Government of the People's Republic of Bangladesh

Ministry of Railways, Bangladesh Railway

Environmental Impact Assessment

Subproject 2: Feasibility Study, Detailed Design and Tendering Services for Construction of Dual Gauge Double Rail Line and Conversion of existing Rail Line into Dual Gauge between Akhaura and Laksam

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EXECUTIVE SUMMARY

1. The Project entails double tracking of a 72 km rail line, construction of 11 stations, construction of related buildings, improvements of access roads in eastern Bangladesh, and construction of the Engineer's Main Office building in Dhaka. The land use in the Project area is mainly agricultural with no significant environmental features or protected areas. Therefore the Project is classified as category B in accordance with the Safeguard Policy Statement (SPS) of the Asian Development Bank (ADB). Accordingly an Initial Environmental Examination (IEE) has been prepared for the Project. The European Investment Bank (EIB) a co-financier for this project requires the preparation of an Environmental Impact Assessment (EIA) in accordance with the requirements of EIB Environmental and Social Handbook, 2013-Version 9.0. In accordance with the requirements of the Department of Environment (DoE), Ministry of Environment and Forests, Government of Bangladesh the Project is classified as red category and requires a full EIA[1]. The 69 types of projects listed as red category in the Environmental Conservation Rules 1997 includes engineering works where the capital investment is more than 1 million taka and construction of bridges longer than 100 m. The Project investment is more than 1 million taka and includes bridges longer than 100 m, and hence is a red category project.

2. To avoid duplication, preparation of multiple reports and potential confusion during implementation, one report has been prepared to meet the requirements of ADB, EIB as well as DoE. Since under ADB requirements the Project is category B and the report fulfils the requirements of an IEE, this report will be referred to as an IEE and has been prepared a separate version of this report only for ADB. However, this report fulfils the requirements of an EIA for EIB and DoE, hence for EIB and DoE this report will be referred to as an EIA. Aside from the title of the report the technical contents of the report including the EMP is the same. The following text summarises the key findings of the EIA.

3. Akhaura to Laksam is one of the busiest rail lines in Bangladesh. Every day up to 31 sets of trains run between Akhaura and Laksam. Of these, three are container freight trains, the rest passenger and other trains. At present, approximately 40,000 passengers travel this stretch every day. This line will also be used as a link in the Trans-Asian Railway corridor, requiring the construction of additional rail capacity and the upgrading of the existing line to meet international standards as well as future demands.

4. The Project will double the capacity of this 72 km long existing stretch of the BR's rail network. Bridges, replacing the existing structures will be needed at the Dakatia River (proposed bridge length 73.15 m), the Gumti River (proposed bridge length 175.25 m), Gumti Spill (proposed bridge length 73.15 m), Sidai Khal (proposed bridge length 72.10 m), and Howrah River (proposed bridge length 104.2 m), plus another 8 bridges with lengths between 20 m and 70 m. The proposed second track will require the placement of between 2.0 and 2.2 million m^3 of sand, earth, brick and embankment and ballast material. Around 40% of these materials will be transported to the Project by truck while the rest will be dredged from rivers and conveyed to the alignment directly. The 840,000 m^3 of materials transported by truck will require more than 56,000 truck-trips using the existing road network.

5. An estimated 2,500-2,900 people will work on this Project at any one time and most of them will be housed in approximately nine work camps; with locations to be identified and cleared with Bangladesh Railway (BR) before locations are finalised. Of the 14 rail stations existing along the line, eleven rail stations will be reconstructed (not

[1] The Consultant, on behalf of BR, organised a meeting with the Department of Environment (DoE) in late October 2012, where DoE instructed the Consultant to complete a full EIA for the Project, adhering to both the GoB's and ADB's environmental regulations and guidelines.

needed for Laksam, Comilla, and Akhaura) plus Engineer's Main Office (EMO) building at Dhaka. The construction work is expected to start in mid-2015 and will require four years to complete. The second line will be placed into operation in 2019.

6. Since the new rail line will be built parallel to and within 6 metres of the existing rail line (in operation for >100 years), impacts will be most noticeable during the construction period, but will be easily prevented or mitigated.

7. All impacts, mitigative measures and monitoring requirements have been defined in an Environmental Management Plan (EMP), included in the EIA and organised into three components, pre-construction construction and operations. Most of the pre-construction and operating period measures will be implemented by BR, while the construction period measures will be the contractor's responsibility and overseen by BR. The construction period section of the EMP has been integrated into the construction contract as a set of environmental clauses and costed as a separate Bill of Quantities (BoQ) section, allowing for easy calculation of financial penalties.

8. For the construction period 20 mitigative and monitoring actions were defined. Construction period actions will concentrate around issues arising due to the blockage of surface water flows and constrictions at existing river crossings by the new 2-6 m high, and 70 km long embankment.

9. The first construction period impact is the transport of the approximately 840,000 m^3 of embankment material, subgrade aggregate and ballast by truck, which will affect haul roads. All haul roads will be carefully maintained and traffic controls will be in place to prevent delays. Further, all trucks used will be required to have annual maintenance inspections to be sure they are properly tuned and emissions are within permitted levels. About 1.3 million m^3 of embankment material will be dredged sand, pumped as slurry through a pipeline from rivers to the embankment, where it will be allowed to drain and compact. The material will be taken from only those rivers where dredging is allowed. Erosion protection will be essential and to that end the contactors will be required to complete a landscaping and replanting programme as each section of the line is built (not at the end of construction).

10. The second important construction period impact would be problems arising at the larger bridge crossings where there is the chance that materials will fall into the river; machinery operate illegally in the water; or the crossing width is constricted, resulting in flow blockage and erosion. To avoid this, BR has designed all bridges to the 100 year design flow and culverts to pass the 50 year design flows.

11. The third important construction period impact will be associated with the sighting and operation of the concrete batch plant used to build the bridge elements. Its location will be at least 500 m away from residences and sensitive noise receptors and will be equipped with dust suppression equipment.

12. The storage of any material will be carefully monitored and sites fully restored after use, including any borrow sites created during the construction period.

13. A total of 9 bridges, where the piers are located in water, piles will need to be bored, requiring the use of drilling muds such as bentonite. Bentonite is fine clay that, once released to the water body, will remain in suspension for a long time, affecting the turbidity and degradation of fish habitat. To avoid this, a strict bentonite handling and recovery protocol has been defined to which the contractor will be required to adhere. The contractor will be encouraged to replace bentonite with muds available locally.

14. Poor housekeeping by the contractor at work camps and construction sites is frequently a serious problem. Unenforced and poor contractor site management could lead to serious pollution from fuel spills, sewage discharges into surface and

groundwater, garbage littering as well as inadequate occupational health and safety measures. The operation of batch plants, with their noise and dust, is often a prime area where occupational health and safety measures are not enforced and noise and cement dust inhalation issues arise.

15. Given that the new operating double track will have steadily increasing traffic, and given the existing frequency of a train around every 20 minutes, level crossings (legal and unauthorised) will have an increased safety risk as the interval between crossing closure is reduced, and traffic and frustration builds up among pedestrians and road users. BR will address this by closing some crossings and significantly upgrading the operating efficiency of crossing facilities. These facilities will be included as part of the construction work.

16. The contractor will be required to conduct a regular air, water and noise quality monitoring programme, specified in the EMP, and submit reports, on a monthly and quarterly basis. The contractor's environmental safeguard personnel will have to attend a mandatory training workshop on EMP implementation, prior to the start of work.

17. During the operating period, BR's mitigation and monitoring work will focus on inspection of contractor work areas, their waste disposal sites, their rehabilitation/ revegetation, proper landscaping, re-establishment of local access, debris clearance from reconstructed station bulidings, culverts as well as the Engineer's Main Office (EMO), etc. Secondly, BR will implement an air and noise quality monitoring programme during 3 operating years to establish the noise and air quality degradation (if any) at sensitive sites, identified during the EIA and to implement proper noise and air quality attenuation measures.

