided. A security guard should be deputed in these areas and entry should be restricted				
Disaster Management	• All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	Entire Project site	During Construction	Contractor	BEZA/PMC
Clearing of Construction of Camps & Restoration	• Contractors shall prepare site restoration plans. The plans shall be	All Workers' Camps		Contractor	BEZA/PMC

Impact	Mitigation Measures	Location	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy.				

8.7. Mitigation Plan for Water Supply System

It is planned to build three new bore wells and pumping stations at village Manik Nagar to draw the ground water along with pumping main length of approximately 20-21 km to the proposed EZ. It is also planned to construct an underground service reservoir to store the water within EZ. The water supply scheme including distribution is planned based on the peak flow, minimum residual pressure and pipe material.

Impacts associated with development of the pipeline system and proposed mitigation measures are given below. The Contractor shall carry out all mitigation and enhancement measures (including those related to mitigation of air/noise/water pollution; drainage/traffic congestion) as specified in the EMP tabulated below.

Table 64: Environmental Impacts and Mitigation Plan for Development of Water Supply System

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
Removal of Vegetation	• Vegetation/trees which has been identified & approved to be removed shall only be removed for site clearance	Pre-construction phase	Contractor	BEZA/PMC
Setting up of construction camps/labour camps	• The construction camps should be at least 500 m distance from habitations from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. • Location for stockyards for construction materials will be identified at least 1 km from water sources • The living accommodation and ancillary facilities for labour shall be erected and maintained to standards	Pre-construction phase	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	and scales approved by the resident engineer • All sites used for camps will be adequately drained. They will not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures • The camps will be located such that the drainage from and through the camps will not endanger any domestic or public water supply • All sites will be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance • Construction camps shall be provided with sanitary latrines (1 per 25 pax), bathing facility and urinals. • Sanitary latrines shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings • Adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labour employed therein. • Sewerage drains will be provided for the flow of used water outside the camp. • Drains and ditches will be treated with bleaching powder on a regular basis. • The sewage system for the camp will be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. • Clean potable drinking water facility should be provided at the site and the			

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	water quality should be monitored regularly • Crèche facility should be provided for children if female workers are employed • First aid facilities should be made available at construction camp. First aid box should contain small, medium and large sized sterilized dressings, sterilized burns dressings, 2 % alcoholic solution of iodine, bottle containing salvolatile, snakebite lancet, , bottle of potassium permanganate crystals, scissors, Ointment for burns & surgical antiseptic solution • 1 first aid box should be available per 50 labour • A person trained in first-aid treatment shall be made in charge who shall always be readily available during the working hours at the work place • A suitable motor transport shall be kept readily available to carry injured or ill person to the nearest hospital.			
Identification of dumping sites for debris	• The dumping sites shall not be located within designated Forest/protected areas • Residential facility or sensitive facilities like hospitals, schools etc shall not be located in downwind direction of the identified dumping sites • Dumping shall not impact natural drainage courses • Dumping sites should be located at least 1 km from sensitive locations • Permission from concerned local body should be taken before finalizing the location • Agriculture lands should be avoided & waste lands should be preferred	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	• Selected site should not support significant vegetation • The area should be sprinkled with water to suppress the dust emissions • Plant species suitable to grow in that conditions should be planted at the time of closure			
Soil Erosion and Sedimentation control	• To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. • Sedimentation tanks should be provided in line with storm water drains to trap the sediments from run-off. Sand bags can be used to trap sediments more effectively	During Construction	Contractor	BEZA/PMC
Disposal of Debris and any waste generated	• Waste from construction camp should be segregated at site. Food/wet waste should be composted in pit at the site, recyclable should be send to authorized recyclers and rejected waste should be disposed regularly through responsible agency in the area • Dustbins should be provided at the site and construction camps to prevent littering of waste • Storage area of minimum 2 days should be provided at construction camp for storage of the waste generated from labour camps • Construction debris should also be segregated at the site. This debris should be used for filling to the extent possible. Recyclable waste should be sold through authorized dealers and reject waste should be sent to the identified debris disposal site • All arrangement for transportation during	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	construction including provision, maintenance, dismantling and clearing debris, where necessary will be considered incidental. • Construction debris should be stored under covered sheds on paved surfaces to prevent leaching • Any hazardous waste generated during construction activity shall be stored at suitable place and then disposed off in consultation with the guidelines. • Contaminated runoff from storage areas shall be captured in ditches with an oil trap at the outlet. • Utmost care shall be taken to ensure that the Municipal Corporation norms are met for the safe collection, transport and disposal of construction waste and debris.			
Dust Generation	• Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. • Compaction of prepared site to re-strain the fugitive emissions. • Water should be sprayed in the cement and earth mixing sites as well as after compaction. • In high dust areas, workers should be provided and encouraged to use masks. • Regular maintenance, servicing of the vehicles and periodic emission check for equipment and machinery would be carried out in conformity with the Central Motor Vehicles Rules, 1989. • Water will be sprayed on the haul road. • All the vehicles entering the project site will be checked for Pollution-Under-Control Certificates.	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	• Air quality monitoring to be carried out during construction phase to check the pollutants level in the air			
Contamination of surface & ground water	• Construction close to water bodies shall be avoided • Car washing / workshops near water bodies will be avoided. • Avoid excavation during monsoon season • Loosened soil will be stabilized by Contractor through landscaping and developing vegetation, wherever possible, once construction activity is completed at any site. • Sanitation facility with septic tank followed by soak pit will be developed. Common toilets will be constructed on site during construction phase and the waste water would be channelized to the septic tanks and soak pits in order to prevent waste water to enter into the water bodies. • Provision of oil & grease traps upstream of storm water drains • Surface run off due to construction activity will not be discharged in open without treatment. • No construction debris should be dumped into the aquaculture ponds and waterbodies in the area.	During Construction	Contractor	BEZA/PMC
Noise from Vehicles, Plants and Equipment	• Construction activities would be carried out in the daytime only. • The construction equipment would be provided with adequate noise control measures and should comply with the noise standards as prescribed by DoE • Regular maintenance of vehicles and equipment would be carried out and corrective action taken in case of any deviation.	Throughout construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	• Ear muff/ear plug shall be given to the workers working around or operating plant and machinery emitting high noise levels. • Labour working in noise prone area should be provided with ear plugs and job rotation should be practiced to prevent the prolonged exposure of any workers to high noise levels			
Accidents	• Safety officer should be appointed at site to ensure all the safety guidelines are being followed at site • Cautionary guidance should be provided at site to aware people about the associated risk with the area. Entry to the fuel storage room or machinery operation room should be restricted only to authorized trainer personnel • All Accidents shall be reported immediately and incident analysis, preventive measures shall be implemented.	During Construction	Contractor	BEZA/PMC
Clearing of Construction of Camps & Restoration	• Contractors shall prepare site restoration plans. The plans shall be implemented prior to demobilization. • On completion of works, all temporary structures shall be cleared, all rubbish burnt, excreta or other disposal pits or trenches filled in and sealed and the site left clean and tidy,.	Post Construction	Contractor	BEZA/PMC
Occupational Health & Safety Plan	• All construction worker should wear a safety jacket and other protective equipment like helmet, gloves, gum boots, ear plugs, mask while working at the site • Workers should be made aware about the health issues related with open defecation • Training to workers should be provided for handling	During Construction	Contractor	BEZA/PMC

Impact	Mitigation Measures	Time Frame	Implementation of Mitigation Measures	Monitoring & Supervision
	the construction equipment and machinery • Training to the workers should be provided to handle the emergency situations like fire, floods etc. • First aid facility and sufficient nos. of trained personnel should be available at all the time at construction camp • Cautionary signage and notice should be displayed in local language and English at the required places like fuel storage area so that hazards can be avoided. A security guard should be deputed in these areas and entry should be restricted			
Disaster Management	All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.	During Construction	Contractor	BEZA/PMC
Compensatory Tree Plantation	Compensatory tree shall be planted @ 1:2 basis.	During Construction.	Contractor	BEZA/PMC

8.8. Mitigation Plan for EZ

The detailed plan shall be prepared by prospective developers. However following measures shall mandatorily form part of EMP for EZ development and operation:

- Seperate environment clearance should be taken by developer before developing economic zone from DoEB
- Industries should obtain environment clearance individually from DoEB prior to establishment and commencement.

