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Ministry of Industries
Bangladesh Chemical Industries Corporation

Environmental Impact Assessment
of
Ghorasal Polash Urea Fertilizer Project

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Abbreviations and Acronyms

ACS	Asbestos Cement Sheet
ADB	Asian Development Bank
ADDKF-SGP	Abu Dhabi Dialogue Knowledge Forum Small Grants Program
AEGLs	Acute Exposure Guideline Levels
AEZ	Agro-ecological Zone
AIDS	Acquired Immune Deficiency Syndrome
ALOHA	Areal Locations of Hazardous Atmosphere
AP	Affected Person
ASR	Ambient Sensitive Receptors
BADC	Bangladesh Agricultural Development Corporation
BCC	Behavior Change Communication
BBS	Bangladesh Bureau of Statistics
BDT	Bangaldeshi Taka
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BOD	Biochemical Oxygen Demand
BPDB	Bangladesh Power Development Board
BCIC	Bangladesh Chemical Industries Corporation
BSCIC	Bangladesh Small and Cottage Industries Corporation
BWDB	Bangladesh Water Development Board
CAMS	Climate Anomaly Monitoring System
CEAP	Construction Environmental Action Plan
CEGIS	Center for Environmental and Geographic Information Services
CEMS	Continuous Emission Monitoring System
CER	Certified Emission Reduction
CESMP	Contractor's Environment and Social Management Plan
CITES	Convention on International Trade of Endangered Species
CMB	Central Monitoring Basin

CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
CT	Cooling Tower
CW	Cooling Water
DAE	Department of Agricultural Extension
dB	Decibel
DCIS	Distributed Control and Information System
DCS	Distributed Control System
DEM	Digital Elevation Model
DESA	Dhaka Electric Supply Authority
DIA	Direct Impact Area
DM	De-mineralization
DMB	Disaster Management Bureau
DO	Dissolved Oxygen
DoArch	Department of Architechture
DoE	Department of Environment
DoF	Department of Fisheries
DPHE	Department of Public Health Engineering
DPP	Development Project Proforma
EA	Environmental Assessment
ECA	Environment Conservation Act /Ecologically Critical Area
ECC	Environmental clearance certificate
ECP	Environmental Code of Practice
ECR	Environment Conservation Rules
EHS	Environmental Health and Safety
EHSU	Environmental Health and Safety Unit
EIA	Environmental Impact Assessment
EMAP	Environmental Management Action Plan
EMMP	Environmental Management and Monitoring Plan

EMP	Environmental Management Plan
EP	Equator Principle
EPC	Engineering, procurement and construction
ERG	Emergency Response Group
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESF	Environmental and Social Framework
ESS	Environmental and Social Standard
ETP	Effluent Treatment Plant
EU	European Union
FAO	Food and Agriculture Organization
FD	Forest Department
FGD	Focus Group Discussion
FRSS	Fishery Resources Survey System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GI	Galvanized Iron
GIS	Gas Insulated System/Geographical Information System
GLC	Ground Level Concentration
GO	Government Organization
GoB	Government of Bangladesh
GPS	Ghoarshal Power Station
GPUFP	Ghorasal Polash Urea Fertilizer Project
GRC	Grievance Redress Committees
GRP	Grievance Redressal Plan
GRM	Grievance Redress Mechanism
GT	Gas Turbine
GTG	Gas Turbine Generator
GUFF	Granular Urea Fertilizer Factory
HFO	Heavy Fuel Oil
HIV	Human Immunodeficiency Virus

HRSG	Heat Recovering Steam Generator
HP	High Pressure
HR	Human Resources
HSE	Health Safety Environment
HTW	Hand Tube Well
HYV	High Yielding Variety
ICIMOD	International Centre for Integrated Mountain Development
IDLHs	Immediately Dangerous to Life and Health Limits
IEE	Initial Environmental Examination
IESCs	Important Environmental and Social Components
IFC	International Finance Corporation
ILO	International Labour Organization
IMR	Infant Mortality Rate
IMT	Incident Management Team
IP	Intermediate Pressure
IPCC	Intergovernmental Panel on Climate Change
IRT	Incident Response Team
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
KV	Kilo Volt
KWh	Kilo Watt hour
LEL	Lower Explosion Limit
LGRC	Local Grievance Redress Committee
LLP	Low Lift Pump
LNG	Liquefied Natural Gas
LOC	Level of Concern
LP	Low Pressure
MAOP	Maximum Allowable Operating Pressure
MEAs	Multilateral Environmental Agreements
MGLC	Maximum Ground Level Concentration

MHI	Mitsubishi Heavy Industries
MICS	Multiple Indicator Cluster Surveys
MMCFD	Million Cubic Feet per Day
MMSCFD	Million Standard Cubic Feet Per Day
MoC	Ministry of Commerce
MoEF	Ministry of Environment and Forest
MoH	Ministry of Health
MoI	Ministry of Industries
MoPEMR	Ministry of Power, Energy and Mineral Resources
MoS	Ministry of Shipping
mPWD	Meter Public Works Datum
MT	Metric Ton
MW	Mega Watt
NAAQS	National Ambient Air Quality Standards
NBSAP	National Biodiversity Strategy and Action Plan
NCA	Net Cultivable Area
NCS	National Conservation Strategy
NEP	National Energy Policy
NEMAP	The National Environment Management Action Plan
NGO	Non-Government Organization
NH3	Ammonia
NHS	National Health Service
NIOSH	National Institute for Occupational Safety and Health
NOx	Oxides of Nitrogen
NoA	Notification of Award
NOC	No Objection Certificate
NWRD	National Water Resources Database
OE	Owner's Engineer
OHS	Occupational Health and Safety
OHSAS	Occupational Health and Safety Management Systems
O&M	Operation and Maintenance

OP	Operational Policy
PAP	Project Affected Person
PCB	Polychlorinated Biphenyl
PCM	Public Consultation Meeting
PD	Project Director
PEC	Predicted Environmental Concentration
PESMP	Participatory Environmental and Social Monitoring Plan
PGRC	Project Grievance Redress Committee
PIU	Project Implementation Unit
PM	Particulate Matter
POP	Persistent organic pollutants
PP	Power Plant
PPE	Personal Protective Equipment
PSC	Power Station Construction
PSMP	Power System Master Plan
PUFFL	Polash Urea Fertilizer Factory Ltd
PWD	Public Works Datum
RCC	Roller-Compacted Concrete
RCP	Representative Concentration Pathways
REB	Rural Electrification Board
RMS	Regulating Metering Station
RO	Reverse Osmosis
RRA	Rapid Rural Appraisal
RS	Remote Sensing
SA	Social Accountability
SBR	Sequential Batch Reactor
SCC	Site Clearance Certificate
SDG	Sustainable Development Goal
SEID	Stakeholder Engagement and Information Disclosure
SIS	Small Indigenous Species
SOx	Oxides of Sulphur

SPM	Suspended Particulate Matter
SRDI	Soil Resources Development Institute
STD	Sexually Transmitted Disease
STG	Steam Turbine Generator
STI	Sexually Transmitted Infection
TB	Tuberculosis
TDS	Total Dissolved Solid
TSS	Total Suspended Solids
TGTDCL	Titas Gas Transmission and Distribution Co. Ltd.
ToR	Terms of Reference
TPD	Ton Per Day
TPY	Ton Per Year
UEL	Upper Explosive Limit
UFFL	Urea Fertilizer Factory Ltd.
UHC	Upazila Health Complex
USEPA	United States Environment Protection Agency
VEC	Valued Environmental Component
VOC	Volatile Organic Compound
WARPO	Water Resources Planning Organization
WBG	World Bank Group
WHP	World Health Organization
WHS	Workplace Health and Safety
WTP	Water Treatment Plant
WWTS	Waste Water Treatment System

Glossary

Aman: A group of rice varieties grown in the monsoon season and harvested in the post-monsoon season. This is generally transplanted at the beginning of monsoon from July-August and harvested in November-Dec. Mostly rain-fed, supplemental irrigation needed in places during dry spell.

Aus: A group of rice varieties sown in the pre-monsoon season and harvested in the monsoon season. These are broadcasted/transplanted during March-April and harvested during June-July. Generally rain-fed, irrigation needed for HYV T. Aus.

B Aman: Broadcast aman, which is direct-seeded before the wet monsoon (March to June).

Bazar: Market

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

Boro: A group of rice varieties sown and transplanted in winter and harvested at the end of the pre-monsoon season. These are mostly HYV and fully irrigated, planted in December-January and harvested before the onset of monsoon in April-May.

Kutcha: A house made of locally available materials with earthen floor, commonly used in the rural areas.

Khal: A drainage channel usually small, sometimes man-made, the channel through which the water flows. These may or may not be perennial.

Kharif: Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into kharif-1 (March-June) and kharif-2 (July-October).

Jhupri: A type of house which consists of mud walls of 1.5 to 3.0 ft thickness, which carry the roof load. Earthen floor, thatch or CI sheets are used as roofing materials. . There is no monolithic joint between the wall and the roof.

Mauza: The smallest revenue geographic unit with a Jurisdiction List (JL) number.

Pucca: Well constructed room or building using modern masonry materials.

Rabi: Dry agricultural crop growing season; this term is mainly used for the cool winter season between November and February.

T. *Aman*: When preceding a crop means transplanted (T. Aman).

Upazila: Upazila is an administrative subdivision of a District.

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Executive Summary

Background: Sustainable chemical fertilizer, predominantly the Urea, is an important precondition for the agro-based socio-economic development of Bangladesh. The use of chemical fertilizers in agriculture in Bangladesh has steadily increased since its introduction in 1949-50 and has contributed significantly to attaining sufficiency in food grain production thereby ensuring food security and improving nutritional status of the people of Bangladesh. It is reasonable to assume that in the near future the predominant variety of rice will be the HYV type, and all the local varieties of rice except the exotic ones will be replaced with HYV and the same will take place with other crops including vegetables, fruits and hence the demand for chemical fertilizers will increase.

At present, the domestic production covers only about 31% of the total demand of Urea. It is quite evident that the limited fertilizer production is compensated by imported Urea. The installed capacity of the existing six urea fertilizer factories under Bangladesh Chemical Industries Corporation (BCIC) is about 2.80 million MT. However, due to the shortage of gas supply, aging, prolonged operation, sharp rise in down time, usage ratio and maintenance frequency these factories cannot sustain the installed capacity. As a result, the production is gradually decreasing. The present annual production of Urea is only 0.76 million MT whereas the demand is about 2.44 million MT and deficit is more than 1.98 million MT [including the production (0.3 million MT) that would be lost due to shut down of Urea Fertilizer Factory Ltd. (UFFL) and Polash Urea Fertilizer Factory Ltd. (PUFFL)].

Realizing the importance of sustainable agriculture and meeting up the increasing demand, the Government of Bangladesh (GoB) has planned to increase the production of chemical fertilizer within the country and accordingly, BCIC has planned to establish a new and modern, energy efficient Granular Urea Fertilizer Factory (GUFF) with higher production capacity of Urea 0.924 million MT at the rate of 2,800 Ton Per Day (TPD) with 330 stream days. With this production, the deificit of urea fertilizer will be reduced to 1.05 million MT.

Methodology: The methodology for the EIA study has been undertaken following DoE's guidelines and some other international guidelines for industries as well. In line with these requirements, Primary data has been collected through field visit based on sample collection from the field and Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA). Intensive stakeholder's participation was also ensured at every stage of the EIA process. Statistical data from secondary sources on different relevant aspects like hydrology, meteorology, ecology, fisheries, agriculture, and socio-economy for the study area have been collected from respective organizations, GOs and other NGOs.

Legislative, Regulation and Policy Consideration: In accordance with the compliance of ECR, 1997 (all amendments), the proposed Fertilizer factory falls under "Red" category and the proponent (BCIC) requires to submit both Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) for obtaining Site Clearance Certificate (SCC) and subsequently Environmental Clearance Certificate (ECC) before installation of the project. Accordingly, to conduct the noted study, BCIC employed Center for Environmental and Geographic Information Services (CEGIS) under an agreement. However, as the proposed project planns to install the fertilizer factory within the existing BCIC owned land of Polash Urea Fertilizer Factory Ltd. (PUFFL) at Ghorasal, the proponent has already obtained

exemption of IEE submission and obtained approval of Terms of Reference (ToR) for EIA study of the proposed project. Accordingly, this present EIA has been undertaken to meet the national regulatory requirements.

Based on the criteria of Exhibit I of the Equator Principle, the proposed Project is considered a 'Category B', as there are 'potential limited adverse social or environmental impacts' that are few in number, generally site- specific, largely reversible and readily addressed through mitigation measures' as well as IFC guidelines to meet requirements of other lenders under WB group.

Analysis of Alternatives: With regard to the alternative analysis for this proposed project, selection of technologies for the proposed Project has been assessed in the feasibility study from techno-economic point of view. Feasibility report has justified the rationale of establishment of a new urea fertilizer factory in place of Urea Fertilizer Factory Ltd. (UFFL) and Polash Urea Fertilizer Factory Ltd. (PUFFL) with higher energy efficiency and production capacity. Therefore, decision making for "No Action" alternative is excluded by this study. Comparing the competencies, merits-demerits and environment friendliness, the selected technologies are as follows: Haldor Topsoe A/S (HTAS), Denmark for Ammonia Plant, SAIPEM S. p. A., Italy for Urea Melt Plant, thyssenkrupp Fertilizer Technology GmbH (TKFT), Germany for Granulation Plant and Mitsubishi Heavy Industries, Ltd (MHI), Japan for CO_2 Recovery from Primary Reformer. The urea produced in the GPUFP will be dispatched from the production unit to jetty through closed conveyor belt for supplying different areas of the country through water ways using barge. The fertilizer will also be transported through railways that would be built inside the plant and through roadways from the production unit.

The construction site of the components of the proposed Plant has not been brought under alternative analysis as the site is earmarked by BCIC. In terms of cooling cycle, closed cycle cooling option has been selected so alternative analysis for this issue is found redundant. Environmental protection and social acceptability has been duly considered during the analysis for this proposed project, and, found this project as the best option.

Project Location and Study Area: Administratively, the proposed site for the construction of Ghorasal Polash Urea Fertilizer Project (GPUFP) is located on the left bank of the Shitalakhya River in Polash Mauza of the Ghorasal Municipality under Polash Upazila of Narsingdi district.

The site is surrounded by Ghorasal Power Station on the South, the Shitalakhya River on the West, countryside on the North and East. The Project area is of about 110 acres of land having grasses, bushes, trees (sapling, juvenile and adult), old civil structures including warehouses mostly shabby in condition, lagoon, etc. No new land acquisition is required and the issue of compensation and resettlement is redundant because the site is located inside BCIC's own land.

Project Data Sheet: The proposed Project is a natural gas-based GUFF with the capacity of 2,800 TPD which will be constructed as turnkey project of BCIC. A consortium of Mitsubishi Heavy Industries Ltd. (MHI) of Japan and China National Chemical Engineering No.7 Construction Company Ltd. (CC7) is the EPC contractor for establishing the factory. The major components of the proposed project are: (i) Ammonia Plant, (ii) Urea Melt Plant, (iii) Urea Granulation Plant, (iv) Carbon Dioxide (CO_2) Recovery Plant, (v) Power Plant, and (vi) Jetty. In addition, there will be about thirteen utilizes and another thirteen support facilities within the proposed layout of the project.

The site comprises of modest vegetation cover constituting herbs, shrubs and 3,750 number of trees (mostly sapling, some are juvenile and adult) and a number of old civil structures occupying 59,204 sq. meter comprising of administrative buildings, health center, warehouse, club, canteen, rail line, road, etc. The buildings are mostly vacant while some are functioning as office, store and pump house. There are about 550 asbestos cement sheets (ACS) weighing about 15 tons, which needs special care to handle and dispose off safely. These buildings need to be demolished, shrubs and trees to be cut and two ponds need to be filled. The Contractors will prepare one Civil Structures Demolition Action Plan based on terms and conditions and procedures provided in Demolition Plan and one Construction Environmental Action Plan to address pollution prevention, occupational health, safety and environment, and emergency response including the requirements of the ECPs and EMP. During demolition, all suggested mitigation measures shall be followed for protection of visitor wildlife under supervision of a Wildlife Ecologist as per the EMP.

Project Design and Description: A layout plan has been developed by the EPC Contractor by showing all relevant structures, internal road, drainage network, different pollution abatement measures, waste water treatment system (WWTS) and effluent treatment plant (ETP). The EPC contractor is expected to have around 400 workers including unskilled, skilled, supervisors, engineers, management staff of local and expatriate in Demolition stage; around 600 during site preparation; around 4,000 during construction; and around 1,000 during operation stage. There are about 126 employees will be deployed from BCIC during the construction and commissioning phases.

At present, approximately 0.583 m^3/s of surface water from the Shitalakhya River is used for different cooling water systems, boiler and cooling blow down, etc. of both UFFL and PUFFL. For the proposed Project (GPUFP), raw water withdrawal from the Shitalakhya River will be about 0.567 m^3/s (2,040 t/h) (Design value); after storage tank it will be about 0.322 m^3/s (1,159 m3/h); and after clarified water tank it will be about 0.283 m^3/s (1,020 t/h). The residual quantity of water at different stages will be released into the source river. This means the net withdrawal of water from the Shitalakhya River would be about 0.283 m^3/s (1,020 t/h), which is highly below the existing withdrawal and negligible percentage of existing dry season flow (83 m^3/s) of the river. The withdrawal of this noted amount of water from the Shitalakhya river in the dry season for this proposed Project will not have quantifiable impact on the flow of river, aquatic species of the river and will not pose conflict with other river water users.

Description of Baseline Environment: Environmental and social baseline has been prepared using both primary and secondary data collected for the proposed Project site and defined study area (10 km radius from the mid- point of the site). The baseline condition has been defined in respect of physical environment (e.g., including meteorological, hydrological, geological, environmental quality, components and processes), biological environment (e.g., including flora, fauna, and ecosystems, fisheries and agriculture) and socio-economic environment (e.g., demography, lifestyle, employment, cultural activities, economic status, and hazards of the study area).

The study area (31,415 ha) consists of flat topography and is vulnerable to occasional riverine flood. The Project site is situated at the elevation ranges between 7-12 m PWD. The major land uses of the area are: agricultural lands, followed by rural and urban settlements with homestead vegetation, water bodies, forest area, industrial area, roads, char lands and etc. According to the new Bangladesh National Building Code (BNBC), the Project site is on the borderline of Seismic Zone II and has a mediocre vulnerability for earthquake with a risk of possible magnitude of 6 on Richter scale.

The Shitalakhya River is the only surface water source that flows beside the site, with an average lowest discharge flow of 83 m^3/s during dry and the average highest discharge flow of 1,181 m^3/s to 1,066 m^3/s during monsoon. The average maximum and minimum water level varies seasonally from 1.24 m PWD to 5.86 m PWD respectively. The highest water level was recorded 7.84 m. PWD in 1988, which was an extreme flood event in Bangladesh. As the site elevation ranges from 7-12 m PWD, the proposed site is not vulnerable to flooding unless any extreme natural hazard occurs in future. The river inundates nearby agricultural lands during monsoon and remains navigable round the year. An analysis of the average minimum water level (1981-2017) of the Shitalakhya revealed a minimum depth of 4 m in the whole reach of the river throughout the year. The tendency of the river erosion is very low. The average depth of the shallow tube well in the project area is 61 m (200 ft).

During October-March (Cluster 4 and 1), wind blows from northwest to southeast direction, inclined towards east; and from April to September (Cluster 2 and 3) wind blows from south and southeast to north and northwest.

Exceedance of Bangladesh National Standards and WHO Guidelines for 24-hr (PM_{10}- 300 and $PM_{2.5}$- 208 $\mu g/m^3$) are found in the ambient concentrations for PM_{10} and $PM_{2.5.}$ Other parameters are found well below within the WHO guidelines (113 $\mu g/m^3$) and Bangladesh National standard.

Ambient noise levels were measured at 14 locations including 13 sensitive receptors inside and outside PUFFL. Noise levels varied between 48.1 dBA to 78.1 dBA during the day time and between 42.7 dBA to 65.7 dBA during night time. The noise levels inside the PUFFL residential area have exceeded the standard level during day and night time.

Surface water quality parameter like DO is inferior to the standard while COD and iron (Fe) are beyond the acceptable limit at some locations. Other parameters of the water quality are within the acceptable limit. The pH at intake point was around the upper limit of the ECR 1997. For groundwater, most of the water quality standards fell within the recommended level set out in ECR 1997, except for iron levels.

The Project site is located within the existing premise of PUFFL having plant facilities, civil structures, trees, bushes, etc. Crop fields are located around 1.5 to 2 km away from the site. There is about 14,000 ha of agriculture land which produces about 120,720 tons of crops annually of which rice is approximately 49,462 tons (40%) and non-rice- approximately 71,258 tons (60%). The cropped area is mostly irrigated by the power plant water while on the other side of the river crop land irrigation is done using low lift pump (LLP).

The project site contains two ponds and a lagoon. The ponds are poorly managed and the lagoon does not have any kind of fishing activity. The study area has both capture and culture fishery. The estimated area of fish habitats in the study area accounts for about 7,000 ha (capture fishery about 90% and culture fishery about 10%). The estimated yearly total fish production is about 3,546 tons (culture fishery, about 66% and capture fishery, about 34%)). The indicator fish species of the river are Kalibaush (*Labeo calbasu*), Chital (Chitala chitala), Batashi (Pseudeutropius atherinodes), Golsha (Mystus cavasius), Gheor (Clupisoma garua), Punti (Puntius spp.), Narkeli chela (Salmostoma bacaila), etc.

The project site is located in two Bio-ecological Zones: a) Brahmaputra-Jamuna Floodplain and b) Madhupur Sal Tract. The project component site mainly comprises terrestrial ecosystem having moderate biodiversity. A large number (about 3,750) of small to big-sized trees, mostly saplings, exist in the site are to be cut down during site preparation releasing

approximately 1,239 t/ha of carbon to the atmosphere. There are some indicator wildlife in the site which include Bengal Fox (*Vulpes bengalensis*), Civet Cat (*Viverra zibetha*), etc. The Shitalakhya river is an Ecologically Critical Area (ECA) passes beside the project site. The indicator mammal species of the river is river dolphin (*Platanista gangetica*).

The total population is about 526,463 where 49.7% are male and 50.3% female with an average population density of 2,088 per square kilometer while the national average is of 1,055 per square kilometer. Only around 29.5% of the total population of this area is economically active. The employment rate is 51.6%, whereas the unemployment rate is 48.4%. About 84.5% households are under electricity coverage. Drinking water supply is met mostly from tube wells (92%) and the rest 3% from open water bodies. There are six ethnic communities namely Bamon, Coach, Garo, Barmon, Chakma and Marma are living in the study area but there is no ethnic community in close proximity to the Project site.

Environmental and Social Impacts: The major beneficial impacts of the project include the augmentation of generation capacity of the urea fertilizer; decrease specific-relative consumption of natural gas and water; improvement of the socio-economic condition and lifestyle of the country's population. A large number of employment opportunity will be created at different phases of the Project. Employment opportunity for 400 people will be created during Demolition phase, 600 people during site preparation phase, 4,000 people during construction phase and 1000 people during operation phase.

Odor of ammonia (NH_3) will not be persisted in the operation period of the Project for which local people will feel soothing in terms of present condition.

Major significant adverse impacts anticipated from the proposed project activities include inhalation of airborne asbestos fiber during asbestos cement sheet demolition and handling, elevated noise level from the operation of heavy equipment, injuries arising from civil structure demolition and construction activities, shifting of wildlife habitats due to clearance of vegetation in the project site, reduce potentiality of 1,239 t/h of carbon sequestration due to cutting down of trees during site preparation and labor camp induced sanitation and social stresses. Fish, which cannot sustain the intake velocity (0.51 m/s) of water may be entrained and damaged.

It is expected that noise levels in the Project area would increase during demolition activities and construction and hoisting of new equipment. A simulation study of the noise propagation is done by using SoundPlan Essential Software during the operation of the proposed plant. SoundPLAN is the widely used modeling software for noise propagation simulation in research and consultancy services. A number of standard processes can be calculated through this SoundPlan model. The ISO-9613 calculation process is used for this modeling purpose.

During baseline study, equivalent noise level at 14 locations have been monitored both day and night period in order to assess the background noise situation. The receptors are classified based on sensitivity of the receptors. As per the noise level monitoring records, it can be concluded that the existing ambient noise level at five locations i.e. PUFFL colony mosque (R-5), PUFFL colony Main Gate (R-6), UFFL Main gate (R-7), Near Titas Gas Distribution (R-8) and Nargana Purbo Para School (R-14) are exceeds the standard noise limit (ECR, 2006 and IFC, 2007) especially during day period.

After the modeling study, the predicted noise level of at the receptor point are estimated both day and night time. At some places, the resultant noise level might be exceeded the standard limit both of ECR, 2006 and IFC, 2007 especially at the places where the background noise level recorded was initially higher. But this proposed project will not increase significant noise

level at any of the receptor points. However, generation of impulse noise in short period of time especially during startup and shutdown may affect the community people for a short period of time.

Emissions from the existing two fertilizer factories are mainly responsible for increasing NH_3 at the ambient environment. These factories also influence the increase of NOx and particulate matters especially PM_{10} of the proposed project airshed. At present, the baseline concentration of the NOx, NH_3 and PM_{10} has been measured for 24-hr continuously at the potentially impacted locations and sensitive places. The average 24-hr concentration of NOx is recorded 35-48 µg/m³, NH_3 is around 34-733 µg/m³ and PM_{10} is 96-145 µg/m³. Two existing fertilizer factories are operating in normal stage during the sampling period. However, the present concentration of NOx, NH_3 and PM_{10} are recorded within the limit of national (ECR, 2005) and international (IFC 2007) standard.

In order to predict the air pollution during operation of the proposed Project, an air dispersion modeling study has been conducted which includes 20kmx20km grid with one hour interval annual atmospheric data, topographical effects, land use and land cover status. USEPA regulatory model AERMOD is used to predict the effects of air pollutants (NOx, NH_3 and PM_{10}) on the ambient air quality in the airshed. A Tier-2 (Ambient Ratio Method) modeling approach is used for NO_2 prediction. In addition, two different methods are used to predict the 1-hr NO_2 compliance concentrations; USEPA method and EU method.

Based on the Sensitivity of the location around 11 ambient sensitive receptors have been pointed for assessing the air pollution level during operation of the proposed fertilizer factories. Reformer, boiler and granulation stack are the main sources of the emission and the rate of emission and stack features have been confirmed by the feasibility study. However, the predicted ground level concentration of the pollutants have been assessed for different averaging time in order compare with the standard.

During operation period, the maximum ground level NOx for 1-hr and annual averaging are predicted to be 141.4 µg/m³ and 4.7 µg/m³ respectively. If the maximum background measured concertation would add with the predicted maximum GLC of NOx for 1 hr, the resultant concentration would be utmost 190 µg/m³. Both baseline and operation stage NOx level will be within the national and international standard limit.

For NH_3, the predicted maximum ground level 24-hr and 24-hr averaging values are found to be well within the national standards (ECR, 1997). The maximum background concentration of NH_3 in the project area is found to be 733 µg/m³ for 24-hr averaging period which will be increased utmost 753 µg/m³. Demolition of the existing Polash Fertilizer factories, shutdown of Ghorashal existing fertilizer factories and implementation of state-of-art technologies of proposed fertilizer factories will definitely reduce the ambient ammonia concentration in the study area.

Granulation stacks are the key sources of emission of PM_{10} into the ambient environment. During operation stage PM_{10} will contribute maximum 7.8 µg/m³ for 24hr and 1.8 µg/m³ for annual at the ground level. Increasing background concentration of PM_{10} will breach the standard limit during operation stages of GUFFP. A number of other sources like paved or unpaved road, vehicular transportation, power plant operation, bricklins and other fugitive sources are responsible for exceedance of the PM_{10} of the project airshed.

Mitigation of Impacts: The proposed GPUFP has considered a number of environmentally friendly components and technologies, such as, closed cycle cooling, water/effluent treatment system, energy, water and air efficient technology, etc. Moreover, an asbestos cement sheet

pit or disposed of from the site, a well-designed and higher capacity drainage system and a temporary storage facility for scrap materials are to be developed. The mitigation measures proposed during pre-construction (demolition and site preparation), construction and operation phases are as follows:

Pre-construction Phase (Demolition and Site Preparation)

Asbestos Cement Sheet*:*

- The asbestos disposal site will be protected by a three meter high GI sheet to prevent trespassers coming into close proximity of the sheets.
- The workers should use the appropriate PPEs during dismantling tin-shed asbestos cement sheets.
- Workers must follow the OHSAS 18000 guideline and observe onsite safety precautions regularly.
- Water spraying should be done on all asbestos containing materials in the morning especially before commencing the work and subsequently when required to prevent asbestos particles disperse in the ambient air.

Water quality:

- Proper installation of water management system i.e., water proofed dyke, water proofed slope, water drains and tanks.
- In addition, a secondary drain and collection tank should be installed at the outskirt of the primary water dyke to prevent water leakage to nearby areas.

Occupational health and safety:

- Proper health and safety training to handle equipment and hazard identification must be provided to the workers before commencing work, especially demolition activities.
- The health and safety officer should ensure that the equipment and safety control mechanisms are working properly before commencing the work. If faulty equipment are identified, it must be replaced promptly.
- An on-site medical team should be available and emergency first-aid kit should be at hand in case of the occurrence of any accidental injuries (burns, cuts, broken bones etc.).
- The workers should use the appropriate PPEs and wear appropriate cloths/glasses during demolition.
- Workers hygiene and health status must be ensured. Monthly health check ups should be conducted and appropriate treatments for any ailments should be provided.
- The contractors should ensure all types of compliance issues for the workers during the course of the demolition and construction process, as per Bangladesh Labour Act, 2006.
- During site preparation, water spraying facilities must be arranged for avoiding dust dispersion.
- Throttled down the machinery should be ensured if not in use.

Hazardous solid waste handling:

- At first, asbestos containing wastes should be segregated from other solid wastes before disposal. The contractor must establish the means to prevent any potential

dispersion outside the designated asbestos disposal area during handling and disposal operations.

- Finally, in presence of the official of BCIC, the asbestos containing disposal site is to be sufficiently covered to ensure complete coverage of the disposed asbestos and prevent re-exposure during continuing disposal operations. During this operation, the workers must follow the guidelines of OHSAS 18001 for hazardous waste management.