18. Three major positive operating period impacts of the Project have been identified. The first positive impact will be the *traffic diversion and fuel saving*. The proposed train service will divert road users to the improved train service that will reduce road traffic congestion and generate fuel savings. It was estimated that due to the diverted traffic in 2023, when 44 train sets are in operation an estimated 64.4 million litres of diesel fuel/year would be saved, with a net benefit, once train consumption is deducted, of 53.78 million litres/year. The second positive impact will be a *reduction of the carbon footprint*. Fuel saving of 53.78 million litres/year, which translates into a saving of 155,000 metric tons of CO_2/year (using a CO_2 emission factor of 2.69 kg CO_2/l of diesel fuel consumed), and accounting for the fuel used for the additional train trips. The third positive impact will be the *construction of environment friendly rail stations and EMO bulding.* All new rail station and EMO buildings will be constructed with modern facilities including environment friendly solar panel system, rainwater harvesting systems and improved station facilities and accessibility for physically challenged persons.

19. The measures defined in the EMP as well as other environmental clauses in the construction contract, are estimated to cost a total of USD 666,000 for the four construction years and three years of operating period monitoring. Breaking this down into the three phases, for the pre-construction period the costs are all BR planning costs and not included in this calculation. For the four-year construction period, the total cost is estimated to be USD 580,300, of which USD 252,500 is the cost of the tree replanting programme. The operating period mitigation and monitoring is estimated to require USD 48,000, not including the cost of the Environmental and Social Safeguard Unit (ESSU), for which there is a separate calculation.

20. To conclude, this Project could generate a number of environmental impacts, such as those associated with the embankment construction, the river crossings or poor housekeeping by the contractor. The EIA's EMP provides the specific guidelines which BR has put in place to prevent or mitigate these effects. BR is committed to

implementing these measures and has fully endorsed the EIA which is the basis for the EMP. BR will ensure that the work is carried out in an environmentally acceptable manner and the monitoring and reporting are completed in a compliant and timely fashion, acceptable to DoE, ADB and EIB.

Acronyms and Definitions

ADB	=	Asian Development Bank
As	=	Arsenic
BADC	=	Bangladesh Agricultural Development Corporation
BD	=	Bangladesh
BIWTA	=	Bangladesh Inland Water Transport Authority
BoQ	=	Bill of Quantities
BR	=	Bangladesh Railway
BUET	=	Bangladesh University of Engineering and Technology
BWDB	=	Bangladesh Water Development Board
CO	=	Carbon Monoxide
CPRs	=	Community Property Resources
CROW	=	Construction Right of Way
The Engineer	=	Construction Supervision Consultant Engineer
CWLR	=	Continuous long welded rail track system
dd/mm/yy	=	Date notation to be used at all times
DG	=	Director General
DO	=	Dissolved Oxygen
DoE	=	Department of Environment
DoF	=	Department of Forest
DPHE	=	Department of Public Health Engineering
ECA	=	Environmental Conservation Act
ECR	=	Environmental Conservation Rules
EIA	=	Environmental Impact Assessment
EMoP	=	Environmental Monitoring Plan
EMP	=	Environmental Management Plan
EPAS	=	Environmental Parameter Air Sampler
EQS	=	Environmental Quality Standards
ESCAP	=	United Nations Economic and Social Commission for Asia and the Pacific
EMiT	=	Environmental Mitigation Table
EMoT	=	Environmental Monitoring Table
EMO	=	Engineer's Main Office (in Dhaka)
ESSU	=	Environmental and Social Safeguards Unit
FD	=	Forest Department
Fe	=	Iron
FGD	=	Focus Group Discussion
GHG	=	Greenhouse Gases
GM	=	General Manager
GoB	=	Government of Bangladesh
GPS	=	Global Positioning System
GRC	=	Grievance Redress Committee
GRM	=	Grievance Redress Mechanism
GW	=	Ground Water
ha	=	Hectare

h	=	Hour
HYV	=	High Yield Variety
IC	=	Inter-City
ICTPs	=	International Conventions, Treaties and Protocols
EIB	=	European Investment Bank
IEE	=	Initial Environmental Examination
IESR	=	Initial Environmental Scoping Report
IUCN	=	International Union for Conservation and Nature
JICA	=	Japan International Cooperation Agency
Khadi	=	rough textures of the spun cotton
Km	=	Kilometre
Km/h	=	Kilometre per Hour
LGED	=	Local Government Engineering Department
M	=	Metre
Mn	=	Manganese
MPTS	=	Multipurpose Tree Species
NE	=	Northeast
NEMAP	=	National Environmental Management Action Plan
NGO	=	Non-Government Organisation
NM	=	Noise Measurement
NO	=	Nitric Oxide
NO_2	=	Nitrogen di-oxide
O_3	=	Ozone
PC	=	Public Consultation
PCRs	=	Physical and Cultural Resources
$PM_{2.5}$	=	Particulate Matter (less than or equal to 2.5 microns
PM_{10}	=	Particulate Matter (less than or equal to 10 microns
PAPs	=	Project Affected Persons
PRA	=	Participatory Rural Appraisal
Q/A	=	Questions and Answers
QS	=	Questionnaire Survey
RCC	=	Reinforced Cement Concrete
RCI	=	Regional Cooperation and Integration
RCIP-Rail	=	Regional Cooperation and Integration Project-Rail Component
RH	=	Relative Humidity
RHD	=	Roads and Highway Department
RoW	=	Right of Way
RLFL	=	Recorded lowest Flood Level
RHFL	=	Recorded Highest Flood Level
RTW	=	River Training Works
S	=	Sulphur
SAARC	=	South Asia Association of Regional Cooperation
SHWL	=	Standard High Water Level
SO_2	=	Sulphur di-oxide
SPS	=	Safeguards Policy Statement
SRDI	=	Soil Resource Development Institute

SRMTS	=	SAARC Regional Multimodal Transport Study
SW	=	Surface Water
TDS	=	Total Dissolved Solids
TEU	=	20 foot equivalent units
TOC	=	Total Organic Carbon
ToR	=	Terms of References
TSS	=	Total Suspended Solid
UNO	=	Upazila Nirbahi Officer
UP	=	Union Parishad
USD	=	US Dollars
USEPA	=	US Environmental Protection Agency
VOC	=	Volatile Organic Compound

Currency Equivalents

(as of 18 March 2014)

Currency unit	–	Bangladesh Taka (BDT)
BDT 1.00	=	$ 0.13
$1.00	=	BDT 77.70

Weights and Measures

1 ha	–	2.47 acre
1 ha	–	10,000 sq.m
1 acre	–	100 decimal

Note

- The Construction Supervision Consultant Engineer is referred as The Engineer, throughout this report, since this is the terminology used in the construction contract documents.
- This Project, Subproject 2, is one of seven subprojects being investigated under the RCIP-Rail Component. It shall be referred to herein as “the Project”.

I. INTRODUCTION

A. Background

1. Bangladesh is an important land transport crossroad, since it links Nepal, Bhutan, and India (NE part) with SE Asia. Existing connectivity is inadequate and therefore the Government of Bangladesh is undertaking extensive improvements in transport logistics. These improvements should bring significant economic benefits to the countries of the region in general, and to Bangladesh in particular. Priority is being given to the railway sector since it is considered the best land transportation option for the country. It is a better people-moving mode than long distance buses, is more cost effective for transporting bulk freight, and has overall lower adverse environmental impacts than other modes of transport. It is considered that the preferred solution will solve many of the country's land transport restrictions[2].