Measures that should be taken by developer and individual industrial owners whicle development and operation phase is tabulated in table below

Table 65: Mitigation Measures Suggested for Developer

Impact	Mitigation Measures During Construction Phase
Identification of Site for Disposal of construction Debris, construction labour camp and plant site	• Site identified should be 1.0 km away from settlement, sensitive locations, like school, hospital, religious structures, reseve forest and any other eco-sensitive zone etc. • Site identified should be approved by BEZA and PMC • Site should be located in downwind direction from settlement area • Fertile agricultural land and community land should be avoided for setting of these facilities
Air Pollution	• Sprinkling of water during construction phase on all unpaved roads, site and haul roads • Avoiding excess pilling of raw material and debris at site • Storage & transportation of raw material and debris in covered conditions • Cutting of only identified trees after obtaining permission of forest department • Regular cleaning of site • Provision of adequate parking space at site so as to prevent idling of vehicles during construction phase • Upkeeping and maintenance of all the construction vehicles, machinery and equipment used for construction purpose • All vehicles entering the EZ site should carry PUC • Guiding signage should be provided at the site for vehicles enetering the site to minimize the movement of vehicle within the site • Timings of the construction material vehicles should be fixed and should be during non-peak hours to prevent traffic congestion and traffic jams • Speed limits should be restricted within the site for all the construction vehicles • Usage of low energy intensive building material like fly ash mic cement and bricks • Usage of low sulphur diesel for running DG sets, construction vehicles and equipments • Obtaining temporary electricity connection during construction phase and operating DG sets only during power failure • Provision of wheel washing facility at exit point of site • Adequate air pollution control measures like provision of bag filters, stacks of adequate height should be provided with WMM, hot mix plant, batching plant etc. • Open burning of wood or any other material should be prohibited at site and all the workers should be made aware about the same • Zonation of EZ should be carried out such that high polluting industries should be located in downwind direction
Water Pollution & water Conservation	• Minimizing the run-off from the site by construction of sediment basins for collection of storm run-off and re-using that water for curing purpose and wheel washing • Curing of structures to be done by spraying and during early morning and evening hours only to minimize the water requirement • Maintaining the flow of water sprinklers so as to avoid wastage of water • No debris should be thrown or disposed off in any water body like river, pond, canal etc or ground water source like

Impact	Mitigation Measures During Construction Phase
	functional or abandoned well • Excavation should not be carried out during monsoon • Provision of temporary storm water drainage system during construction phase to drain the storm water and should be connected to nearest surface water body • Excavated pits should be provided with garland drains to prevent enterance of water inside the pit • Provision of oil & grease traps wih the storm water drains draining the parking and fuel storage area • Provision of septic tanks and soak pits at the site & labour camps for disposal of sewage generated by construction labour • Waste generated by construction camps should be disposed off regularly at the identified site for debris disposal • Provision of cross drainage structures like balancing for maintaining the drainage pattern • Stone & bricks should be purchased only from licenced vendors • Keeping provision of land for development of CSTP and CETP in future • Provision of rain water harvesting should be made at the point of extraction of ground water, i.e in Manik nagar by adopting the village pond/abandoned wells/ hand pumps/tube wells and enhancing the recharge by installation of injection wells. Recharge should be atleast equal the amount of water extracted • Rain water harvesting tank should be developed at the site so as that water can be used for meeting daily water demand • Tank alarms should be installed so as to prevent overflow of water • Leakage detection should be carried out quarterly so as to detect any leakages in the pipeline from Manik Nagar to EZ site • Provision of land for CSTP an CETP should be made atleast 30 m away from the water pipeline, water storage tank and rain water storage tank
Soil Quality	• Top soil, if excavated from the project site should be stored in covered condition and should be used later for landscaping purpose • Storage of raw materials, debris and fuel on paved surfaces • Training the workers to handle the material so as to minimize spillage of material on soil • Provision of cross drainage structures to prevent water logging and soil erosion • Stone pitching with grass turfing should be done for the high embankment close to water body • Disposal of construction debris, municipal waste from labour camps and hazardous waste from site should be disposed off at the identified site • Keeping provision of land for development of soild waste management facility within the EZ site • No open area should be left without the vegetation to protect the soil. • Mulching of soil should be done regularly to prevent direct exposure of soil to wind and water
Noise Pollution	• Construction vehicles, machinery and equipment used for construction purpose should meet the standards prescribed by DoE • Upkeeping and regular maintenance of all the construction vehicles, machinery and equipment used for construction

Impact	Mitigation Measures During Construction Phase
	purpose • Speed limits should be restricted for all construction vehicles and equipment • Honking should be prohibited at the site • Provision of acoustic enclosures, noise mufflers, silencers etc with the DG sets and any noise generating machinery • Provision of temporary noise shield/barrier in areas where more noise will be generated
Ecology	• Only identified trees should be fell down after obtaining permission from forest department • Comensatory plantation should be carried out in ratio of min 1:2 under guidance of forest department • Development of 10 m (minimum) thick green buffer all along the periphery of EZ (especially in east & West direction due to presence of Gona and Mongla River) • Boundary should be constructed around the EZ site to prevent trespassing of the animals • Native plant species requiring should be considered for plantation • Timber should be purchased only from authorized vendors • No waterbody should be filled outside the EZ site
Socio-economy and aesthetics	• All proposed air, water, noise and soil pollution control measures should be taken • Provision of employment opportunity during construction phase to local people • Provision of personal protective equipment to all the workers • Job rotation should be practiced for workersexposed to high noise levels • Relocation of affected people should be as per RAP • Compensation should be given to affected people as per RAP • Site should be covered from all the site during construction phase • Drinking water facility, adequate nos. of toilet, septic tank/soak pit, bathing facility, lighting should be provided in labour camps • Storm water drainage system should also be provide in labour camps to prevent water ponding and breeding of mosquitoes • LPG should be provided as fuel in the labour camps • Provision of facility like guest house, community building, commercial area, ATM, Bank, hospital and parking should be made within the Ez site
Disaster and Risk Management	• Provision of first aid kit and first aid room and well trained first aid practioner at the site all the time • Ambulance facility should be provided at the site • Tie-ups with local hospital should be made to handly emergency case, if any • Availability of safety officers and supervisiors at all the time on the site • Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone • Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safery measures

Impact	Mitigation Measures During Construction Phase
	• Emergency handling cell & room should be developed at the site and should be headed by project & safety manager • Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room

Table 66: Mitigation Measures Suggested for Individual Plot Owners

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Construction Phase
Air Pollution	• Sprinkling of water during construction phase on all unpaved roads, site and haul roads • Avoiding excess pilling of raw material and debris at site • Storage & transportation of raw material and debris in covered conditions • No trees should be fell down without permission of BEZA and forest department • Regular cleaning of site • Provision of adequate parking space at site so as to prevent idling of vehicles during construction phase • Upkeeping and maintenance of all the construction vehicles, machinery and equipment used for construction purpose • All vehicles entering the EZ site should carry PUC • Guiding signage should be provided at the site for vehicles enetering the site to minimize the movement of vehicle within the site • Timings of the construction material vehicles should be fixed and should be during non-peak hours to prevent traffic congestion and traffic jams • Construction vehicles should follow the speed limits set up for EZ zone • Usage of low energy intensive building material like fly ash mix cement and bricks • Usage of low sulphur diesel for running DG sets, construction vehicles and equipments • Obtaining temporary electricity connection during construction phase from BEZA and operating DG sets only during power failure • Provision of wheel washing facility at exit point of site • Open burning of wood or any other material should be prohibited at site and all the workers should be made aware about the same	• Installation of air pollution control devices like Electro-static precipitator, bag filters, separators, cyclones, multi-level condensers & evaporators, scrubbers, quenchers, stacks of height as per DoE norms • Disposal of the waste material at the designated site for waste disposal in covered condition • All the roads within the plot should be paved & water sprinkling should be practiced to minimize dust generation. • Adequate stack height should be provided for dispersion of the emissions • Chemicals having potential to releace VOCs should be stored, handled and used in closed system • Quarterly monitoring should be carried out for testing ambient air quality • Development of thick green belt of 10 m all along the industrial plot periphery

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Construction Phase
Water Pollution & water Conservation	• Minimizing the run-off from the site by construction of temporary storm water drainage, sediment basins for collection of storm run-off and re-using that water for curing purpose and wheel washing • Curing of structures to be done by spraying and during early morning and evening hours only to minimize the water requirement • Maintaining the flow of water sprinklers so as to avoid wastage of water and ponding of water • No debris should be thrown or disposed off in any water body like river, pond, canal etc or ground water source like functional or abandoned well • Excavation should not be carried out during monsoon • Excavated pits should be provided with garland drains to prevent enterance of water inside the pit • Provision of septic tanks and soak pits at the site for disposal of sewage generated by construction labour • Waste generated during construction should be disposed off regularly at the identified site for debris disposal • Stone & bricks should be purchased only from licenced vendors	• Provision of ETP & STP for treatment of sewage and industrial effluent • Provision of dual plumbing system so as treated water from STP can be re-used for flushing, horticulture and cooling purpose • Seperation of the effluent streams depending on the nature of pollutants • Monitoring the quality of sewage, treated water, drinking water quality and ground water quality regularly • Tank alarms should be installed so as to prevent idle running of pumps • Provision of storm water drainage system at site and it should be connected to rain water harvesting system. Storm water drains should also be connected to the nearest surface water body to drain excess flow, if any • Provision of rain water harvesting system so that water can be collected and used to meet daily water demand. • Provision of oil & grease traps wih the storm water drains draining the parking and fuel storage area • Leakage detection system should be provided and the water supply system should be regularly inspected to detect leakages • Distance of STP/ETP and RWH pits should be minimum 30 m to prevent contamination of collected storm water • Untreated effluent should not be discharged into surface water body or any abandoned ground water source or to ground. • No hazardous waste, municipal waste, industrial waste should be disposed off in the water bodies or in ground • Leachates, if any or untreated sewage should be stored only in lined ponds to prevent contamination of ground water
Soil Quality	• Top soil, if excavated from the project site should be stored in covered condition and should be used later for landscaping purpose • Storage of raw materials, debris and fuel on paved surfaces • Training the workers to handle the material so as to minimize spillage	• All industries should use best technologies for optimal utilization of the raw material and re-use & recycling of waste material in the process to reduce waste generation as well as raw material demand for the project. • All industries should be responsible