Labor migration:

- Awareness should be created on HIV/AIDS infection and diseases through a well-designed campaign and implementation plan targeting all risk-prone groups;
- Behavior Change Communication (BCC) should be carried out amongst target groups;
- A referral healthcare facility should be established;
- Serious cases of infection should be referred to a specialized treatment facility;
- Women should be empowered through employment in the construction work;
- Frequent medical check-ups should be done in order to control the spread of diseases. Emergency medical services and adequate first aid facilities should always be available at the site.

Construction Phase

Aquatic habitat quality:

- Dredging operation should be carried out in the route having minimum aquatic habitats. Appropriate benthic survey must be carried out prior to any dredging activity.
- The shipping company must ensure that the ship carrying construction materials and other raw materials, obey the appropriate International Maritime Laws as applicable.

Dust and gases generated from excavation, construction equipment, and vehicles:

- Casing will be used when buried pipes cross a road.
- Trench should be carefully dug / excavated so that the pipe is evenly bedded throughout its length with sufficient joint holes and trial holes made where necessary.
- Pipeline should be evenly bedded upon the bottom of the trench throughout its length and should be correctly positioned, before any back filing is performed.
- Compaction of back filling material should be performed by an approved method to prevent any subsequent settlement.

Noise level:

- The machines/equipment/vehicles should be turned off when not in use.
- PPEs should be used during construction work.

Water pollution:

- Oils, lubricants and other hazardous materials should be bounded and stored separately so as to limit the spillage.
- Workers should be trained on safety precautions on using/handling such hazardous materials.
- The workers should be encouraged to use PPEs every time when handling oils, lubricants, chemicals and other hazardous materials.

Health and safety hazard:

- Proper health and safety training on hazard identification and handling hazardous equipment must be provided to the workers.
- The health and safety staff of the contractor must ensure that the equipment and safety harnesses are working properly. On identification of faulty equipment, they must be promptly repaired or replaced.
- An on-site medical team should be set up and emergency first-aid kit should be at hand in case of any accidental injuries (burns, cuts, broken bones etc.).
- The workers should use appropriate PPEs.
- Workers hygiene and health status should be ensured. Monthly health check-ups should be conducted to monitor their health condition and appropriate treatments should be provided for any ailments.

Fire hazards from welding:

- All arc welding and cutting operations should be shielded by noncombustible or flameproof screens.
- In addition, the welders should use appropriate PPEs and welding trucks should be equipped with approved fire extinguishers and first aid.

Storage space and visual effect:

- Rubbles generated from the construction site should be stored in appropriate bins/skips, should be well-covered and later should be buried in an approved landfill site.
- All solid wastes, hazardous and non-hazardous, should be stored in designated sites prior to final disposal.

Operation phase

Maximum ground level concentration of air pollutants:

- Regular overhauling of machinery should be done as per planned schedule for controlling air pollutants.
- High officials of BCIC should take the initiative at policy level to limit emission from the adjacent Power Plants.
- Regular sampling of gaseous emissions should be done and tested in the chemical laboratory. The result should be disseminated to the Plant Managers for necessary action if exceedance is found.

Noise level inside the control room, administrative buildings:

- A two point five (2.5) m high brick +0.75m barbed wire boundary walls should be constructed and plantation should be grown to attenuate noise in the sensitive receptors.
- Doors of the control room, windows and other doors should be fitted with proper insulation to attenuate noise.
- The machines/equipment/vehicles should be turned off when not in use.
- The noise generating components of ammonia and urea process plants, pumps, fans etc. should be covered with soundproof dampeners if possible to limit the spread of noise.

- Greenbelts should be developed around the proposed Project area to limit the spread of noise to the nearby community and aslo to add aesthetic value.
- Workers should use appropriate PPEs (sound proof earpiece, earmuffs, etc.) while working close to the noise generating equipment.

Pollution of receiving water bodies:

- A leak-proof scientific pit should be constructed to store sludge coming from the Waste Water Treatment System (WWTS). The dimension of such pit should be at least 100 m X 50 m to limit any spillage.
- The sump should be monitored and maintained by on board chemist and technicians and they should ensure everything (e.g. pollutant content, spill control etc.) goes smoothly.
- In addition, sewage should also be treated through Sewage Treatment Plant (STP) and discharge standards should be followed according to the GoB and IFC guidelines as applicable.

Risks and emergencies:

- Aboveground pipes and fittings should be protected against corrosion by means of external corrosion resistance painting.
- Holiday detector shall be used to detect any hole in the pipe coating or holiday and should be repaired.
- Cathodic protection test points should be installed and connected to temporary cathodic protection facilities in accordance with the specification as the final operation of lowering or tie-in is in progress.
- An inspection should be conducted after all the installation activities and before back-filling.
- Cleaning regime should include a combination of on-line cleaning and semi-annual off-line washing.

Environmental Management Plan: The Environmental Management Plan (EMP) includes several plans for implementing mitigation and enhancement measures, emergency response, occupational health and safety, and Environmental Code of Practices. Generally, the impacts, which are minor or moderate, are to be mitigated by adopting Environmental Code of Practices (ECP) and Contractor's good practices during project implementation. On the other hand, impacts and risks which are critical or major will be mitigated or prevented by adopting mitigation measures. The contractor would prepare and implement the mitigation measures, which will be supervised by the proponent, PIU or a Health and Safety Officer as required. The total estimated cost of implementing the EMP will be about USD 2.94 million.

Emergency Response Plan: As part of the EIA, an Emergency Response Plan (ERP) has been prepared and presented in a separate volume of the Report (Volume 2). Each Contractor, after assessing potential emergencies that could be encountered during construction phase, would prepare site specific ERPs (guidance taken from the ERP proposed in this EIA) and would include them in their Construction Environmental Action Plan (CEAP). The CEAP would be submitted to the Owner's Engineer (OE) and Project Implementation Unit (PIU) for review and approval before contractor mobilization.

Hazard and Risk Assessment: Potential hazards during demolition might include mechanical hazards, such as, falling debris or machineries, fall from heights, cuts, burns etc.; inhalation

of asbestos dust etc.; non-functioning of equipment and safety gears and; road accidents. Potential hazards during the construction stage might include leakage of flammable natural gas, leading to explosion and fire hazards. Finally, during the operation phase, potential hazard might also include leakage of gas (natural gas, NH_3, etc.) and other toxic compound, leading to fire hazards, explosion and human toxicity.

Environmental Monitoring Plan: Various monitoring programs have been proposed in the EIA, which include compliance monitoring, impact monitoring, and external or independent monitoring. The objective of this monitoring program is to ensure that the various tasks detailed in the environmental management plan, particularly the mitigation measures are implemented in an effective manner, and also to evaluate the project's impacts on the key environmental and social parameters. The total estimated cost of monitoring would be around USD 0.59 million.

Institutional Arrangements and Capacity Building: In order to implement the EMP as proposed in the EIA, an effective PIU with dedicated staff would be of crucial significance. For effective and meaningful implementation of the EMP, it was recommended that one Deputy Manager (EHS) and one Sub-Divisional Engineer/Assistant Engineer (Environment), with requisite training and practical experiences in implementing and/or monitoring environmental, health and safety (EHS) issues pertaining to chemical sector, need to be recruited. The Deputy Manager (EHS) would be supported by one Sub-Divisional Engineer/Asst. Engineer (Environment). An effective Environmental Health and Safety Unit (EHSU) with experienced and dedicated staff were also suggested, which include:

- One Deputy Manager, for environmental health and safety;
- One Sub-Divisional Engineers or Assistant Engineers with Environment background under deputy manager environment;
- One medical officer, two assistant medical officer, four nurse and four office associate;
- Environment engineers and occupational health and safety officers must have qualifications in their relevant areas of expertise; and
- An EHS Consultant to support EHSU in environmental, health, and safety aspects of the project implementation.

Capacity building training to strengthen the PIU and EHSU of GPUFP staff in the field of environmental management and occupational health and safety was also proposed. Finally, two grievance redress committees (GRCs) would be formed comprising of local grievance redress committee (LGRC) and project grievance redress committee (PGRC). Their aim would be to resolve most of the grievances at LGRC within seven (7) days of receipt of compliant with a few of them being forwarded to PGRC.

Public Consultation and Information Disclosure: People are, in general, in favor of this project as it would create employment opportunities for skilled, semi-skilled and unskilled people. Implementation of this project would also alleviate the existing odorous problem around the lagoon generated from lagoon when ammonia mixed effluent injects into it. It would also alleviate the community from being counting loss from aquaculture and open water fishing as well as due to release of ammonia gas as currently happening from the fertilizer factory. It would also help in elevating the Bangladesh's standard of living because of the increased production of Urea fertilizer would give more coverage of urea fertilizer-based crop cultivation, contributing to further agro-based industrial set up (which further leading to more employment opportunities). Although GPUFP will not have any contribution to environmental pollution,

people are, however, concerned about the atmospheric pollution like gaseous emissions, effluent discharge etc.; particularly from the quick rental power plants like Agreeko, Max Power Plant, etc. located nearby the project site. Hence, they strongly demanded mitigation measures and an effective plan to minimize such impacts. Accordingly, the EIA had proposed mitigation measures to alleviate the above mentioned issues and concerns, its implementation plan, monitoring plan and the required budgets. The major findings of the public disclosure are as follows: local people are very much supportive to the Project with some observations like widening the road passes beside the PUFFL Colony if existing road is closed for the public accessibility, avoid reappearance of NH_3 odor, avoid discharge of untreated effluent and engage local people in different phases of the Project activities.

Finally, the EIA, documenting the mitigation measures and consultation outcomes, is available for public review at BCIC and the lender's websites for easy access.

Conclusions and Recommendations: It can be concluded that the new urea fertilizer factory with state-of-art technology will be more environmentally friendly compared to other similar factories of Bangladesh. In addition, the Plant will substantially reduce greenhouse gas emissions during its entire lifetime.

Stakeholder enegagement in the study procee revealed that people of all walks of life are in favour of construction and implementation of the Project. Based on the findings of this assessment, CEGIS is of the opinion that the proposed fertilizer factory EIA to be approved and an ECC to be issued in favour of the project on the basis of the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the EIA Report and EMP being implemented.

1. Introduction

1.1 Background

1. Supplying food and nutritional demand of the country is a national goal. Special emphasis has been given on modernizing agriculture based on appropriate technology. Various reform measures have been taken for ensuring the availability of related agricultural inputs including all kinds of fertilizer. The Urea fertilizer is used for all types of rice cultivation. Urea constituted about 54% of all fertilizers in 2012-13 and historically it was above 60%. Present domestic production cannot meet the total demand of Urea (2.44 million MT), currently meeting only about 31% of demand (Table 1.1). The shortage is compensated by imported urea. The installed capacity of existing six urea fertilizer factories under BCIC is about 2.80 million MT per annum. But due to suspension and rationing of gas, aging and rise in down time older factories cannot sustain the production at installed capacity and gradually the production has been decreasing.

2. The annual production of Urea in 2017-18 is only about 0.76 million MT. Shortfall against the consumption of urea would be about [1.68+(0.30 million MT from shut down of UFFL and PUFFL)= 1.98 million MT] in the light of the consumption pattern during the last five years.

3. Realizing the importance of sustainable agriculture and meeting up the increasing demand, the Government of Bangladesh (GoB) is going to establish a new modern, energy efficient Urea Fertilizer factory with the nameplate capacity of 2,800 TPD (Ton Per Day) of Granular Urea, which annually stands about 0.924 million MT. With this new production, the deficit of urea fertilizer will be reduced to about 1.05 million MT (Table 1.1), which indicates the need of construction of more urea fertilizer factory.

Table 1.1: Urea production statistics of existing plants and GPUFP

Particulars	Quantity (in MT)	Quantity (in Million MT)
Existing Urea Fertilizer Plants		
Installed Capacity (Six Plants)	2,795,060	2.80
Present Production (2017-18)	764,006	0.76
UFFL and PUFFL (2017-18)	**297,000**	**0.30**
Demand (2017-18)	2,442,800	2.44
Shortfall/Deficit	1,678,794+**297,000** =1,975,794	1.68+**0.30**=1.98
Production function of Demand (%)	31.3	-
Proposed Urea Fertilizer Project		
Particulars	**Quantity (in MT)**	**Units**
GPUFP	2,800	TPD
Stream days	330	Day
Total production=	924,000	TPY
	0.92	Million Ton
Shortfall/Deficit	1.05	Million Ton

Source: BCIC, 2019

4. BCIC has therefore entered into an Agreement with CEGIS on 16th October 2018 for the tenure of three (03) months for conducting the Environmental Impact Assessment (EIA) of

the proposed Project to obtain the IEE clearance certificate and EIA approval from the Department of Environment (DoE) by following the existing environmental rules and regulations.

5. Since the proposed Project is located on the same platform within the same boundary of the existing factories, the site clearance certificate may not be required from the DoE. The proponent i.e., the BCIC, has obtained site clearance certificate and approved Terms of Reference (ToR) from DoE for conducting the EIA study of the proposed Project (**Appendix 1.1**).

6. CEGIS, as per the Agreement signed, has prepared a detailed methodology for conducting the EIA study and deployed a multidisciplinary team with relevant expertise to conduct the reconnaissance field visit to the proposed Project site in Ghorasal. This reconnaissance visit was carried out during 31 October to 1 November, 2018. Based on the review of the ToR and outcomes of the reconnaissance visit, this report focuses on the scopes of work (including issues that merit further discussions between BCIC and CEGIS to carry forward the process), methodology of conducting the work, field findings, utilization of services of various professionals, periodic communications and consultations with the BCIC regarding data and information about the various components of the existing factories as well as reporting.

7. The major outputs of the study is the EIA report including Environmental Management Plan (EMP), Monitoring Plan, Emergency Response Plan (ERP) and Grievance Redressal Plan (GRP).

1.2 Objective of the Project

8. The overall objective of the Project is to set up a new, modern, energy efficient and higher capacity Urea Fertilizer Factory. The specific objectives are:

- To ensure availability of urea fertilizer to the farmer at lower cost, meet up the growing Urea Fertilizer demand in the country and thereby ensuring food security of the country;
- To reduce the import of urea fertilizer and save hard-earned foreign currency; and
- To create employment opportunity.

1.3 Targets

By fulfilling the set objectives, the Proponent intends to meet the following targets:

- To produce 2800 TPD (9,24,000 TPY) of Granular Urea;
- To create employment opportunity about 968 persons;
- To save yearly approximate Tk.1075.39 crore equivalent foreign currency; and
- To reduce greenhouse gas emission through the Recovery of CO2 from Primary Reformer Flue Gas at the rate of 240 TPD for supplementing the requirement of carbon dioxide for urea synthesis.

1.4 Brief Description of Project

9. The nature of the proposed “Ghorasal Polash Urea Fertilizer Project (GPUFP)”, hereinafter termed as ‘the Project’ is a chemical fertilizer factory with cogeneration of power

for its captive use. It is a natural gas-based 2,800 TPD capacity Granular Urea factory, which is equivalent to about one million ton per year (330 stream days).

10. Proposed project comprises of Granulated Urea (2,800 TPD), Urea (2,800 TPD) and Ammonia (1,600 TPD), a 2X32 MW capacity Steam Turbine Generator (STG) and a 9 MW Gas Engine Generator (GEG) Power Plant.

11. A consortium of Mitsubishi Heavy Industries Ltd. (MHI) of Japan and China National Chemical Engineering No.7 Construction Company Ltd. (CC7) is the EPC contractor for constructing the factory. The proposed Project is a new, modern, energy efficient and higher capacity Urea Fertilizer Factory in place of the old and inefficient Urea Fertilizer Factory Ltd. (UFFL) and Polash Urea Fertilizer Factory Ltd. (PUFFL). The information of the existing UFFL and PUFFL are attributed in the **Appendix 1.2.** The proposed Project site is located inside the premise of PUFFL. The site is a raised land of about 110 acres having old buildings and large open space with vegetation coverage. The site also includes the lagoon situated adjacent to PUFFL where urea factories discharge untreated or limited treated effluent. Most parts of the lagoon (about 28 acres of 34 acres) will be filled up by the dredged materials of the nearby Shitalakhya River. So, land acquisition as well as other associated issues like resettlement activities are redundant in this case.

12. The site comprises of herbs, shrubs, trees, a number of old civil structures like administrative buildings, health center, warehouse, club, canteen, rail line, road, etc. The buildings are mostly vacant while some are functioning as office, store and pump house. These buildings need to be demolished, shrubs and trees to be cut and two ponds need to be filled. The major project units are:

Sl. No.	Project Units	Sl. No.	Project Units
1	Ammonia Plant	4	Power Plant
2	Urea Plant	5	Other auxiliary and ancillary units
3	Urea Granulation Plant		

Ammonia Production

13. Ammonia is basically produced from water, air and energy. The energy source is generally natural gas/ hydrocarbon that provides hydrogen for fixing the nitrogen. The other energy input is required for steam and power. Steam reforming process of light hydrocarbons particularly Natural gas is the most efficient route for production of Ammonia (NH_3). It may be mentioned that production of Ammonia from natural gas is the best option in respect of Carbondi Oxide (CO_2) emission.

Granulated Urea Production

14. Urea is made from ammonia and carbon dioxide. The ammonia and carbon dioxide are fed into the reactor at high pressure and temperature, and the urea is formed in a two-step reactions. The urea contains unreacted ammonia (NH_3) and CO_2 and ammonium carbamate. As the pressure is reduced and heat applied the ammonium carbamate decomposes to NH_3 and CO_2. The ammonia and carbon dioxide are recycled. The urea solution is then concentrated to give 99.6% w/w molten urea, and granulated for use as fertilizer and chemical feedstock.

Requirement of Natural Gas

15. Urea can be manufactured from several different hydrocarbons. In case of the proposed Project, Natural Gas has been chosen as the raw material and energy for the Plant.

16. The estimated requirement of natural gas is about 66 MMSCFD for the proposed Project with the capacity of 2,800 TPD of Urea. This gas will be used as raw material (feedstock) of Ammonia Plant and fuel of the Power Plant (2X32 MW Steam Turbine Generator (STG) and 9 MW GEG. Currently, about 64.7 (UFFL- 48 and +16.7) MMSCFD gas is being supplied to UFFL and PUFFL from the City Gate Station (CGS) of Titas Gas Transmission and Distribution Company Ltd. (TGTDCL) located at UFFL area. So, the basic infrastructure is there to supply gas to the proposed plant. However, following two issues has to be ensured:

a) Contract with TGTDCL for supply of gas up to the Plant life; and

b) A hookup line from CGS to the proposed plant with ancillaries.

17. Currently, 900 TPD of Urea is being produced together from both UFFL and PUFFL with 64.7 MMSCFD gas. With almost the same connected load of gas 2,800 TPD of Urea is expected to produce in the proposed GPUFP. This will be a big saving of gas and compliance of National Energy Policy of Bangladesh (1995).

Power Plant

18. The proposed Project will have a 2x32 MW STG and a 09 MW GEG power plant as captive power plants for its day to day use. Only in case of emergency the plant will draw power from the national grid. Cooling of condenser and other heat exchangers will be done by surface water from the Shitallakhay River using a cooling tower.

19. The power plant will receive required gas for generation of 73 MW electricity (2x32 MW STG + 09 MW GEG Power Plant) from the already allocated gas for existing fertilizer factory units by the TGTDCL. Normally one STG will be operated and GEG will be used for meeting power requirement for safe shutdown of the complex in case of total power failure.

20. The major air pollutants that are produced from a fossil fuel-based Power Plant are SO_x, NO_x, CO_2, CO and SPM. The proposed plant is a natural gas-based Power Plant. Natural Gas of Bangladesh contains negligible percentage of sulphur and hence formation of SO_2 would be insignificant. NOx may be generated during fossil fuel combustion at temperatures above 1300^0 C if corrective measures are not applied. The possibility of NOx generation by GEG is unlikely as the combustion temperature will be below 1300^0 C. Moreover, the GEG with the capacity of 9 MW will only operate during start-up time.

21. Substantial reductions in emissions of CO_2 could be achieved due to high efficiency of burning in modern boilers i.e., burning less fuel for the same megawatt of electricity generation.

22. Moreover, development of green belts in and around the project site will also greatly reduce CO_2 from the environment. For continuous flue gas pollutant monitoring, different electronic analysers like CO_2 analyser, NOx analyser, etc. shall be installed in analyser room of the chemical laboratory.

1.5 Objectives of the Study

23. The overall objective of the EIA study is to ensure that potential environmental and social impacts associated with development of the Project are identified, assessed and managed appropriately to meet the compliance requirement of the Government of Bangladesh (GoB)[1] and the World Bank Group (WBG). Mitigation measures are then developed and incorporated into the project to eliminate, minimise or reduce adverse impacts and, where practicable, to enhance benefits.The specific objectives are:

- To prepare a detailed environmental and social baseline situation;
- To predict and evaluate possible environmental and socio-economic impacts;
- To delineate Environmental Management Plan and Monitoring Plan;
- To develop Emergency Response Plan; and
- To prepare Grievance Redressal Mechanism.

1.6 Need of the Study

24. The Urea Fertilizer Factory construction Project generally falls under 'Red Category" defined by the Department of Environment. This requires Initial Environmental Examination (IEE) followed by a detailed Environmental Impact Assessment (EIA) study orderly for issuing Site Clearance Certificate (SCC) and the Environmental Clearance Certificate (ECC) as per Section 12 of the Environment Conservation Act, 1995 (Amended Section 1 in 2000) and Environmental Conservation Rules, 1997. Since the Project site belongs to existing premise of PUFFL, so Site Clearance has been waived as well as IEE study has been exempted and ToR for conduction of EIA study has been approved by DoE. This study has identified and evaluate potential impacts of the proposed Urea Factory on environmental and socio-economic conditions in pre-construction, construction and operation phases. A detail Environmental Management Plan (EMP) has been proposed to mitigate the Project induced negative impacts. It is expected that the study will facilitate the planning and design of the proposed Project in more environment friendly manner so that implementation of the Project exerts lesser negative impacts and generate greater benefits. The study would, therefore, contribute in better understanding of the whole range of environmental and socio-economic dimensions of the proposed interventions and help the BCIC to be judicious in implementing the activities that are outlined in the Project and realize the Project objectives.

25. According to Equator Principle [EP-1: Review and Categorization], based on the nature, scale, stage of the project, reversibility, and environmental and social risks of the proposed Ghorasal Polash Urea Fertilizer Project (GPUFP) falls under 'Category B'.

1.7 Scope of EIA Study

26. The EIA study aims to explain the legal context through identification of statutory requirements of law of the land, following the guidelines of the DoE and the World Bank Group's (e.g., JBIC, HSBC and MIGA) Environmental and Social Framework (ESF) and International Finance Corporation (IFC) guidelines including health and safety guidelines,

[1] The GoB requires 2 stages environmental assessment as per the Environment Conservation Act 1995 and Environment Conservation Rule 1997: (i) initial environmental examination and site clearance; and (ii) environmental impact assessment and environmental clearance.

against which the Project interventions are to be judged. Detailed assessment and evaluation of potential environmental and socio-economic impacts of the Project has formed the basis for designing the EMP.

- Task 1: Description of the proposed Project;
- Task 2: Analysis of alternatives;
- Task 3: Description of the Environment (baseline situation);
  - Physical environment (Land resources, topography, climate and meteorology, hydrology, environmental quality, etc.);
  - Biological environment (Agricultural resources, fisheries and ecological resources); and
  - Socio-cultural environment (Social, cultural and archaeological issues).
- Task 4: Policy, rules and regulatory framework;
- Task 5: Identification, selection and rationalization of Important Environmental and Social Components (IESCs) or Valued Environmental Components (VECs) likely to be impacted by the interventions;
- Task 6: Determination of potential environmental and social impacts of the proposed Project;
  - Pre-construction (including Demolition) phase;
  - Construction phase; and
  - Operation phase.
- Task 7: Cummulative impact assessment;
- Task 8: Conduction of consultation meetings with the local stakeholders;
- Task 9: Development of an Environmental Management Plan (EMP) including Monitoring Plan;
- Task 10: Development of Emergency Response and Disaster Management Plan;
- Task 11: Risk and Hazard Assessment; and
- Task 11: Conduction of Consultation and Disclosure Meeting and Grievance Redress.

1.8 Study Limitations

27. The time allotted for completion of the study is in total three (03) months, which is extremely inadequate to cover all issues in great details and thus may become limiting factor to realize all the outputs of highest scientific standard. For example, according to the World Bank Standard covering the JBIC, HSBC and MIGA requirements and guidelines/instructions issued by the DoE, the EIA study should be carried out considering seasonal aspects of a complete hydrological cycle. However, in the DoE instructions there are provisions that in case of priority projects and emergency of work, EIA might be carried out in a limited time frame covering parts of both dry and wet seasons if possible or otherwise use secondary data from authentic source(s). The current study will take the above noted timeframe as reference in conducting the EIA and present the results for acceptance by all parties including the DoE.

28. A DoE approved Terms of Reference (ToR) of the EIA study has been appended with this report in **Appendix-1.1** based on which the study has been conducted and prepared corresponding report for approval of the DoE. CEGIS expects BCIC to be proactive in soliciting DoE's cooperation for early arrangement of EIA approval procedure to avoid unexpected delay of beginning the construction activities of the project.

1.9 Methodology Followed

29. This environmental impact assessment followed a number of steps and process presented in Figure 1-1. The main steps are:

- Review of previous studies.
- Harmonization of Environmental Safeguard Requirements of the Government and the World Bank.
- Scoping, baseline environmental quality monitoring and ecological and fisheries surveys and finalization of the ToR for the EIA Study.
- Screening of impacts and prioritization.
- Expert consultations with scientific and professional community.
- Conduct focus group discussions in the project area.
- Public consultation with affected population, local government bodies, public representatives, NGOs and business communities to introduce the project components and anticipated impacts.
- Prediction of impacts/risks and prepare mitigation/enhancement measures by field investigation, data analysis, and mathematical modelling.
- Integration of environment with engineer's design.
- Preparation of Draft EIA Report, Environmental Management and Monitoring Plan, Civil Structures Demolition/Demolition Plan, and emergency response and disaster management plan.
- Present Draft EIA Report in Public Consultation Meetings and disclosure in the BCIC, to Lenders, and DoE websites for Public review and comments.
- Revise the Draft and update EIA Report, EMP, Civil Structures Demolition Plan, and emergency response and disaster management plan based on comments by the BCIC Advisor, DoE, the Lenders and the public at large.
- After incorporation of all comments, submit the Final EIA Report, EMMP, Civil Structures Demolition Plan, and emergency response and disaster management plan to DoE and the Lenders for Approval.
- Implement Civil Structures Demolition Plan during pre-construction, EMMP (including emergency response and disaster management plan) during construction and operation and maintenance (O/M) stages.
- Environmental auditing by assessing EIA process and feedback to future EIA Study.
- Implement measures beyond compliance.

30. Initial step of an EIA is the collection of primary and secondary data. Reviews of available literature from various sources, interviews of experts and representatives of agencies and institutions, and consultation with local stakeholders and site visits are conducted to collect baseline information for the Project site as well as for the study area. Important

Environmental and Social Components (IESCs)/Valued Environmental Components (VECs) are identified through scoping session based on the physical investigation, expert consultations and dialogues with local stakeholders. Setting up of boundaries is an important step, as this takes into account elements such as geographical boundary, time horizon for alternative actions and the affected groups, etc. The bounding is done with reference to IESCs/VECs which are covered under the scoping.

31. A number of methods have been used to conduct impact assessment for the EIA study. In this project, matrix methods by determining magnitude and sensitivity have been used to identify significance of impacts of the proposed Project. Mitigation measures of the identified significant impacts have been suggested and a comprehensive Environmental Management Plan (EMP) has been proposed for the EIA study. The unresolved critical issues and resolution of issues have been discussed in the EMP.

32. The EIA report of the proposed Project has been prepared to fulfil the requirements of Environmental Conservation Rules (ECR), 1997, its subsequent amendment 2005 and Noise Pollution (Control) Rules, 2006. The report was developed based on field observations and consultation with various stakeholders. This study was initiated with the collection of environmental and socio-economic data from secondary sources. The primary data and public opinions have been collected from the project site and the study area. However, most of the data, which were used for outlining the baseline condition, are from secondary sources, especially National Water Resources Database (NWRD) of WARPO archived in CEGIS, Fisheries Resources Survey System (FRSS), Soil Resource Development Institute (SRDI) and Repowering of Ghorasal Unit 4 EIA report prepared by CEGIS under the auspices of BPDB and funded by the World Bank. Remotely sensed satellite images were procured, processed, verified with field condition (i.e., ground truthing) and interpreted for enrichment of this EIA study. The various environmental standards considered in this report were based on the standards set out in the ECR, 1997, its subsequent amendment 2005 and Noise Pollution (Control) Rules, 2006, Environmental Health and Safety Guidelines of IFC, 2007, etc.

33. The baseline has covered a detail description of the ***physical environment, water resources, land resources, agriculture, fisheries, eco-systems*** and ***socio-economic*** conditions including identification of problems in respect of resources management.

34. Field visits were carried out for data collection as well as conducting public consultation and disclosures as suggested in the EIA guidelines of the DoE. Baseline situation of soil and climatic conditions (temperature, rainfall etc.) were established through the use of long term data that were at the disposal of different organizations like: Soil Resource Development Institute (SRDI), Bangladesh Water Development Board (BWDB), Bangladesh Small and Cottage Industries Corporation (BSCIC), Department of Fisheries (DoF), Department of Public Health and Engineering (DPHE), Bangladesh Meteorological Department (BMD), Department of Environment (DoE) and Upazila Offices of different agencies. Furthermore, as part of baseline primary data on air quality, water quality, micro-climatic parameters, fisheries, and ecological information were collected from the field. Most of the social and economic data have been generated from the census reports of the Bangladesh Bureau of Statistics (BBS). CEGIS's own database for different resource sectors, were also used in preparing the EIA report.

35. Data from secondary as well as primary sources on physical environment, water resources, land resources, agriculture, fisheries, eco-systems and socio-economic conditions

have been collected for assessing environmental and social impact of the proposed project and developing the environmental management plan.

36. In the impact assessment, various modeling software/tools were used for predicting parameters of different aspects of the physical environment. For the prediction of air quality, United States Environment Protection Agency (US-EPA) regulatory model AERMOD[2] has been used for air quality assessment. Also, for noise modeling, SoundPlan model, ALOHA for chemical exposure modeling and SWAT tool for hydrological and hydrodynamic analyses have also been used.