2. The rail system in Bangladesh needs to be modernised and expanded to facilitate efficient internal and cross border transport linkages, and as such some investment projects have been approved. The Government's Sixth Five-Year Plan, 2011-2015 assigned the highest priority to increasing the capacity of the Dhaka-Chittagong corridor by completing double tracking on the entire line. After the 12 January 2010 signing of Joint Communiqué on between Bangladesh and India, the Regional Cooperation and Integration (RCI) Project for road, rail and waterways transport improvement was approved and seven rail projects were initiated (see **Figure 1**) The focus of this Environmental Impact Assessment Report (EIA) is the 'Construction of Dual Gauge Double Rail Line and Conversion of existing Rail Line into Dual Gauge between Akhaura and Laksam (see **Figure 2**). The remainder of the report will be referred as the Project.

3. The objective of this Project is to build a second rail line and upgrade the existing line between Akhaura to Laksam in the east zone of Bangladesh. With the increasing population and businesses in and around the country, demand of development for double line railway is crucial for creating employment opportunity and business development of the country.

B. Need for Project

4. Dhaka and Chittagong are the two major metropolitan areas of Bangladesh. Dhaka is the main commercial and administrative centre of the country and Chittagong is the primary seaport; with the two accounting for about 90% of imports and exports. More than a quarter of Bangladesh's population of 150 million lives in the Dhaka-Chittagong corridor. Therefore, the Akhaura and Laksam Double Tracking Project is a top priority. Implementation of the Project will significantly benefit various sectors of the economy of Bangladesh, and will allow the operation of additional trains for sub regional trade from Chittagong Port to Bhutan, India, Nepal, and eventually to SE Asia.

5. The construction of this Project will not require the provision of new rolling stock, but with these improvements the level of service provided will improve, leading to increased service for passenger and additional capacity for freight traffic on this link. Additional rolling stock will be procured by Bangladesh Railway under a separate rolling stock procurement programme.

[2] Most major roads in Bangladesh now exceed their design capacity and experience massive and frequent traffic delays, and huge cost to the economy.

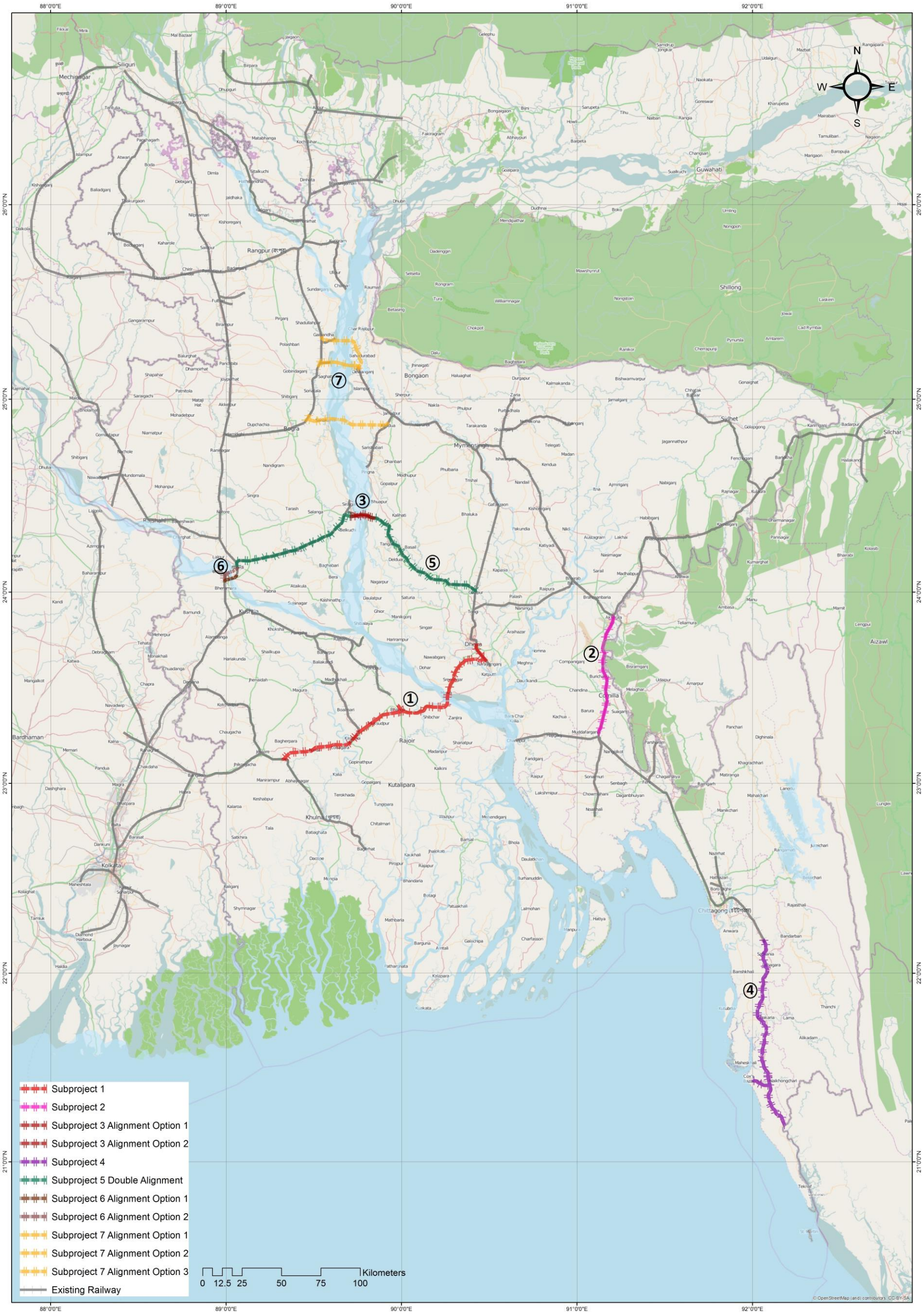


Figure 1: RCIP- Rail Component: Location of Seven Subprojects

Figure 2: Project – Akhaura to Laksam Dual Gauge Double Line

C. Scope of Environmental Assessment

6. According to the Table of Content (ToC) submitted to the Department of Environment along with the Initial Environmental Scoping Report in May 2013, the following tasks were to be undertaken:

- Conduct field visit, reconnaissance survey and consultation with local stakeholders;
- Collect primary data on water resources, land resources, agriculture, livestock, fisheries, ecosystems and socio-economic condition through focus group discussion (FGD), rapid rural appraisal (RRA), participatory rural appraisal (PRA), questionnaire survey (QS) and other method for the establishment of baseline conditions of the Project;
- Identify important environmental and social components likely to be impacted by the proposed Project;
- Assess environmental and social impacts of the proposed interventions of the double line railway development;
- Conduct comprehensive public consultations; and
- Include in the environmental assessment report an environmental management plan (EMP) which includes a listing of mitigation table (EMiT) and monitoring table (EMoT) as well timing and responsibility.

D. Objectives of the EIA

7. The overall objective of the EIA is to ensure that the Project is developed in an environmentally sound and sustainable manner ensuing that all negative effects are mitigated as best as practical and positive impacts are enhanced. More specifically, the EIA aims to identify the likely potential impacts likely to be generated by the Project; to quantify and where possible value these, providing BR with a set of actions it needs to implement in order to meet national and international environmental safeguard standards.

E. Methodology

8. In July 2013, BR received the Department of Environment's (DoE's) approval of its Initial Environmental Scoping Report, which included a detailed Terms of Reference (ToR) for the Project (**Annex 1**).

9. A complete primary data collection programme was initiated, involving two sampling periods, one in March 2013 and a second in January 2014. The purpose of the seasonal sampling was to record dry and wet (at least shoulder) season conditions. The sampling focused on air quality, noise, surface water quality and groundwater quality. A total of 24 air, 24 surface water, and 20 groundwater samples were collected and 48 noise readings were taken in the Project corridor. This provided information on existing conditions, against which measurements during the construction period can be compared in order to assess any changes and their significance. The design of the environmental sampling programme and a map showing all the sampling stations is provided in **Annex 2**.