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Construction Phase
	of material on soil • Disposal of construction debris, municipal waste and hazardous waste at designated sites	for management of the solid and hazardous waste generated from their plots. Industries should be liable to pay penalty in case of non compliance of conditions laid down by DoE • It should be mandatory for all industries to provide storages for different category waste, its processing and safe disposal. Options for composting of compostable waste, segregation and selling recyclable waste should be opted • Waste storage area should be paved surfaces and covered • No open area should be left without the vegetation to protect the soil.
Noise Pollution	• Construction vehicles, machinery and equipment used for construction purpose should meet the standards prescribed by DoE • Upkeeping and regular maintenance of all the construction vehicles, machinery and equipment used for construction purpose • Speed limits should be restricted for all construction vehicles and equipment • Honking should be prohibited at the site • Provision of acoustic enclosures, noise mufflers, silencers etc with the DG sets and any noise generating machinery • Provision of temporary noise shield/barrier in areas where more noise will be generated	• Usage of machineries of modern make and adoption of latest available technology which compiles to noise levels standards laid by DoE • Provision of personal protective equipment to workers exposed to noisy operations. Audiometric tests should be carried out for workers exposed to high noise levels. Job rotation should be practiced to prevent continual exposure. • Noise levels in industries should be monitored regularly using noise meters. • Minimal usage of horns within industrial plot. Specification of speed limits on roads made by BEZA should be followed. Provision of speed breakers at regular intervals to regulate speed of vehicles • Regular maintenance of vehicles & construction machinery involved in industrial operation • Noisy operation should be taken up in covered conditions so that no disturbance due to noise is caused • Thick green belt should be developed within each industrial plot that will act as noise barrier..
Ecology	• Only identified trees should be fell down after obtaining permission from forest department • Compensatory plantation should be carried out in ratio of min 1:2 under guidance of forest department • Native plant species requiring should be considered for plantation • Timber should be purchased only from authorized vendors	• Green belt of 10 m thickness should be developed all along the periphery of the industrial plot • Native plant species requiring should be considered for plantation

Impact	Mitigation Measures During Construction Phase	Mitigation Measures During Construction Phase
Socio-economy and aesthetics	• All proposed air, water, noise and soil pollution control measures should be taken • Provision of employment opportunity during construction phase to local people • Provision of personal protective equipment to all the workers • Job rotation should be practiced for workers exposed to high noise levels • Site should be covered from all the site during construction phase • Drinking water facility, adequate nos. of toilet, septic tank/soak pit, bathing facility, lighting should be provided for construction labour • Storm water drainage system should also be provide at site to prevent water ponding and breeding of mosquitoes	• Social welfare activities shall be carried out by each industrial owners in nearby areas of EZ like development of cattle sheds, arranging trainings for villagers for best agriculture practices, providing skill generation training to locals so as they can be employed in industries • Providing employment to local people preferably • Adoption of all proposed air, noise, soil and water quality measures • Rain water harvesting should be carried out in the Manik Nagar area by adoption of village ponds/abandoned wells etc so as to replenish the depleting ground water levels
Disaster and Risk Management	• Provision of first aid kit and first aid room and well trained first aid practioner at the site all the time • Ambulance facility should be provided at the site • Tie-ups with local hospital should be made to handly emergency case, if any • Availability of safety officers and supervisiors at all the time on the site • Workers should be given training for handling construction vehicles, equipment and handling emergency situations like fire, floods, earthquake and cyclone • Cautionary signage should be provided in the areas associated with risks like storage of explosives, fuels, heavy construction material etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safery measures • Emergency handling cell & room should be developed at the site and should be headed by project & safety manager • Contact no. of nearest fire-station and hospitals should be displayed within the emergency handling room	• Provision of first aid kits at the site • Tie-ups with local hospital should be made to handly emergency case, if any • Regular medical check-ups of the employees • Training should be given to workers for handling the equipment and managing emergency situations • Material safety data sheets of chemicals to be used should be displayed on local languages at work station • Provision of personal protective equipment to the workers as per requirement • Cautionary signage should be provided in the areas associated with risks like storage of chemicals, explosives, fuels etc. Entry for only trained authorized personnel should be allowed in such areas with adequate safery measures

8.9. Enhancement Plan

The proposed project involves development of EZ and off-site facilities for the upcoming Mongla EZ. These off-site facilities will be developed by BEZA. Development of these off-site infrastructure facilities will attract the investors and make the proposed site location more accessible for trading and business. Proximity of the proposed project site to the existing EPZ, Mongla Port and Kulna Dhaka Highway and an already existing inland water transportation system further adds to the suitability of site for setting up the industries.

Since BEZA shall be making arrangement for water supply and medical facilities. As part of enhancement measure it is propose to consider providing drinking water and medical facilities to the nearby villagers.

8.10. Contingency Plan

In order to be in a state of readiness to face adverse effects of accidents, a Contingency Plan is required to be prepared which includes on-site and off-site emergency plan by the individual industry and industrial estate. BEZA is committed to develop a Contingency Plan in consultation with district authorities and industry association.

The Contingency Plan will have the following minimal components:

- Accidents preventions procedures/ measures
- Fire prevention planning and measures
- Fire water storage and foam system
- Accident/emergency response planning procedure
- Communication
- Emergency control centre
- Emergency information system with role & responsibility and command structure
- Recovery procedure
- Assessment of damages and rectification
- Evaluation of functioning of disaster management plan
- Accident investigation
- Clean-up and restoration

8.11. Compensation Plan

All the affected families will be entitled to a combination of compensatory measures and resettlement support, depending on the nature of ownership rights of lost assets and as well as the category and extent of the impact caused due to project interventions. A detailed description of each compensatory measures and assistance as decided has been provided in the Entitlement Matrix.

Table 67: Entitlement Matrix

Loss of houses/structures used for living, business & other activities	Shiftable & Nonshiftable Structures on Khas & Other Public Lands	Leaseholder/tenant who currently use the premise	1. Replacement assistance of house/ structure used for living /business, and 2. Compensation for income loss for a period of 30 days • (Both shiftable and non-shiftable

			houses/structures will be ineligible for compensation if (a) they are not used by the owners themselves, or (b) rented out to others) New relocation areas will be identified by MPA.
Loss of agriculture land	Land used for the paddy cultivation and aqua cultivation	Legal Owners, as determined by DC	1. Compensation-under-law (CUL) or replacement costs, whichever is greater. 2. Transition allowance equal to three times the harvest prices of one year's crops produced in the acquired parts of the lands.
Loss of trees on Khas and other public land	Trees planted by encroachers in the government land	Owners of the affected trees	Cost of labour for the removal and replantation of the trees

Valuation Procedure

Valuation of houses/structures used for living and business at the approach road, Mongla: The replacement assistance involves a 'shiftable allowance' of BDT 7000 to the leaseholders who are currently residing at the affected households. Those who are not staying are not eligible for this assistance. Notification for the removal of the eight temporary structures of the PAPS will be communicated by MPA.

Valuation of income of PAHs for a period of 30 days: The income of the leaseholders and tenant for a period of 30 days has been calculated based on the annual income of the head of the PAHs from their primary occupation.

Valuation of agriculture land of PAHs at the pumping stations at Maniknagar:

Valuation of agriculture land: The valuation has been done based on the average market value of the agriculture land per Bigha in Maniknagar during the last 12 months. This is around BDT 4.5 lakh per bigha.

Valuation of crops: The valuation for the loss of crops has been calculated based on the transition allowance equal to three times the harvest prices of one year's crops produced in the acquired parts of the lands

Valuation of affected trees:

The entitlement proposed for the affected trees are the cost of removal and replanting of the affected trees. The valuation of removal and replanting has been done based on the following assumptions:

- Seven days have been considered for demobilization of trees and other seven for remobilizing them back.
- Removal /replantation of 20 trees a day per helper and the number of helpers have been assumed to be 5 working for 8 hours per day.
- The cost of helper who will help in demobilization and remobilization of trees to be BDT 300 /day

Compeansation Budget

Provisional budget for the rehabilitation and compensation of PAHs is given below

1. Shiftable allowance to the six leaseholders out of eight along with a compensation for loss of income. The two leaseholders are not eligible for allowance as they are not currently residing at the affected house**;**
2. Compensation-under-law (CUL) or replacement costs, whichever is greater for the loss of agriculture land and transition allowance equal to three times the harvest prices of one year's crops yields from the acquired parts of the lands
3. Cost of labour for the removal and replantation of the trees

Table 68: Compensation Budget Estimation

1	Loss of houses/ structures used for living, business & other activities and loss of income	0.042	0.018	0	0	0	0	0	0.11
2	Partial loss of agricultur e land and income	0	0.3	0.18	0	0	0	0	0.22
3	Affected Trees								
a	Owners of tree (private people who have Planted tree in Governme nt land)	0	0	0	0.3	-	-	0	0.3
b	Removal and replantin of trees	0	0	0	0	0.03	-	0	0.03
c	Cutting down of trees at	0	0	0	0	0	0.003	0	0.003

	governme nt land								
d	Sapling Planting	0	0	0	0	--	--	0.0075	0.007 5
	Total								0.67
	Contingen cy	10% extra							0.07
	Grand Total								0.74

The total budget for ARP is estimated around BDT 0.74 million. This includes the 10% contingency. Without the contingency, the total budget estimate is BDT 0.67 million.Detail compensation plan is given in RAP of the project attached as annexure VI

8.12. Monitoring Plan

The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. A monitoring schedule has been sketched based on the environmental components that may be affected during the construction and operation of the project and is given below.