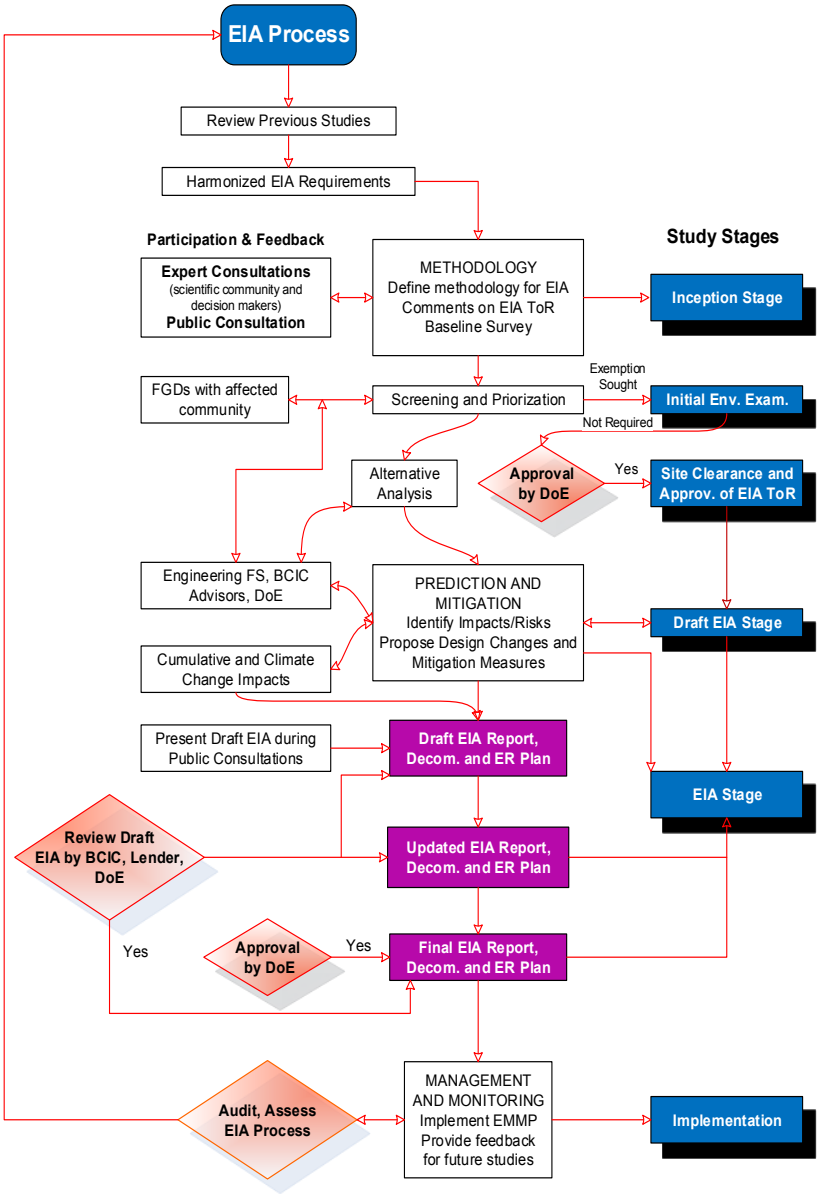


Figure 1.1: Steps of carrying out EIA study

[2] A steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

1.10 EIA Study Team

37. After obtaining the Notification of Award (NoA) on 16 October, 2018, CEGIS has mobilized a core group of highly skilled professionals as proposed in the Technical Proposal. Initiatives have been taken for accomplishing the study within the expected time-frame through formulation of an action plan, setting up of Project Monitoring Cell at the CEGIS office in Dhaka for providing all necessary logistics and technical support to perform required investigations and production of the reports.

1.10.1 Team Formation

38. A multidisciplinary EIA team has been formed as proposed in the Technical Proposal. The study team and their responsibilities as per Technical Proposal, is presented in **Table 1.2** below.

Table 1.2: Team Composition for the EIA Study

Sl. No.	Name of Professional	Position Assigned
1.	Dr. Kazi Md Noor Newaz	Team Leader and Environmental Expert
2.	Kazi Kamrull Hassan	Deputy Team Leader and EMP Specialist
3.	Nasir Ahmed	Chemical Engineer
4.	Dr. Maminul Haque Sarker	Morphologist
5.	Md. Sarfaraz Wahed	Hydrologist
6.	Mohammad Abdur Rashid	Agriculture Engineer
7.	Dr. Ashraful Alam	Fisheries Specialist
8.	Subrata Kumar Mondal	Sociologist
9.	Mr. Pronab Kumar Halder	Environmental modeler (air, water and noise)
10	Mir Fahim Shaunak	GIS and RS Specialist
11	Tanvir Ahmed	Hydrodynamic modeler
12	Rafiqul Islam	Chemist
13	Sharmin Akhter	Research Consultant

39. In addition to the above mentioned professionals some additional professionals listed below are to be engaged in this study to complete it within the stipulated time (**Table 1.5**).

Table 1.3: Additional Team Composition for the EIA Study

Sl. No.	Name of Professional	Position Assigned
1	Mohammed Mukteruzzaman	Project and Co-Team Leader and Biologist
2	Motaleb Hossain Sarker	Water Resources Expert
3	Jalal Ahmed Choudhury	Power Plant and Instrumentation Expert
4	Md. Maqbul-E-Elahi	Geologist and Primary Energy Expert
5	Gazi Md. Riasat Amin	Water Balance Specialist
6	Billal Hossain Mazumder	GIS Specialist
7	H. M. Nurul Islam	Limnologist (Benthic and Water Quality)
8	Roland Nathan Mondal Mr.	Jr. Fisheries Specialist
9	Deeba Farzana Moumita	Disaster Specialist
10	Dr, Shawkat Hossain Sohel	Ecology and Biodiversity Specialist
11	Md. Mutasim Billah	Risk and Hazard Specialist
12	Redwan Hossain Jeshan	Occupational Health and Safety Specialist
13	Md. Ashis Mawla	Jr. Anthropologist

Sl. No.	Name of Professional	Position Assigned
14	Most Tania Karim	Jr. Agriculture Specialist
15	Amena Binte Ariff	Junior Water Resources Engineer
16	Sharmin Akhter	Research Consultant (Fisheries)
17	Nusrath Jahan Nisha	Research Consultant (Civil Engineer)

1.11 Report Structure

40. The report has been prepared in accordance with the ToR, and it contains 14 chapters. These are as follows:

Chapter 1 describes the introduction containing background, purposes, and methodologies, limitations of EIA study, need of the project and concludes by introducing the study team.

Chapter 2 is on legislative and regulatory aspect describing the relevant policy and legal frameworks for the EIA process of the power plant Project.

Chapter 3 presents an analysis of various alternatives options for project component siting, fuel type, technology selection, cooling water system, and water treatment system.

Chapter 4 covers project data sheet of the proposed fertilizer factory comprising of Project proponent, Project location and area, Project Impact Area, nature and size of the Project, Project concept, Project components, Project activities, Project schedule, resources required and their quality, and utilities demand etc.

Chapter 5 covers Project description depicting Project layout, raw materials and fuel requirement and performance, water requirement and hydrology of the Shitalakhya River, Technology Selection and Process description, Description of Major Sub-Systems, Emission, Solid Waste Disposal, Emission Monitoring etc. of the proposed fertilizer plant. Chapter 6 describes the environmental and social baseline condition with detail on land use and cover, physical environment, water resources, land resources, agricultural resources, fisheries, ecological resources and socio-economic conditions.

Chapter 7 presents the potential impacts of Project during demolition of civil structures, pre-construction; construction and post-construction phases. This chapter also includes cumulative impacts of identified IESCs/VECs.

Chapter 8 identifies mitigation measures for various identified impacts, enhancements, and compensation to restore including transport routes, disposal routes or locations of hazardous waste, pollution control systems, waste treatment, engineering measures etc.

Chapter 9 describes the Environmental Management Plan (EMP) with mitigation measures for minimizing the effect of the negative impacts and enhancement measures for increasing the benefits of the positive impacts during demolition, pre-construction, construction, and operation stages. Institution strengthening and capacity building, institutional arrangements for the implementation of the EMP are also covered in this chapter.

Chapter 10 outlines all possible hazards and risks associated with the demolition and proposed fertilizer factory, and management of the hazard and risks.

Chapter 11 describes the Environmental Monitoring Plan, Implementation of Monitoring Plan, performance indicators, and reporting and feedback mechanisms.

Chapter 12 outlines institutional arrangements and capacity building.

Chapter 13 presents the results of Public Consultation and Information Disclosure including consultation with experts' representatives of institutions and selected focus group discussions.

Chapter 14 presents the Conclusions and Recommendations based on the study outcome.

41. Literature used in preparation of the report is listed under references at the end of the report.

2. Legislative, Regulation and Policy Consideration

2.1 Introduction

42. The environmental approval process in Bangladesh is controlled by the Department of Environment (DoE) under the Ministry of Environment and Forest (MoEF) and the key regulations which govern this process are: ECA, 1995 (including all amendments) and ECR, 1997 (including all gazetted amendments).

43. This chapter of the EIA describes the key regulatory framework relevant to the project which includes national regulations and also international treaties and conventions applicable for the project. Therefore, only those regulatory requirements which are directly relevant for this proposed project will be outlined below.

2.2 Legislation Framework

2.2.1 Overview of Bangladesh Approval Process

44. Accordingto the the national environmental legislation of Bangladesh (ECA, 1995), all development projects are governed by some legal and institutional requirements. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Before initiating any development project, it is hence required to obtain Environmental Clearances or approval from the Department of Environment (DoE).

45. In accordance with the ECR, 1997 the proposed Urea Fertilizer plant project falls under the 'Red' category and as such requires for submission of IEE and also EIA to obtain Site Clearance Certificate (SCC) and subsequently Environmental Clearance Certificate (ECC).

46. An SCC will be issued by DoE upon approval of the IEE study and ECC will be issued upon approval of EIA report (including associated EMP). The process is shown in **Figure 2.1**.

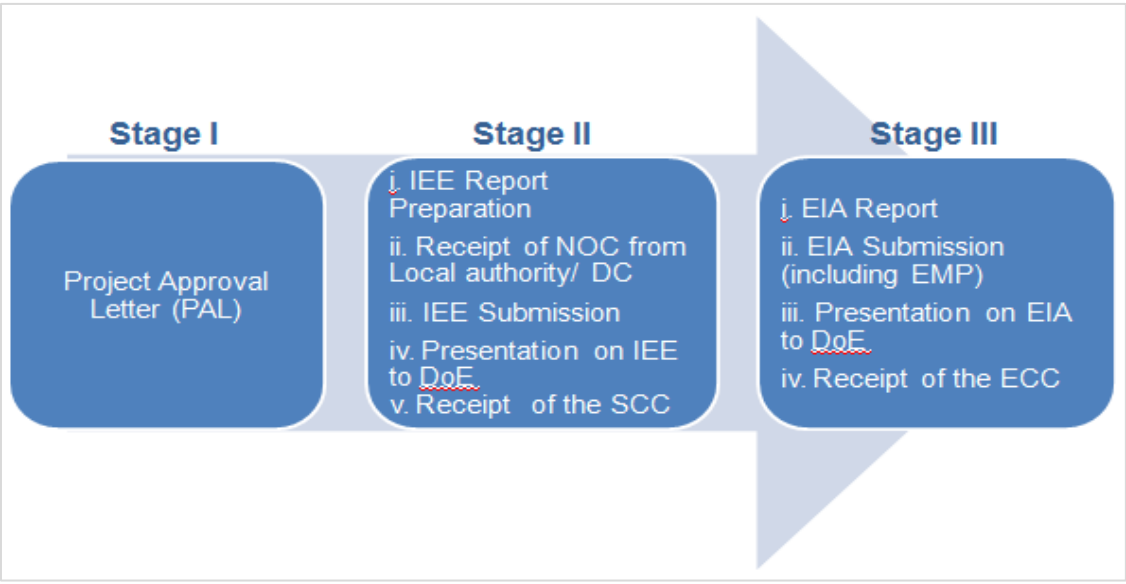


Figure 2.1: Stages for obtaining SCC and ECC from DoE for RED category project (As reference)

2.2.2 Administrative Letter

47. The No Objection Certificate (NOC), which is a document of "proof of authorization", is needed for initiating any project. This NOC has to be obtained for this study from the local government, and may be the aviation authority.

2.2.3 Key Legislative Approval

48. Certain permits and clearances are required to be obtained by the project proponent from different Government and statutory agencies at various stages of development of the project. A preliminary list of the required legislative approval is provided in **Table 2.1**.

Table 2.1: Required Permission for Project under Bangladesh Legislation

Legislation	Permission Required	Purpose	Permission Given by
▪ Environment Conservation Act, 1995 ▪ Environment Conservation Rules,1997	Site Clearance Certificate (SCC) and Environmental Clearance Certificate (ECC).	DoE will issue SCC and approve ToR for EIA to allow for a detailed EIA as per Section 12 (ECA), Rule-7 and Form-3 of the ECR.	Director General of, DoE
▪ Explosives Act, 1884 ▪ Explosive Substances Act, 1908 ▪ Explosive Rules, 2003	License for explosive import, transport and possession	Licenses for explosive-related activities will be required, including import, transport and possession.	Chief Controller of Imports and Exports Chief Inspector of Department of Explosives
Bangladesh Electricity Act (1910) and Regulations	Permission/ Licence required	Laying down or placement of electricity supply lines	National Electricity Board

49. Inconnection to the legislative requirements, currently the proponent has planned to conduct EIA study and subsequently to submit report to DoE for obtaining ECC. However, Proponent will also take initiative to request DoE for exemption of IEE based on the following noted grounds (i) the proposed project will be installed within the BCIC owned abandoned land currently occupied under by Ghorasal and Polash fertilizer projects (ii) Government priority project.

2.2.4 Relevant Bangladesh Legislation

50. The Bangladesh Legislations that are relevant to this proposed project are categorized by sectors and listed below in **Table 2.2**.

Table 2.2: Sector-wise Relevant Bangladesh Legislations/ Policies

Issue	Bangladeshi Legislation or Regulation	Remarks
Prevention of pollution and Protection of Environment	The Forests Act- 1927 (including all amendments)	Not directly applicable- The proposed interventions of Urea Fertilizer plant including connected gas source may have impact on the social forestry.
	Wildlife (Protection and Safety) Act- 2012-	Applicable- The project proposes to use part of the abandoned area having trees for construction of Fertilizer Plant which may be

Issue	Bangladeshi Legislation or Regulation	Remarks
		hosting wild life. In addition will extract water from adjacent river.
	Environment Conservation Act-1995 (including all amendments)	Applicable- The project proposes for construction of Fertilizer Plant which falls within jurisdiction of this Act.
	Environment Conservation Rules-1997 (including amendments)	Applicable- As the Rules categorize subject project as "Red" category and requires clearance from DoE.
	The Environment Court Act- 2000	Applicable-As the court has jurisdiction, in accordance with the act's provisions, over trial for an offense.
	Noise Pollution Control Rules-2006	Applicable-As the project will create noise
	Bangladesh Water Act- 2013	Applicable-As the project proposes to utilize waterways.
	National River protection commission Act-2013	Applicable- as the proposed project has likeliness of pollution impact in the river.
	National Conservation Strategy-1992	Applicable- as the project is related to conservation of environment.
	NEMAP- 1995	Applicable- as it is related to the conservation of habitat and biodiversity etc.
	Environmental Policy- 1992	Applicable- as the proposed project has likeliness of having impacts on the surrounding environment.
	National Forest policy-1994	Applicable- as the policy focuses on the management of social forestry and development of social forest area
	National Water Policy- 1999	Applicable- The project proposes for transportation of equipment through water ways.
Fisheries	The Protection and Conservation of Fish Act- 1950 and The Protection and Conservation of Fish Rules- 1985	Applicable- The project requires compliance with any rules related to inland waters of Bangladesh.
	National Fisheries policy-1998	Applicable- as the policy provided guidelines for protection of fish in the water bodies.
Land use	National land use policy- 2001	Applicable– The proposed project area may be developed and need to change based on the requirements of the proposed industry.
	The Acquisition and Requisition of Immovable Property Ordinance- 1982	Not directly applicable
power generation, energy utilization and utilities	Power System Master Plan-2010 and 2016	Partially applicable- as the proposed project is related to natural gas utilization
	Bangladesh Energy Regulatory Commission Act-2003	Applicable- as the subject project is related to natural gas
	National Energy policy-(1995)	Partially applicable- as the subject project is related to primary energy.
	Import and Export Control Act-1950	Applicable- as the project equipment/ machineries and materials will be imported.

Issue	Bangladeshi Legislation or Regulation	Remarks
	The Public Procurement Regulations- 2003 (including all amendments)	Applicable- Government procurement process will be adopted for development of this proposed project.
Procurement in Bangladesh	Fatal Accidents Act- 1855	Applicable- as the proposed project has provision of accidental event and may cause fatal accidents.
Health and Safety and labor management	Dangerous Cargoes Act- 1953	Applicable- as the proposed project has provision of carrying of materials/ chemicals for Fertilizer Plant construction/operation.
	The Explosives Act- 1884	Applicable- as the proposed project has provision of using explosive materials for different project phases.
	The Penal Code- 1860	Applicable- as the proposed project has provision of pollution impact on the surrounding environment.
	Fire prevention and Extinguish Act- 2003	Applicable- as the proposed project has provision of accidental event and may create fire.
	Final Draft National Building Code of Bangladesh (2015)	Applicable- as all building structures related issues are highlighted in the code which shall be considered as appropriate for implementation of this project.
	Labor Law- 2006 and 2013	Applicable – as this law provided guidelines for employment of workers.

2.2.5 Brief outlines of relevant regulations

51. **The Environment Court Act, 2000:**The Environment Court Act, 2000 provides for the establishment of environment courts and matters incidental thereto. This act also provides the jurisdictions of environment court, penalty for violating court's order, trial procedure in special magistrate's court, power of entry and search, procedure for investigation, procedure and power of environment court, authority of environment court to inspect, appeal procedure and formation of environment appeal court.

52. **The Bangladesh Environment Conservation Act of 1995 (ECA, 1995):** This Act is the key legislation in relation to environment protection in Bangladesh. This Act is promulgated for environment conservation, standards, development, pollution control, and abatement. It has repealed the Environment Pollution Control Ordinance of 1977. The Act has been amended in 2000, 2002, 2007 and 2010.

53. The main objectives of the Act are:

- Conservation and improvement of the environment; and
- Control and mitigation of pollution of the environment.

54. The main strategies of the Act can be summarized as:

- Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried/initiated in the ecologically critical areas;
- Regulations in respect of vehicles emitting smoke harmful for the environment;
- Environmental clearance;

- Regulation of the industries and other development activities' discharge permits;
- Promulgation of standards for quality of air, water, noise and soil for different areas for different purposes;
- Promulgation of a standard limit for discharging and emitting waste; and
- Formulation and declaration of environmental guidelines which include both GoB (ECR, 1997) and IFC standards.

55. **The Bangladesh Environment Conservation Act (Amendment), 2000 focuses on:** (1) ascertaining responsibility for Compensation in cases of damage to ecosystems, (2) increased provision of punitive measures both for fines and imprisonment and (3) fixing authority on cognizance of offences.

56. **The Bangladesh Environment Conservation Act (Amendment), 2002 elaborates on:** (1) restriction on polluting automobiles, (2) restriction on the sale and production of environmentally harmful items like polythene bags, (3) assistance from law enforcement agencies for environmental actions, (4) break up of punitive measures and (5) authority to try environmental cases.

57. **The Bangladesh Environment Conservation Act (Amendment), 2010:** This amendment introduces new rules & restriction on: a) Ensure proper management of hazardous wastes to prevent environmental pollution and Health Risk, b) No remarked water body cannot be filled up/changed; in case of national interest; it can be done after getting clearance from the respective department; and c) Emitter of any activities/incident will be bound to control emission of environmental pollutants that exceeds the existing emission standards (d) Government may declare any ecosystem as "Ecologically critical area" if it appears to be degraded or expected to be degraded and take all precaution measures to protect that ecosystem. In addition, government shall stop any ongoing activities and will not allow any new developments in the ecosystem after declaration of "Ecologically Critical Area".

58. **The Bangladesh Environment Conservation Rules, 1997:** This is the first set of rules, promulgated under the ECA 95 (so far there have been three amendments to this set of rules – February and August 2002 and April 2003). The Environment Conservation Rules of 1997 has provided categorization of industries and projects and identified types of environmental assessments needed against respective categories of industries or projects.

59. Among other things, these rules set (i) the National Environmental Quality Standards for ambient air, various types of water, industrial effluent, emission, noise, vehicular exhaust etc., (ii) the requirement for and procedures to obtain environmental clearance, and (iii) the requirement for IEE and EIA's according to categories of industrial and other development interventions.

60. The proposed project, according to the DoE, as mentioned earlier is considered under the "Red" category of the Environmental Conservation Rules, 1997.

61. **Noise Pollution (Control) Rules, 2006:** This Rule gives the authority to all the Union Councils, Paurasabhas, City Corporations, City Development Authority (i.e. RAJUK, CDA, KDA, RDA etc.) to mark off the areas under their jurisdiction as silent, residential, mixed, commercial or industrial. They should also put signs to mark those areas. The Act also describes the approved standard limit of sound in the added schedule 1 and 2. In the schedule 1, silent area means area up-to a radius of 100 meters around hospitals or educational institutions or special institutions/establishments identified/to be identified by the government.

In the silent area it is prohibited to use any kind of horns of vehicles, audio signals and loudspeakers. According to this Act, daytime is counted from 6am to 9pm whereas nighttime is counted from 9pm to 6am. The proposed project has provision of creating noise pollution in the surface and therefore, this act is applicable.

62. **The Motor Vehicle Ordinance, 1983:** This regulation stated to impose a penalty of maximum two hundred taka for those vehicles that are emitting smokes that poses health hazard in the public places. It also restricts the passenger from smoking in public service vehicles and in any other vehicles with notice of not smoking. This ordinance is enforced occasionally but a regular enforcement would be helpful to reduce air pollution in big cities including Dhaka. However, it is to be noted that the amount of the penalty is very low which may be revised as well.

63. **The Forest Act, 1927 and Amendment Act 2000:** The Forest Act of 1927 provides for reserving forests over which the Government has an acquired property right. This Act has made many types of unauthorized uses or destruction of forest produce punishable. The Government may assign any village community its right to or over any land, which has constituted a reserved forest.

64. Accordingto the Act, the government may prohibit certain activities in the declared reserved forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc.

65. The proposed location of the Urea Fertilizer Plant is at the BCIC owned land currently occupied with some trees, abandoned structure of Ghorasal and Polash Fertilizer Plant. Therefore, this regulation is not directly applicable for this project. However, there is homestead forest, therefore, during implementation of the project, all related activities to be performed following regulation of this Act.

66. In addition, the Supplementary Rules of 1959 empowered the concerned Governmental bodies to restrict totally and for a specified period, the shooting, hunting or catching of various birds, animals and reptiles in the controlled and vested forests. The Private Forest Ordinance of 1959 provides for the conservation of private forests and for the forestation, in certain cases, of waste-land in Bangladesh.

67. **Wildlife (Protection and Safety) Act 2012:** The Wildlife (protection and safety) Act 2012, passed in Parliament on 8th July, 2012. Under this act, the hunting, trapping, killing of wildlife are strictly prohibited. There are certain provisions kept in this Act, e.g. entrance, management, rules and regulation of the protected area etc. If any person without license performs any kind of trade, he will be imprisoned for at least one year. The project site is an abandoned land of BCIC occupied by some vegetation of trees with visiting/hosting wildlife. In addition, this proposed project will extract water from adjacent water ways which may have impact on aquatic life.

68. **The Protection and Conservation of Fish Rules, 1985:** These are a set of rules in line with the overall objectives of the Fish Act. Section 5 of the Rules requires that “No person shall destroy or make any attempt to destroy any fish by explosives, gun, bow and arrow in inland waters or within coastal waters”. Section 6 of the Rules states:-“No person shall destroy or make any attempt to destroy any fish by poisoning of water or the depletion of fisheries by pollution, by trade effluents or otherwise in inland waters”. Therefore, these rules are relevant for this proposed project and subsequently the proposed intervention needs to be conducted

in such a manner that the activities do not cause damage to the inland waters or within coastal waters fisheries.

69. **The Bangladesh Water Act 2013:** The Bangladesh Water Act 2013 was passed by the Government on 6 November 2013 to ensure "integrated development, management, abstraction, distribution, use, protection and conservation of water resources". By virtue of this Act all rights over surface water, ground water, sea water rain water and water in the atmosphere is vested on the State. Notwithstanding the above, "rights over the surface water on any private land shall remain with the owners of such land", and such right to use the water shall be subject to the provision of the Act. Furthermore, under the provisions of this Act, "right to potable water, and to water for hygiene and sanitation shall be treated as the highest priority right".

70. The Act makes a provision for constituting a National Water Resources Council headed by the Prime Minister. The Council is the highest decision making body and is empowered to make policies, give instructions to develop National Water Resources Plan for integrated development and safe abstraction of water and its proper use to ensure protection and conservation of water resources. The Council is also mandated to approve the National Water Resources Plan and ensure its implementation, as well as give advice to the Government to enter into agreement through signing a memorandum of understanding and/or signing conventions and treaty with any Government and international or regional organization to undertake joint survey, exchange data/information with respect to common water resources and its abstraction and development and undertaking joint measures to prevent pollution of common water resource.

71. The Act also makes a provision for approving national water resources plan prepared in accordance with the water resources planning Act, 1992 containing among others the following matters namely:

- Analysis of economic, natural, social, political, environmental, and ecological and institutional elements, characteristics and impact of water resources;
- Integrated use of surface and ground water emphasizing the highest possible use of rain water;
- Determination of water quality standard;
- Fixation of priority of water use.

72. The Act also makes further provision for:

- Declaration of water stress area and management thereof;
- Preferential use of water in the water stress area and exemption thereof;
- Fixing the lowest safe yield level of aquifer and restrictions on abstracting groundwater; and
- Protection of flood control embankment, which states "to ensure the sustainability of the flood control embankment, no person shall, without the permission of the appropriate authority, be allowed to construct any house, establishment or any other structure on, or on the slope of such embankment."

73. Finally, if anybody deliberately violates or ignore the responsibility or protection under this Act, in that case, under the provisions of sub-section (2), she/he will get maximum of 5 years imprisonment or maximum Tk. 10,000 as financial punishment or both the punishments.

As the proposed project has provision of creating pollution in the water ways, hence this act is applicable.

74. **The Bangladesh Petroleum Act, 1974:** The Bangladesh Petroleum Act is enabling legislation that allows the Government of Bangladesh to enter into all aspects of petroleum exploration, development, exploitation, production, processing, refining and marketing. In addition, the Government is authorized to enter into Petroleum Agreement(s) with any person(s) for the purpose of petroleum operations. The duties of such person(s) are:

- To ensure that petroleum operation is carried out in a proper way and in accordance with good oil field practice.
- To carry out petroleum operation in any area in a manner that does not interfere with navigation, fishing and conservation of resources.
- To consider the factors connected with the ecology and environment.

75. Clause 6(2) of the Act sets out certain details related to environment and safety: "In particular, and without prejudice to the generality of the foregoing provision, a person engaged in any petroleum operations shall, in carrying out such operations in any area:

- Control the flow and prevent the waste or escape' in the area, of petroleum or water;
- Prevent the escape in that area of any mixture of water or drilling fluid with petroleum or any other matter;
- Prevent damage to petroleum-bearing strata in any area, whether adjacent to that area or not; and
- Keep separate any petroleum pool discovered in the area."

76. Apart from the above, the law provides the following obligations:

- Prescribing places where petroleum may be imported and prohibiting its import elsewhere;
- Regulating the import of petroleum;
- Prescribing the periods within which licenses for the import of [class i] petroleum shall be applied for, and providing for the disposal, by confiscation or otherwise, of any [class i] petroleum in respect of which a license has not been applied for within the prescribed period or has been refused and which has not been exported;
- Regulating the transport of petroleum;
- Specifying the nature and condition of all receptacles and pipe-lines in which petroleum may be transported;
- Regulating the places at which and prescribing the conditions subject to which petroleum may be stored;
- Specifying the nature, situation and condition of all receptacles in which petroleum may be stored;
- Prescribing the form and conditions of licenses for the import of dangerous petroleum, and for the transport or storage of any petroleum, the manner in which applications for such licenses shall be made, the authorities which may grant such licenses and the fees which may be charged for such licenses; (i) determining in any class of cases whether a license for the transport of petroleum shall be obtained by the consignor. Consignee or carrier;

- Providing for the granting of combined licenses for the import, transport 18 [storage and distribution] of petroleum, or for any two of such purposes.
- Prescribing the proportion in which any specified poisonous substance may be added to petroleum, and prohibiting the import, transport or storage of petroleum in which the proportion of any specified poisonous substance exceeds the prescribed proportion;
- Regulating the distribution of petroleum;
- Prescribing the conditions for the appointment of, and the granting of the licenses to, agents, dealers and stockiest;
- Prescribing the form and conditions of agreement between and agent, dealer or stockiest and an oil marketing company;
- Providing for cancellation or restoration of licenses of an agent or a dealer and of agreement between an oil marketing company and an agent, dealer or stockiest; and
- Generally, providing for any matter, which in its opinion, in expedient for proper control over the import, transport, storage and distribution of petroleum.

77. The project is related to gas based and natural gas will be transmitted through gas line for using a source of fuel for this Fertilizer Plant and power generation for this project will also use natural gas and therefore, the provisions of this law to be followed during implementation of this project.

2.3 Brief outline of Environmental and Energy Policy Guidance

78. Under the study a number of sectoral national policies have been reviewed to identify the guiding principles which are relevant to the proposed gas based Fertilizer Plant installation, operation and maintenance activities. The sectoral policies will include energy, environment, water, forest, transport, import; fisheries etc.

79. **National Environment Policy-1992:** The National Environment Policy of 1992 sets out the basic framework for environmental action, together with a set of broad sectoral action guidelines. The Policy provides the broader framework of sustainable development in the country. It also stated all major undertakings, which will have a bearing on the environment; (including setting up of an industrial establishment) must undertake an IEE and EIA as required before initiating the project.