10. Secondary information sources including published material, statistics, maps and reports were collected from various government and non-government organisations such as: Bangladesh Water Development Board, Bangladesh Meteorological Department, Soil Resource Development Institute, International Union for Conservation and Nature (IUCN) and were reviewed. These data were used to define the existing baseline conditions in the proposed Project area.

11. The sampling and collection of environmental data was limited to an area on both sides of the existing rail line referred to as the corridor of impact. The general boundaries were 50 m on either side of the centre line of the existing rail line, with a few variations depending on the parameter being sampled. For example noise measurements were taken at the closest receptor as well as at a distance of 50 m and 100 m from the existing tracks.

1) Air Quality and Noise

12. **Ambient Air Quality** – A total of 24 air samples were collected from the vicinity of populated or existing rail station areas within the existing rail Right of Way (RoW) in the Project rail corridor between Akhaura and Laksam. The parameters were measured in the field using the Environmental Perimeter Air Sampler (EPAS) (model haz-Scanner) of Environmental Devices Corporation (EDC), USA. A total of six air sampling stations were selected during site visits and two samples were taken per station: one at the closest sensitive receptor and the second 50 m distance. EPAS - portable air quality analyser - using an automated air sampling sensor array system, measures seven parameters (CO, NO_2, NO, PM_{10}, $PM_{2.5}$, O_3 and SO_2) as well as air temperature, humidity, wind speed and direction. The instrument was calibrated using standard calibration gases, one for each parameter, certified by USEPA (shipped with the EPAS). A Consultant's environmental specialist travelled to the manufacturer's premises in Canada to receive training and certification in the equipment's operation and calibration. A copy of the calibration certificate of the EPAS is provided in **Annex 3**.

Photo 1: EPAS in Operation, including Sound Meter

Photo 2: Environmental Perimeter Air Sampler

13. Measurements were recorded continuously using a battery-operated instrument, Environmental Perimeter Air Sampler (EPAS) (**Photo 1** and **Photo 2**), sampling for one to five minutes repeatedly over a one-hour sample period (also selectable on the data logger)[3]. Further, these measurements were taken during the dry season and the monsoon-shoulder period and within these periods during the day and evening (see **Annex 4**).

[3] Detailed description of this sensor array and the calibration and certification information are provided in Annex 2 of this EIA.

14. **Conversion of Hourly to 24 hour Averages** - Agencies, including the GoB's DoE, use the 24-hour collection period as the standard for establishing ambient air quality levels. However, with over 30 stations and hundreds of hours of sampling to complete, 24-hour sampling was not technically or financially feasible for RCIP. Many agencies (e.g. New York State Dept. of Environmental Conservation, California Office of Environmental Health Hazards Assessment, USEPA, Ontario Ministry of Environment) face the same problems and have had to adapt by applying a conversion process using Pasquill's (1961) air mass dispersion tables defining six air mass stability classes (**Table 1**) and a set of meteorological conditions (**Table 2**). Using the simple power law principle[4] Schroeder and Jugloff (2012) described the steps for converting one-hour readings to 24-hour values[5].

15. The stability classes (**Table 1**) are related to average wind speed, daytime solar radiation and night-time cloud cover and a second table (**Table 2**), refining these relationships, was also developed by Pasquill[6].

Table 1: Pasquill-Gifford Air Dispersion Stability Classes and Associated Dispersion Exponents

Stability Class	p	Definition
A	0.5	Very unstable
B	0.5	Unstable
C	0.333	Slightly unstable
D	0.2	Neutral
E	0.167	Slightly stable
F	0.167	Stable

Source: Table 1, pg 15, of (J. Schroeder and D. Jugloff, 2012)

Table 2: Meteorological Conditions Used to Define the Stability Classes

Surface wind Speed		Daytime Incoming Solar Radiation		Night Time Cloud Cover	
m/s	Strong	moderate	slight	>50%	<50%
< 2	A	A – B	B	E	F
2 – 3	A – B	B	C	E	F
3 – 5	B	B – C	C	D	E
5 – 6	C	C – D	D	D	D
> 6	C	D	D	D	D

Source: Table 2, pg 15
Note: Grey highlight indicates condition selected for Bangladesh

16. Therefore, taking the simple average of these three values from **Table 1**, the Project stability class was calculated as 0.39 (see below).

$$p = \frac{0.5+0.5+0.167}{3} = 0.389 \approx 0.39$$

[4] a relationship between two quantities such that one is proportional to a fixed power of the other.

[5] J. Schroeder and D. Jugloff, 2012. Interpretation of 24-hour sampling data: Development of 24-hour ambient air quality criteria and their use in Ontario, Toronto, ON: Standards Development Branch, Ontario Ministry of the Environment

[6] Pasquill, F., 1961. Atmospheric Diffusion: The Dispersion of Windborne Material from Industrial and other Sources. London: D. Van Norstand Company, Ltd.

17. This suggests a somewhat unstable air mass, resulting in considerable dilution of a one-hour sample when spread out over a 24-hour period. In order to provide 24-hour averages for the seven parameters the following power-law equation, as defined in Schroeder and Jugloff was applied:

$$C_{24h}=C_{1h}(t_{short}/t_{long})^{0.39}$$

18. Where C 1h is the measured 1 hour concentration and C 24 h is the estimated average using the exponent 0.39., and "t" is time. Therefore:

$$C_{24h}= C_{1h}\ (1/24)^{0.39}$$
$$= C_{1h\ X}\ (0.0416)^{0.39}$$
$$= C_{1h\ X}\ 0.289$$

19. So for example for the one-hour measurement of PM_{10} of 80.72 µg/m^3 the 24-hour average would be:

$$\text{24hr Avg. } PM_{10} = 80.72 \times 0.289$$
$$= 23.36\ \mu g/m^3$$

20. This generalised approach was applied to all data, and the 24-hour averages generated, in order to be able to compare Project results to GoB standards.

21. The Bangladesh University of Engineering and Technology laboratory (BUET) applied the same methodology for some of their data but used 'p' values specific to a given parameter, which ranged between 0.068 for SO_2 to 0.1267 for PM, suggesting extreme dispersion. The USEPA and Government of Ontario, Canada use a 'p' value of 0.29. This Project has adopted a single p-value of 0.39. If time permits and budget is available, these data will be field tested by completing a few 24-hour field samples and comparing those averages with the figures generated by the approach defined above.

2) Noise

22. Noise level was measured at 6 stations along the rail corridor, four measurements per station, namely two measurements (50 m and 100 m from the source) during the day time (0600-2100), and only 50 m during the night time (2100-0600) measurement[7]. For safety reasons night-time measurements were taken only in villages and at road crossing points of the proposed construction area. Measurements were taken using a SPER Scientific Sound metre[8], connected to the EPAS data recorder, thereby permitting locomotive emissions and train noise to be measured together. Daytime noise was recorded for one hour periods while for only 15 minute during evening hours.

23. Ambient noise was measured using the EPAS's electronics allowing the selection of the number of sound reading and the readings per interval and measurement duration for this Project. Given the large number of samples to be collected and significant logistical issues the noise measurements, noise readings were standardised across the five major projects as follows:

- Measurements are taken during the day and after 2100 at each station;
- At each station measurements were taken at three distances from source:
  - i) closest receptor if less than 50 m,
  - ii) 50 m and

[7] If a night reading exceeded the GoB standard additional readings were taken to identify the dividing line between compliant and non-compliant noise readings
[8] Sper-Scientific Brand, Type 2 (IEC651 Type 2, ANSI s1.4 Type 2); range 30 - 130 dBA sound recording metre

iii) 100 m from the source, or centreline of the proposed line (if a new rail line)

- During the day, i.e. between 0700-1900
- Measurement duration was 1 hour and recorded once every minute
  i) During the night, i.e. after 2100; and,
  ii) Measurements were taken for 15 minutes and within that period once a minute.