Table 69: **Environmental Monitoring Plan**

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
1.0	**Construction Phase**						
1.1	Local Manpower Absorption	Construction Works	Contractor's report No. of people working in the project	Monthly	Civil Contract Awardee	BEZA & PMC	4 No.
1.2	Soil Erosion	Excavation, disposal, cut & fill and land clearing activities for site levelling and internal roads, disposal	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	During Rainy Season	Contractor	BEZA & PMC	
1.3	Greenbelt Development	-	Survival rate of species planted; Density of	Half Yearly	Contractor/BEZA	BEZA & PMC	

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
			vegetation				
1.4	Air Quality	Transportation of construction materials, road construction, construction of utilities	Survey & observations; Levels of PM_{10}, $PM_{2.5}$, SO_2, NOx, CO	Once in each season for twice a week for two weeks at 3 locations		BEZA & PMC	
1.5	Waste Management	Restoration of disposal sites and construction areas	Status of protection measures	Quarterly	Contractors	BEZA & PMC	
1.6	Noise Level	Noise levels compliance with respect to industrial standards	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time at 6 to 8 locations	Daily	Contractors	BEZA & PMC	
1,7	Drinking Water	Contamination	All physio-chemical & biological parameters	Once in month	Contractor	BEZA & PMC	
2.0	**Operation Phase**						
2.1	Noise Levels	Noise levels compliance with respect to industrial standards	Ambient Equivalent continuous Sound Pressure Levels (Leq) at day and Night time at 6 to 8 locations	Once in every month		BEZA	6 Nos
			Plant periphery and near noise generation sources	Monthly	Individual Industrial Units	BEZA	
2.2	Biological Environment	Horticulture/ Greenbelt Development	Survival rate of plants and shrubs	Quarterly	BEZA	BEZA	
			Survival rate of plants and shrubs at individual unit	Quarterly	Individual unit	BEZA	
2.3	Ambient Air Quality	Dust levels	Ambient PM levels as per ECR, 1997	Quarterly	Individual unit	BEZA	

S. No.	Aspect	Source of Impact	Monitoring Methods and Parameters	Frequency	Executing Agency	Enforcement Agency	Man-Power Reqiurement for supervision & reporting
		Emissions from vehicles and industrial operations	Ambient emissions levels as per ECR, 1997	Quarterly	Individual unit	BEZA	
2.4	Drinking water Quality	All physio-chemical parameters including TDS, pH, salinity, As.	Water quality standards as per ECR, 1997	Quarterly	Individual unit	BEZA	
2.5	Sewage & Effluent	TSS, BoD, CoD, Oil & Grease & pH	Water quality standards as per ECR, 1997	Daily	Individual unit	BEZA	

8.13. Monitoring Indicators

The physical, biological and social components which are of particular significance to the proposed project are listed below:

- Air quality
- Water quality
- Noise levels
- Solid & Hazardous Waste Management
- Re-plantation success / survival rate
- Soil Erosion

These indicators will evaluated periodically based on the monitoring results, baseline conditions, predicted impacts and mitigation measures.

8.14. Institutional Arrangement

BEZA has developed Environmental Management Framework with the help of World Bank. The institutional arrangement is aligned as per this framework. BEZA will have an Environmental and social cell which will coordinate with site engineers and PMC.

9. Cost Estimation for Environment Mitigation Measures and Monitoring

9.1. Environment Management Cost

Environment management cost includes the cost of mitigation measures as proposed under impact identification chapter. Most of the costs are part of construction costs. Detailed cost breakup for the project is given below in the following table.

Table 70: Environment Management Cost of Project during Construction and Operation phase

S. No.	Environment Management Measure	Capital Cost	Recurring Cost	Responsible Institution
Construction Phase				
1.	Provision of Personal protective Equipment to all labour involved in construction of proposed off-site developments	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
2.	Construction of Labour camps	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
3.	Construction of Toilets & Septic Tanks/Soak Pits	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
4.	Construction of Temporary storm water drainage system	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
5.	Construction waste management and disposal	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
6.	Provision of clean drinking water supply	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
7.	Water sprinkling	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
8.	Compensatory Plantation about 1400 trees 2000TK/tree	2.8 Mn TK	0.28 Mn TK	Contractor, PMC & BEZA
9.	Environmental monitoring • Air quality • Noise level • Drinking water quality	-	0.20 Tk Mn per annum	Contractor, PMC & BEZA
10.	Safety & Quality inspections	Included in construction cost	Included in construction cost	Contractor, PMC & BEZA
11.	Environmental Training	-	0.2 Mn per annum	Contractor, PMC & BEZA
Operation Phase				
12.	Environmental monitoring • Air quality • Noise level • Ground Water Quality at Manik Nagar • Ground Water level at 4 locations (withdrawing stations & nearby area)	-	0.30 Tk Mn per annum	BEZA

10. Conclusion and Recommendation

10.1. Conclusions

EZ project has been proposed by Govt. of Bangladesh for rapid economic development in the area including the backward and undeveloped areas. BEZA, formed under EZ Act, 2010 is overall agency for implementation of EZ projects. EZ will be developed following PPP approach. This will make development less reliant on Government fiscal subsidies. BEZA will invest in land and related on-site infrastructure development so as to make zone accessible and resourceful. Thereafter economic zone development will be responsibility of private developers. Off-site facilities proposed to be developed by BEZA include development of administration building, boundary wall, electrical supply, water supply, access road and bridge.

The project subject to its nature of activities falls under Red category as per ECA, 1995 and requires prior environment clearance from DoE, Bangladesh. To obtain approval of DoEB, an Initial Environment Examination (IEE) Report for development of off-site facilities along with proposed Terms of Reference (ToR) was submitted vide letter dated 20.01.2015. Site clearance certificate for the project has already been obtained from DoE. DoE suggested making revisions in the ToR and the revised proposed ToR was submitted on 8.03.2015. Approved ToR was granted by DoE vide Memo No. 03. 761. 018. 00. 00. 66. 2013 - 946, dated 30th March, 2015. EIA study has been carried out as per the approved ToR by DoE and World Bank guidelines.

Upcoming EZ is adjacent to existing EPZ site. River Gona & Mongla abuts the projects site in East and West direction respectively. North to the project site lies agriculture land and village Burirdanga. Two HT lines and one LT line exists at the site. HT line can be remained undisturbed as they lie within buffer area of EZ site whereas LT line will require to be shifted. Presently site is not accessible through any public road. Site can be accessed through a kachha road from EPZ which is not motorable. To make site accessible BEZA has proposed to develop access road of 15 m width and 350 m length. This road will connect EZ site to existing Mongla port road via proposed bridge of 35 m over Gona River. Site is at elevation from nearby areas due to sand filling to level of 6 ft. by Mongla Port Authority. Ground water and surface water resources in the region are saline due and no source of fresh water is there in area except rain water harvesting ponds. BEPZA and Mongla Port Authority fulfil their water demand by withdrawing ground water from Foyla Hatt located at about 20 km distance.

BEZA has also proposed to withdraw ground water from Manik Nagar to fulfil third dilly water demand during operation phase. Manik nagar is located at distance of app. 20-21 km. Underground water pipeline will be laid along the Kulna Dhaka Highway. Electricity will be sourced from Mongla substation located at app. 1 km distance from EZ site.

To carry out impact assessment, baseline data was collected for the site and study area through the site visits, existing studies of the area and published literature. Detailed baseline of the project site and study area is given in Chapter 5 of the report. Project site and site for proposed off-site development is flat. EZ site is devoid of vegetation whereas naturally grown/planted trees exist in small stretch of access road and water supply pipeline alignment. Most of the land proposed for off-site development and EZ development is Govt. Land. Only 0.166 acres of agriculture land is required to be acquired/purchased for construction of pump house.

Attempts were made to assess all the predicted environmental and social impacts with evaluating the nature, temporal and spatial extent, reversibility and likelihood of the predicted impacts. Finally, the predicted impacts were summarized in a qualitative scale of consequence. The assessment includes

impacts on physical setting, impacts on air quality, impacts on water resources, impacts on land and agricultural resources, impacts on fisheries, impacts on ecosystem resources, and impacts on socio-economic environment.

Key impacts anticipated for the project are relocation of HHs, dust emission from construction activity, acquisition of agriculture land and withdrawal of ground water. A land has been identified for relocation of affected HHs by Social Team and appropriate compensation should be provided to agriculture land owners. Being off-site development project major impacts are anticipated during construction phase which are generally site specific and exists for short period. 4 MLD of ground water will be withdrawn from proposed water supply system after development of EZ which will have significant impact on ground water resources. As discussed earlier app. 30-40 trees will be fell for development of access road& bridge and 696 trees (planted like banana, papaya & natural) will be fell for laying water supply pipeline. No impacts are anticipated due to off-site developments on Sundarbans RF located at app. 5 km distance from EZ site in SW direction. No impacts on fisheries and agriculture are anticipated due to project development. Only 0.166 acres of agriculture land will be acquired thus impacts are minimal.

Impacts identified are largely insignificant and can be mitigated with appropriate mitigation measures.

Management plan has been prepared to address the issues identified during impact assessment. Mitigation plan for the environmental and social issues is given in Chapter-9 of the report in detail.

10.2. Recommendations

Recommendations made for the project development on the basis of EIA study are given below:

- Proposed environment management plan should be implemented strictly both during operation and construction phase of the project
- Compensatory plantation should be carried out for trees to be fell for off-site development minimum in ratio of 1:2
- Suggestions & requests made by public for water supply and employment shall be taken into consideration
- Proper training of maintaining environment, health and safety should be given to Project management unit in both construction an operation phase
- Provision of garland drain, thick green belt, CETP, STP, segregated storm water shall be adhered.
- Construction activities for proposed off-site developed should only be started after obtaining environment clearance certificate from DoE, Bangladesh
- Environmental monitoring should be conducted as proposed in environment management plan
- Seperate environment impact assessment study is to be carried out by developer for whole zone before developing the EZ.