80. The Policy delineates DoE, as the approving agency for all such IEE and EIA's to be undertaken in the country. The policy guidelines of fifteen sectors are stated in the Policy. Under the 'energy and fuel sector' (section 3.4), the use of environmentally sound and less harmful fuel has been encouraged in Section 3.4.1. Section 3.4.5 provides, 'Conservation of country's fossil fuel reserve and renewable sources of energy'. And, section 3.4.6 provides that EIA should be conducted before implementation of projects for extraction of fuel and mineral resources.

81. Under the Environmental Action Plan Section of the Policy and sub-section 'Fuel and Energy' provides that:

- Section 4.2 "In the rural areas the use of gas, coal, kerosene and petrol as fuel will be expanded, so that fuel wood, agricultural residues and cow dung are conserved. This will help the use of agricultural residues, and cow dung etc. as manure"

- Section 4.7 “Appropriate measures will be taken to ensure that extraction, distribution and use of natural resources such as oil, gas, coal, peat etc. do not adversely affect air, water, land, the hydrological balance and the ecosystem”.
- Section 3: ‘Forest, wildlife and biodiversity’ directs the followings:
    - Conserve wildlife and biodiversity, strengthen related research and help dissemination and exchange of knowledge in these areas; and
    - Conserve and develop wetlands and protection of migratory birds.

82. **Power System Master Plan, 2010 and 2016**: Power System Master Plan-2010 and 2016 formulated a Master Plan for the attainment of stable power supply in the People's Republic of Bangladesh up to the year 2030 and 2041 respectively in consideration of the diversification of fuel resources, including an optimum power development plan, power system plan, and identification of the potential power plant sites based on the fuel diversification study. Therefore, this study includes a comprehensive power development master plan where the study of the fundamental conditions of the development (demand forecast, procurement of primary energy resources, optimum power development plan, future optimum power supply structure including the positioning of gas-fired power plants, and so on) are added.

83. In this Master Plan, the target composition of power supply as of 2030 and 2041 is set at 50% for domestic and imported coal, 25% for domestic and imported (in the form of LNG) natural gas and 25% for other sources such as oil, nuclear power and renewable energy. However, this project is not a power plant project but Urea Fertilizer Plant project which will consume notable amount of natural gas for production of urea fertilizer and in addition, some amount of natural gas will also be used for generation of power for this fertilizer plant as well. Hence, this Master Plan as stated above will also be applicable for this project.

84. **National Environment Management Action Plan 1995**: The National Environment Management Action Plan (NEMAP) is a wide ranging and multi-faceted plan, which builds on and extends the statements set out in the National Environment Policy (NEP). NEMAP was developed to address issues and management requirements for a period between 1995 and 2005 and set out the framework within which the recommendations of the National Conservation Strategy (NCS) are to be implemented.

85. NEMAP has the following broad objectives:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation;
- Improvement of the natural and built environment;
- Conservation of habitats and biodiversity;
- Promotion of sustainable development; and
- Improvement in the quality of life of the people

86. One of the key issues in NEMAP regarding the energy sector is “energy conservation awareness is generally low throughout the country”. However, the policy focuses on the precaution for control of environmental degradation and conservation of the biodiversity.

87. **The National Forest Policy (1994)**: This is the revised version of the National Forest Policy of 1977 in the light of the National Forestry Master Plan. The major targets of the Policy

are to conserve the existing forest areas; management of protected areas, bring about 20% of the country's land area under the afforestation program, and increase the reserve forestland by 10% by the year 2015 through coordinated efforts of GO-NGOs and active participation of the people.

88. The priority protection areas are the habitats which encompass representative flora and fauna in the core area of national parks, wildlife sanctuaries, and game reserves.

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

90. **The National Energy Policy (1995):** The National Energy Policy provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy sources and environmentally sounds sustainable energy development programs. The Policy highlights the importance of protecting the environment by requiring IEE and EIA as well for any new energy development project as "Red" category project, introduction of economically viable and environment friendly technology.

91. One (Section 1.2) of the seven objectives addresses the environment and states, "(vi) to ensure environmentally sound sustainable energy development programs causing minimum damage to the environment".

92. The seven specific policy recommendations are listed under Chapter 1.9. Of those, the following three are relevant to the present project:

- EIA should be made mandatory and should constitute an integral part of any new energy development project;
- Use of economically viable environment friendly technology is to be promoted; and
- Public awareness is to be promoted regarding environmental conservation.

93. **The National Water Policy (1999):** The National Water Policy of 1999 was adopted 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. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

94. It provides the framework for the management of water resources of the country in a comprehensive, integrated and equitable manner. The policy recognizes that water is essential for human survival, socio-economic development of the country, and preservation of its natural environment. It is vital that the continued development and management of the nation's water resources should include the protection, restoration, and preservation of the environment and its bio-diversity.

95. The Policy states that excessive water salinity in the southwest region is a major deterrent to industrial growth. In addition, pollution of both surface and groundwater around various industrial centers of the country due to untreated effluent discharge into water bodies

is a critical water management issue. The Policy suggests that the following matters should be considered:

- Zoning regulations will be established for location of new industries in consideration of fresh and safe water availability and effluent discharge possibilities;
- Effluent disposal will be monitored by relevant Government agencies to prevent water pollution;
- Standards of effluent disposal into common watercourses will be set by WARPO in consultation with DoE;
- Industrial polluters will be required under law to pay for the cleanup of water- bodies polluted by them.

96. **National Fisheries Policy-1998:** The National Fisheries Policy provides the framework for the conservation and management of fisheries resources to ensure supply and enhance production. All the water bodies suitable for fisheries production and their fisheries resources conservation, development and management are addressed under this policy. These include rivers and canals, haor and baor, floodplains, open and coastal water systems.

97. **Wetland Policy, 1998:** The Policy is relevant to the Project because the proposed project has the provision of transportation of equipment and construction materials along river ways to the Urea Fertilizer project site and may pose threat due to routine and unplanned event. In addition, the policy seeks to conserve wetlands to sustain their ecological and socio-economic functions and further sustainable development; establish key principles for wetland sustainability and unsustainable practices; maintain existing levels of biodiversity; maintain wetland functions and values; and actively promote integration of wetland functions in resources management and economic development decision taking.

98. **National 3R Strategy for Waste Management:** The 3R Strategy (means Reduce, Reuse and Recycle, is the principle of reducing, reusing and recycling resources and products) has been formulated in line with the National Goal of eliminating of waste disposal on open dumps, rivers and flood plain by 2015 and promoting recycling of waste through mandatory segregation of waste at source as well as creating a market for recycled products and providing incentives for recycling of waste. The priority sectors for 3R are identified as municipal solid waste, industrial waste, biomedical waste, institutional and commercial waste and agricultural waste.

99. The first core principle of the National 3R Strategies distinguishes waste as a resource. Realizing the importance of the source separation of waste, it is regarded as the second core principle of the strategies. Third and fourth principles state that technologies should be environment friendly, appropriate and affordable. Cleaner production is another core principle which is the continual effort to prevent pollution, reduce the use of energy, water and material resources and to minimize waste in the production process.

100. Productlife extension, industrial symbiosis and by-product exchange, polluters pay principle and take back provisions, green purchasing, establishing environmental management system, public-private partnership to secure improvements in the services, collaboration with scientific research bodies to promote 3R. Additionally another core principle of the strategies suggests undertaking separate laws for specific products, setting recycling target, including ‘design for environment considerations’ concepts for reducing environmental impacts at all phases of product life cycle.

101. **National Conservation Strategy – 1992:** Bangladesh National Conservation Strategy was drafted in late 1991 and submitted to the Government in early 1992. This was approved in principle. However. the Cabinet is yet to give its final approval of the document. For sustainable development in the energy sector, the strategy document offered various recommendations but none was there concerning the present specific project execution program or related matter. Major relevant recommendations are:

- To use minimum possible area of land in exploration sites;
- Rehabilitate site when abandoned;
- To take precautionary measures against Environmental Pollution from liquid effluents, condensate recovery and dehydration Plants; and
- Technology assessment for selection of appropriate technologies.

102. **National Biodiversity Strategy and Action Plan for Bangladesh – 2004:** The National Biodiversity Strategy and Action Plan of Bangladesh (NBSAP) "provides a framework for conservation, sustainable use and sharing the benefits of biodiversity of the country" (GoB 2004: v). The core focus of NBSAP has been ensuring cross-sectoral linkages and provides a framework for securing the necessary environmental settings to reduce poverty and ensure sustainable development. Sixteen strategies have been developed to shape and direct the actions towards achieving the goals and objectives of the NBSAP. The NBSAP emphasizes on integration of biodiversity conservation into the national development planning and processes.

103. From this perspective, the proposed project needs to recognize the value and importance of biodiversity and adopt measures to ensure that the integrity of the ecosystems is not adversely impacted by project activities in any stage of project implementation and operations. This is also reflected in the National Energy Policy of 1995, which committed "to ensure environmentally sound sustainable energy development programs causing minimum damage to environment".

2.4 Brief outline of Port and water ways transportation sector

104. **Ports Act, 1908:** The Ports Act 1908 was adopted to consolidate the enactments relating to Ports and port charges. The administering authority is the Ministry of Shipping. Subject to this Act, a Conservator is appointed to each port. Now, the Mongla Port's Harbor Master is acting as Conservator of Chittagong Port and administers the provisions of the Act for the Port.

105. Specific environmental management provisions of the Act are given under s.21 (1) which prohibits the discharge of ballast, rubbish and oil into any port or adjacent areas. Under s.31 of the Act, the movement of vessels of 200 tons or more cannot enter, leave or be moved within any port without having a pilot on board. In addition, no vessel of more than 100 tones is to enter, leave or be moved within any port without having a pilot, unless authority to do so has been given in writing. The lawful use of infrastructure such as piers and moorings, and ensuring navigable waters are not obstructed is detailed under s.10, whereas s.21 prohibits interference with buoys, beacons and moorings. Unless permission has been granted by the Conservator, any action that causes or may cause injury to the bank or shore is prohibited under s.30 (1).Therefore, the proposed project activities are to be conducted following the guidelines of this act.

106. **The Dangerous Cargoes Act, 1953:** The Dangerous Cargoes Act, 1953 was enacted to provide provisions related to the safety of ports in respect of the transit, working and storage of dangerous cargoes. Relevant provisions include s.3 (which deals with explosives and fires on vessels), s.6 (safety of vessels imports) and s.9 (enforcement). The concerned authority is the Deputy Conservator of the Port, Board of Trade or the Ministry of Communication and the Chief of Naval Staff.

107. **Import and Export Control Act, 1950:** The Government may prohibit, restrict or otherwise control the import or export of goods of any specified description, or regulate generally all practices (including trade practices) and procedures connected with the import or export of such goods. No goods of the specified description shall be imported or exported except in accordance with the condition of a license to be issued by the Chief Controller.

2.5 Administrative and land acquisition sector (Brief outlines of some laws)

108. **The Penal Code, 1860:** The Penal Code of 1860 has some valid provisions related to pollution management, environment protection and protection of health and safety. 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; and Section 286: Negligent Conduct with Respect to Explosive Substance.

109. According to the 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.

110. According to the 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 neighborhood or passing along a public way will get punishment.

111. The proposed Fertilizer Plant project is expected to have potential impact on the surrounding environment and life, hence this law is applicable.

2.6 Health and safety sector (Brief outlines of some laws)

112. **The Fatal Accidents Act, 1855:** An Act to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. It is mentioned in s.1, whenever the death of a person shall be caused by wrongful act, neglect or default, and the act, neglect or default is such as would (if death had not ensued) have entitled the party injured to maintain an action and recover damages in respect thereof, the party who would have been liable if death had not ensued shall be liable to an action or suit for damages, notwithstanding the death of the person injured, and although the death shall have been caused under such circumstances as amount in law to felony or other crime. The proposed project has possibilities of unplanned accidental event during project life cycle; hence this law is applicable.

113. **Fire prevention and extinguish Act, 2003:** The Act states to obtain license from Director General of Fire Services in case of constructing any warehouse. The proposed project activities expected to encounter accidental fire; hence this regulation will be applicable.

114. **The Explosives Act, 1884:** Section-5 under clause-1 states that the Government may for any part of Bangladesh, make rules consistent with this Act to regulate or prohibit, except under and in accordance with the conditions of a license granted as provided by those rules, the manufacture, possession, use, sale, transport and importation of explosives or any specified class of explosives.

115. Section-6 and sub-section-3 stipulated that any person manufacturing, possessing, using, selling, transporting or importing an explosive in contravention of a notification issued shall be punishable with imprisonment for a term which may extend to ten years and shall not be less than two years and also with a fine which may extend to fifty thousand Taka, in default of which with a further imprisonment for a term which may extend to one year, and in the case of importation by water or land, the owner and master of the vessel or carriage in which the explosive is imported shall, in the absence of reasonable excuse, each be punishable with imprisonment for a term which may extend to ten years and shall not be less than two years and also with a fine with a further imprisonment for a term which may extend to one year. Since the proposed project activities involve using natural gas for generation of electricity for running the proposed plant and will also utilize natural gas for production of fertilizer, and in that case this law appears to be applicable.

116. **The Fire Services Ordinance 1959:** The Fire Services Ordinance 1959 states that the owner needs to obtain a license under the Ordinance before using premises as a warehouse.

2.7 Relevant International Legal Obligation

117. It has been noted that Bangladesh has already had accessed to, ratified or signed a number of important multilateral environmental agreements (MEAs) related to environment protection and conservation of natural resources which shall have to be complied with during implementation of the project. The pertinent ones of these are highlighted in **Table 2.3** below:

Table 2.3: Relevant Environment related International Convention and Treaties

Sector	International Convention and Treaties	Status and remarks
Environment and biodiversity	Convention on the Conservation of Migratory species of wild Animals (Bonn 1979)	1-12-2005 (ratified)- Applicable as the proposed project site is situated at the bank of Shitalakhya river and may have likeliness of potential impact on biodiversity.
	Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985) and Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1997)	02.08.90 (ratified). It is not directly applicable. However, use of any ODS could have impact on ozone layer depletion and affect food chain.
	United Nations framework convention on climate change-1992	Applicable- as the proposed project has likeliness of emission of Green House Gas (GHG) and requires compliance of this convention.
	Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) ("CITES Convention")	20-11-1981 (ratified)- Applicable as the subject project is adjacent to Shitalakhya river which may contain species of conservation values.

Sector	International Convention and Treaties	Status and remarks
	Convention on Biological Diversity, (Rio De Janeiro, 1992.)	23.5.2001 (signed) 3-5-1994 (ratified)- Applicable- as the proposed project has likeliness of potential impact on the biodiversity of rivers and water bodies of the surrounding areas.
	Convention on persistent Organic Pollutants, Stockholm	20 March, 1994 (ratified). Not directly applicable. However, the presence of any of listed materials/chemicals will be prohibited during project life cycle based on the guidelines.
	Basal Convention on the control of Transboundary Movements of Hazards wastes and their disposal (1989)	1-4-1993 (ratified). Applicable- as the proposed project has provision of carrying hazardous material.
Marine/sea	United Nations Convention on the Law of the Sea (Montego Bay, 1982.)	10.12.82 (ratified). Applicable- as the proposed project has provision of carrying equipment/chemicals.

2.7.1 Outline of the provisions of major International Legal Obligation

118. Bangladeshis signatory to a number of Multilateral Environmental Agreements (MEAs) and also some bilateral instruments. Some of them are very important in context of environmental protection and the pertinent are described below.

119. **Rio Declaration on Environment and Development 1992:** Rio declaration on Environment and Development adopted the global action program for sustainable development called 'Rio Declaration' and 'Agenda 21'.

120. Principle 4 of the Rio Declaration, 1992, to which Bangladesh is a signatory along with a total of 178 countries, states, "In order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it". The proposed Fertilizer Plant project is expected to pose threat to the habitat to threaten aquatic species of the Shitalakhya River; hence Principal -4 of the Rio declaration is applicable for this project and therefore, special caution shall be taken care during implementation of this project activity.

121. **Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973):** Entered into force on 1 July 1975, this frame work addresses the overharvesting and exploitation patterns that threatened species of flora and fauna. Bangladesh ratified in 20 November-1981. Under this Convention, the governments agree to restrict or regulate trade in species that are threatened by unsustainable patterns and to protect certain endangered species from overexploitation by means of a system of import/export permits.

122. Project components need to be ensured that it will not cause any harvesting and exploitation of wild flora and fauna during pre-construction, construction, operation, and demolition.

123. **Vienna Convention for the Protection of the Ozone Layer (1985):** A framework for efforts to protect the globe's ozone layer by means of systematic observations, research and information exchange on the effects of human activities on the ozone layer and to adopt legislative or administrative measures against activities likely to have adverse effects on the ozone layer. Bangladesh ratified in 2nd August-1990.

124. Project components will not use chemicals that can affect the ozone layer such as methyl chloroform, a solvent generally used for industrial processes.

125. **Convention on Biological Diversity (1992):** The Convention on Biological Diversity, Rio de Janeiro, 1992 was adopted on 5 June 1992 and entered into force on 29 December, 1993. Bangladesh ratified the Convention on 20 March, 1994.

126. The Contracting Parties of the Convention have committed to:

- Introducing appropriate procedures requiring environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biodiversity, with a view to avoiding or minimizing such effects, and where appropriate allow for public participation in such procedures; and
- Introducing appropriate arrangements to ensure that environmental consequences of its programs and policies, that are likely to have significant adverse impacts on biodiversity are duly taken into account.

127. Obligation has been placed on State parties to provide for environmental impact assessments of projects that are likely to have significant adverse effects on biological diversity (art. 14).

128. **United Nations Convention on the Law of the Sea, Montego Bay, (1982):** This Convention was adopted on 10 December 1982 at Montego Bay, Jamaica. Bangladesh has ratified this Convention.

129. Main objectives of the convention are:

- To set up a comprehensive new legal regime for the sea and oceans, as far as environmental provisions are concerned, to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment; and
- To establish basic environmental protection principals and rules on global and regional cooperation, technical assistance, monitoring, and environmental assessment, and adoption and enforcement of international rules and standards and national legislation with respect to all sources of marine pollution.

130. **United Nations Framework Convention on Climate Change (1992):** The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Parties should protect the climate system for the benefit of present and future generations of humankind on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.

131. Bangladesh is a signatory to the Protocol and thus the Project is being undertaken in line with the Bangladesh Government's strategies for greenhouse gas planning for the country. As the proposed Fertilizer Plant project has the provision of greenhouse gas emission (fugitive as well), hence this convention is applicable.

2.8 Development Agency's Health and Safety Guidelines

132. There are a number of international financing agencies such as IFC, WB and ADB. All these agencies have their own policies and guidelines for management of health and safety issues. In addition, new financial agencies such as Equator Principles Financial Institutions (EPFIs) also have developed their own policies, procedures and guidelines for the management of environmental and social issues for financing development projects. If the proposed project has plan for receiving financial assistance from any of these financial institution, in that case, the proposed project shall have to follow environmental and social safety guidelines of that particular agency. However, for this proposed project, the financial assistance may be received from JAVIC and other banks/organizations that shall have to meet the requirements under Equator Principles and subsequently IFC guidelines. Therefore, salient features of WB, Equator Principles and IFC guidelines/standards are described below:

2.8.1 Social Safeguards Policies of WB

133. The World Bank Policy has been amended in October 1, 2018 and currently applies to all new World Bank investment project financing. With existing projects continuing to apply the Safeguard Policies, the two systems will run in parallel for an estimated seven years. The current guidelines also categorized projects in four types which include Category A, Detailed Environmental Impact Assessment (EIA) Category B, Environmental Management Plan (EMP) Category C, No requirement and Category FI, Environmental Framework. As per WB guide lines the proposed project falls under "A" category. During implementation of WB funded projects both national and IFC standards are applied.

2.8.2 Environmental and social guidelines for Equator principles

134. The Equator Principles (EPs) are a voluntary set of standards for determining, assessing, and managing social and environmental risk in project finance, in which the lender looks primarily to the revenues generated by a single project both as the source of repayment and as security for the exposure. Project financiers may encounter social and environmental issues that are both complex and challenging, particularly with respect to projects in the emerging markets.

135. The Equator Principles are intended to serve as a common baseline and framework. The follower banks (HSBC and JBIC, and the Grunter MIGA) commit to implementing the Equator Principles in their internal environmental and social policies, procedures and standards for financing Projects. The banks will not provide Project Finance or Project-Related Corporate Loans to Projects where the client will not, or is unable to, comply with the Equator Principles. As Bridge Loans and Project Finance Advisory Services are provided earlier in the Project timeline, the EPFIs request the client explicitly communicates their intention to comply with the Equator Principles.

136. EPFIs review the Equator Principles from time-to-time based on implementation experience, and in order to reflect ongoing learning and emerging good practice. The banks will only provide loans to projects that conform to the Equator Principles listed below:

Principle 1: Review and Categorization

137. As part of the EPFI's internal social and environmental review and due diligence, the EPFI will categories each project based on the magnitude of its potential impacts and risks, in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC) (Exhibit I of EP).

138. Using categorization, the EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts. The categories are:

> Category A- Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;
>
> Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and
>
> Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

139. Based on these criteria (Exhibit I of the EP), the proposed Project, the Ghorasal Polash Urea Fertilizer Factory Project (GPUFP) is considered a 'Category B', as there are 'potential limited adverse social or environmental impacts' that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures'.

Principle 2: Social and Environmental Assessment

140. For a project classified as category A or B, the borrower should carry out a Social and Environmental Assessment ("Assessment") which addresses all relevant social and environmental risks of the Project. The Assessment may address, if relevant, the illustrative list of issues described in Exhibit II, which includes the following items:

a) Assessment of baseline environmental and social conditions;

b) Consideration of feasible environmentally and socially preferable alternatives;

c) Requirements under host country laws and regulations, applicable international treaties and agreements;

d) Protection and conservation of biodiversity (including endangered species and sensitive ecosystems in modified, natural and critical habitats) and identification of legally protected areas;

e) Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems);

f) Use and management of dangerous substances;

g) Major hazards assessment and management;

h) Efficient production, delivery and use of energy;

i) Pollution prevention and waste minimization, pollution control (liquid effluents and air emissions), and solid and chemical waste management;

j) Viability of Project operations in view of reasonably foreseeable changing weather patterns/climatic conditions, together with adaptation opportunities;

k) Cumulative impacts of existing projects, the proposed project, and anticipated future projects;

l) Respect of human rights by acting with due diligence to prevent, mitigate and manage adverse human rights impacts;

m) Labour issues (including the labour standards), and occupational health and safety;

n) Consultation and participation of affected parties in the design, review and implementation of the project.

o) Socio-economic impacts;

p) Impacts on affected communities and disadvantaged or vulnerable groups;

q) Gender and disproportionate gender impacts;

r) Land acquisition and involuntary resettlement (Not applicable for the GPUFP);

s) Impacts on indigenous peoples and their unique cultural systems and values (Not applicable for the GPUFP);

t) Protection of cultural property and heritage;

u) Protection of community health, safety and security (including risks, impacts and management of Project's use of security personnel); and

v) Fire prevention and life safety.

141. Note: As mentioned in Exhibit II of the Equator Principles, the above list of issues is for illustrative purposes only. The Assessment process of each project "may or may not identify all issues noted above, or be relevant to every project" (Equator Principles, July, 2013). The Assessment should also propose mitigation and management measures appropriate to the nature and scale of each specific project.

Principle 3: Applicable Environmental and Social Standards

142. The present Project (GPUFP) is located in Bangladesh of South Asia. The country (Bangladesh- Lower Middle Income) is not designated as High-Income, as defined by the World Bank Development Indicators Database, 2018, the Assessment should also refer to the then applicable IFC Performance Standards (Exhibit III of the EP) and the then applicable Industry Specific Environmental Health and Safety Guidelines ("EHS guidelines") (Exhibit III of the EP). Like this for all projects, the assessment process should address compliance with relevant requirements of host country (in this case Bangladesh) laws, regulations, and permits pertaining to social and environmental matters.

Principle 4: Action Plan and Management System

143. For all 'Category A' and 'Category B' projects located in South Asian countries not designated as High-Income, as defined by the World Bank Development Indicators Database, 2018, the borrower should develop or maintain an Environmental and Social Management Plan (ESMP), which addresses the relevant findings and draws on the conclusions of the Assessment. The ESMP should describe and prioritize the actions needed to implement mitigation measures or corrective actions, and monitoring measures necessary to manage the impacts and risks identified in the Assessment. Borrowers will build on, maintain or establish

a Social and Environmental Management System (ESMS) that addresses the management of impacts, risks, and corrective actions.

Principle 5: Consultation and Disclosure

144. For category A and, as appropriate, category B projects (for this case 'category B') located in South Asian countries not designated as High-Income, as defined by the World Bank Development Indicators Database, 2018, the government, borrower or third party expert should consult with project affected communities and where relevant, other Stakeholders, in a structured and culturally appropriate manner (Chapter 13). The Assessment documentation and ESMP or a nontechnical summary thereof, should be made available to the public by the borrower for a reasonable minimum period in the local language and in a culturally appropriate manner. The borrower should take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation.

Principle 6: Grievance Mechanism

145. For category A and, as appropriate, category B projects (GPUFP) located in South Asian countries not designated as High-Income, as defined by the World Bank Development Indicators Database, 2018, to ensure that consultation, disclosure and community engagement continues through construction and operation of the project, the borrower will establish appropriate procedures in order to receive and address concerns or grievances about the project's social and environmental performance.

Principle 7: Independent Review

146. For all Category A and, as appropriate for Category B projects (GPUFP falls in 'Category B'), an independent social or environmental expert not directly associated with the borrower should review the Assessment Documentation including the ESMPs, the ESMS and the Stakeholder Engagement process documentation in order to assist EPFI's due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

147. An important strength of the Principles is the incorporation of covenants linked to compliance. For all Category A and Category B Projects (GPUFP- category B), the borrower will covenant to:

a) Comply with all relevant host country social and environmental laws, regulations and permits;

b) Comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects;

c) Provide regular reports in a format agreed with EPFIs on compliance with the ESMPs and Equator Principle AP (where applicable), and on compliance with the relevant local, state and host country social and environmental laws, regulations and permits; and

d) Decommission the facilities in accordance with an agreed Decommissioning Plan (where applicable). The level of detail contained in a decommissioning plan (where necessary) will depend on the identified impacts and risks of the project (please refer to quote below):

148. "The Action Plan may range from a brief description of routine mitigation measures to a series of documents (e.g., resettlement action plan, indigenous peoples plan, emergency preparedness and response plan, decommissioning plan, etc.). The level of detail and complexity of the Action Plan and the priority of the identified measures and actions will be commensurate with the project's potential impacts and risks" (Equator Principles, 2013).

149. Where a borrower is not in compliance with its social and environmental covenants, EPFIs will work with the borrower to bring it back into compliance to the extent feasible, and if the borrower fails to re-establish compliance within an agreed grace period, EPFIs reserve the right to exercise remedies, as considered appropriate.

Principle 9: Independent Monitoring and Reporting

150. To ensure ongoing monitoring and reporting to EPFIs over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert or require the borrower to retain qualified external experts to verify its monitoring information.

Principle 10: Reporting and Transparency (EPFI reporting)

151. Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

2.8.3 IFC HES guidelines

152. The International Finance Corporation (IFC) developed its Sustainability Framework in 2006, and further revised in 2012 which articulates its strategic commitment to sustainable development. The IFC's Environmental and Social Performance Standards, part of the overall Sustainability Framework, have been adopted by many lending agencies such as WB, ADB and other banks that require meeting Equatorial Principles as an international benchmark for identifying and managing environmental and social risks. Therefore, for accessing fund under this institution for this project, the IFC safeguard policies shall be followed. In addition, IFC guidelines are also applied where GoB does not have appropriate guidelines.

2.9 Environmental Standards relevant to the project

153. As per contract of the Project, the study shall cover compliance guidelines and standards appropriate with environmental, health and safety laws of Bangladesh as well as the World Bank Group Guidelines (IFC guidelines, 2007) including applicable equatorial principles to meet lenders requirements. The present study will follow all available standards from Bangladesh (including ECR, 1997, Noise Pollution control Rules, 2006) and also IFC General Health Safety guidelines (GHS), Environmental, Health and Safety Guidelines-Thermal Power Plants (2012), IFC Environmental, Health and safety Guidelines for Nitrogenous Fertilizers Production and other applicable standards. For each environmental parameter, more stringent standards will be applicable as stated above for this project which has been indicated with color cells in some cases and shown in the table below as easy reference.

2.9.1 Emission Standards of GoB and IFC relevant for the proposed project

154. The gaseous emission standards in Bangladesh are promulgated under the Environment Conservation Rules of 1997 in Schedule-11. There are standards prescribed for

varying emissions with sources of industries. The relevant Gaseous Discharge Quality Standards for Industrial Units [vide Rule 13] of ECR 1997 and the air emission standards specified as performance Indicators and Monitoring under EHS guidelines for Nitrogenous Fertilizers of IFC guidelines (2007) are presented side by side as reference in **Table 2.4**.

Table 2.4: Gaseous emission standard for Nitrogenous Fertilizer and Thermal Power Plant

Gaseous Emission		Bangladesh Regulations	IFC/EHS Guidelines	
			Nitrogenous Fertilizer Production	Thermal Power Plant
Aux. Boiler	Unit			
NO_X as NO_2 (with 3% O_2 dry)	**mg**/Nm^3	150	300	**240**
Particulate Substance	**mg/Nm^3**	100	50 (3% O_2-d)	**N/A**
Primary Reformer				
NO_X as NO_2 (with 3% O_2 dry)	**mg/Nm^3**	--	300	**240**
Granulation Stack				
Particulates	**mg/Nm^3**	150	50	
NH_3	**mg/Nm^3**	--	50	

2.9.2 Ambient Air Quality Requirements

155. The emitted polluted air from different sources increase the load on the ambient environment. To maintain the quality of ambient environment the Department of Environment, Bangladesh has standardized the ambient air quality standard in ECR, 1997 in Schedue-2. The standard values are precisely changed in the subsequent amendment of ECR in 2005. The air quality standards of Bangladesh Regulations and IFC Guidelines are presented in **Table 2.5**.