24. Using these data, average daytime and night time values were generated, and used in this report.

25. Operating period noise levels were predicted using UK's 1995 Calculating Rail Noise (CRN) parameters, applied in the Cadna (Computer Aided Noise Abatement) version A 4.4 noise modelling software[9].

3) Surface and Groundwater

26. **Surface water** was sampled from ten locations during two seasons using six sampling stations along the proposed and existing rail line. Sampling stations were determined during the site visit. Surface water samples were collected mainly at four bridges: two stations per bridge, one sample was taken 25 m upstream, and another 25 m downstream from the bridge construction site. The samples were collected from 01 - 03 April 2013 and from 15 - 16 January 2014. The parameters measured were pH, total organic carbon (TOC), total phosphate, total suspended solids (TSS), oil and grease, and dissolved oxygen. All samples were collected in plastic sample bottles and analysed within 24 hours of being collected. Samples were stored on ice and/or fixed as per instructions from the laboratory.

27. **Groundwater** samples were collected from ten sampling stations (ten tube wells around bridge crossings; and one sample per tube wells). The parameters measured were pH, total dissolved solids (TDS), Chloride (Cl), four heavy metals, Arsenic (As), Iron (Fe), Manganese (Mn), and Sulphur (S). All samples were collected in plastic and amber sample bottles, kept in an ice cooler, after necessary stabilisation /fixing, and analysed within 72 hours of collection.

4) Terrestrial and Aquatic Ecological Survey

28. A brief terrestrial and aquatic ecological survey was conducted in the Project corridor of impact areas to determine the extent, species composition and living condition of existing vegetation communities, wildlife, threatened and protected flora and fauna, and important habitat for local migratory species. A tree assessment survey has been conducted by the social assessment group of RCIP-Rail that will be used for the replacement of tree programme.

5) Public Consultations

29. Public consultation sessions were completed in two phases during the study period, at seven locations along the corridor. The purpose of these two phases was to disclose the Project first and take opinion from stakeholders and secondly to disclose the proposed EMP that was developed based on their opinions and experts observation and field works. One-on-one as well as group discussions were held to record the perception of the proposed work by the local communities and to seek their support, cooperation with suggestions on how to reduce any potential impacts to the community; the local landscape, the agriculture, and the environment (see **Annex 5** for meeting minutes). A detailed land use map was prepared including the locations of

[9] (http://www.datakustik.com/en/products/cadnaa)

environmental sampling, public consultation, and other major features of this Project (see **Annex 2**), and was used during the consultation sessions.

F. Environmental Classification of Project

30. This Project was classified as environment Category B according to the ADB Safeguard Policy Statement (SPS) 2009[10] as there are no environmentally sensitive sites within the Project area and the Project includes construction of tracks alongside an already existing track. Hence an Initial Environmental Examination (IEE) has been prepared.

31. The European Investment Bank (EIB) a co-financier for this Project requires the preparation of an Environmental Impact Assessment (EIA) in accordance with the requirements of EIB Environmental and Social Handbook, 2013-Version 9.0.

32. In accordance with the requirements of the Department of Environment (DoE), Ministry of Environment and Forests, Government of Bangladesh the Project is classified as red category and requires a full EIA. The 69 types of projects listed as red category in the Environmental Conservation Rules 1997 includes engineering works where the capital investment is more than 1 million Taka and construction of bridges longer than 100 m. The Project investment is more than 1 million taka and includes bridges longer than 100 m, and hence is a red category Project.

[10] ADB, 2009. *Safeguard Policy Statement,* Manila: Environmental Division of the Asian Development Bank.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. Bangladesh

33. For the protection, conservation, and management of the biophysical and social environment from damaging development pressures, the Government of Bangladesh has developed a complete legal framework, including laws, regulations, decrees, and standards addressing environmental and social safeguards. These are presently under review and draft materials are being circulated, but cannot be applied until they are promulgated. Of the existing documents, those most relevant to this Project are summarised in this chapter.

1) Environmental Policy, Regulations, and Guidelines of the Government of Bangladesh (GoB)

34. **National Environmental Policy, 1992** - The Bangladesh National Environmental Policy, approved in May 1992, sets out the basic framework for environmental action together with a set of broad sectorial action guidelines. Key elements of the Policy are:

- Maintaining ecological balance and ensuring sustainable development of the country through protection and conservation of the environment;
- Protecting the country from natural disasters;
- Identifying and regulating all activities that pollute and destroy the environment;
- Ensuring environment-friendly development in all sectors;
- Ensuring sustainable and environmentally sound management of the natural resources; and
- Maintaining active association, as far as possible, with all international initiatives related to environment.

35. The Policy seeks to ensure that transport systems, including roads and inland waterways, do not pollute the environment or degrade resources. The Policy states that Environmental Impact Assessments (EIAs) must be conducted before projects are undertaken.

36. **National Environmental Management Action Plan (NEMAP), 1995** - The National Environmental Management Action Plan (NEMAP) is a wide-ranging and multi-faceted plan which builds on and extends the statements set out in the National Environmental Policy. NEMAP was developed to address issues and management requirements during the period 1995 to 2005, and set out of the framework within which the recommendations of the National Environmental Policy were to be implemented. It identified four broad objectives and remains highly relevant today. The four key environmental management directions specified were:

- Identification of key environmental issues affecting Bangladesh;
- Identification of actions necessary to halt or reduce the rate of environmental degradation of the natural environment ;
- Sustainable resource use and the conservation of habitats and biodiversity; and,
- Improvement of the quality of life of the people.

37. **The Environment Conservation Act, 1995 (Amended 2010)** - The Act is applied by the Department of Environment, (DoE), within the Ministry of Environment

and Forest. The Act forms the basis of the country's environmental safeguard system. It authorises the Director General (DG) of DoE to undertake any activity deemed necessary to control, prevent, and mitigate pollution and to conserve and enhance the quality of environment. It lays out the basic rules on damage to the ecosystem, discharge of wastes, and the agency's power to enter and collect samples as part of any investigation. The Act also defined the powers of DoE to prepare Rules in support of the Act.

38. **Environment Conservation Rules, 1997 (amended 2005)** - The Environment Conservation Rules, 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. These Rules provide for, inter alia, the following:

- procedures from planning and completion of EIAs, including the preparation of Environmental Management Plans, document format and content, as well as the and for the provision of environmental clearance;
- national Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- a listing of industries, development projects and other activities. grouped into four environmental assessment categories on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollutant loading; and,
- procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

39. Depending on the industry, activity, Project location, type of work, size and severity of pollution loads, DoE classified 186 activities into four environmental assessment categories. These are Green for work that does not require any environmental assessment, Orange that requires Initial Environmental Examination (IEE) and Red, requiring full environmental assessment. Projects 1 through 5 being undertaken as part of the RCIP fall under Red Category item 67 of Red Category in Schedule 1 (the listing) of the ECR. Although rail is not specifically mentioned in the Rules, in practice linear transportation development includes railway lines. Red Category Item 68 also applies to most of the RCIP-Rail and specifies that before construction of bridges with spans ≥ 100 m, a full EIA must be completed and approved by DoE. This means that any rail line with a bridge having a span of ≥ 100 m triggers a Red Category or full EIA. This latter requirement is different from the ADB's guidelines which do not categorise on the basis of bridge length, and as such has created conflicts in establishing the type of assessment to be performed. ADB often classifies projects with bridges > 100 m long as B requiring IEEs, but Schedule 1 requires a full EIA (Red Category).