Annexures

Annexure-I

Government of the People's Republic of Bangladesh
Prime Minister's Office
Bangladesh Economic Zones Authority (BEZA)
"Support to Capacity Building of Bangladesh Economic Zones Authority" Project
BDBL Bhaban (Level-15)
12 Karwan Bazar, Dhaka-1215

Memo No: 03 .761. 018. 00. 00. 66. .2013 - 946 Date: March 30, 2015

To

Mr. Manish R Sharma
Team Leader, TAS Firm, Price Water House Coopers Ltd. (PWC).
Bldg # 10, Tower C, Floor 17, DLF Cyber City,
Gurgaon 122002, Hariana, India.

Subject: ToR for Mongla EZ approved by DoE and preparation of EIA for Mongla EZ

Dear Mr. Manish,

Enclosed herewith please find a Terms of Reference (ToR) duly approved by the Department of Environment (DoE), which is self-explanatory. You are requested to prepare an EIA (Environmental Impact Assessment) in line with the approved ToR.

An early submission of the EIA will be highly appreciated.

With best regards.

30.3.2015
(Md. Harunur Rashid)
Project Director (Joint Secretary)
Phone: 8180170, Fax: 8180172

Copy for information to:

1. Executive Chairman, Bangladesh Economic Zones Authority.
2. Mr. Manju Haththotuwa, Senior Private Sector Development Specialist
   Task Team Leader,Private Sector Development Support Project (PSDSP) IDA Cr. 4866-BD
   World Bank Office, E-32, Agargaon, Sher-E-Banglanagar, Dhaka-1207.
3. Mr. C K Veeresh, Consultant (STC), Private Sector Development Support Project (PSDSP), World Bank Office E-32, Agargaon, Sher-E-Banglanagar, Dhaka-1207.

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

Memo No: DoE/Clearance/5324/2014/122 Date: 29/03/2015

Subject: **Approval of Terms of Reference (TOR) for EIA of Mongla Economic Zone at Mongla, Bagerhat.**

Ref: Your Application dated 20/01/2015 and 08/03/2015.

With reference to your application dated 20.01.2015 and 08/03/2015 for the subject mentioned above, the Department of Environment hereby gives approval of the Terms of Reference (ToR) for Environmental Impact Assessment (EIA) Study of the proposed Mongla Economic Zone at Mongla Upazila under Bagerhat District subject to fulfilling the following terms and conditions :

I. The project authority shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of the said project in accordance with this ToR and following additional suggestions.

II. The EIA report should be prepared in accordance with following indicative outlines :

1. Executive summary
2. Introduction: (Background, brief description, rationale of the project, scope of study, methodology, limitation, EIA team, references)
3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)
4. Project Description
   - i. Introduction
   - ii. Project Objective
   - iii. Project Options
   - iv. Interventions under Selected Options
   - v. Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation
   - vi. Project schedule: The phase and timing for development of the project
   - vii. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project
   - viii. Map and survey information
     Location map, cadastral map showing land plots (project and adjacent area), geological map showing geological units, fault zone, and other natural features.
   - ix. Project Plan, Design, Standard, Specification, Quantification, etc.
5. Environmental and Social Baseline
   - 5.1 Meteorology
     - 5.1.1 Temperature
     - 5.1.2 Humidity

III. Without obtaining approval of EIA report by the Department of Environment, the project authority shall not be allowed to conduct earth filling or any kind of physical intervention in the proposed project site and also not be able to start the physical activity of the project.
IV. This approval of the Terms of Reference (TOR) would not mean any acceptance or site clearance of the project.
V. The proposed EIA study would not establish any claim, right in favour of the proponent for getting site clearance or environmental clearance.
VI. Without obtaining Environmental Clearance, the project authority shall not be able to start the operation of the project.
VII. The project authority shall submit the EIA along with the the No Objection Certificate (NOC) from the local authority, NOC from Forest Department (if it is required in case of cutting any forested plant, private or public) and NOC from other relevant agencies for operational activity etc. to the Bagerhat District Office of DOE with a copy to the Head Office of DOE in Dhaka.

27.03.2015

(Syed Nazmul Ahsan)
Director (Environment Clearance, c.c)
Phone # 02-8181778

Project Director
Support to Capacity Building of Bangladesh Economic Zones Authority Project
Bangladesh Economic Zones Authority (BEZA)
BDBL Bhaban, Level # 15
12, Kawran Bazar, Dhaka-1215.

Copy Forwarded to:

1) PS to Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Khulna Divisional Office, Khulna.
3) Deputy Director/Office Incharge, Department of Environment, Bagerhat District Office, Bagerhat.
4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

Annexure-II

FAX NO. :62133 17 Feb. 2014

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জেলা প্রশাসকের কার্যালয়, বাগেরহাট
স্থানীয় সরকার শাখা
www.bagerhat.gov.bd

স্মারক নং-০৫.৪৪.০১.০০.০১১.৫৬.০৫৭.১৩- ১৩৫ (যুক্ত) তারিখ : ১৭ .০২.২০১৪ খ্রিঃ

বিষয় : বাগেরহাট জেলাধীন মোংলাপোর্ট পৌরসভার এলাকাভুক্ত ২০৫ একর জমি পৌর এলাকা বহির্ভূত ঘোষণা প্রসংগে।

সূত্র : (১) স্থানীয় সরকার বিভাগের স্মারক নং-প্রঃ৬.০৬৩.০০৪.০৩.০০.০০৫.২০১৩(অংশ-১)-১২৮; তারিখ : ০৩.০২.২০১৪ খ্রিঃ।
(২) এ কার্যালয়ের স্মারক নং-০৫.৪৪.০১.০০.০১১.৫৬.০৫৭.১৩-৫৮(যুক্ত), তারিখ : ২৩.০১.২০১৪ খ্রিঃ।
(৩) উপজেলা নির্বাহী অফিসারের কার্যালয়, মোংলা এর স্মারক নং-উনিঅ/মোংলা/২০১৪- ৮৬(যুক্ত); তারিখ : ০৬.০২.২০১৪ খ্রিঃ।

উপর্যুক্ত বিষয় ও সূত্রোক্ত স্মারকের পরিপ্রেক্ষিতে মহোদয়ের সদয় দৃষ্টি আকর্ষন পূর্বক জানানো যাচ্ছে যে, দেশের অর্থনৈতিক উন্নয়নের লক্ষ্যে বাগেরহাটের মংলা বন্দর সংলগ্ন এলাকায় অর্থনৈতিক অঞ্চল প্রতিষ্ঠার জন্য মোংলা উপজেলাধীন ২০ নং কামারডাঙ্গা মৌজার ১৫/৬৬-৬৭ নং এল,এ কেসের মাধ্যমে মংলাবন্দর কর্তৃপক্ষের অনুকূলে অধিগ্রহণকৃত জমির মধ্য হতে ২০৫(দুইশত পাঁচ) একর জমি বাংলাদেশ অর্থনৈতিক অঞ্চল কর্তৃপক্ষের বরাবর সরকার কর্তৃক হস্তান্তরের সিদ্ধান্ত গ্রহণ করা হয়েছে। উক্ত অর্থনৈতিক অঞ্চল প্রতিষ্ঠার জন্য মোংলা পৌরসভার এলাকাভুক্ত ২০৫(দুইশত পাঁচ) একর জমি পৌর এলাকা বহির্ভূত ঘোষণার বিষয়ে এ কার্যালয়ের ০৬.০২.২০১৪ খ্রিঃ তারিখের ০৫.৪৪.০১.০০.০১১. ৫৬.০৫৭.১৩-৬৭ নং স্মারকে পত্রজারি করা হয়(ছায়ালিপি সংযুক্ত)। উক্ত পত্রবিজ্ঞপ্তি জারীর পর নির্ধারিত সময়ের মধ্যে কোন আপত্তি পাওয়া যায়নি। গত ০৯.০২.২০১৪ খ্রিঃ তারিখে অনুষ্ঠিত মোংলাপোর্ট পৌরসভার বিশেষ সভায়ও এ বিষয়ে আলোচনা হয়েছে এবং তফসিল বর্ণিত ২০৫(দুইশত পাঁচ) একর জমি মোংলা পোর্ট পৌর এলাকা বহির্ভূত করে মোংলা উপজেলাধীন ২ নং ঘুড়িরডাঙ্গা ইউনিয়ন পরিষদের অন্তর্ভূক্ত করার বিষয়ে অনাপত্তিসহ সুপারিশ করা হয়েছে (সভার কার্যবিবরণীর ছায়ালিপি সংযুক্ত)।

একই সাথে স্থানীয় সরকার (পৌরসভা) আইন, ২০০৯ এর ধারা ৩(১) ও (২) অনুযায়ী (১) নং সূত্রোক্ত স্মারকের চাহিত তথ্যাদি উপজেলা নির্বাহী অফিসার, মোংলা সূত্রোক্ত (৩) নং স্মারকে প্রেরণ করেছেন, যা নিম্নরূপ :

ক, প্রস্তাবিত এলাকার লোকসংখ্যা	ঃ	স্থায়ীভাবে কোন লোক বসবাস করেনা (ই.পি.জেড এলাকাভুক্ত)
খ, প্রস্তাবিত এলাকার জনসংখ্যার ঘনত্ব প্রতি বর্গ কিঃমিঃ গড়ে লোকসংখ্যা	ঃ	কোন লোক বসবাস করেনা
গ, প্রস্তাবিত এলাকার অকৃষি পেশায় নিয়োজিত ব্যক্তির হার	ঃ	প্রযোজ্য নহে
ঘ, অকৃষি ভূমির হার	ঃ	পতিত ভাঙ্গা
ঙ, প্রস্তাবিত এলাকার তফসিল (পৌরসভার নাম, মৌজার নাম, জে.এল, নং এবং দাগ নম্বর সমূহ)	ঃ	নির্ধারিত ছকে অপর পাতায় উল্লেখ করা হয়েছে
চ, প্রস্তাবিত এলাকার দাগ নম্বর সমূহ পরস্পর সংযুক্ত কিনা	ঃ	পরস্পর সংযুক্ত।
ছ, প্রস্তাবিত এলাকাটি সেনানিবাস এলাকা বহির্ভূত কিনা	ঃ	হ্যাঁ
জ, স্থানীয় আয়ের উৎসসহ	ঃ	প্রযোজ্য নহে
ঝ, সরকারী অনুদান বা সাহায্য ব্যতীত প্রস্তাবিত এলাকায় বিগত ০৩ (তিন) বছরের গড় রাজস্ব আয় এবং	ঃ	প্রযোজ্য নহে
ঞ, প্রস্তাবিত পোর্ট পৌরসভা গঠনের যৌক্তিকতার তথ্য	ঃ	তথ্য সংযুক্ত

FAX NO.