Table 2.5: Air quality Standard

Air Pollutants	Bangladesh Regulations (ECR, 2005)		IFC, 2007	
	Concentration (µg/m^3)	Average Period	Concentration (µg/m^3)	Average Period
SO_2	80	Annual	**-**	Annual
	365	24 hr	125 (IT-1)	24 hr
	--	--	50 (IT-2)	
	--	--	20	
	--	**--**	**500**	10 min
NOx	100	Annual	**40**	Annual
	--	--	**200**	1 hr
SPM	200	8 hr	**--**	**--**
PM_{10}	50	Annual	70 (IT-1)	**Annual**
	--	**--**	50 (IT-2)	
	--	**--**	30 (IT-3)	
	--	**--**	20 (G)	
	--	**--**	150 (IT-1)	**24 hr**
	--	**--**	100 (IT-2)	
	--	**--**	75 (IT-3)	
	150	24 hr	50	

Air Pollutants	Bangladesh Regulations (ECR, 2005)		IFC, 2007	
	Concentration (µg/m³)	Average Period	Concentration (µg/m³)	Average Period
$PM_{2.5}$	15	Annual	35(IT-1)	**Annual**
	--	--	25(IT-2)	
	--	--	15 (IT-3)	
	--	--	10	
	65	24 hr	75(IT-1)	**24 hr**
	--	--	50(IT-2)	
	--	--	37.5(IT-3)	
	--	--	25	
CO	10	3 hr	--	--
	40	8 hr	--	--
O_3	235	1 hr	--	--
	157	8 hr	--	--

Note: IT-Interim Target

2.9.3 Ambient Noise Level

156. The national ambient noise level standard has been noted Noise pollution control Rules (2006). Besides, the General EHS Guideline of IFC provides the international standard for the ambient noise level Table 2.6.

Table 2.6: Noise level standard

	Bangladesh standard (Noise pollution control Rules, 2006)			International standard (IFC, 2007)		
Sl. No.	Zone Categorization	Standard dB(A) Leq		Receptor	Leq (dBA)	
		Day (06:00-21:00)	Night (21:00-06:00)		Day (07:00-22:00)	Night (22:00-7:00)
1	Silent Zone	50	40	Educational	55	45
2	Residential Zone	55	45	Residential		
3	Mixed Zone	60	50	Institutional		
4	Commercial Zone	70	60	Commercial	70	70
5	Industrial Zone	75	70	Industrial	70	70

Note: Colored cell represents the standard values applicable to this Project

157. Both the National and international standards depend on the temporal and spatial sensitivity. Since the national standard for ambient noise level, except for industrial zone, is more stringent than international standard.

2.9.4 Effluent Standard

158. **Table 2.7** presents the standards for effluent disposal quality for industrial project according to ECR 1997 & IFC EHS Guidelines as appropriate. It also shows ECR, 1997 and effluent levels for Nitrogenous Fertilizers Manufacturing Plants as per IFC Guidelines (2007). For IFC standard, the guideline values for effluents are applicable for direct discharges of treated effluents to surface water for general use. Site-specific discharge levels may be established based on the availability and conditions in the use of publicly operated sewage collection and treatment systems or, if discharged directly to surface waters, on the receiving

water use classification as described in the General EHS Guidelines. These levels should be achieved, without dilution, at least 95 percent of the time that the Plant or unit is operating, to be calculated as a proportion of annual operating hours.

Table 2.7: Standards for industrial effluents

Standards for Industrial Effluents (GoB and IFC guidelines)						
Liquid Effluents			Bangladesh Regulations	IFC / Environmental, Health,and Safety Guidelines		
				Nitrogenous Fertilizer Production	GENERAL EHS Guidelines	Thermal Power Plant
		Unit				
Ammonical Nitrogen	as N	[mg/l]	50	15 (Total Nitrogen)	10 (Total Nitrogen)	
Ammonia (as free ammonia)	as free NH3	[mg/l]	5	5		
Arsenic	as AS	[mg/l]	0.05			0.05
BOD5 at 20°C	-	[mg/l]	50	-	30	
Boron	-	[mg/l]	2	-		
Cadmium	as CD	[mg/l]	0.5	-		0.1
Chloride	-	[mg/l]	600	-		
Chromium	as total Cr	[mg/l]	0.5	-		0.5
COD	-	[mg/l]	200	-	125	
Chromium	as hexavalent Cr	[mg/l]	0.1	-		
Copper	as Cu	[mg/l]	0.5	-		0.5
Electro-conductivity (EC)	-	[µS/cm]	1200	-		
Total Dissolved Solids	-	[mg/l]	2100	-		
Fluoride	as F	[mg/l]	2	-		
Sulfide	as S	[mg/l]	1	-		
Iron	as Fe	[mg/l]	2	-		1
Total Kjeldahl Nitrogen	as N	[mg/l]	100	-		
Lead	as Pb	[mg/l]	0.1	-		0.5
Manganese	as Mn	[mg/l]	5	-		
Mercury	as Hg	[mg/l]	0.01	-		0.005
Nickel	as Ni	[mg/l]	1	-		
Nitrate	as N	[mg/l]	10	-		
Oil and Grease	-	[mg/l]	10	-	10	10
Phenolic Compounds	as C6H5OH	[mg/l]	1	-	-	-
Dissolved Phosphorus	as P	[mg/l]	8	-	2 (Total P)	

Standards for Industrial Effluents (GoB and IFC guidelines)						
Liquid Effluents			Bangladesh Regulations	IFC / Environmental, Health,and Safety Guidelines		
				Nitrogenous Fertilizer Production	GENERAL EHS Guidelines	Thermal Power Plant
pH	-	-	6.5 - 8	6.0 - 9	6.0 - 9	6.0 - 9
Selenium	as Se	[mg/l]	0.05	-	-	-
Zinc	as Zn	[mg/l]	5	-	-	1
Temperature	(Summer)	[°C]	40	Temp. Increase < 3	-	-
	(Winter)		45			
Suspended Solids (SS)	-	[mg/l]	100	30 (TSS)	50 (TSS)	50 (TSS)
Cyanide	as Cn	mg/l	0.1	-	-	-
Total Nitrogen	As N_2	mg/l	50	15	-	-
Urea (prilling/ granulation)	-	mg/l	-	1	-	-
NH_3 (prilling/ granulation)	-	mg/l	-	5	-	-

2.9.5 Sewage Discharge

159. Sewage or sanitary wastewater may discharge from the Fertilizer Plant including effluents from domestic sewage, food service, laundry facilities and other miscellaneous sources. The Environment Conservation Rules, 1997 represents the Bangladesh National Standard and IFC EHS General Guidelines, 2007 for Sewage Discharge as shown in **Table 2.8**.

Table 2.8: Standards for Sewage Discharge

Parameters	Units	Bangladesh Standard (ECR, 1997)	IFC Standard (2008)
pH	-	-	6-9
BOD_5	mg/l	40	30
COD	mg/l	-	125
Total Nitrogen	mg/l	-	10
Total Phosphorus	mg/l	-	2
Nitrate	mg/l	250	-
Phosphate	mg/l	35	-
Suspended Solids (SS)	mg/l	100	50
Temperature	^0C	30	-
Total Coliform Bacteria	MPN/ 100ml	1000	400*
Oil and Grease	mg/l	-	10

Note: Applicable to centralized, municipal, waste water treatment systems which are included in EHS Guidelines for Water and Sanitation.

MPN=Most Probable Number

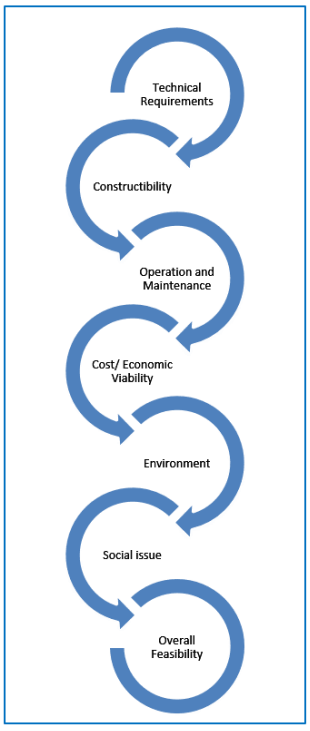
3. Analysis of Alternatives

3.1 Introduction

160. This chapter presents alternative analysis of the Project Site and components in terms of infrastructure siting, selection of urea fertilizer production options, technology options, selection of cooling water system, various water and effluent treatment systems, and a comparison with 'no' Project scenario. Alternatives are compared in terms of potential social and environmental impacts, costs, technical requirements, constructability, operation and maintenance requirements. The alternative analysis has been carried out in reasonable detail to enable the Bangladesh Chemical Industries Corporation (BCIC), MHI, JBIC, HSBC and MIGA and other stakeholders, if any, to appreciate the recommended options and be confident on the preferred options. Further details about the selected options are included in other chapters of this report.

3.2 Framework for Assessment of Alternatives

161. Consideration and evaluation of project alternatives are important parts of the environmental and social impact assessment process. An alternative analysis has been conducted in terms of project options including: location, urea production options, technology selection, cooling water system, water and effluent treatment system, and operation and maintenance procedures. A comparison of the proposed project alternatives is made with the 'without-project' alternative to provide a fuller picture of the pros and cons of implementing the proposed urea fertilizer project. Alternatives are compared in terms of technical requirements, e.g., constructability, operation and maintenance, economic and financial viability, and potential environmental and social impacts (Table 3.1). The overall feasibility of the project alternatives is considered based on the combination of the criteria upon which the alternative components are evaluated.



162. This chapter provides an overview of considered alternatives, with particular attention to environmental and social impacts accounted for in the evaluation and selection process and potentially needing mitigation during project implementation.

Table 3.1: Criteria and sub-criteria used in evaluating project alternatives

Criteria	Sub-Criteria
Technical Requirements	Life time
	Capacity/output
	Efficiency
	Fuel Consumption / energy requirements
Constructability	Suitability of construction/erection
	Materials/ Machineries required as per the considered options are available.
	Disposal of non/hazardous waste

Criteria	Sub-Criteria
Operation and Maintenance	Availability of fuel
	Automated Control System
	Operation and maintenance ease
Cost / Economic Viability	Construction Cost
	Operation Cost (including Maintenance and Energy Cost)
	Economic rate of return
Environment	Air pollution and noise
	GHG emission benefits
	Solid waste
	Centralized water/effluent treatment system
Social	Improved Urea Supply Security
	Employment Potential

3.3 Without Project Alternative

163. 'No project alternative' in a simple term which means without implementing the proposed project of a new, modern, energy efficient and higher capacity Urea Factory in place of UFFL and PUFFL.

164. This without project scenario is not recommendable because at present Bangladesh is suffering from acute shortage of Urea which is seriously hindering the agriculture-based economic growth of the country as well as achieving the Government's Sustainable Development Goal (SDG). This project is a part of the total effort of BCIC to reach closer to the demand of Urea 2.8 million metric tons in Bangladesh (Source: BCIC, 2016) in a most economic and efficient way and fulfillment of Government's commitment to provide urea with reasonable price.

165. Implementation of the project will increase the present Urea production by about 2,800 TPD using the same amount of natural gas that is being used in the PUFFL and UFFL for producing (installed capacity) 300 TPD and 1,137 TPD respectively. The Plants are currently running with very low production capacity mainly due to aging and sharp rise in down time, usage ratio and maintenance frequency. If the project is not implemented the existing urea plants which are to be replaced in the long run will remain in its present low efficiency level. The specific relative requirements of fuel will be significantly less in the new plant.

3.3.1 Environmental and Social Impacts of Without Project Alternative

166. The 'without project alternative' has some positive impacts (benefit) that it will avoid the negative impacts of the project implementation during demolition of civil structures construction and operation phase such as generation of hazardous waste, fugitive particulate matter, gaseous pollutants, release of solid waste, toxic chemicals, etc.

167. However, these are limited to demolition and construction period only and are mitigable with proper mitigation measures. The most significant negative impact of the without project alternative is the continued chemical pollution of Shitalakhya River water through contaminated effluent discharge generated from the plant. There is a potential of hydrazine based deoxygenated water and resin based demineralization effluent discharge to the river. Hydrazine is mostly used as oxygen scavenger in the high pressure bioler all over the world, as such it will be used in GPUFP as O_2 scavenger as per proposal of world renowned process Licensor and EPC Contractor M/S MHI, Japan. After the deaeration of the boiler, hydrazine will be dosed into the boiler system to remove the remaining trace level of dissolved oxygen.

168. Hydrazine efficiently eliminates the residual oxygen by reacting with the oxygen and forms water and gaseous nitrogen.

169. This dosing system is closed loop system as such there is no scope to spill over it into the environment.

170. The most important negative social impacts of no project alternative are the loss of new job opportunity of un-skilled, semi-skilled and skilled people and the loss of additional economic activity in the communities and national development from the augmented Urea production.

3.4 Locations of the Plant

171. The proposed site for the GPUFP is ear-marked and will be built in the existing premise of the PUFFL. The site is developed and suitable because of the availability of land, natural gas as raw material and fuel and water including transport facilities through rail, road and water ways.

3.4.1 Site Selection Criteria

172. The selection of site for locating a chemical process plant requires considerations of a wide range of points. The following points have influenced the selection of the site for the new fertilizer factory:

- Existence of vacant land under PUFFL that can accommodate the complex.
- The main raw material Natural Gas is available from the existing network.
- Existing jetty facility of UFFL and PUFFL may be used for carrying construction materials and machineries.
- Availability of both surface and ground water from the existing supply system (only during construction period).
- The surrounding environment and infrastructures are suitable for the Plant.
- Availability of experienced work force during construction.

3.4.2 Site Selected for Constructing New Fertilizer Plant

173. The site selected for the proposed Project has the following important features:

- Land availability: The vacant land of about 110 acres under PUFFL can be utilized and this is adjacent to PUFFL plants. Lagoon area (28 acres out of 34 acres) will also be used for the Plant.
- Availability of raw material: Natural gas as main raw material is available.
- Proximity of raw material source: Source of natural gas and its transmission and distribution line is close to the site.
- Communication system: The project site is already linked to a favorable and strong communication network (viz. rail, river and road).
- Jetty facility: Jetty facility is already available on the bank of the Shitalakhya River for unloading of construction materials and machineries for taking to the site. Available space for construction of new and larger jetty in place of the existing jetty for unloading of plant machinery and loading of urea fertilizer to the barge.

- Raw Water Intake: Available space and facility for raw water intake pump set up exist in the Shitalakhya River, which is very close the site.
- Availability of Common Utilities: Common utilities like electricity, water, gas can be supplied from existing plants during all phase.
- Marketing and Distribution of Fertilizer: It is envisaged that no major problem will be encountered in marketing and distribution of product if a fertilizer factory is set up at PUFFL site.
- Interference: Non-interference with UFFL and PUFFL projects.
- Demolition: Demolition or relocation of existing structures of PUFFL will be bare minimum.

3.4.3 Merits of the site

- The land is vacant, no major existing structure shall be relocated;
- Sufficient land is available for the new fertilizer factory and availability of all utility services as well;
- The site is developed and levelled;
- The location is suitable for future expansion; and
- During construction of the Plant, infrastructures including roads can be used.

174. Taking into consideration all these factors, the project site is selected for new fertilizer factory within the premises of PUFFL. A satellite view of this site is available from Google is shown in Figure 3.1.

3.5 Overall Plot Plan of the Facilities

175. The overall plot plan of the configured complex is to be prepared by designating areas for battery limit plants, product storage, utility, auxiliaries and offsites and buildings, etc. The plot plan for the proposed GPUFP is prepared by reviewing the plot plans of Shahjalal Fertilizer Project (SFP), Jamuna Fertilizer Company Limited (JFCL), Chittagong Urea Fertilizer Limited (CUFL) and Ashuganj Fertilizer & Chemical Company Limited (AFCCL) (Figure 3.2). In preparing the plot plan short comings and limitations of the plot plan of the above mentioned fertilizer factories have been considered and measures have been considered to overcome those constraints and limitations in the proposed fertilizer factory.

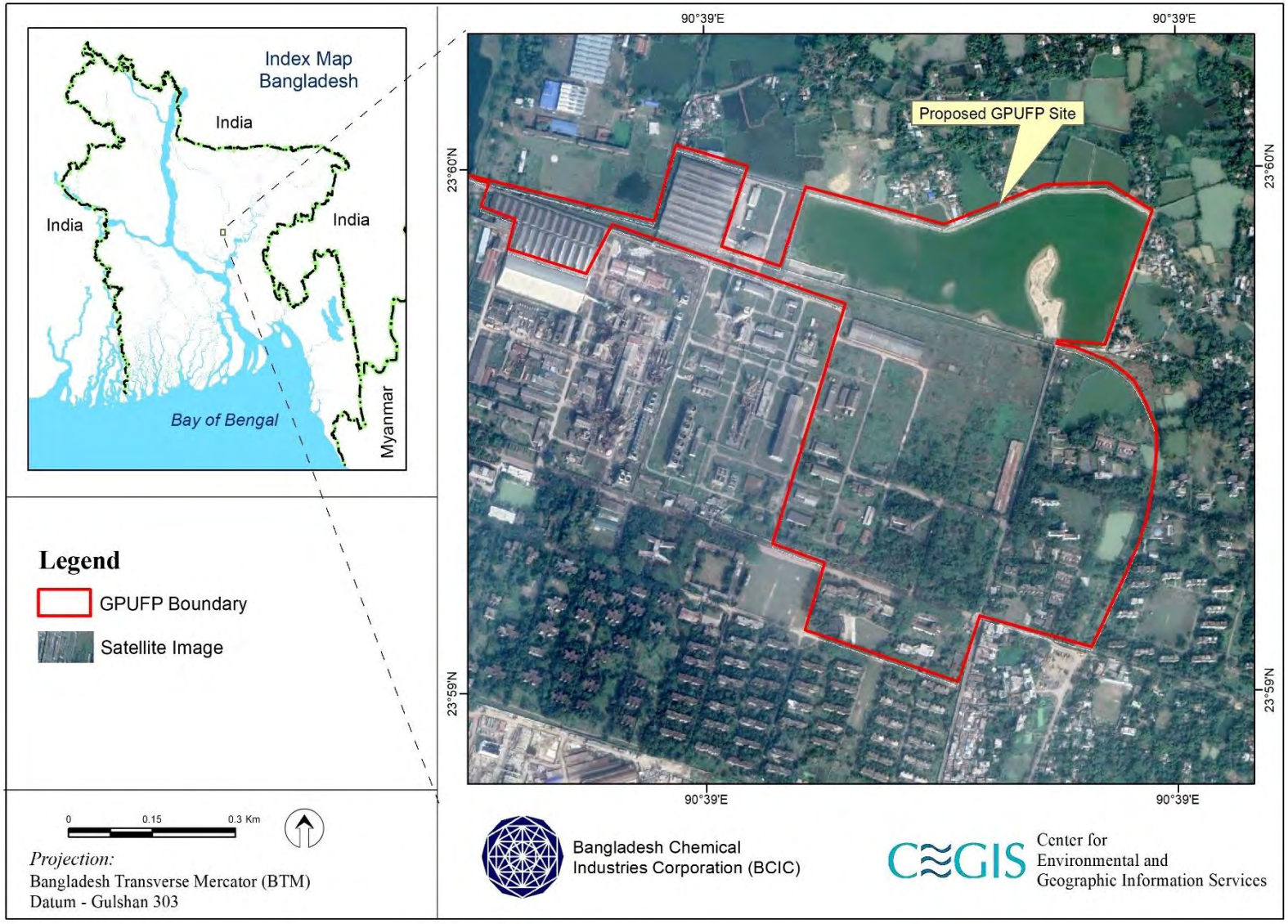
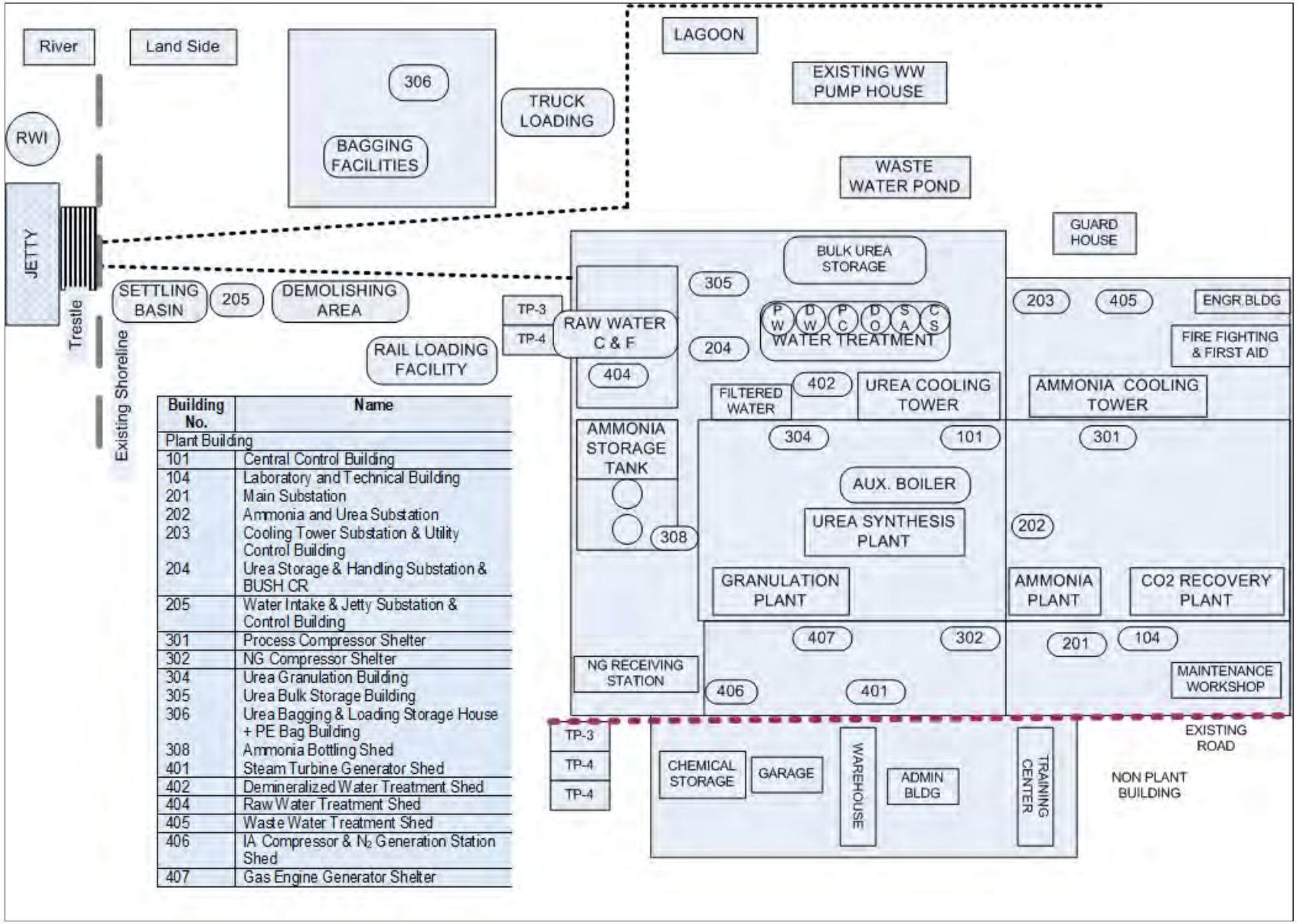


Figure 3.1: Satellite view of the Project site

404 Raw Water Treatment Shed
405 Waste Water Treatment Shed
406 IA Compressor & N_2 Generation Station Shed
407 Gas Engine Generator Shelter



Building No.	Name
Plant Building	
101	Central Control Building
104	Laboratory and Technical Building
201	Main Substation
202	Ammonia and Urea Substation
203	Cooling Tower Substation & Utility Control Building
204	Urea Storage & Handling Substation & BUSH CR
205	Water Intake & Jetty Substation & Control Building
301	Process Compressor Shelter
302	NG Compressor Shelter
304	Urea Granulation Building
305	Urea Bulk Storage Building
306	Urea Bagging & Loading Storage House + PE Bag Building
308	Ammonia Bottling Shed
401	Steam Turbine Generator Shed
402	Demineralized Water Treatment Shed
404	Raw Water Treatment Shed
405	Waste Water Treatment Shed
406	IA Compressor & N_2 Generation Station Shed
407	Gas Engine Generator Shelter

Figure 3.2: Plot plan of the Project site

3.6 New Urea Fertilizer Factory Options

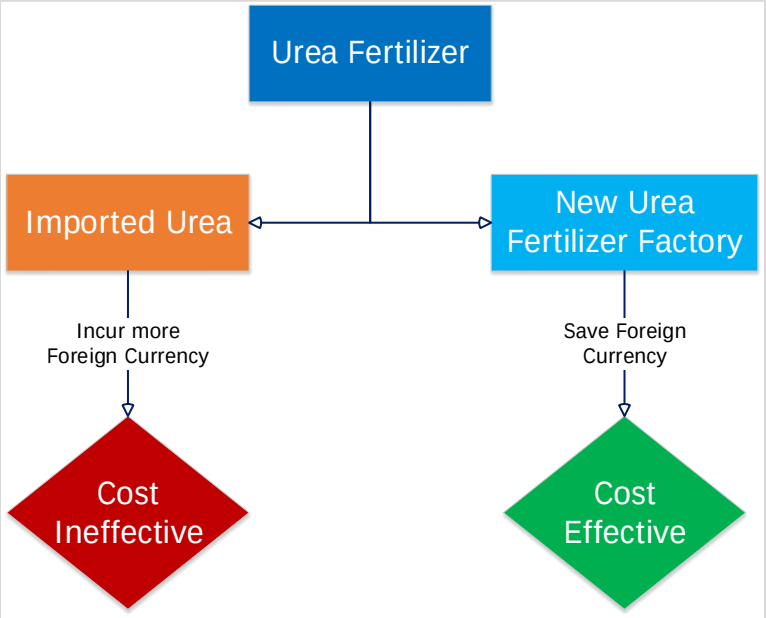


Figure 3.3: Cost effectiveness option

176. The demand of urea for the year 2017-18 was about 2.44 million MT and the actual production/sale was only 0.76 million MT. The demand of Urea Fertilizer has the increasing trend. As the internal production cannot meet the domestic demand, Government started importing urea in large scale since 1996-1997. Since BCIC's attainable capacity is now 1.7 million MT/year and the actual production is around 0.76 million MT in 2017-18 fiscal year (Table 1.1), the remaining urea fertilizer demand is met by import from KAFCO [BCIC's share is 42% (privately run in Bangladesh) and other countries such as KSA, UAE, Kuwait, China, etc. The amount of imported urea was about 1.75 million MT in the year 2017-18 at the FOB rate of 431 US$ per ton. With this background, BCIC has intended to construct a new modern, energy efficient and environment friendly urea plant of 2,800 TPD capacity in the premise of PUFFL. This will offset the amount of urea to be imported in coming days and save the foreign currency.

3.7 Alternative Fuel Analysis

177. Presently, proposed GPUFP's viability is established considering Natural Gas as Raw material and Fuel for the complex. The probable alternate fuels for Ammonia Urea fertilizer plant could be:

- Natural Gas
- Liquefied Petroleum Gas (LPG)
- Liquefied Natural Gas (LNG)
- Naptha
- Coal
- Refinery Gases
- Heavy Oil and
- Hydrogen-rich Off-gases

178. There are two potential fuel users in this complex namely captive power plant (CPP) and Ammonia Plant Reformer. Natural gas is being used as feedstock forthe Ammonia Plant. The alternate fuels namely coal, etc. are not used as fuel in the primary reformer.

179. While for CPP alternate fuels can be examined, following considerations gives NG as a preferred alternate over other fuels:

Benefits of Natural Gas over Coal (and other fuels)

- Natural gas is the cleanest fossil fuel to burn in terms of air quality and carbon emissions, emitting significantly less carbon dioxide than coal when burned. Thus NG preference over coal will contribute in less green house gase emissions.
- Handling of huge quantity of ash is another environmentally unfriendly.
- The energy efficiency of coal based thermal power plant is much lower than a GEG power plant.
- Using natural gas over coal and other fuels has the potential to reduce costs associated with the handling of coal and related waste streams.
- Additionally, using natural gas over coal (and other fuels) could also decrease some operations and maintenance costs, in addition to lessening the physical impact on the surrounding environment.

180. Accordingly, it is proposed to utilize NG as fuel as well as feed instead of coal and other fuels.

3.8 Ammonia Plant

181. Nearly all commercial fertilizer nitrogen comes from synthesis ammonia. Single train 1500-2000 TPD ammonia plants are now being built and in operation. These large capacity plants are more energy efficient and economically competitive. The current efficiency level of about 7 Gcal/t of ammonia is approaching the theoretical minimum of about 5 Gcal/t, assuming an ideal and reversible thermodynamic process. Improvements in process and equipment will lead to further reduction in energy consumption in future. Basic Design Features of the Ammonia Plant are as follows:

- Highest priority for proven reliable design.
- Proven process Licensor
- Energy efficient
- Minimum environmental effect
- Safety
- Operational flexibility
- High on-stream factor.

3.8.1 Feedstock (Energy) Option for Ammonia Plant

182. The main feedstock for Ammonia production usually are: Natural Gas, Liquefied Petroleum Gas (LPG), Liquefied Natural Gas (LNG), Naptha, Coal, Refinery Gases, Heavy Oil and Hydrogen-rich Off-gases. The primary feedstock of most new plants is natural gas which accounts for about 78% of the world ammonia capacity. Future predictions indicate that natural gas is to remain as the main feedstock for ammonia considering its reserves and opportunity costs, especially in developing countries.

183. Methane as a feedstock for ammonia synthesis is preferable to the higher hydrocarbons because of the lower carbon: hydrogen ratio requiring smaller and less expensive purification units in the synthesis gas preparation section.

184. In nearly all ammonia plants the same raw material is used as both feedstock and fuel. The fuel requirements may be 40% of the total or more, depending on the extent to which heat

recovery is practiced. **Table 3.2** shows the requirements for fuel plus feedstock assuming efficient heat recovery for different H-C sources.