40. **The EIA Guidelines for Industry (1997)** - The EIA Guidelines is a handbook defining procedures for preparing EIAs and for reviewing them, prepared for the benefit of the development partners, EIA consultants, reviewers, and academicians. The Guidelines provide a step-by-step methodology for the completion of EIAs, following slightly more general ECR 1997 and its subsequent amendments 2002, 2003, and 2010).

2) Secondary Relevant National Legislation

41. **Annex 6** presents an annotated list of the other national legal instruments that have relevance to the proposed Project, addressing both social and environmental Project planning and EIA preparation considerations.

B. Relevant International Conventions, Treaties and Protocols (ICTPs)

42. Bangladesh is a party to a large number of international conventions; treaties and protocols (ICTPs) related to the Project and is committed to insuring that these protocols are complied with during all development work. The five applicable ICTPs (**Table 3**) which the BR is also aware of and is complying with are:

Table 3: International Conventions, Treaties and Protocols Signed by Bangladesh

Conventions	Signed	Ratified/Accessed (AC)/Accepted(AT)	Relevance
International Plant Protection Convention (Rome, 1951) and Plant Protection Agreement for SE Asia and Pacific (1999 Revision)		01.09.1978 04.12.'74 (AC)	Ensuring that Project work or construction materials , do not introduce plant pests
Convention on Wetlands of International Importance ("Ramsar Convention":1971		20.04.1992 (ratified)	Protection of significant wetland and prevention of draining or filling during construction
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972)		03.08.1983 (AT) 03.11.83 (ratified)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.
Convention on Biological Diversity, (Rio de Janeiro, 1992.)	05.06.1992	03.05.1994	Protection of biodiversity during construction and op.
Convention on Persistent Organic Pollutants, Stockholm.	23.05.2001	In process	Restrict use of pesticides and herbicides along rail lines

Source: footnote [11]

C. GoB Environmental Clearance and Public Consultation Procedure

43. Steps to be followed for obtaining the Environmental Clearance Certificate for this rail link are shown in **Figure 3.** For any Orange B or Red category Project an IEE[12] must be submitted to DoE in order to obtain clearance to proceed to construction or to undertake the full EIA if Orange B is bumped up to Red by DoE. Once the Orange B IEE is approved by DoE, the environmental requirements have been met. All Red Category Projects require a DoE approved IEE before proceeding to EIA preparation. For the case of all proposed projects under RCIP, including the current Project, DoE agreed to replace the IEE with the IESR to speed up the document preparation process for RCIP, given that DoE and ADB would be overseeing these submissions jointly. Once the EIA has been approved, the clearance certificate is issued.

[11] MoEF, 2013. Convention & treaties. [Online] Available at: http://www.moef.gov.bd/html/protocol/protocol_main.html[Accessed 03 12 2014].

[12] The GoB IEE is significantly different from the ADB's IEE; essentially presenting the EIA's ToR and ToC.

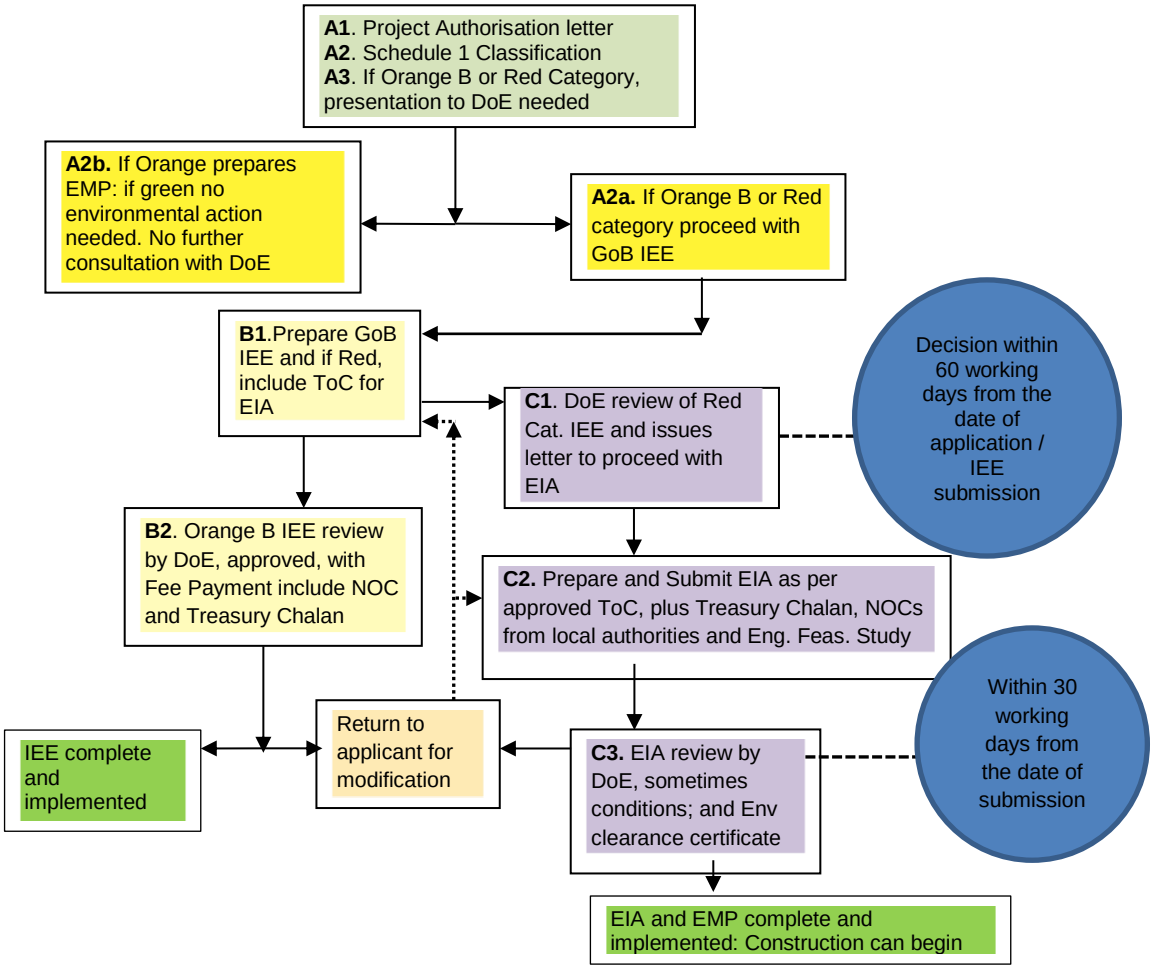


Figure 3: Government of Bangladesh Environmental Assessment Process

44. The Project is a Red Category Project and prepared Initial Environmental Scoping Report (IESR) as suggested by DoE in order to approve the ToR for EIA. With this EIA, the Project will have met all GoB environmental safeguard requirements.

45. Public participation/consultation during the EIA process is not a condition in the Act, the ECR 1997, or EIA Guidelines; it is, however a mandatory requirement as part of Condition 9 of DoE ToR is for this Project and also as part of ADB SPS 2009. Therefore, public consultation programme is considered as a mandatory task and is included in the environmental assessment report.

D. The Asian Development Bank (ADB)

46. Safeguard Policy Statement, 2009: ADB Safeguard Policy Statement, 2009[9] defines, generally, the actions that should be undertaken to avoid, minimise, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalised by the development process. The three operational components of the safeguard policy are: protection of the environment, protection of vulnerable (Indigenous) people, and preventing/minimising involuntary resettlement. These three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the Project cycle. The safeguard policies require (i) identification and assessment of impacts early in the Project cycle; (ii) developing and implementing plans to avoid, minimise, mitigate, or compensate for the potential adverse impacts; and (iii) informing and consulting affected people during Project preparation and implementation. The policies apply to all ADB-financed projects, including private sector operations, and to all

projects components, as well as to all components outside the Project scope but which if not included would make the Project non-viable; referred to as associated Projects.