০২

৬. প্রস্তাবিত এলাকার তফসিল:

ক্রমিক নং	পৌরসভার নাম	মৌজার নাম	জে.এল নং	দাগ নং	জমির পরিমাণ
০১	মোংলাপোর্ট পৌরসভা	কামারডাঙ্গা	২০	১১৯, ১২১, ১২৩, ১২৫, ১৩৪, ১৩৭, ১৩৮, ১৩৯, ১৪০, ১৪১, ১৪২, ১৪৩, ১৪৪, ১৫০, ১৫১, ১৫২, ৭১৩, ৭১৫, ৭১৬, ৭২০, ৭২২, ৮০৬, ৮০৭, ৮০৮, ৮০৯, ৮১০, ৮১১, ৮১২, ৮১৩, ৮১৪, ৮২২, ৮২৩, ৮২৪, ৮২৭, ৮২৯, ৮৩০, ৮৩১, ৮৩২, ৮৩৩, ৮৩৪, ৮৩৫, ৮৩৬, ৮৩৭, ৮৩৮, ৮৩৯, ৮৪০, ৮৪১, ৮৪২, ৮৪৩, ৮৪৪, ৮৪৫, ৮৪৭, ৮৪৮, ৮৪৯, ৮৫১, ৮৫২, ৮৫৩, ৮৫৪, ৮৫৫, ৮৫৬, ৮৫৭, ৮৫৮, ৮৫৯, ৮৬০, ৮৬১, ৮৬২, ৮৬৩, ৮৬৪, ৮৬৫, ৮৬৬, ৮৬৭, ৮৬৮, ৮৬৯, ৮৭০, ৮৭১(প্রস্তাবিত অর্থনৈতিক অঞ্চলসহ)	২০৫.০০ (দুইশত পাঁচ) একর

এমতাবস্থায়, বাগেরহাটের মংলা বন্দর সংলগ্ন এলাকায় অর্থনৈতিক অঞ্চল স্থাপনের নিমিত্ত মোংলা উপজেলাধীন ২০ নং কামারডাঙ্গা মৌজার তফসিল বর্ণিত ২০৫(দুইশত পাঁচ) একর জমি মোংলাপোর্ট পৌর এলাকা বহির্ভূত ঘোষণা করে মোংলা উপজেলাধীন ২ নং বুড়িরডাঙ্গা ইউনিয়ন পরিষদের অন্তর্ভুক্ত করার প্রয়োজনীয় ব্যবস্থা গ্রহণের জন্য মহোদয়কে সবিনয়ে অনুরোধ করা হলো।

সংযুক্ত : বর্ণনামতে
..................কপি।

(মুঃ শুকুর আলী)
জেলা প্রশাসক
বাগেরহাট।
ফোন : ০৪৬৮-৬২৫২৫
e-mail-dcbagerhat@mopa.gov.bd

সচিব
স্থানীয় সরকার বিভাগ
স্থানীয় সরকার, পল্লী উন্নয়ন ও সমবায় মন্ত্রণালয়
বাংলাদেশ সচিবালয়, ঢাকা।
(দৃষ্টি আকর্ষণ : জনাব মোঃ খলিলুর রহমান, উপ-সচিব, পৌর-১ শাখা)

অনুলিপি সদয় অবগতির জন্য প্রেরণ করা হলো :

০১। মন্ত্রিপরিষদ সচিব, মন্ত্রিপরিষদ বিভাগ, বাংলাদেশ সচিবালয়, ঢাকা।
০২। সচিব, ভূমি মন্ত্রণালয়, বাংলাদেশ সচিবালয়, ঢাকা।
০৩। নির্বাহী চেয়ারম্যান, বাংলাদেশ অর্থনৈতিক অঞ্চল কর্তৃপক্ষ, বিডিবিএল ভবন, ১৫ তলা, ১২ কারওয়ানবাজার, ঢাকা।
০৪। বিভাগীয় কমিশনার, খুলনা বিভাগ, খুলনা।
০৫। উপজেলা নির্বাহী অফিসার, মোংলা, বাগেরহাট।
০৬। মেয়র, মোংলাপোর্ট পৌরসভা, বাগেরহাট।
০৭। চেয়ারম্যান, বুড়িরডাঙ্গা ইউনিয়ন পরিষদ, মোংলা, বাগেরহাট।

জেলা প্রশাসক
বাগেরহাট

একই স্মারক ও তারিখে প্রতিস্থাপিত

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
উপজেলা নির্বাহী অফিসারের কার্যালয়
মোংলা, বাগেরহাট।

স্মারক নং- উনিঅ/ মোংলা/ ২০১৪- ৮৬ (যুক্ত) তারিখ ঃ ০৬/০২/২০১৪ খ্রিঃ।

বিষয় ঃ বাগেরহাট জেলাধীন মোংলা পৌরসভা এলাকাভুক্ত ২০৫.০০ একর জমি পৌর এলাকা বহির্ভূত ঘোষনা প্রসঙ্গে।

সূত্র ঃ মহোদয়ের কার্যালয়ের স্থানীয় সরকার শাখার ০৫. ৪৪. ০১. ০০. ০১১. ৫৬. ০৫৭. ১৩. ৮৯, তারিখ ঃ ০৩/০২/২০১৪ খ্রিঃ নং স্মারক।

উপর্যুক্ত বিষয়ের প্রেক্ষিতে জানানো যাচ্ছে যে, বাগেরহাট জেলাধীন মোংলা পোর্ট পৌরসভা এলাকাভুক্ত ২০৫.০০ একর জমি পৌরসভা বর্হিভূত এলাকা ঘোষনার প্রেক্ষিতে মন্ত্রনালয় হতে প্রেরিত সংযুক্ত ছক পুরণ পূর্বক প্রতিবেদন, স্কেচ ম্যাপ যৌথ স্বাক্ষর করতঃ মহোদয়ের সদয় অবগতি ও পরবর্তী ব্যবস্থা গ্রহণের জন্য অত্রসাথ প্রেরণ করা হলো।

সংযুক্ত ঃ ০৪ (চার) ফর্দ।

০৬/০২/১৪
(ড. মোঃ মিজানুর রহমান)
উপজেলা নির্বাহী অফিসার
মোংলা, বাগেরহাট।

জেলা প্রশাসক
বাগেরহাট।

" প্রতিবেদন "

বিষয় ঃ বাগেরহাট জেলাধীন মোংলা পৌরসভা এলাকাভুক্ত ২০৫.০০ একর জমি পৌর এলাকা বহির্ভূত ঘোষনা প্রসঙ্গে।

সূত্র ঃ জেলা প্রশাসকের কার্যালয়, বাগেরহাট স্থানীয় সরকার শাখার স্মারক নং- ০৫. ৪৪. ০১. ০০. ০১১. ৫৬. ০৫৭. ১৩. ৮৯, তারিখ ঃ ০৩/০২/২০১৪ খ্রিঃ।

উপর্যুক্ত বিষয়ের প্রেক্ষিতে জানানো যাচ্ছে যে, বাগেরহাট জেলাধীন মোংলা পোর্ট পৌরসভা এলাকাভুক্ত ২০৫.০০ একর জমি পৌরসভা বর্হিভূত এলাকা ঘোষনার লক্ষ্যে মন্ত্রণালয় হতে প্রেরিত সংযুক্ত ছক পূরন করতঃ মহোদয়ের সদয় অবগতি ও পরবর্তী ব্যবস্থা গ্রহণের জন্য অত্রসাথে প্রেরণ করা হলো।

-ঃ ছক ঃ-

ক. প্রস্তাবিত এলাকার লোকসংখ্যা	ঃ	স্থায়ীভাবে কোন লোক বসবাস করেনা (ইপি.জেড এলাকাভুক্ত)।
খ. প্রস্তাবিত এলাকার জনসংখ্যার ঘনত্ব প্রতি বর্গ কিঃমিঃ গড়ে লোকসংখ্যা	ঃ	কোন লোক বসবাস করেনা।
গ. প্রস্তাবিত এলাকার অকৃষি পেশায় নিয়োজিত ব্যক্তির হার	ঃ	প্রযোজ্য নহে।
ঘ. অকৃষি ভূমির হার	ঃ	পতিত ভাঙ্গা
ঙ. প্রস্তাবিত এলাকার ডকসিল (ইউনিয়নের নাম, মৌজার নাম, জে.এল. নং এবং দাগ নম্বর সমূহ)	ঃ	লিজে দেয়া হলো।
চ. প্রস্তাবিত এলাকার দাগ নম্বর সমূহ পরস্পর সংযুক্ত কিনা	ঃ	পরস্পর সংযুক্ত।
ছ. প্রস্তাবিত এলাকাটি সেনানিবাস এলাকা বহির্ভূত কিনা	ঃ	হ্যাঁ
জ. স্থানীয় আয়ের উৎসসহ	ঃ	প্রযোজ্য নহে।
ঝ. সরকারী অনুদান বা সাহায্য ব্যতীত প্রস্তাবিত এলাকার বিগত ০৩ (তিন) বছরের গড় রাজস্ব আয় এবং	ঃ	প্রযোজ্য নহে।
ঞ. মোংলা পোর্ট পৌরসভা গঠনের গেজেটের কপি	ঃ	কপি সংযুক্ত।