Table 3.2: Energy requirement per ton of ammonia for different feedstock

Feedstock and Fuel	Assumed Heating Value[a]	Quantity	Gcal
Natural Gas	8,015 kcal/ Nm^3	873m^3	7.0
Naphtha	10,556 kcal/kg	0.72 t	7.6
Fuel Oil	9,722 kcal/kg	0.87 t	8.5
Coal	6,333 kcal/kg	1.54 t	9.8

** All values are lower heating values (LHV)*

3.8.2 Energy Consumption Cost Option

185. Ammonia is produced basically from water, air and energy. The energy source is usually hydrocarbon that provides hydrogen for fixing the nitrogen. The other energy input required is for steam and power. Steam reforming process of light hydrocarbons particularly Natural Gas (NG) is the most efficient route for the production of Ammonia. Another route is a partial oxidation of heavy hydrocarbons. Coal may also be used to produce ammonia by coal gasification process.The following is an approximate comparison of the energy consumption cost of the plants for the three feedstock (Table 3.3).

Table 3.3: Comparison of the energy consumption cost of different feedstocks

Sl. No.	Feedstock and Fuel	Natural Gas	Hydrocarbon	Coal
1	Energy Consumption	1	1.3	1.7
2	Investment Cost	1	1.4	2.4
3	**Production Cost**	**1**	**1.2**	**1.7**

186. From the above table it is seen that production cost of ammonia using natural gas is the lowest. Natural gas (NG) is therefore the most appropriate source of feedstock in all the three accounts. Based on the known resources of fossil raw materials and economy of use on all accounts, it is likely that NG will dominate as feedstock for ammonia production in the foreseeable future. Coal may become a competing feedstock if the prices of the other two become very high due to continuous depletion.

187. Production of ammonia from NG is best with respect to CO_2 emission which is more environment friendly than ammonia from Coal as it produces highest CO_2 emission. Efficient production of NH_3 has greatest impact on specific energy consumption as 80% of energy for urea production is consumed in NH_3 plant.

3.8.3 Ammonia Processor Technology

188. There are various technologies of ammonia production process of which the leading Ammonia Plant Process Designers with proven processors are: Haldor Topsoe of Denmark, Uhde GmbH of Germany, KBR and other ones**.** Today all low-energy designs use indirectly cooled converters. The design and layout offered by various ammonia plant designers differ considerably. KBR's Horizontal Converter and Topsoe's Series 200 Converter use two catalyst layers with an intermediate heat exchanger for the feed, all in one vessel for a plant size of at least 1800 tpd.

189. Uhde uses three catalyst beds. The first two beds and an interchange are in one vessel. A waste heat boiler generating HP steam cools the gas before it enters a second vessel containing the third catalyst bed. The effluent of the third bed goes through a second HP steam boiler.

190. KBR uses a horizontal cylindrical converter in which catalyst beds are arranged side by side. Adiabatic converter is a variation of the concept in which the effluent from the first bed is cooled in a heat exchanger directly coupled to the converter. There are two adiabatic converters in series; each contains a single catalyst bed held in a simple cylindrical vessel. The reactor wall comes in direct contact with 400^{o}C gas.

191. There have been tremendous advancement in Ammonia Technology by different designers, some of which are mentioned below:

- Adiabatic pre-reforming for steam reforming of hydrocarbon feedstock ranging from natural gas to heavy naphtha, which has been proposed by Topsoe;
- Topsoe's Economic Process: Topsoe continuously improves the energy efficiency of its design by optimizing all units of the ammonia process rather than using radically new schemes. The plant in Indonesia and Bangladesh confirmed energy consumption during the test run at about 7 Gcal/ton of ammonia.

192. Comparing with other technologies, considering the plant size, production efficiency and energy consumption and economic point of view Haldor Topsoe of Denmark Ammonia Reactor Process has been selected for the proposed fertilizer factory. The steam reforming process based on NG is considered to be the most dominating and best available technique for production of ammonia.

3.8.4 Control System Option

193. Completely Integrated Control System (ICS) and Emergency Shutdown (ESD) are already in place. The scan time of ESD is considerably low as compared to the Distributed Control System (DCS). The fertilizer and captive power plants of the GPUFP will be controlled by DCS and Programmable Logic Controler (PLC) system.

194. A suitable control system with a complete package of most sophisticated online vibration analysis with self-diagnostics and decision making tools which will not only save the critical machineries from any major failures but also the accuracy of the system.

3.9 Urea Plant

3.9.1 Urea Processor Technology

195. Like ammonia plant, urea manufacturing process also has many renowned technologies which are equally comparable with respect to plant cost and energy consumption. Mostly adopted Urea processor technology world-wide are as follows:

a) Saipem's ammonia stripping process;

b) Stamicarbon CO_2 Stripping Process; and

c) Toyo Access 21 process.

196. Basically, all new plants use total-recycle processes. However, once-through or partial recycle processes may still be preferred in some countries, and in some cases stripping can be considered a refinement of total recycle.

197. The carbamate solution recycle system became the most popular of the original total-recycle processes which is supported by proprietary processes of Saipem, Stamicarbon, Toyo Access 21, etc.

198. In total-recycle processes, all the unconverted ammonia-carbon dioxide mixture is recycled to the urea reactor (conversion is about 99%), and no nitrogen co-product is necessary. This is the most flexible of the urea processes because it depends only upon the CO_2 and NH_3 supply from its supporting ammonia plant for operation.

199. Saipem has been designing and building mega Urea fertilizer plant utilizing NH_3 as the stripping agent in more environment friendly way than other renowned technologies.

200. Each of these three licensors has different approaches, and each has revised and improved its technology over the years. It is apparent that further improvements will be made. All three processes closely approach stoichiometric values in raw material consumptions, and all have reduced their steam consumption to a minimum apparent economic level. The last avenues available for further improvements appear to be in reduction of capital costs, improved reliability and efficiency of mechanical equipment and metallurgical advances.

201. All processes still require use of oxygen for passivation in the synthesis loop. Metallurgical advances have reduced the amount required. Saipem now utilizes a bimetallic zirconium/25-22-2 (Ni, Cr, Mo) tube in its stripper. The corrosion rate for zirconium in urea service is nil. Toyo utilizes duplex alloy (ferrite-austenite), DP28W, which requires less oxygen. Stamicarbon, working with the Swedish steel producer Sandvik, has patented a proprietary material called Safurex R, which requires very little oxygen; future plants will use this new material. Therefore, Saipem processor technology is thus more suitable than other technologies in this regard.

202. Considering the above-mentioned aspects of different urea production technologies, Saipem has been selected for the proposed GPUFP. Except Saipem processor technology, other technologies are operated in once through or partial recycle process method, which is not as efficient as a stripping and total recycle process method. Once through process is not a complete reaction of chemicals in urea reactor. Unconverted ammonia-carbondioxide mixture is recycled in the urea reactor (Conversion is 99% efficient) and also contamination reduce with the stripping method.

203. For the above reason, total recycle process reduce raw material consumption, steam consumption, capital cost, and improve reliability and efficiency of mechanical and meterological advances. NH_3 vented with inerts is minimized in the selected Saipem technology as quantity of air required for passivation is much less than other technologies.

3.10 Granulation Plant

204. Urea can be prilled, granulated, flaked, and crystallized. At present, only prilling and granulation can be considered important since these two forms are mostly used by the farmers. In Bangladesh, granular urea is the preferred option for farmers of Bangladesh due to its efficient use.

205. There have been many granulation processes developed and operated world-wide over the years. These include thyssenkrupp Fertilizer Technology GmbH (TKFT), Germany Fluid bed granulation, TVA pan granulation, C&I Girdler spherodizer spray-drum, Norsk Hydro pan granulation and Fisons.

206. In recent years Toyo Engineering Corporation developed a spouted bed process, which was used in Japan and New Zealand. A few years ago, these two manufacturers/ companies redesigned the process and now offer a spouted-fluid bed system. Toyo has considered 1,760 tpd as the maximum single-train size.

207. Because of its high efficiency and a granulator that ensures excellent product quality with extremely low solid recycle rates, the fluid-bed granulation process by Uhde Fertilizer Technology (UFT) later on changed into thyssenkrupp Fertilizer Technology GmbH (TKFT), Germany is the leading granulation technology. It permits the construction of single-train granulation plants which are in line with the largest synthesis units so far constructed. The process conforms to the most stringent environmental laws as there is no waste water and only minimum dust emissions. Maximum operating flexibility and reliability as well as minimum maintenance and operating staff requirements are further features of this advanced process with single-stream capacities ranging from 500 mt/d to 3,850 mt/d.

208. The TKFT fluid-bed granulation process can produce all required product sizes (2–8 mm) in the same plant with only minimal adjustments. The urea granules are well rounded, very hard, and ultra-resistant to crushing and abrasion. As a result, the urea granules remain dust-free, non-caking and completely free-flowing, even after long storage, frequent handling and shipping. With the superior features of bulk trans-portability, bulk blending suitability and greater agronomical efficiency, granular urea can be substituted for prilled urea in all applications.

209. The granulator contains no moving parts, thus minimizing maintenance. The number of solid-handling equipment is significantly reduced compared to other technologies and reduce investment costs. For the above reasons, TKFT technology has been selected for the proposed GPUFP.

3.11 CO_2 Recovery from Primary Reformer

210. The technology to be licensed by MHI recovers CO_2 from flue gas emitted during the Ammonia production process, which uses natural gas as fuel, and provides the captured CO_2 as feedstock for urea synthesis. Urea fertilizer production consists of two processes: ammonia production and urea production. CO_2 contained in the flue gas emitted from the primary reformer during the ammonia production process will be absorbed into the KS-1 proprietary solvent, which MHI jointly developed with Kansai Electric Power Company, Inc. (Kansai EP). The CO_2 is then synthesized with ammonia for use as feedstock for urea production. The technology can recover approximately 90% of the CO_2 in flue gas.

4. Project Data Sheet

4.1 Project Proponent

212. The Proponent of the Project is the Bangladesh Chemical Industries Corporation (BCIC), fully owned by the Government, was established in July, 1976 by a Presidential Order. BCIC is now managing 13 large and medium size industrial enterprises engaged in producing a wide range of products like Urea, TSP, DAP, Paper, Cement, Glass Sheet, Hardboard, Sanitary Ware and Insulator etc. BCIC oversees the enterprises under its management and is responsible for developing new industries in the Chemical and allied Sectors and operated under the Ministry of Industries (MoI) of the Government of Bangladesh. BCIC intends to build a grass root Fertilizer Complex for producing Urea. This chapter describes the location of project, production process, product and information on various effluents, waste and emissions.

4.2 Project Location and Study Area

213. Administratively, the proposed site for the construction of Ghorasal Polash Urea Fertilizer Project (GPUFP) is located at Khanepur Mauza under Ward No. 01 of the Ghorasal Municipality with JL- 67 under Polash Upazila of Narsingdi district (Figure 4.1). The site is located at about 4.7 km northeast of the Ghorasal Municipality Office, 6.0 km northeast of the Ghorasal Railway Bridge and 4.7 km northeast of the Polash Upazila Headquarters. The site is aerially about 38 km northeast of Dhaka Zero Point (Table 4.1 and Figure 4.2). The Councilor of respective Ward has given the No Objection Certificate (NOC) for the implementation of the Project appended in Appendix 4.1.

214. Geographically, the Project site is located on the left bank of the river Shitalakhya and on the western side of the Polash-Issakhali Road. The site is bounded on the North-West at around 23°59'27.87"N latitude and 90°38'40.32"E longitude, on the North-East 23°59'27.53"N latitude and 90°38'58.47"E longitude, on the South-East 23°59'4.35"N latitude and 90°38'47.33"E longitude and on the South-West 23°59'7.64"N latitude and 90°38'36.98"E longitude.

215. The site is surrounded by Ghorasal Power Station on the South, the Shitalakhya River on the West, and countryside on the North and East. The Project area is of about 110 acres of land having grasses, bushes, trees (sapling, juvenile and adult) planted by PUFFL since 1984, old civil structures including store houses mostly shabby in condition, lagoon, etc.The land belongs to BCIC and is within the boundary of the Polash Urea Fertilizer Factory Ltd. **Hence, no new land acquisition is required and issue of compensation and resettlement is redundant**.

216. The major point sources of pollution around the Project site is shown in Table 4.2 and distances of the point sources of pollution from the project site is shown in Figure 4.3. Details of the emissions of pollutants are given in Chapter 6 for the considered sources for air quality modelling activities.

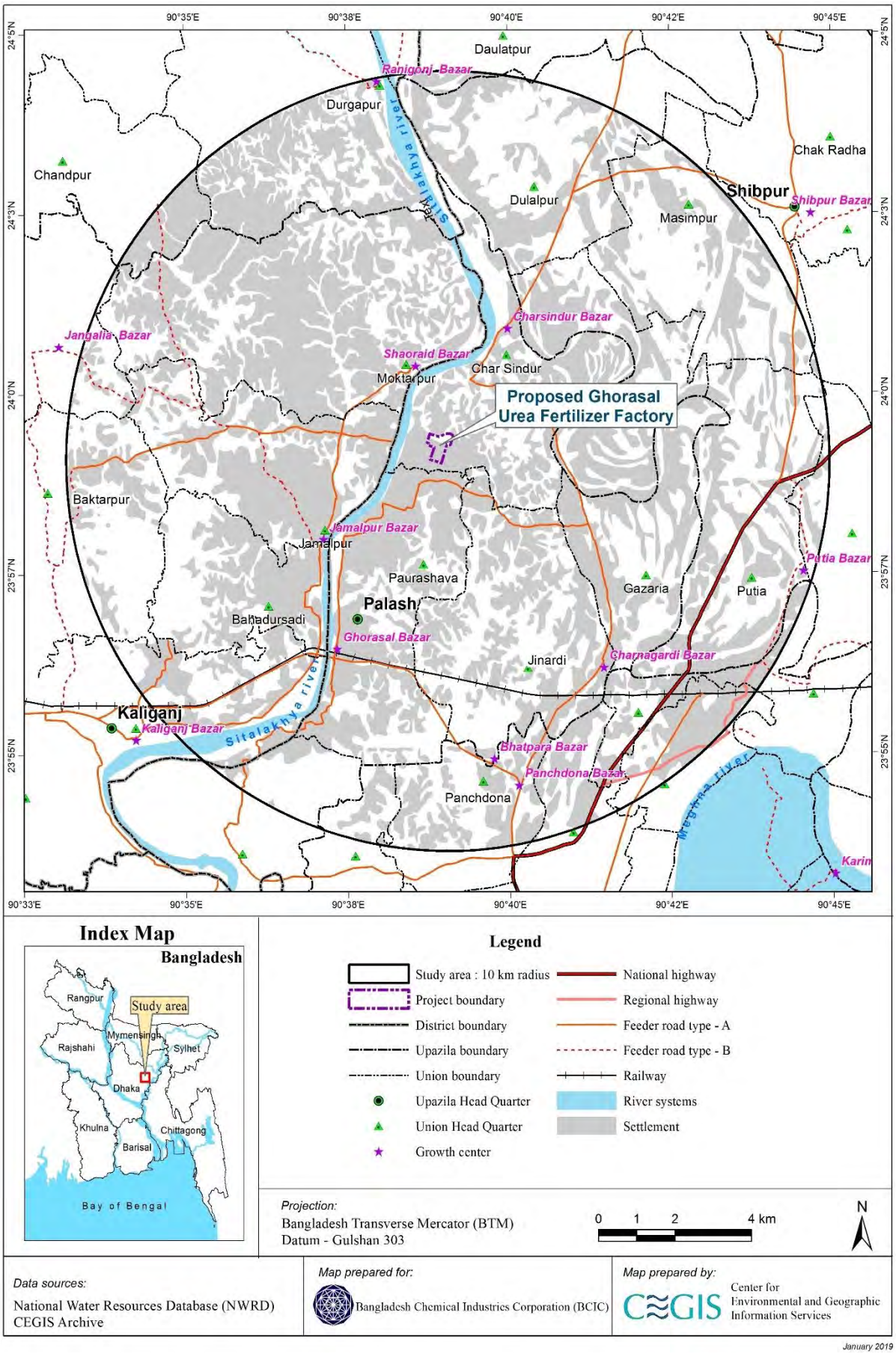


Figure 4.1: Base map of the study area showing the proposed Project site

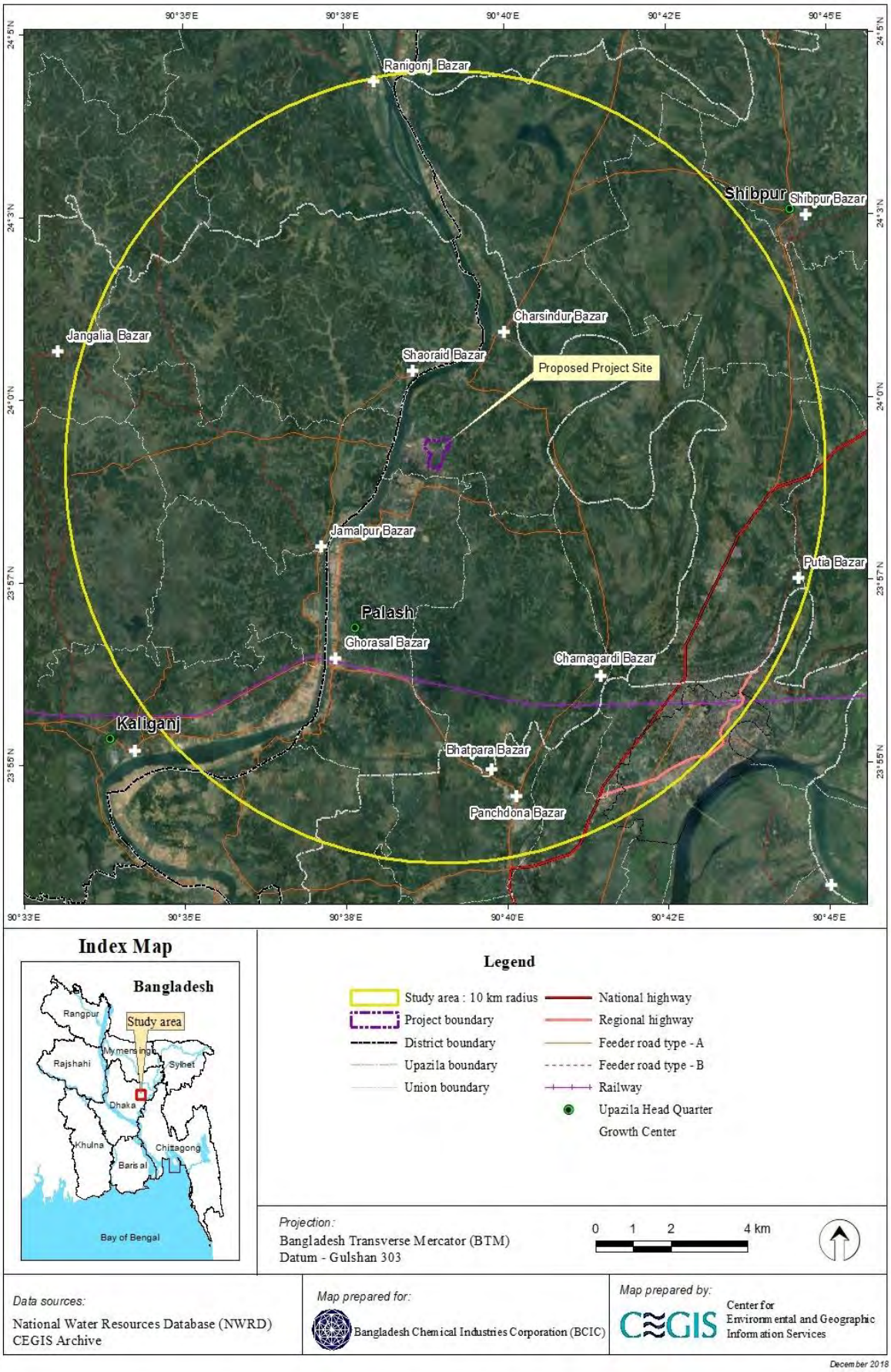


Figure 4.2: Base map of the study area showing the proposed Project site

Table 4.1: Aerial distances of different facilities from the proposed project location

Sl. No.	Facility Name	Distance (km)	Sl. No.	Facility Name	Distance (km)
1	Ghorasal Municipality	4.2	10	Ghorasal Power Station	1.30
2	Polash Upazila HQ	4.73	11	Gazaria Union HQ	7.2
3	Jinardi Union HQ	6.6	12	Panchdona Union HQ	7.8
4	Bahadursadi Union HQ	2.7	13	Panchdona Road Morr	10.0
5	Jamalpur Union HQ	2.5	14	Railway line	5.80
6	Moktarpur Union HQ	3.1	15	Zero point at Dhaka	36.0
7	Char Sindur Union HQ	4.2	16	Shahjalal International Airport	28.0
8	Tongi Power Station	24.7	17	Aggreko Rental Power	0.90
9	Regent Power	1.88	18	Max Power Station	0.80

Source: Imagery and NWRD of WARPO archived in CEGIS using GIS tool

Table 4.2: Major point sources of pollution around the Project site

Sl. No.	Name/Type of Industry/Pollution Source	Within Aerial Distance from the Plant Location
1	Ghorasal Power Plant	1.20 km
2	Janata Jute mill	2.78 km
3	Ghorasal Power Station	1.30 km
4	PRAN Industrial Park	3.8 km
5	Amigo Bangladesh Limited	5.03 km
6	Omera Petroleum Limited LPG Satellite Plant	4.6 km
7	Shun shing Power plant	6.78 km
8	RFL Industries Park	7.85 km
9	Aggreko International Power Plant	0.90 km
10	Regent Energy and Power plant	1.88 km
11	Polash Upazila	4.73 km
12	Ghorasal Rail Station	5.80 km
13	Ghorasal Sub Power plant	6.25 km
14	Bangladesh Jute Mills Limited	6.73 km
15	Aqua Refinery Limited	7.74 km
16	Momtex Expo Limited	9.41 km
17	Hamid Fabrics Limited	10.27 km
18	Gazi Textile	7.50 km
19	Shibpur Upazila	11.25 km

Source: Development of GIS based industrialdatabase of the DoE, 2015

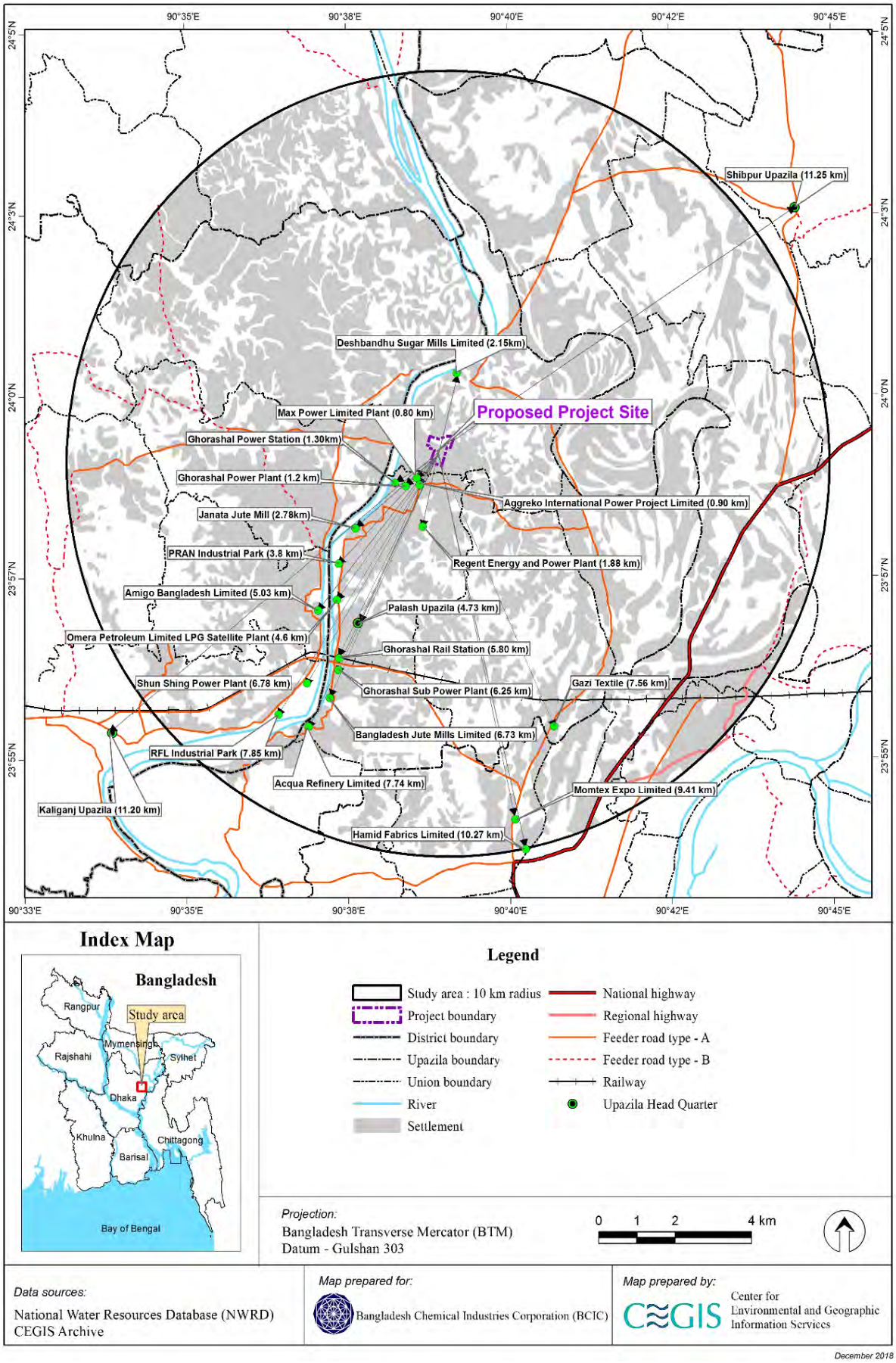


Figure 4.3: Distances of polluting industries from the project site

217. Different types of infrastructures of a total area of about 6,37,263 sqft (59,204 sqm) located in the eastern side of the PUFFL will be dismantled and decommissioned. The area of such infrastructures will be replaced by the components of the proposed project.

218. The proposed utility boiler (60mX100m), central store (120mX48m), ammonia plant (230mX135m), cooling tower (210mX66m), central control room (60mX40m), urea unit (96mX135m), demi water unit (60mX51m), pumping station (80mX51m), ammonia storage tank (104mX74m), power plant (77mX81m), Waste Water Treatment System (WWTS)/Effluent Treatment Plant (ETP) (75mX50m), etc. will be installed at the eastern side of the PUFFL unit. The new equipment will be sited in the 110 acres of land designated for the construction work, which is now covered by grasses and bushes and occupied by some old office buildings, warehouses and other structures mentioned in Table 4.3. There are a number of other major point sources in the air shed and their distance from the GPUFP site is presented in Table 4.2.

219. Installation of major components of the proposed urea plant will require a land space of roughly 500 m width and 700 m length though the size of each facility will be finalized during detail engineering stage.

4.3 Project Impact Area

220. Siting of project components will require roughly 500 m width and 700 m length land within the PUFFL property boundary. The Department of Environment (DoE) requires a 10 km radius area as minimum, centering the stack location of the proposed urea fertilizer plant. This 10 km radius is used for environmental quality baseline and ecology and fisheries impact assessment (Figure 4.4). A two (02) km buffer area from the project boundary has been considered as Direct Impact Area (DIA) as the impact nature of the proposed project from different components support it (Figure 4.5). In the cumulative impact assessment, an air shed of 25 km x 25 km is considered centering the stack of GPUFP for air quality impact, water quality impact in the Shitalakhya, and water demand assessment.