47. ADB classifies all its projects into three categories with Category A requiring full EIA and B requiring an ADB-style IEE (as distinct from the GoB IEE) and C requiring only a short Project description/justification statement. Category A projects require two consultation phases as well as the placement of the EIA on ADB's website for 120-day before ADB Board approval. The classification is completed primarily by Bank staff and the Project is implemented with a classification included. Occasionally the Consultant is asked to classify projects, as was the case with RCIP.

48. ADB's safeguard policies have provisions for compliance monitoring throughout the Project cycle and an accountability mechanism whereby people adversely affected by ADB-financed projects can express their grievances and seek solutions. The procedure referred to as the grievance-mechanism must be defined in every IEE and EIA. It is presented in Chapter VII of this EIA.

E. European Investment Bank (EIB)

49. The European Investment Bank (EIB), the second donor participating in this Project, is the lending bank of the EU. Its lending strategy focuses on the promotion of sustainable development; in particular the protection and enhancement of biodiversity, the fight against climate change and the respect of human rights. Its safeguard standards (EIB Environmental and Social Handbook, 2013-Version 9.0)[13], sets the policy context for the protection of the environment and human well-being. The safeguards framework, as expressed in the Handbook, promotes the EU's approach to responsible environmental and social issues management, aligned with international best practice.

50. The EIB's environmental safeguard requirements closely mirror those of the ADB, with some differences; mainly the requirements relating to labour relations and disclosure of all safeguard documents to public scrutiny. Before the EIB proceeds with full due diligence, an Environmental and Social (E and S) screening is carried out for all projects. The Project Team (a Consultant, the proponent and/or the EIB) first defines the Project assessment area, its ancillary/associated facilities/ infrastructure as well as the Project's area of influence. The Project Team will then, to the extent possible, determine the potential environmental and social risks and impacts of concern, the nature and magnitude of the potential impacts on the biophysical and social environment and assess the proponent's capacity to manage these issues.

51. This screening analysis should lead to specific questions on environmental and social matters sent in the questionnaire to the proponent. The results of this analysis are recorded in an Opinion for Appraisal document (PJ OA). Normally the PJ OA text on environment and social issues will be used directly by the Bank in their Agreement to Appraise and in the environment section of the Note to the European Commission, in compliance with Article 19 (Section B.1.9).

52. The EIB has an environmental assessment process very similar to ADB's with the following four assessment categories: the first three matching ADB's A to C categorisation (**Table 4**).

[13] Environment, Climate and Social Office, EIB, 2013. Environmental and Social Handbook. [Online] Available at: http://www.eib.org/attachments/strategies/environmental_and_social_practices_handbook_en.pdf [Accessed 20 03 2014].

Table 4: Comparison of ADB and EIB Deliverables

EIB Category	EIB EA document	Description	ADB Category	ADB EA document
A	Screening	Minimal or no adverse impacts – Low risk.	C	Rapid Environmental Assessment (Screening)
B	Basic EIA	Environmental and social impacts can be readily identified and mitigation and/or remedial measures well known -medium risk	B	IEE
C	ESIA	Highly significant, adverse and/or long-term environmental and social impacts, - high risk	A	EIA
D	Decision Statement	Not meeting EIB core terms and therefore not eligible	-	Decision Statement

Source: footnote: 10

53. When the EIB is co-financing in partnership with other IFIs that have developed, and apply their own Environment and Social policies, such as with ADB, adequate implementation of those policies may prove enough to meet the EIB standards, pursuant to EIB's own assessment. This does not relinquish the EIB's own environmental and social due diligence duty and any gaps between that and other lenders' shall be duly accounted for.

III. DESCRIPTION OF THE PROJECT

A. General

54. The Government of Bangladesh, with funding provided by ADB Loan No 2688-BAN (SF) and operating through Bangladesh Railway, has initiated a Project to improve railway operations throughout the country and the integration of rail transport with that of the South Asia region. The following are the priority projects (**Table 5**) identified for potential investment in the ADB supported SAARC Regional Multimodal Transport Study[14] and the UNESCAP Study on the Trans-Asian Railway[15].

Table 5: Seven Subprojects of RCIP-Rail

Project	Description
1	Feasibility Study for Construction of Railway Link from Dhaka-Bhanga-Jessore through Padma Bridge (Phase I and Phase II), and Detailed Design and Tendering Services for Phase I (Dhaka-Bhanga Rail Line)
2	Feasibility Study, Detailed Design and Tendering Services for Construction of Dual Gauge Double Rail Line and Conversion of existing Rail Line into Dual Gauge between Akhaura and Laksam
3	Feasibility Study for Construction of a Railway Bridge parallel to the existing Bangabandhu Bridge with provision of Dual Gauge Double Track over the River Jamuna
4	Update Feasibility Study, Detailed Design and Tendering Services for Construction of Single line Dual Gauge Railway Track from Dohazari to Cox's Bazar via Ramu and Ramu to Gundum near Myanmar Border.
5	Feasibility Study for Construction of Double Line between Joydebpur-Ishurdi sections.
6	Feasibility Study for Strengthening / Re-Construction of Hardinge Bridge to allow Trans-Asian Traffic
7	Feasibility Study for Construction of Railway Bridge over the River Jamuna near Phulchari-Bahadurabad Ghat including approach rail links.

Source: ToR, RCIP-Rail

55. These Projects, along with investments in other modes of transport, will contribute to the development of national, regional, and international trade and economic growth.

B. Project Boundaries and Design

56. The Akhaura to Laksam section of the South Asia Association of Regional Cooperation (SAARC) corridor passes through the Districts of Brahmanbaria and Comilla with a combined population of 8.1 million and a density of around 1,500 persons per square kilometre.

57. It is one of the busiest rail routes of Bangladesh. Every day up to 31 sets of trains run between Akhaura and Laksam. Eight of these trains are Inter City Trains, eight are Mail Trains, seven are Local Trains, and three are Container freight trains. Approximately 40,000 passengers travel this stretch every day. This route will also be used as a link in the Trans-Asian Railway corridor. Therefore, it is necessary to construct additional rail capacity and also to upgrade the existing line to meet international standards as well as future demands. The upgrading works will double the capacity of this 72 km long existing stretch of BR's rail network. From Akhaura moving

[14] SMRTS, 2006. SAARC Regional Multimodal Tranport Study, Kathmandu: SAARC Secretariat.

[15] UNESCAP, 1999. Development of the Trans-Asia Railway-in the Southern Corridor of Asia-Europe Route, New York: United Nations.

southward, the second line will parallel the existing track within the existing RoW, mostly on its west-side. The Project activities will involve construction of railway embankments, track and alignment works, construction of stations and other buildings and the Engineer's Main Office building (in Dhaka), main line track and loop/siding developments, associated facilities-station access roads, hydrology and river training works at bridges sites, bridges and culverts, installation of signalling and interlocking systems, platforms, footbridges at stations, platform sheds and other associated works.

58. New major/minor bridges will be required at the Dakatia River (proposed bridge length 73.15 m), the Gumti River (proposed bridge length 175.25 m), Gumti Spill (proposed bridge length 73.15 m), Sidai Khal (proposed bridge length 72.10 m), and Howrah River (proposed bridge length 104.2 m), plus another eight bridges between 20 m and 70 m in length. The construction work is expected to start in mid-2015 and will require four years to complete. The second line will be placed into operation in 2019.