ঙ. প্রস্তাবিত এলাকার ডকসিল ঃ-

ক্রমিক নং	পৌরসভার নাম	মৌজার নাম	জে.এল নং	দাগ নং	জমির পরিমাণ
০১	মোংলা পোর্ট পৌরসভা	কামারডাঙ্গা	২০	১১৯, ১২১, ১২৩, ১২৫, ১৩৪, ১৩৭, ১৩৮, ১৩৯, ১৪০, ১৪১, ১৪২, ১৪৩, ১৪৪, ১৫০, ১৫১, ১৫২, ৭১৩, ৭১৫, ৭১৬, ৭২০, ৭৯৫, ৮০৬, ৮০৭, ৮০৮, ৮০৯, ৮১০, ৮১১, ৮১২, ৮১৩, ৮১৪, ৮২২, ৮২৩, ৮২৪, ৮২৭, ৮২৯, ৮৩০, ৮৩১, ৮৩২, ৮৩৩, ৮৩৪, ৮৩৫, ৮৩৬, ৮৩৭, ৮৩৮, ৮৩৯, ৮৪০, ৮৪১, ৮৪২, ৮৪৩, ৮৪৪, ৮৪৫, ৮৪৭, ৮৪৮, ৮৪৯, ৮৫১, ৮৫২, ৮৫৩, ৮৫৪, ৮৫৫, ৮৫৬, ৮৫৭, ৮৫৮, ৮৫৯, ৮৬০, ৮৬১, ৮৬২, ৮৬৩, ৮৬৪, ৮৬৫, ৮৬৬, ৮৬৭, ৮৬৮, ৮৬৯, ৮৭০, ৮৭১ (প্রস্তাবিত অর্থনৈতিক অঞ্চলভুক্ত)।	২০৫.০০ (দুইশত পাঁচ) একর।

(চন্দ্র প্রকাশ বসু)
ইউনিয়ন ভূমি সহকারী কর্মকর্তা
মোংলা সদর ইউনিয়ন ভূমি অফিস
মোংলা, বাগেরহাট।

০৬/০২/১৪
(কমল সেনশর্মা)
সার্ভেয়ার
উপজেলা ভূমি অফিস
মোংলা, বাগেরহাট।

(ড. মো: মিজানুর রহমান)
উপজেলা নির্বাহী অফিসার
ও
সহকারী কমিশনার (ভূমি)
মোংলা, বাগেরহাট।

Annexure-III

Mongla Port Authority
Mongla, Bagerhat.
Tidal Information of
Mongla Tidal Station

Zero Value: 0.006m) C.D

Year	Highest High water	Lowest Low Water
1990	3.92	0.03
1991	3.95	(-)0.30
1992	3.99	(-)0.17
1993	4.03	(-)0.46
1994	3.99	(-)0.24
1995	4.17	(-) 0.28
1996	4.37	(-) 0.30
1997	4.54	0.03
1998	4.51	(-)0.03
1999	4.47	0.14
2000	4.54	0.20
2001	4.54	0.06
2002	4.59	(-)0.09
2003	4.56	0.00

Mongla Port Authority
Mongla, Bagerhat
Tidal Information of
Mongla Tidal Station.

Zero Value: 0.00(m) C.D.

Year	Highest High Water	Lowest Low Water
2004	4.73	0.00
2005	4.66	0.02
2006	4.61	(-)0.15
2007	4.59	(-)0.37
2008	4.66	(-)0.02
2009	4.96	0.08
2010	4.65	(-)0.11
2011	4.66	(-)0.12
2012	4.63	(-)0.17
2013	4.74	(-)0.03
2014	4.43	0.32

Annexure-IV

Government of the People's Republic of Bangladesh
Office of the Senior Chemist
Department of Public Health Engineering
Khulna Zonal Lab, Khanjahan Ali Road, Rupsha, Khulna
Phone: 041-721348, Fax: , Email: wqmsc_khulnazonallab@yahoo.com

Lab Memo: 282 / PHE, Zonal Lab, Khulna

Date: 26/03/2013

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: KHU2013030245	Sample Receiving date: 11/03/2013
Ref. Memo No: 874 & Dated: 11/03/2013	Sample Source: Pipe water system
Sent by:Dipok Chandra Talukder ,DPHE , EE, Mongla Division, Mongla, Bagerhat	Dist:Bagerhat, Upa:Mongla
Care Taker: Digraj Bustar Station	Union:Mongla Port Pouraseva, Vill.:Ward No-04
Sample Collection date: 11/03/2013	Date of Testing: 11/03/2013 to 27/03/2013

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.005	mg/L	AAS	0.001
2	Chloride	150-600	425	mg/L	Titrimetic	-
3	Coliform (Faecal)	0	0	N/100ml	MFM	-
4	Hardness	200-500	200	mg/L	Titrimetic	-
5	Iron (Fe)	0.3-1	0.05	mg/L	AAS	0.01
6	pH	6.5-8.5	8.1	-	pH Meter	-
7	Total Dissolved Solid (TDS)	1000	750	mg/L	Multimeter	-
8	Turbidity	10	1.5	NTU	Turbidity Meter	0.0

Comments:

Test Performed by:	Countersigned/Approved by:
1.) Name: Md. Nasrul Islam Designation: Sample Analyzer Signature 28/03/13	1.) Name: Md. Shirazul Haque Designation: Senior Chemist Signature 28/3/13
2.) Name: Designation:	2.) Name: Designation:

Government of the People's Republic of Bangladesh
Office of the Senior Chemist
Department of Public Health Engineering
Khulna Zonal Lab, Khanjahan Ali Road, Rupsha, Khulna
Phone: 041-721345, Fax: , Email: wqmic.khulnazonallab@yahoo.com

Lab Memo: 94 / PHE, Zonal Lab, Khulna

Date: 27/08/2014

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: KHU2014080079	Sample Receiving date: 26/08/2014
Ref. Memo No: 45 / DPHE M.D., Mongla, & Dated: 25/08/2014	Sample Source: Pipe water system
Sent by: Dipok Chandra Talukder, DPHE, EE, Mongla Division, Mongla, Bagerhat	Dist.Bagerhat, Upa.Mongla
Care Taker: Supply Water from Tank - Inside of Mongla Jetti	Union:Mongla Port Paurasava, Vill: Ward No-04
Sample Collection date: 25/08/2014	Date of Testing: 26/08/2014 to 27/08/2014

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
2	Chloride	150-600	412	mg/L	Titrimetic	-
3	Coliform (Faecal)	0	0	N/100ml	MFM	-
4	Hardness	200-500	168	mg/L	Titrimetic	-
5	Iron (Fe)	0.3-1	0.27	mg/L	AAS	0.01
6	pH	6.5-8.5	8.4	-	pH Meter	-
7	Total Dissolved Solid (TDS)	1000	935	mg/L	Multimeter	-
8	Turbidity	10	1.5	NTU	Turbidity Meter	0.0

Comments:

Test Performed by:
1.) Name: Md. Nazrul Islam
Designation: Sample Analyzer
2.) Name:
Designation:
Signature
27/08/14
(Md. Nazrul Islam)
Sample Analyzer, DPHE
Zonal Laboratory, Khulna

Countersigned/Approved by:
1.) Name: Md. Aminur Rahman
Designation: Senior Chemist
2.) Name:
Designation:
Signature
27/08/14
(Md. Aminur Rahman)
Senior Chemist, DPHE
Zonal Laboratory, Khulna

Annexure-V

Lithological Report of Test Tube Well Bore Hole

Date of Construction : March 09, 2014
Location : Very close to the Bus Stand of Foilar Hat (LHS twards Mongla)
Present Status : Working

00' — 40'	Clay
40' — 240'	Fine Sand (white)
240'— 280'	Very Fine Sand
280' --- 370'	Medium Sand (gray)
370'— - 390'	Medium Sand
390' ---500'	Clay & sand Mixed
500'— 630'	Fine Sand and Very Fine Sand (gray)
630' – 710'	Clay
710' – 730	Fine Sand and Very Fine Sand
730' – 900'	Medium Sand (gray)
900' --- 1020'	Clay & Sand Mixed.

Lithological Report of Test Tube Well Bore Hole

Date of Construction : September 01, 2008
Location : 1200' from Ronsen crossing (near ice factory and Taju Master house)
Present Status : Chocked up.