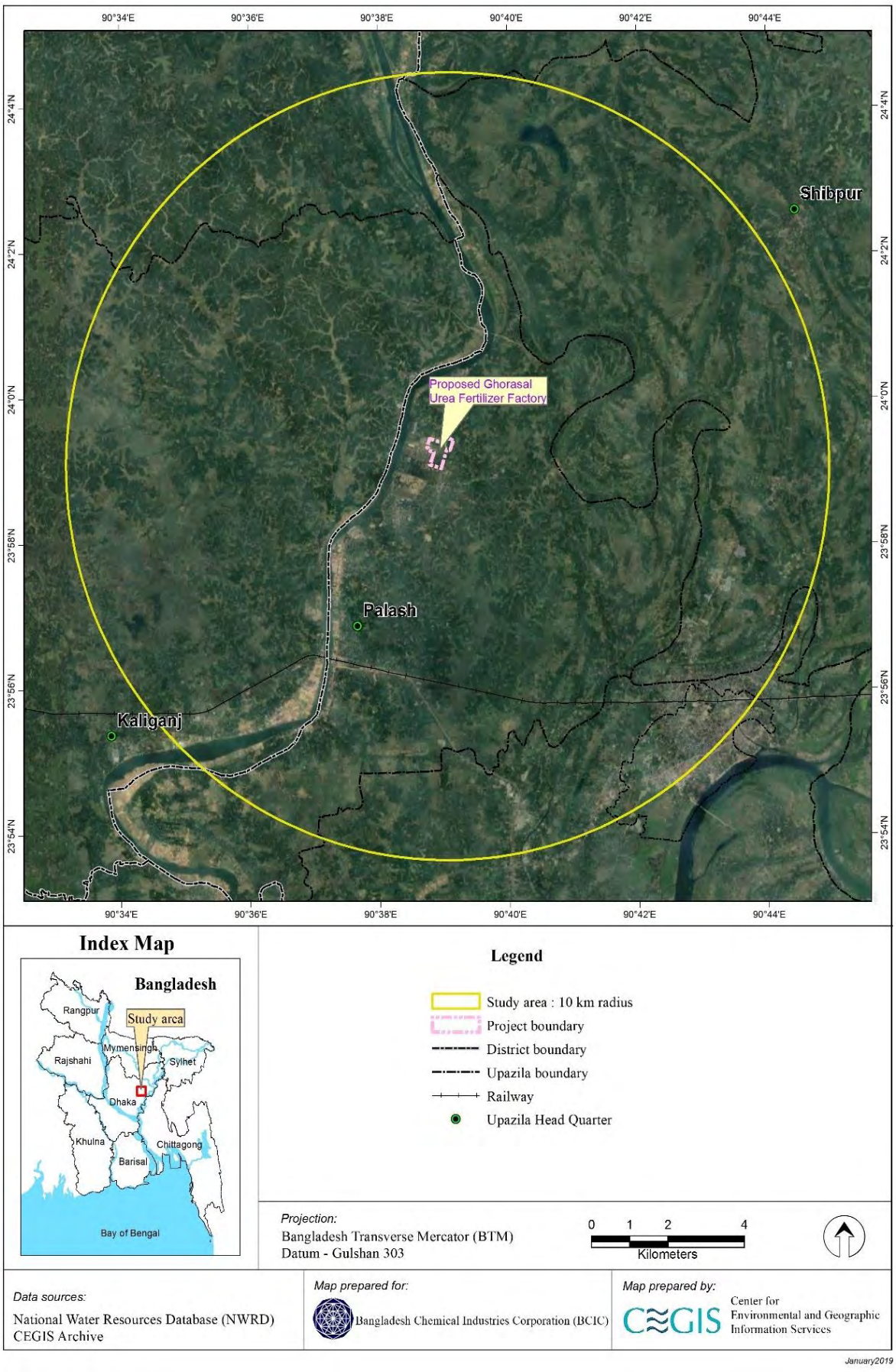


Figure 4.4: Study area (general impact area)

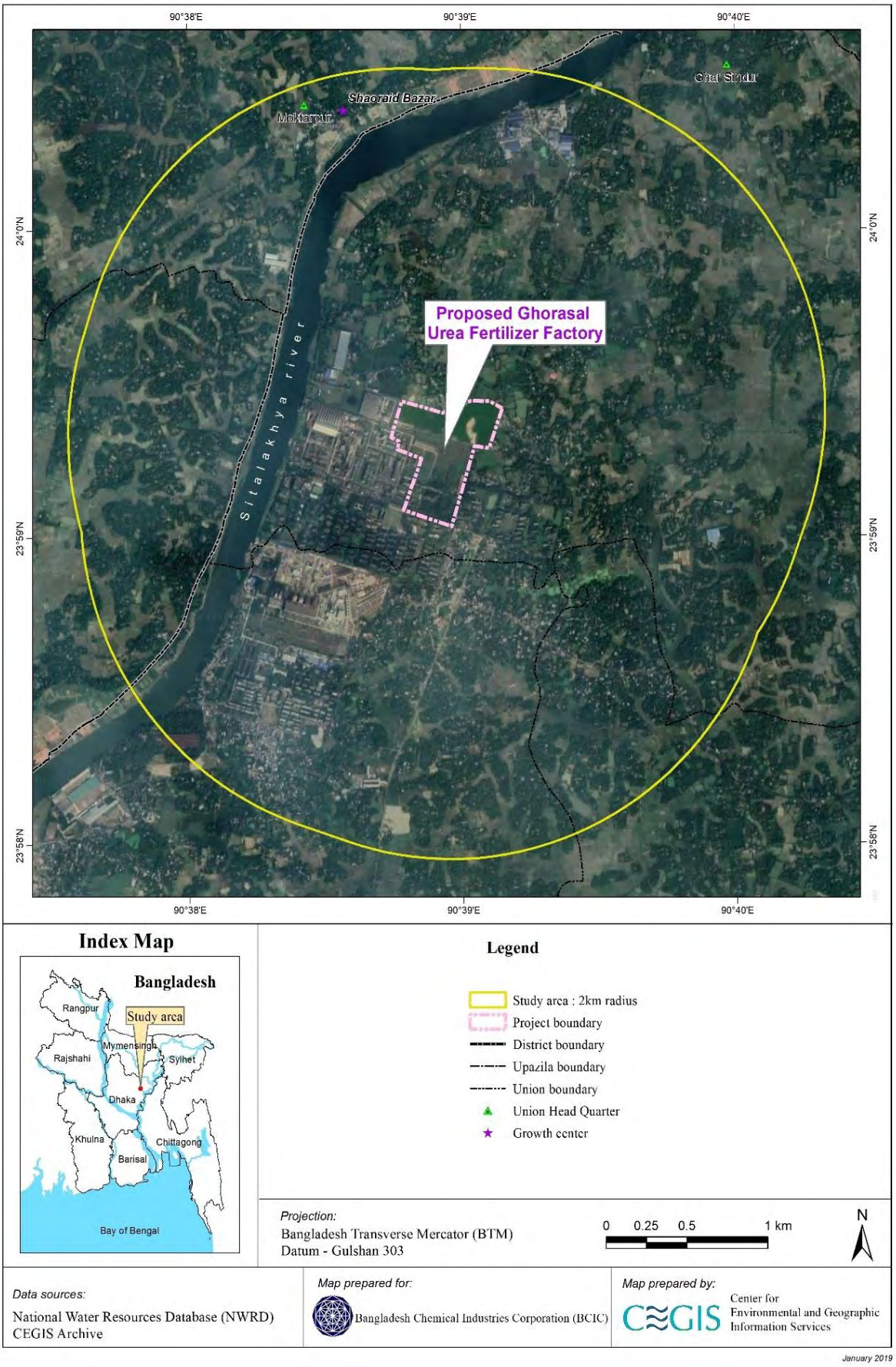


Figure 4.5: Direct impact area for the proposed Project

4.4 Nature and Size of the Project

221. The project involves dismantling of the existing infrastructures located inside the Project site. The nature of the proposed Project is a new construction of natural gas-based granulated urea plant. The urea production capacity of the proposed Project is 2,800 TPD and annual production capacity is based on 330 stream days in a year. For fulfilling the power requirements, the proposed project will have a 2x32 MW Steam Turbine Generator (STG) and one 09 MW GEG power plant as captive plant for its day to day use.

4.5 Project Concept

222. The proposed Project is a new construction of urea plant of about 0.924 million tons of urea at the rate of 2,800 TPD (based on 330 operating/stream days per year). Commissioning of the Urea Fertilizer Factory of above capacity will be done by installing utility boiler, central store, ammonia plant, cooling tower, central control room, urea unit, demi water unit, pumping station, ammonia storage tank, power plant, WWTS/ETP, etc. The proposed project will have a 2x32 MW ST and one 09 MW GEG Power Plant as captive plants for its day to day use. According to the agreement, Titas Gas Transmission and Distribution Company Ltd. (TGTDCL) used to supply about 64.7 MMCFD (UFFL- 48 and PUFFL- 16.7 MMCFD) natural gas at normal supply condition and ensured to supply to the UFFL and PUFFL about 70 MMCFD (UFFL- 52 and PUFFL- 18 MMCFD) natural gas at maximum supply conditions through the existing gas network and the proposed Regulating Metering Station (RMS).

223. Raw water withdrawal from the Shitalakhya River is about 2,040 t/h (0.5667 m^3/s), after storage tank it becomes about 1,159 t/h (0.3219 m^3/s) and the net water intake is about 1,020 t/h (0.2833 m^3/s) will be used for plant's cooling and all other purposes as stipulated below, such as open recirculation cooling (cooling water of 0.2325 m^3/s), other plant use (0.0508 m^3/s), etc.

224. Product urea in bags will be conveyed by a closed conveyor belt to the jetty to be constructed on the left bank of the Shitalakhya River. From the jetty, the urea will be transported by barges. The bagged urea will be transported by trucks and rail wagons through road and railways respectively. A railway line from the site to nearby mainline will be constructed too.

4.6 Project Components

225. The project components are broadly categorized into two types, such as (i) dismantling component; and (ii) new construction component.

4.6.1 Demolition of Existing Infrastructures

226. The existing infrastructures which fall under the proposed project site will be dismantled. The type of infrastructures and the area these belonged to are as follows: buildings of an area of about 1,87,404 sqft (17,410 sqm), semi-pucca tin-shed building of an area of about 94,680 sqft (8,796 sqm), RCC (brick chips) road of an area of about 167,494 sqft (15,561 sqm), RCC (stone chips) road of an area of about 1,680 sqft (156 sqm), carpeting road of an area of about 86,550 sqft (8,040 sqm), boundary wall of an area of about 44,343 sqft (4,120 sqm), tin-shed/asbestos sheet/scrap yard/heavy vehicle of an area of about 10,525 sqft (977 sqm) and Titas infrastructure of an area of about 44,587 sqft (4,142 sqm) (Table 4.3). Approximately 27,400 tons of debris will be generated due to demolition of civil structures. For

storing the dismantled infrastructure components, spacious scrap site will be required temporarily or sold out to the relevant vendors. The existing stores/warehouses will be dismantled.

227. The project site is largely covered by grasses and having different species of trees, shrubs and climbers. Among the trees, the major ones are timber trees followed by fruit and other trees. The major timber trees are: Shegun, Mahogoni, Raindee Koroi, Kanthal, Sirish, Koroi, etc. The fruit trees are: bael, beetel nut, jackfruit, papaya, coconut, , lemon, mango, cashew nut, blackberry, embelic, etc. Trees fall in other category include Jhau, Kamini, Debdaru, Neem, Krishnochura, Bot, Daruchini, etc. A 'Demarcation Report' has been prepared and appended in **Annex 4-1**. Based on the report it is concluded that about 3,750 small to big trees (sapling mostly, juvenile and adult) will be cut down during site preparation. The trees found in the site were planted by PUFFL as a part of a greenery program from the date of commissioning of the Plant.

The hazardous waste generated from demolition of infrastructures will be treated as per the WBG's General EHS Guidelines, 2007 and WBG's Good Practice.

Table 4.3: List of infrastructures inside the proposed site of GPUFP

Sl. No.	Name of Infrastructures	Measurement (in sqft)
1	Administrative office building area (Two storied)	17,026
2	Technical office building area (Two storied)	13,596
3	Canteen building area	2,040
4	General store building area	30,450
5	General store semi-pucca asbestos sheet roof with M.S. tress	21,750
6	Security post (Two storied)	72
7	Factory out gate security office	364
8	Factory main gate security office	960
9	Receiving bay store office	1,200
10	Security office (Housing colony gate)	420
11	VIP Guset House building area	8,390
12	Medical Center (Three storied) and Porch	10,962
13	Officer's Club (Two storied), one storied and Porch	10,572
14	Officer's Hostel (Five storied), Porch, Passage (Three storied)	26,021
15	Employee's Hostel (Five storied), Passage, Porch	30,954
16	Union Office (One storied)	2,592
17	Employee's Club (Two storied) and Porch	9,285
18	UFFL Lagoon pump house	750
A	*Sub-total building area=*	***1,87,404***
B	*Sub-total semi-pucca tin-shed building area=*	***94,680***
C	*Sub-total RCC (Brick chips) road area=*	***1,67,494***
D	*Sub-total RCC (Stone chips) road area=*	***1,680***
E	*Sub-total carpeting road area=*	***86,550***
F	*Sub-total boundary wall area=*	***44,343***
G	*Sub-total tin-shed/asbestos/scrap yard/heavy vehicle area=*	***10,525***
H	***Sub-total Titas infrastructure area=***	***44,587***
I	**Grand total demolished area=**	**6,37,263 sqft~59,204 sqm**

Source: Final Report from Demarcation Committee, BCIC, 2017

4.6.2 Newly Construction Components

228. The major components of the proposed GPUFP can be categorized in three systems/processes. These are: (a) Process Plants; (b) Utility; and (c) Off-sites.

(a) Process Plants: The process plants include the following components-

- Ammonia Plant;
- Urea Plant; and
- Urea Granulation Plant.

(b) Utility: The utility services are composed of following components-

Sl. No.	Components	Sl. No.	Components
1	River water intake Unit	8	Inert Gas Generation and Storage Facilities
2	Water Treatment Unit plus distribution system	9	Waste Water Treatment System (WWTS)/ Effluent Treatment Plant (ETP)
3	Cooling water (Cooling Tower)	10	Polyethylene Bag Making Plant
4	Steam generation Facilities plus distribution system	11	Central Control room, Substation, Switch room, etc.
5	Electrical Generation Facilities and Power Distribution System	12	GEG, Emergency Generator & UPS
6	Instrument Air and Plant Air Facilities		
7	Natural Gas Metering Station		

(c) Off-sites: There are some components of the proposed GPUFP which will function as forward linkages of the project. The components are as follows:

Sl. No.	Components	Sl. No.	Components
1	Ammonia Storage Unit	8	Vehicle parking
2	Urea Handling, Bulk Storage, Bagging Facilities and Bagged Urea Storage	9	Buildings for different uses (Control Room, Administrative, Technical, Maintenance, Engineering, Security etc.)
3	Laboratory facilities	10	Ammonia Bottling station
4	Warehouse for Spares, Catalysts, Resins, Chemicals, Consumable, etc.	11	Jetty
5	Maintenance shops(Mechanical, Electrical, Instrument)	12	Water Intake
6	Fire Fighting System including First Aid Center		
7	Road, Paving, Fencing, Lighting, Drainage Network		

4.7 Resources and Utility Demand

229. Resources required to develop the project include soil, construction material, manpower etc. The site is a part of the existing urea fertilizer plant and of the same level, therefore will need only minor earth dressing except the lagoon. Filling up the lagoon will need soil which may be collected from the nearby the Shitalakhya River through dredging. The estimated dredged materials will be about 2,26,700 m^3. The dredging activities may loosen contaminated bed materials (sediment) and entrain into the food chain of fish and other aquatic

organisms. Local construction material will be used for the proposed project and the project will provide employment for unskilled, semi-skilled and skilled categories. Employment opportunities will be available with the start of construction activities and continue through the operation phase, mainly in service sector.

230. Electricity demand during the construction phase will be met by the existing sub-station and distribution facility. During the construction period, water can be fetched from the nearby Shitalakhya River and drinking water can be drawn from existing underground sources such as Deep Tube well. Natural gas as fuel will be available under the existing supply of the TGTDCL from nearby Regulating and Metering Station (RMS) for the proposed GPUFP. Waste will be disposed of in the approved designated site preferably apart from the Plant site.

231. A temporary sanitation facility for the workers during pre-construction and construction phases will be developed with septic pits or tanks with adequate capacity. The sewerage system will be connected to the existing facility.

232. A temporary road and drainage system will be developed in addition to the existing system until a final road and drainage system is constructed.

4.8 Source of Natural Gas and Quality

233. At present the gas is supplied to the PUFFL and UFFL by the Titas Gas Transmission and Distribution Co. Ltd (TGTDCL) of PetroBangla through a 8″ diameter pipeline and a Regulating and Metering Station (Titas RMS) situated at the Northeast corner of the PUFFL and UFFL complex. The natural gas is supplied under a contract for maximum 70 MMCFD but currently being used 64.7 MMCFD of natural gas for operating UFFL and PUFFL. The contract needs to be maintained to meet the demand of gas for operating the proposed Project.

234. Natural gas will be supplied to the plant site through the existing pipeline system with minimum expected gas pressure at the plant boundary is 7-10 kg/cm^{2}G (6.9-9.8 bar). Considering distance from the location of existing RMS a new NG receiving system will be required to be installed in the space available at the Southwest side of the proposed site. A 8″ diameter gas pipeline from inlet header of the Titas RMS up to the bus of the proposed gas station mentioned above is to be constructed. Existing and proposed gas supply arrangements are presented in **Figure 4-5** and **Figure 4-6** and the composition of gas used in the urea plant is presented in **Table 4.4**.

Table 4.4: Gas analysis report

Gas Composition	% Mole in Gas using PUFFL and UFFL	Expected as per Tender Document
Nitrogen	0.788	0.55
CO_2	0.008	0.43
Methane	97.644	96.6
Ethane	1.544	1.7
Propane	0.006	0.36
Normal Butane	0.002	Butane, i C_4H_{10}: 0.09 and Butane, n C_4H_{10}: 0.052
Hexane Plus	0.008	-
Air/O_2	-	0.10
Hydrogen Sulfide	-	2 ppm max
Calorific Value	>1,000 kcal/Nm^3	8691.98 kcal/Nm^3 (approx.) Lower Heating Value

Source: Bangladesh Gas Fields Company Ltd.

4.9 Pipelines for Natural Gas and new Gas Regulating and Metering System

235. At present the gas is supplied to PUFFL and UFFL from Titas Gas Transmission and Distribution Company Ltd. (TGTDCL). A Gas transmission line constituting 46.31 km distance from Titas field through one DN16 diameter pipeline with 1,000 psi pressure comes to Narsingdi (Figure 4.7). From Narsingdi VS#12, 2 nos. DN 14 of 22.31 km transmission line with the same pressure of 1,000 psi is connect to a Regulating and Metering Station (RMS) situated at the PUFFL and UFFL Complex (Figure 4.8). Gas inlet pressure of Titas RMS varies from 420 psi to 600 psi. A 8″ diameter gas pipeline from inlet header of the Titas RMS up to the site will be constructed along with a new NG receiving system.

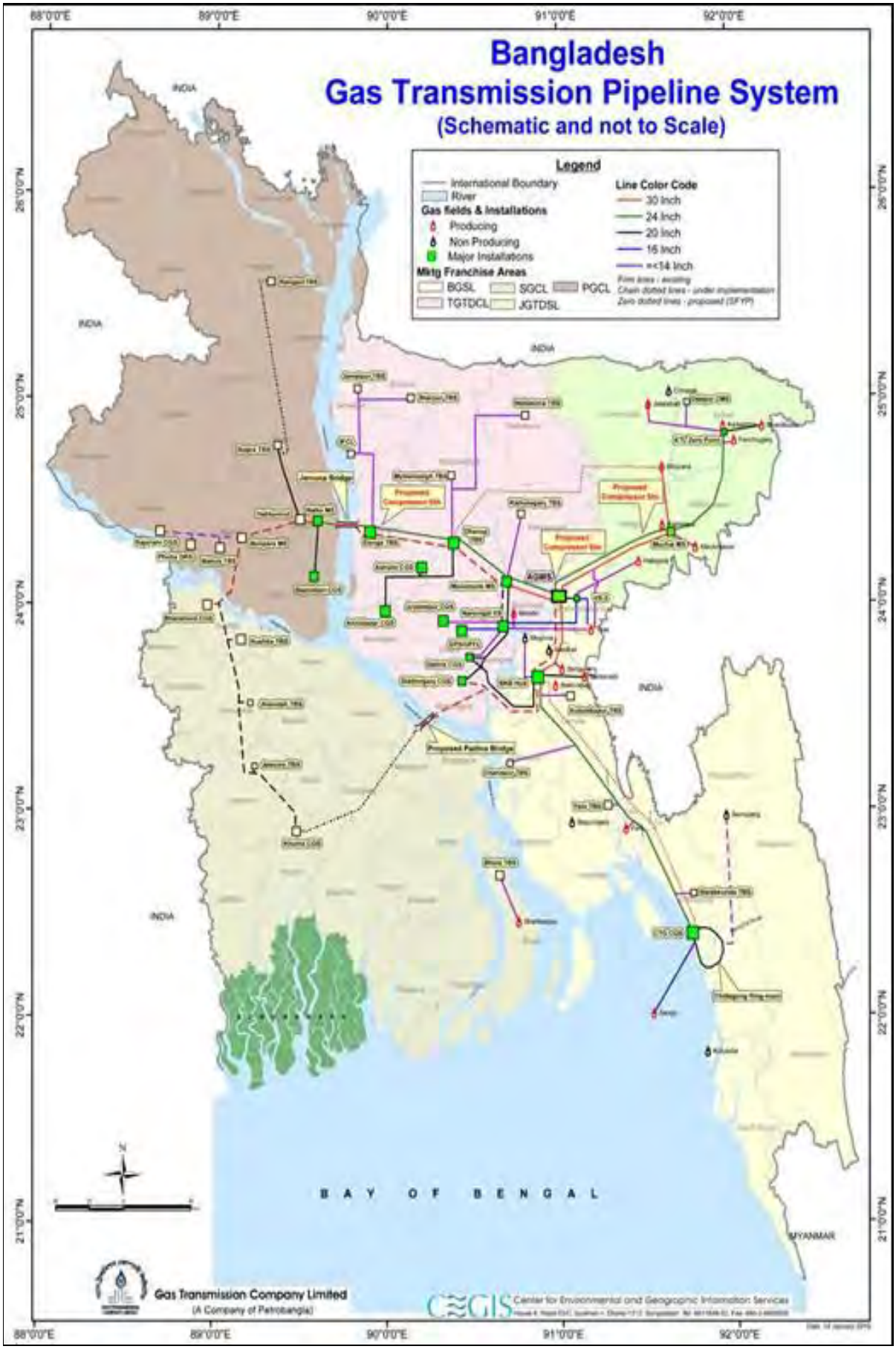


Figure 4.6: Gas transmission network

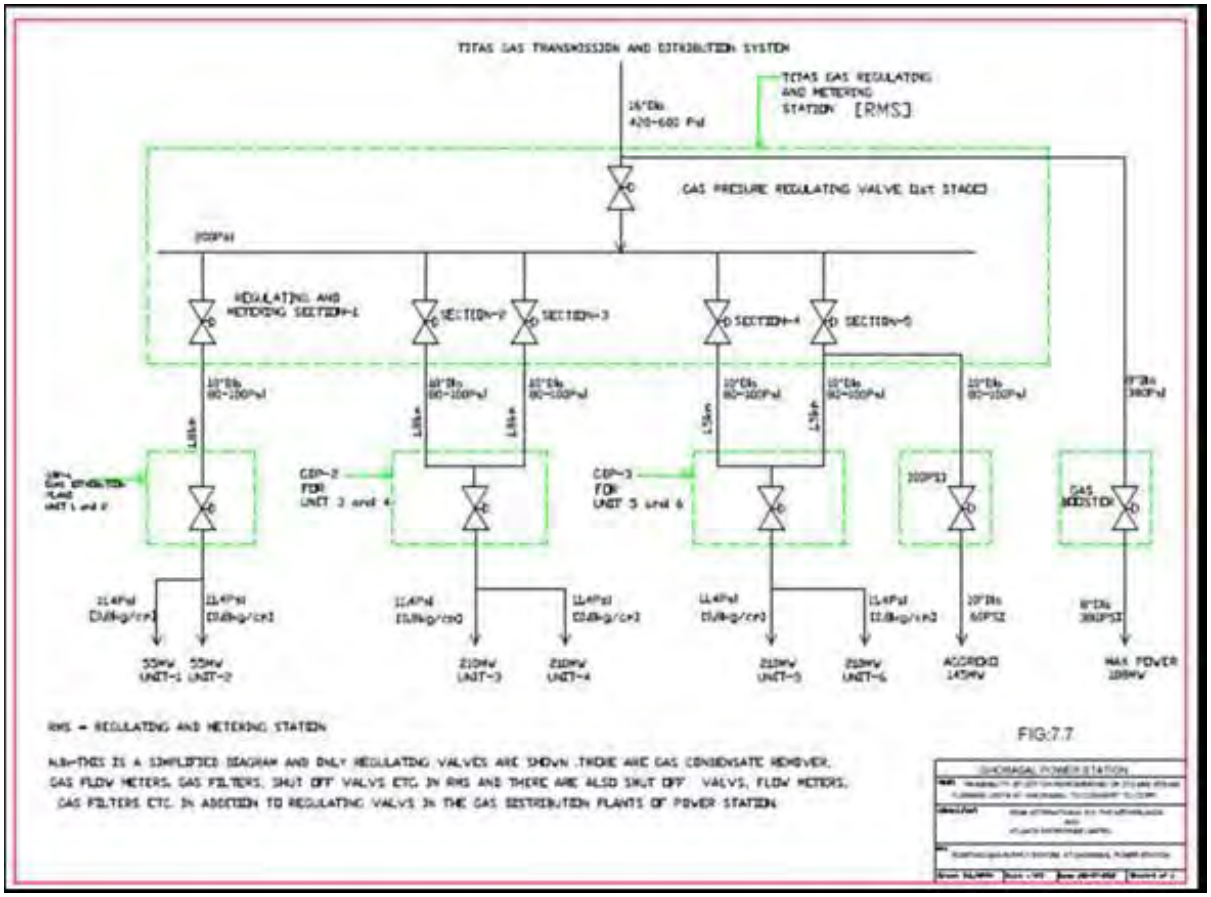


Figure 4.7: Existing Ghorasal gas connection system

4.10 Project Activities and Schedule

4.10.1 Project Activities

236. There are two main project activities, (a) Demolition of existing Infrastructures and (b) New Construction of Urea Fertilizer Factory. A list of project activities and associated concerns are given below in **Table 4.5**.

Table 4.5: List of activities and associated concerns

Sl. No.	Activities	Concerns
A.	**Pre-Construction Phase**	
A1.	Demolition of infrastructures and scraping	• Dismantling activities for the existing civil structures will result in loose soil within the complex. Wind flow is strong during dry months. Thus, the dust generated during the construction activities may spread to the nearby areas • Marginal exhaust emissions from dismantling equipment • Scrapping time dust emission • Noise generation • Associated risks
A2.	Site preparation	• Clearing of vegetation and removal of top soil • Labor mobilization • Lagoon to be filled up by dredged materials from the Shitalakhya River

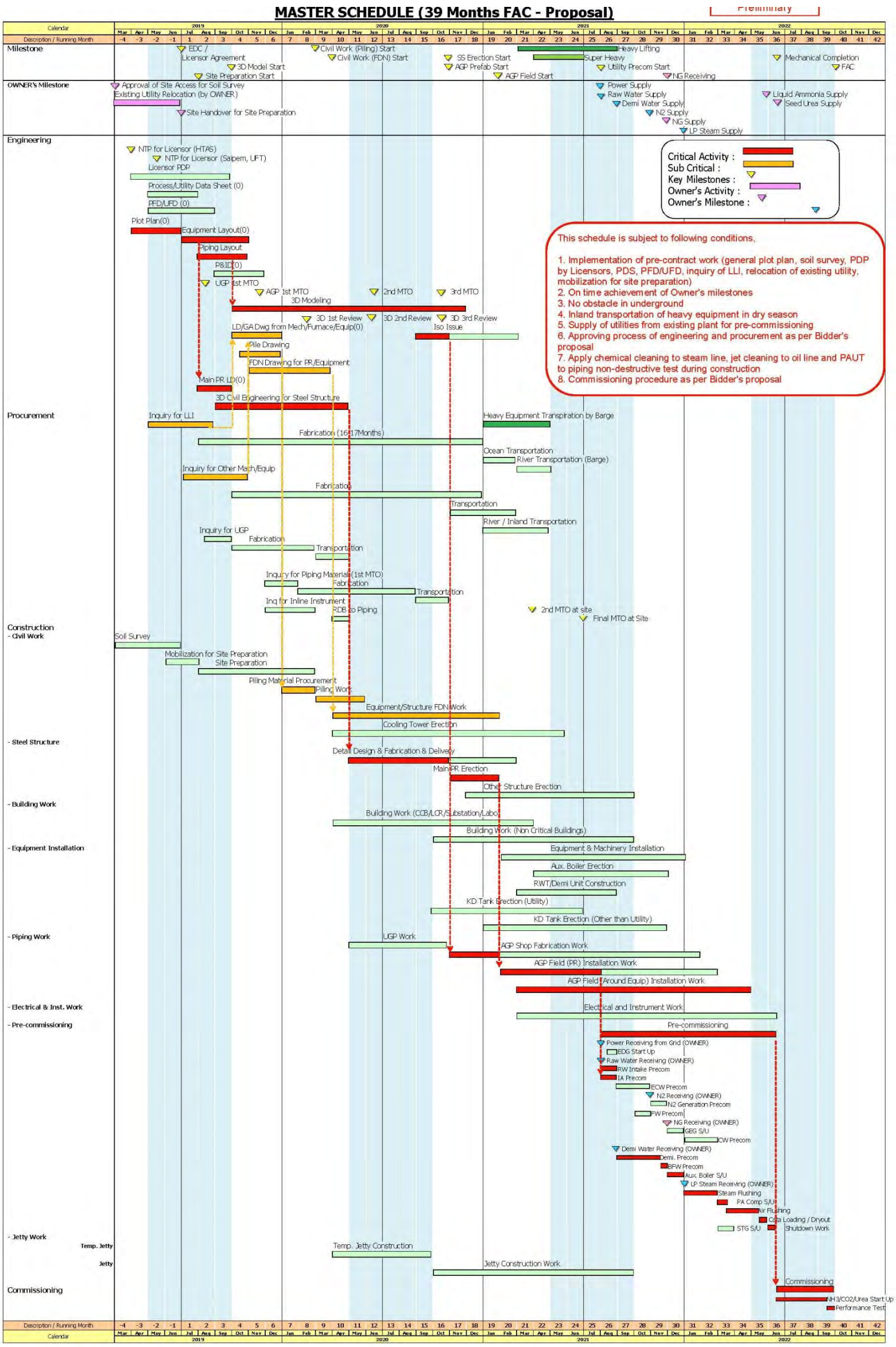
Sl. No.	Activities	Concerns
A3.	Transportation with respect to equipment and materials procured and Site receiving, Handling and Warehousing which include:	
	A3.1 Unloading at the site	Vehicular movement; noise generation
	A3.2 Storing	
	A3.3 Receiving and issuing of equipment and materials	
A4	Temporary Works (needed by the contractor) include:	
	A4.1 Temporary warehouse	Vehicle movement; dust and solid waste generation; generation of sewage
	A4.2 Temporary office	Vehicle movement; dust and solid waste generation; generation of sewage
	A4.3 Water supply within the site	Drainage system
	A4.4 Electricity supply within the site	Pressure on grid and local allocation.
	A4.5 Temporary sewer and drainage system	Hygienic condition of labor shade, office and construction site; Drainage system would facilitate drainage of construction waste water.
	A4.6 Temporary firefighting equipment & first aid facilities.	Fire induced risk would be reduced.
	A4.7 Temporary site canteen	Solid wastage
	A4.8 Camp accommodation for contractor's and its subcontractor's personnel	Land requirement (estimate land area based on area requirement per person), solid waste, sewage, drainage, etc.; Social pressure in local market; Society may feel pressure in the following areas: mixing with local people, anarchy, diseases, house rent may increase, etc.
	A4.9 Other temporary facilities within the site as required such as scaffolding, fencing, guard house etc.	Construction of trenches, Construction waste, dust
B.	**Construction Phase (Construction and Erection work)**	
B1.	**Construction Work**	
	B1.1 Civil work (piling, foundation, structure, buildings, shades, roads, drains, pavements, etc.)	Vehicular movement and operation of construction equipment: Noise, dust, exhaust emissions (marginal increase in the levels of SO_2, NO_X, PM, CO and un-burnt hydrocarbons), construction liquid waste, solid waste, drainage, etc.
	B1.2 Shipment of Machinery to the site	Temporary load of barges increase; marginal exhaust emission; bilge and ballast water may affect water quality, etc.
B2.	**Erection Work: Installation Work (all equipment, package units if any etc.)**	
	B2.1 Piping Work	Noise, dust, exhaust emissions (marginal increase in the levels of SO_2, NO_X, PM, CO and un-burnt hydrocarbons),
	B2.2 Electrical Work	

Sl. No.	Activities	Concerns
	B2.3 Instrumentation Work	construction liquid waste, solid waste, drainage, risk, health and safety, etc.
	B2.4 Insulation Work	
	B2.5 Painting Work	
	B2.6 Flushing and Chemical Cleaning	Chemical contamination to ambient water environment
B3.	B3.1 Jetty construction	• Pile driving may affect aquatic biodiversity, vocalization behavior of the organisms may be affected. • Obstruction to water flow
C.	**Operation Phase**	
	C1. Water intake (2040 t/h) from the Shitalakhya River	Pressure on the river and environmental flow; Aquatic biodiversity; LLP-based agriculture
	C2. Drainage of rejected water	Contamination to water quality; Aquatic biodiversity, soil contamination, etc.
	C3. Sludge to Shitalakhya River	
	C4. Effluent (chemical/fertilizer and oily)	Chemical/fertilizer mixed water pass through the ETP and oil-mixed water through oil separator.
	C5. Boiler (Aux.) and Gas Engine Generator	Flue gas (NOx, Particulate substances)
	C6. Ammonia plant	
	Ammonia Plant	Flue gas (negligible NOx); Noise
	CO_2 recovery plant	Exhaust CO_2
	C7. Urea Plant	
	Urea Granulation Plant	• Urea dust • NH3 (<150 mg/Nm^3-dry) • Noise
	C8. Officials (Administrative, Plant operation, Control Tower, etc.)	Sewage, potable water requirements, solid waste, risk, etc.
	C9. Labor requirements	
	C10. Jetty operation	Solid and liquid waste
	C11. Dispatch of urea	Water, Rail and Road ways; Bilge and ballast water waterway vessel may contaminate water; Vehicle load will be increased; social mobilization may be hampered; exhaust emission (NOx, CO_2, dust, etc.)

4.10.2 Project Implementation Schedule

237. The duration of the Project is about 39 months, started from July, 2019 to September, 2022. The detail schedule of the Project implementation from Site Preparation to Commissioning is given in Table 4.6.

Table 4.6: Project implementation schedule



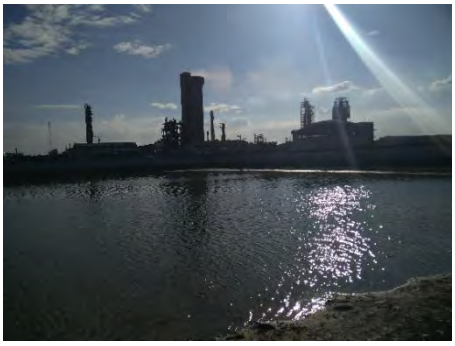
5. Project Design and Description

5.1 Overview of Existing Facility

238. At present, there are six urea fertilizer factories under BCIC. Out of these, the Ghorasal area has two Urea Plants: Urea Fertilizer Factory Ltd. (UFFL) and Polash Urea Fertilizer Factory Ltd. (PUFFL). The installed capacity of six urea fertilizer factories under BCIC is 2.80 million MT. However, due to aging some of these Plants cannot sustain the installed capacity and gradually the production is decreasing.

239. The UFFL is one of the old fertilizer plants in the country and was established in 1970. The installed production capacity of the plant was 340,000 tons of urea per year and the renovated capacity is 470,000 tons per year. At present production has come down to 600 TPD from 1,400 TPD.

240. The PUFFL having yearly production capacity of 95,000 tons of Prilled Urea was established in 1985. The economic life of the project was 15 years. The present production comes down to 250-300 TPD from 305 TPD. **Figure 5.1** shows the existing major equipments of the PUFFL.



PUFFL

Compressor

Water Intake Point

Acid Tanks

Figure 5.1: Existing infrastructures of the PUFFL

5.2 Proposed Project Design

5.2.1 Design Life and Operating Time

241. The design life is 20 years for the process plant subject to appropriate maintenance and replacement for items such as catalysts, furnace tubes and mechanical seals which have

shorter life duration and will require replacement during the life of the Process Plant. The operating time/stream of the proposed plant is 330 days per annum.

5.2.2 Technology Selection

242. The technologies or Process Licensors for Ammonia, Urea Melt, Granular Urea and CO_2 Recovery from Primary Reformer have been selected for this Project based on different aspects mentioned in Sections 3.8, 3.9, 3.10 and 3.11 respectively. The selected Process Licensors are attributed in Table 5.1 below.

Table 5.1: Process Licensors selected for the Project

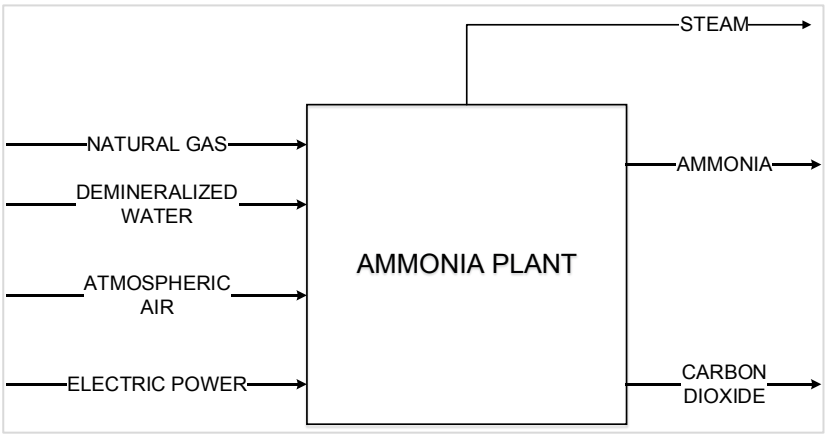
Sl. No.	Process Name	Name of Process Licensor
01.	Ammonia	Haldor Topsoe A/S (HTAS), Denmark
02.	Urea Melt	SAIPEM S. p. A., Italy
03.	Urea Granulation	thyssenkrupp Fertilizer Technology GmbH (TKFT), Germany
04.	CO_2 Recovery from Primary Reformer	Mitsubishi Heavy Industries, Ltd (MHI), Japan

5.2.3 Process Description

Ammonia Process

243. The proposed ammonia plant is designed with a capacity of 1,600 MT/day, based on steam reforming of natural gas. In the plant, ammonia is produced from synthesis gas containing hydrogen and nitrogen in the ratio of approximately 3:1. Furthermore, high purity CO_2 is produced from the CO and CO_2 contained in the reformed gas. Besides these components, the synthesis gas contains inert gases such as argon and methane to a limited extent.

244. The source of H_2 is demineralized water and the hydrocarbons in the natural gas. The source of N_2 is the atmospheric air. The source of CO_2 is the hydrocarbons in the natural gas feed. The main function of the plant is illustrated in the following sketch. The main function of the Ammonia Plant is illustrated in the following sketch and diagram in Figure 5.2.



Sketch of the Ammonia Plant

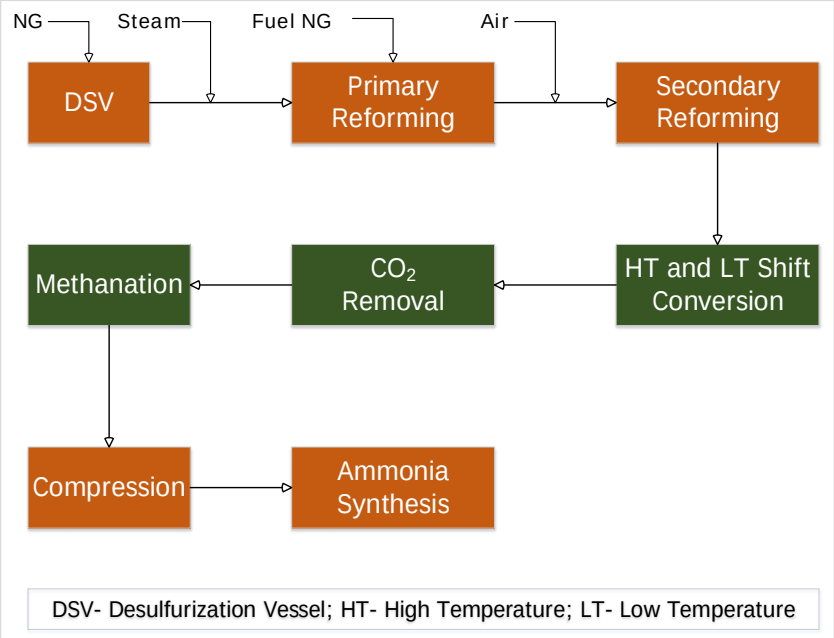


Figure 5.2: Sketch and flow diagram of ammonia synthesis

245. The process steps involved in production of Ammonia are:

- Desulphurization
- Reforming
- Carbon Monoxide Conversion
- Carbon Dioxide Removal
- Methanation
- Ammonia Synthesis
- Ammonia Refrigeration Circuit
- Ammonia Recovery
- Steam System
- Flare and Verit System

246. The descriptions of the various process steps are as follows:

Step-1: Desulfurization

247. The natural gas feedstock contains minor quantities of sulfur compounds which have to be removed in order to avoid poisoning of the reforming catalyst in the primary reformer and in the low temperature CO converter.

248. Natural gas from battery limit at 3.96 MPa g is mixed with recycle gas and heated to 370°C in the flue gas section of the primary reformer. Desulfurization is achieved by converting organic sulfur compounds to H_2S. H_2S is subsequently absorbed on a specially prepared zinc oxide catalyst, contained in sulfur absorbers. The sulfur contained in the natural gas will be reduced to less than 0.05 vol. ppm.

Step-2: Reforming

249. The reforming of the hydrocarbon feed takes place in two stages, a direct fired primary reformer and an autothermal catalytic secondary reformer.

250. The primary reformer is divided into two chambers having a common flue gas duct and a flue gas heat recovery section. In the primary reformer the hydrocarbon mixed with steam is decomposed into hydrogen, carbon monoxide, and carbon dioxide over a nickel catalyst. Flue gas flow is upwards with a temperature of about 1050°C.

251. In the secondary reformer methane is decomposed. The methane concentration in the outlet gas from the secondary reformer is 0.3 vol% (dry basis).

252. Thus, the reforming unit consists of a primary reformer with a waste heat section and a secondary reformer.

Flue Gas Heat Recovery Section

253. The flue gas then passes via the flue gas duct to the flue gas heat recovery section, where most of the heat of the flue gas is utilized for preheating purposes and then leaves through the stake at a temperature of about 190°C.

Secondary Reformer

254. The gas from the primary reformer is passed on to the secondary reformer where it is mixed with the compressed process air at about 3.38 MPa g and is preheated to 550°C.

255. The process gas leaves the reforming section at about 998°C. It is cooled to about 442°C in the RG waste heat boiler, where 12.26 MPa g saturated steam is produced, and further to 360°C in the RG steam superheater. After cooling, the gas flows to the high temperature CO Converter.

Step-3: Carbon Monoxide Conversion (CO)

256. The CO conversion takes place in two adiabatic stages- HT & LT converters. After reforming, about 13.47% CO is present in the gas (dry basis). In the high temperature CO converter the CO content is reduced to approximately 3.19 vol%, and the temperature increases from 360°C to 433°C. It is then cooled to 205°C and passed on to the low temperature CO converter, in which the CO content is reduced to approximately 0.3 vol%, while the temperature increases to 228°C.

Step-4: Carbondi Oxide (CO_2) Removal

257. The gas leaving the CO conversion unit contains a considerable amount of recoverable heat. The waste heat in process gas is recovered in a high pressure Boiler Feedwater (BFW) preheater, in the stripper reboiler and in the demineralized water preheater.

258. Carbon Dioxide (CO_2) is removed from the process gas by counter-current absorption in two stages using an activated Methyl Di-Ethanol Amine (aMDEA) solution. For removal of the CO_2, BASF's OASE process is used. Main equipment in the OASE process is the CO_2 absorber, and the CO_2 stripper. In the lower part of the CO2 absorber, flash-regenerated solution is used for bulk CO removal. In the upper part of the absorber, strip-regenerated Solution is used for scrubbing.

259. The extracted CO_2 will be delivered cooled to 43°C and at a pressure of 0.05 MPa g. In this way, a nearly complete removal of CO_2 with only 0.05 vol% CO_2 (on dry basis) left in the treated gas is obtained at the expense of very low heat consumption.

Step-5: Methanation

260. After the CO2 removal, the gas contains 0.05% CO2 and 0.36% CO (dry basis). These compounds are poisonous to the ammonia catalyst and must be removed before the. gas is

taken to the synthesis section. This is done in the methanator where CO and CO2 react with H2 to form CH4 , which is harmless to the ammonia catalyst. The reaction takes place over a nickel-based catalyst. The content of CO + C02 is reduced to less than 5 ppm. The outlet gas is cooled with the inlet gas and finally cooled to 42°C.

Step-6: Ammonia Synthesis

Compression

261. The synthesis gas is compressed from 2.55 to 18.73 MPa g by the centrifugal synthesis gas compressor.

Synthesis Loop

262. At this point a considerable part of the ammonia produced in the converter has been condensed. The mixture of synthesis gas and liquid ammonia passes from the 2nd chiller to the ammonia separator in which the liquid ammonia is separated. The outlet gas contains 4.05 vol% NH3 at a temperature of 0°C.

263. Ammonia condensation will absorb the traces of makeup gas impurities like H2O and CO2 and are removed with the liquid ammonia in the separator. The gas leaving the separator eventually will go to the hot exchanger and get heated to the converter inlet temperature.

264. The liquid ammonia is depressurized to 2.55 MPa g and taken to the let-down vessel in which the main part of the gases dissolved in the ammonia is liberated. The let-down gas contains a considerable amount of ammonia, which is recovered by water wash in the off-gas absorber. The off-gas is then sent to the fuel header.

Step-7: Ammonia Refrigeration Circuit

265. The refrigeration circuit consists of a compressor unit, a condenser, an accumulator and a number of chillers. Evaporated ammonia from the chillers and the flash vessel is compressed by the ammonia compressor. After compression, the ammonia is collected in the ammonia accumulator.

Step-8: Ammonia Recovery

266. Purge gas from the purge gas separator is sent to the purge gas absorber. Ammonia is washed out of the gas with water and the purified gas is sent to the hydrogen recovery system where 85% of the hydrogen is recovered and returned to the synthesis loop.

267. Inert gas and let down gas is introduced to the off-gas absorber and ammonia is washed out with water. The aqueous ammonia is sent to the ARU distillation column where the ammonia is distilled and returned as product to the let-down vessel. The off-gases from the hydrogen recovery system and the off-gas absorber are mixed and sent to the fuel header.

Step-9: Steam System

268. The major part of the waste heat available is utilized for production of high pressure steam. The produced HP steam is then superheated in the flue gas duct and sent to battery limit at 11.47 MPa g and 510°c.The superheated MP steam required for ammonia plant is imported from battery limit at 3.82 MPa g and 375°C for process and heating purpose.

269. Part of the HP boiler feed water is preheated in upstream and downstream of the low temperature CO converter and in the ammonia synthesis loop. The other part is preheated in the flue gas heat recovery section of the primary reformer.

Step-10: Flare and Verit System

270. Ammonia Plants are provided two (2) separate headers. One is flammable blow out gases without ammonia along with flammable natural gas from utility system is sent to the Vent Stack and discharged to atmosphere without burning. During the normal operation, quantity of blow-out gases is zero or very small. In case of upset conditions and/or during start-up and shut down operations of-the plant, large quantity of blow- out gases is released.

Urea Processing

271. This section contains a technical description of a Urea Melt Production train with a daily operating capacity to allow the production of 2800 MTPD of granulated urea by means of a Granulation Unit based upon "fluidized bed granulation technology". The process flow diagrams of urea fertilizer synthesis are presented in Figure 5.3.

272. Saipem ammonia stripping process is characterized by a urea synthesis loop operating at about 15.2-15.7 MPa(g) with an ammonia to carbon dioxide molar ratio at urea reactor inlet of 3.1-3.5.

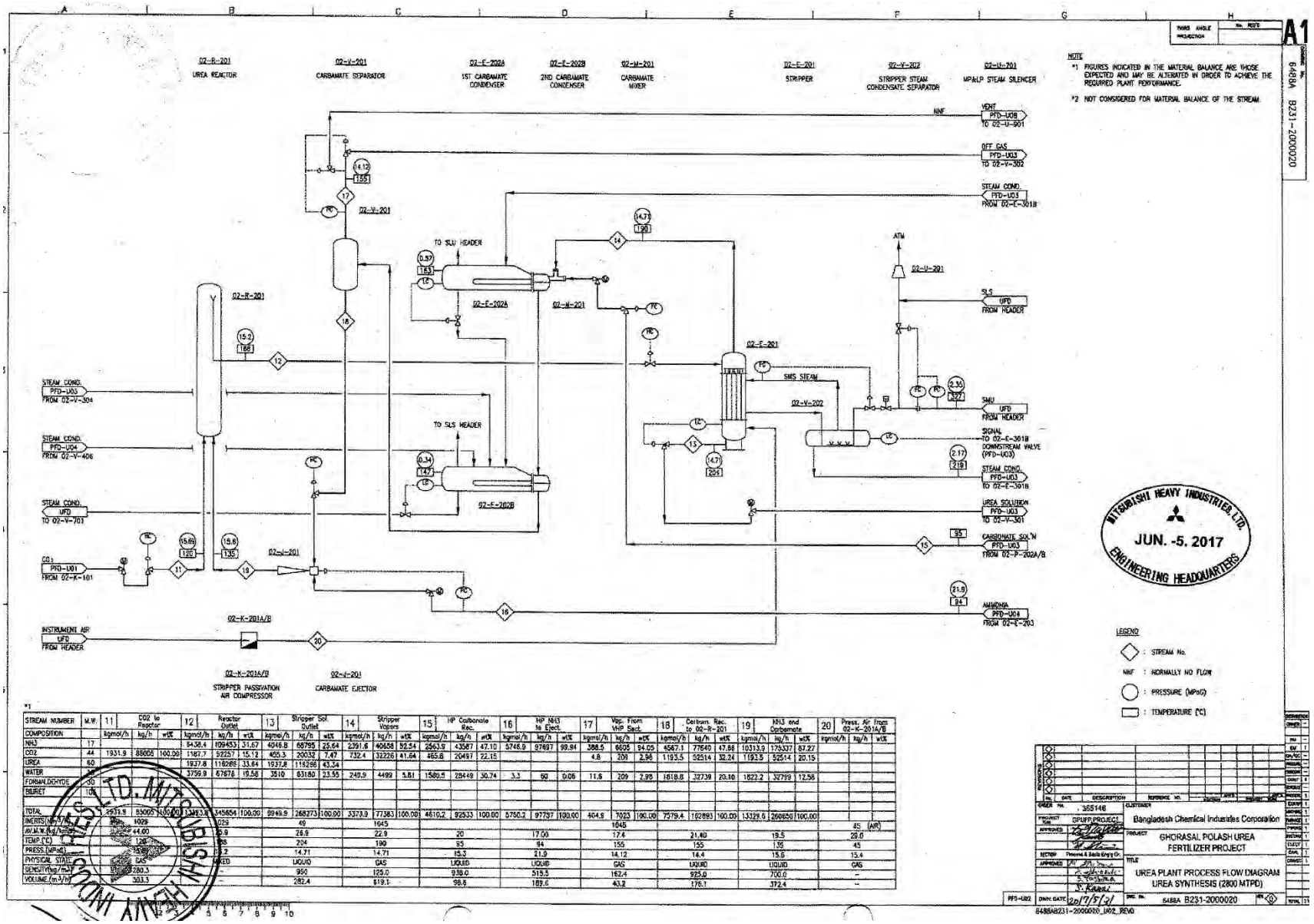
273. Waste heat recovery from process streams in some parts of the process layout have been introduced as a part of recent modifications, thus allowing considerable savings in overall steam and fresh water consumption, viz.:

- HP ammonia to urea reactor preheating with off-gas from LP decomposition stage.
- Heat to vacuum preconcentrator with off-gas from MP decomposition stage.
- Total recovery of process condensate as boiler feed water.

274. This Saipem License Processor allows a CO_2 conversion into urea of 60-63 % in the reactor itself, featuring the perforated trays which prevent back-flow and favor gas absorption by the liquid. Urea Melt Sections are characterized by the following main process steps:

- Urea synthesis and NH_3, CO_2 recovery at high pressure;
- Urea purification and NH_3, CO_2 recovery at medium and low pressures;
- Urea concentration;
- Process condensate treatment.

- Urea melt production unit is also provided with the following:
  - Steam networks;
  - Flushing networks;
  - Auxiliary installation.



*1

STREAM NUMBER	M.W.	11 CO2 to Reactor			12 Reactor Outlet			13 Stripper Sol. Outlet			14 Stripper Vapors			15 HP Carbonate Rec.			16 HP NH3 to Ejct.			17 Vap. From HP Sect.			18 Carbam. Rec. to 02-R-201			19 NH3 and Carbamate			20 Press. Air from 02-K-201A/B		
COMPOSITION		kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%	kgmol/h	kg/h	wt%
NH3	17				54.36.4	109453	31.67	4046.8	68795	25.64	2391.8	40658	52.54	2563.9	43567	47.10	5748.9	97697	99.94	388.5	6605	94.05	4567.1	77640	67.88	10313.9	175337	87.27						
CO2	44	1931.9	85005	100.00	1187.7	52257	15.12	455.3	20032	7.47	732.4	32226	41.64	455.8	20497	22.15				4.8	209	2.95	1193.5	52514	32.24	1193.5	52514	20.15			
UREA	60				1937.8	116286	33.64	1937.8	116286	43.34																					
WATER	18				3759.9	67678	19.58	3510	63180	23.55	248.9	4499	5.81	1580.5	28449	30.74	3.3	60	0.06	11.8	209	2.95	1618.8	32739	20.16	1822.2	32799	12.58			
FORMALDEHYDE	30																														
BIURET	103																														
TOTAL		2931.9	85005	100.00	3443.4	345854	100.00	9949.9	268273	100.00	3373.9	77383	100.00	4610.2	92533	100.00	5750.2	97737	100.00	404.9	7023	100.00	7579.4	162893	100.00	13329.6	260650	100.00			
ENTHALPY (kcal/kg)			1029			629			49			1645									1648								85	(AIR)	
M.W.M (kg/kgmol)			44.00			18.9			26.9			22.9			20			17.00			17.4			21.48			19.5			28.0	
TEMP (°C)			120			205			204			190			95			94			155			155			135			45	
PRESS (MPaG)			15.69			15.2			14.71			14.71			15.3			21.9			14.12			14.4			15.0			15.4	
PHYSICAL STATE			GAS			MIXED			LIQUID			GAS			LIQUID			LIQUID			GAS			LIQUID			LIQUID			GAS	
DENSITY (kg/m3)			280.3			-			950			125.0			938.0			515.5			162.4			925.0			700.0			-	
VOLUME (m3/h)			303.3			-			282.4			$s_{19.1}$			98.6			189.6			43.2			175.1			372.4			-	

ORDER No.	365146	CUSTOMER	Bangladesh Chemical Industries Corporation
PROJECT No.	DPUFF PROJECT	PROJECT	GHORASAL POLASH UREA FERTILIZER PROJECT
SECTION	Process & Basic Engg Gr.	TITLE	UREA PLANT PROCESS FLOW DIAGRAM UREA SYNTHESIS (2800 MTPD)
DWG. DATE	20/7/5/21	DWG. No.	6488A B231-2000020
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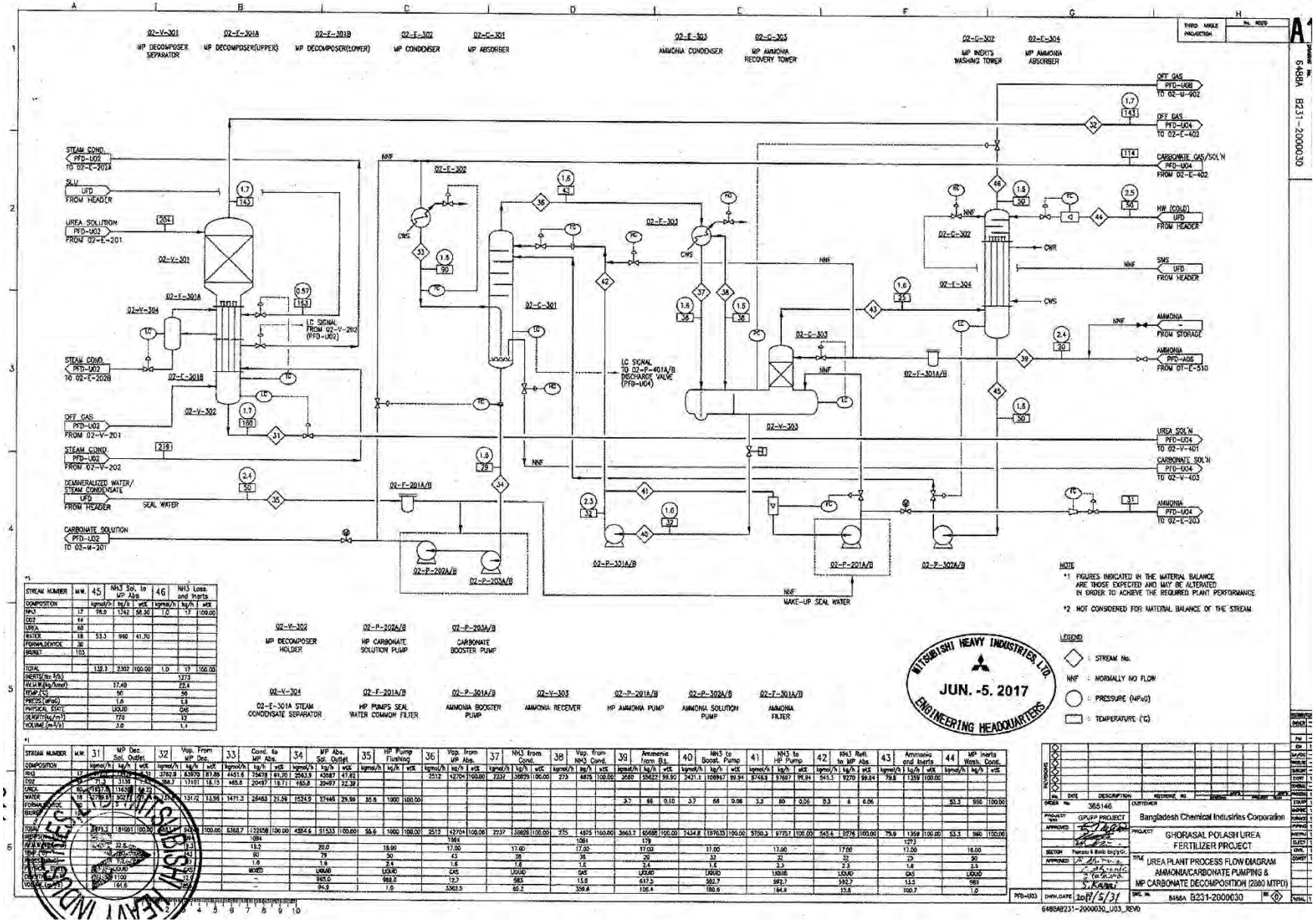
02-V-301
MP DECOMPOSER SEPARATOR
02-F-301A
MP DECOMPOSER(UPPER)
02-F-301B
MP DECOMPOSER(LOWER)
02-E-302
MP CONDENSER
02-C-301
MP ABSORBER
02-E-303
AMMONIA CONDENSER
02-C-303
MP AMMONIA RECOVERY TOWER
02-C-302
MP INERTS WASHING TOWER
02-E-304
MP AMMONIA ABSORBER
STEAM COND. PFD-U02 TO 02-E-202A
SLW UFD FROM HEADER
UREA SOLUTION PFD-U02 FROM 02-E-201
STEAM COND. PFD-U02 TO 02-E-202B
OFF GAS PFD-U02 FROM 02-V-201
STEAM COND PFD-U02 FROM 02-V-202
DEMINERALIZED WATER/ STEAM CONDENSATE UFD FROM HEADER
SEAL WATER
CARBONATE SOLUTION PFD-U02 TO 02-M-301
LC SIGNAL FROM 02-V-202 (PFD-U02)
LC SIGNAL TO 02-P-401A/B DISCHARGE VALVE (PFD-U04)
OFF GAS PFD-U08 TO 02-U-902
OFF GAS PFD-U04 TO 02-E-402
CARBONATE GAS/SOL'N PFD-U04 FROM 02-E-402
HW (COLD) UFD FROM HEADER
SMS UFD FROM HEADER
AMMONIA FROM STORAGE
AMMONIA PFD-A06 FROM DT-E-510
UREA SOL'N PFD-U04 TO 02-V-401
CARBONATE SOL'N PFD-U04 TO 02-V-403
AMMONIA PFD-U04 TO 02-E-203
MAKE-UP SEAL WATER
02-V-302 MP DECOMPOSER HOLDER
02-P-202A/B MP CARBONATE SOLUTION PUMP
02-P-203A/B CARBONATE BOOSTER PUMP
02-V-304 02-E-301A STEAM CONDENSATE SEPARATOR
02-F-201A/B MP PUMPS SEAL WATER COMMON FILTER
02-P-301A/B AMMONIA BOOSTER PUMP
02-V-303 AMMONIA RECEIVER
02-P-201A/B MP AMMONIA PUMP
02-P-302A/B AMMONIA SOLUTION PUMP
02-F-301A/B AMMONIA FILTER
NOTE
*1 FIGURES INDICATED IN THE MATERIAL BALANCE ARE THOSE EXPECTED AND MAY BE ALTERED IN ORDER TO ACHIEVE THE REQUIRED PLANT PERFORMANCE.
*2 NOT CONSIDERED FOR MATERIAL BALANCE OF THE STREAM.
LEGEND
STREAM No.
NNF : NORMALLY NO FLOW
PRESSURE (MPaG)
TEMPERATURE (°C)
MITSUBISHI HEAVY INDUSTRIES, LTD.
JUN. -5. 2017
ENGINEERING HEADQUARTERS
Bangladesh Chemical Industries Corporation
GHORASAL POLASH UREA FERTILIZER PROJECT
UREA PLANT PROCESS FLOW DIAGRAM AMMONIA/CARBONATE PUMPING & MP CARBONATE DECOMPOSITION (2880 MTPD)
6488A B231-2000030