00' — 40'	Clay (hard)
40' — 120'	Fine Sand
120'— 280'	Very Fine Sand
280' — 600'	Fine Sand
600'-- - 620'	Medium Sand
620' —680'	Very Fine Sand
680'— 720'	Medium Sand
720' – 740'	Mediun to Fine Sand
740' – 760	Clay
760' – 800'	Hard Clay
800' — 940'	Medium Sand
940' –1000'	Clay mixed with Sand

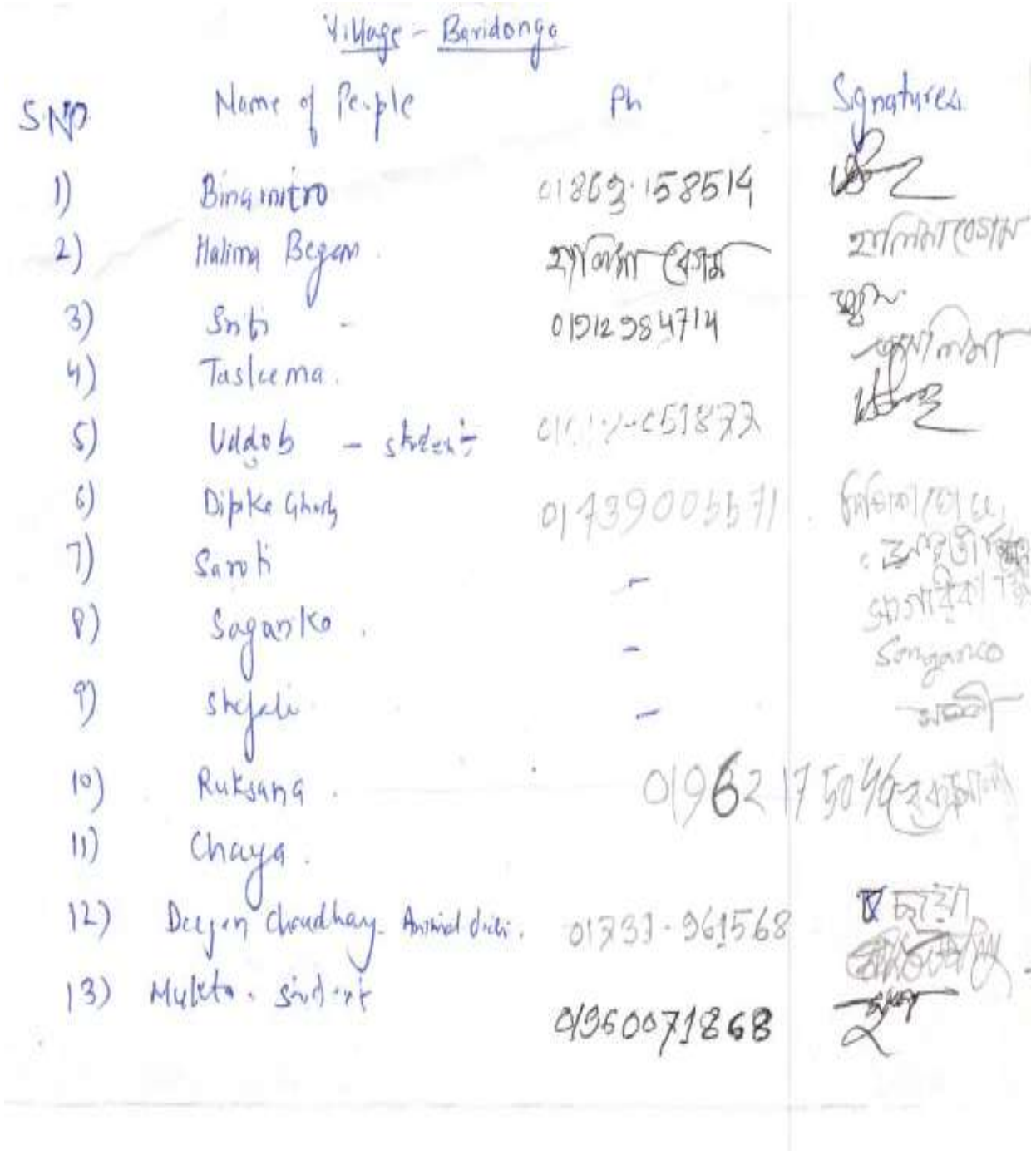
Lithological Report of Test Tube Well Bore Hole
Date of Construction : November 03, 2004
Location : 3000 m from Ronsen Crossing (left side Khulna to Mongla). Name of the place is Govinda Pur (Tajur Bari). from Ronsen crossing (near ice factory and Taju Master house)
Present Status : Chocked up.

00' — 40'	Clay
40' — 180'	Very Fine Sand
180'— 400'	Medium Sand
400' — 540'	Very Fine Sand
540'-- 700'	Clay
700' ---800'	Very Fine to medium Sand
800'--- 900'	Very Fine Sand
900' – 1000'	Mediun Sand

Lithological Report of Test Tube Well Bore Hole
Date of Construction : May 12, 2004
Location : 1000 m from Foilar hat (left side, Khulna to Mongla)
Present Status : Good Running condition.

00' — 20'	Clay
20' — 660'	Fine Sand
660'— 800'	Clay
800' --- 920'	Medium Sand
920'-- 1000'	Clay

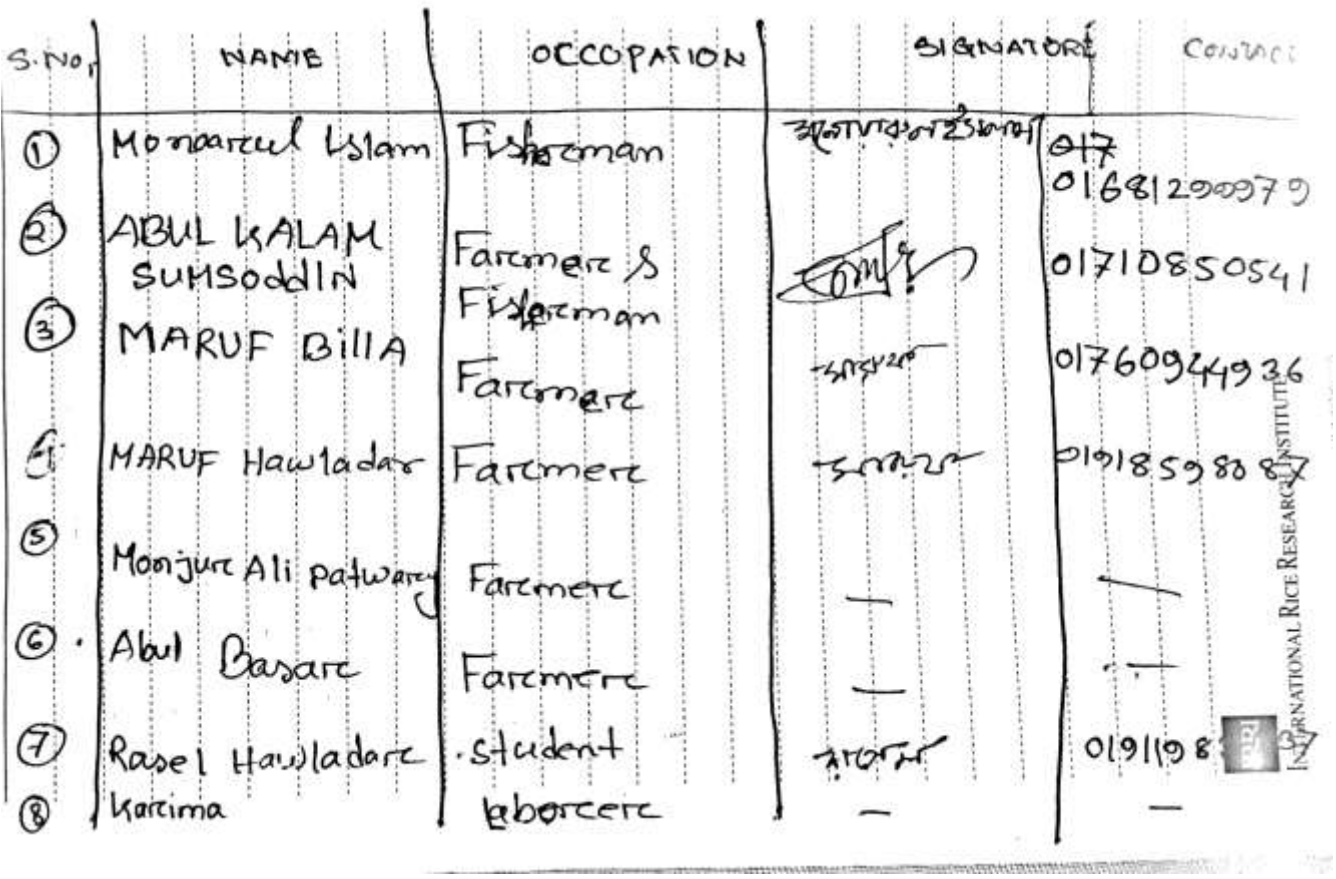
Annexure-VII



Village – Baridonga

SNO	Name of People	Ph	Signatures
1)	Bingmitro	01863-158514	
2)	Halima Begam		
3)	Sonti	01512584714	
4)	Taslima.		
5)	Uddob – student		
6)	Dipke Ghosh	01739005571	
7)	Sonti	–	
8)	Sagorika	–	
9)	Shefali	–	
10)	Ruksana	01962175046	
11)	Chaya.		
12)	Deyen Choudhary. Animal distr.	01731-961568	
13)	Mukta. Student	01960071868	

Annexure-VIII



S.No.	NAME	OCCOPATION	SIGNATORE	CONTACT
①	Monoarul Islam	Fisherman		017 01681209979
②	ABUL KALAM SUMSoddIN	Farmere & Fisherman		01710850541
③	MARUF BillA	Farmere		01760944936
④	MARUF Hawladar	Farmere		01918598887
⑤	Moonjure Ali patwary	Farmere	—	—
⑥	Abul Basare	Farmere	—	—
⑦	Rasel Hawladare	Student		0191198
⑧	Karima	Laborere	—	—

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