59. An estimated 2,500-2,900 people will work on this Project at any one time and about 60% or around 1,700 will be housed in approximately nine work camps; with locations to be identified and cleared with BR and relevant local authorities before being finalised. Of the 14 rail stations existing along the line from Akhaura to Laksam, 11 rail stations will be reconstructed, two of them (Comilla, and Akhaura stations) will be upgraded while one station (Laksam) is being upgraded under a JICA funded Project. Other buildings for staff accommodation, offices and other purposes will be constructed at some stations. Additionally, the Engineer's Main Office building will also be constructed in Dhaka under this Project.

60. The impact assessment was confined to BR's general legal right of way, which is between 50 m and 100 m centred over the existing track and station sections respectively (**Table 6**). However these distances were adjusted in relation to sensitive receptors where excessive noise was predicted, and at river crossings and wetland areas. For these areas the boundary widened to include an examination of possible effects outside the 100 m boundary.

Table 6: Environmental Impact Assessment Boundaries

Component	Definition	Boundary
General Right of Way	Legal RoW of the BR rail line (centred over track) Non station sections:	50 m
	Legal RoW of the BR rail line (centred over track) station sections:	100 m
	Legal RoW of the BR rail line (centred over track) large bridges:	100 m
Air Quality	Along line other than stations (centred over track)	50 m
	Along line passing through stations (centred over track)	100 m
Noise: the boundaries for noise measurements will be a bit more tricky since noise is relevant when it impacts a sensitive receptor and there are rural track sections and sections through urban areas and stations	a) the nearest sensitive receptor (record distance);	Distance to be measured from source to receptor, and noise measurement taken
	b) + 25 m	Distance to be recorded and noise readings taken
	c) + 50 m	50 m from source
	Stations and station sites	10 m, 25 and 50 m from station footprint.
Surface Water Quality	Upstream at river crossing and at least 5 m from shore	25 m U/S of crossing centreline and at 1 m below

Component	Definition	Boundary
		surface
	Downstream at river crossing and at least 5 m from shore	25 m D/S of crossing centreline and at 1 m below surface
Groundwater	Tube wells within General RoW of 100 m	Identify tube well and measures distance from work area
Terrestrial Ecosystem	Can be exceptions if conditions warrant	50 m on either side of tracks centreline
Aquatic Ecosystem	Can be exceptions if conditions warrant	50 m on either side of tracks centreline
Sensitive protected Environmental components	E.g. wetlands, special habitat, large river crossings.	1 km on either side of track centreline
Source: Designed by Environment team of RCIP-Rail		

C. Project Design

1) Track and Alignment

61. The chainage of the existing Laksam Station is taken as Km 129.903, with Km 0.000 at Chittagong, based on the survey chainage of the Laksam-Chinki Astana Double Tracking Project. On the basis of the information collected from the topographic, hydrological and geotechnical surveys, the proposed rail alignment is described in **Table 7** and shown as a set of detailed strip-maps in **Annex 2**.

Table 7: Description of the Alignment

Chainage	Description
Km 129.903 to Km 153.833: (Laksam to Comilla Stations)	Most of these areas are covered with agricultural lands with thickets of tree coverage on homesteads. The tree species on homesteads include the fruit, fuel wood, timber, fodder and medicinal species. Most of the settlements are in Dakshin Durgapur Union of Comilla Sadar Upazila. Surface water bodies and sporadically distributed industrial units are found minimum throughout the section of this alignment.
Km 153.833 to Km 196.123: (Comilla to Gangasagar Stations)	Most of the chainage of this section is agricultural with settlements mostly on existing station areas. The surface drainage of greater Comilla region is influenced by the Gumti River (>100 m width) and its tributaries. The area lying along the rivers is erosion prone and is characterised as low erosion risk areas.
Km 196.123 to Km 201.189: (Gangasagar to Akhaura Stations)	The alignment passes through semi-urban to rural villages. 50 m either side of the proposed alignment is covered with settlements including commercial and residential along with discrete homestead ecosystems and the related wildlife species. The tree species on homesteads include the fruit, fuel wood, timber, fodder and medicinal species. The alignment crosses several open water bodies and four ponds will be impacted from implementation of Project.

Source: RCIP-Rail description

2) Earthworks

62. The Akhaura-Laksam section has embankment of two metres to six metres average height with high embankments of over four metres in some places (**Photo 3** and **Photo 4**), and near bridges on deep foundations. The proposed embankment will be constructed with suitable fill material from outside the proposed RoW. The proposed second track will require the placement of between 2.0 and 2.2 million cubic metres of sand, earth, brick and embankment and ballast material. Around 40% of these materials will be transported to the Project by truck while the rest will be dredged from rivers and

conveyed to the alignment directly. The materials transported by truck will require around 56,000 truck-trips using the existing road network. In order to minimise acquisition of additional land which is scarce and costly, no new borrow pits are proposed for sourcing fill materials within the BR right-of-way. Turfing of slopes with grass is proposed on side slopes of the formation to prevent erosion of slopes during rain and floods. Stone, concrete block or brick retaining works will be used for embankment slopes where the height is more than six metres and in sections of water logged alignment.

63. Earthworks quantities were determined by applying a 6.85 m wide formation width along the entire length of the route (including the siding lengths). Appropriate foundation treatment will be proposed at all soft soil locations. Earthworks required at stations and station yards, for loop lines and platforms will be provided as per requirements.

Photo 3: Soft soil, Akhaura-Laksam Track under Speed Restriction

Photo 4: Soft Soils, Akhaura-Laksam Section

64. **Materials for Construction and Compaction –** The construction of the embankments will be carried out with suitable soil available in nearby vicinity of the embankments with proper design of the slope and ensuring that the subgrade has adequate bearing capacity. Performance of the embankment would depend to a large extent on the quality of the compaction done during execution. Hence there is a need to ensure proper compaction. Compaction is the process of increasing the density of the soil by mechanical means by packing soil particles closer together with reduction of air voids and to obtain a homogenous soil mass having improved soil properties. Compaction of a particular soil is affected by moisture content, compacting effort, type of roller, etc.

3) Stations and Buildings

65. An inspection of all stations and buildings on this section was conducted to evaluate total reconstruction, repairs or otherwise in relation to all stations and buildings on this section. Fourteen railway stations exist between Akhaura and Laksam (**Photo 5** and **Photo 6**). However, eleven station buildings (**Table 8**) will be replaced with modern rail facilities including relay battery, generator rooms and properly sized sewage and waste management facilities; as well as separate facilities specifically for women, and features to facilitate access by the elderly and persons with disabilities. The facilities will include energy saving designs, such as solar panels.

Table 8: Rail Stations between Akhaura and Laksam Requiring New Construction

Name of Stations and Class, Design Chainage (Km)	Location of the Station		Distance from Centreline to Existing Station (m)	Proposed Work
	Existing	Proposed		
Laksam, (B), 129.903	West side	West side		No Change
Alishahar (B), 136.108	West side	West side	17.54	New Construction
Lalmai (B), 141.627	West side	West side	15.68	New Construction
Mainamati (D), 150.364	East side	East side	7.29	New Construction
Comilla, (B), 153.833	East side	East side	16.54	Upgrade
Sadar Rashulpur (B), 159.953	East side	West side	20.69	New Construction
Rajapur (B), 167.276	West side	West side	17.58	New Construction
Shashidal (B), 173.809	East side	East side	16.27	New Construction
Salda Nadi (D), 177.276	West side	West side	20.34	New Construction
Mandabag (B), 179.637	West side	West side	11.65	New Construction
Quasba (B), 185.688	East side	West side	16.14	New Construction
Imambari (B), 191.820	West side	West side	14.68	New Construction
Gangasagar (B), 196.123	West side	West side	13.50	New Construction
Akhaura, (B), 201.189	East side	East side	44/8.75	Upgrade

Source: (RCIP-Rail, 2013)

66. A separate inspection of the EMO building area was conducted to evaluate the existing condition in and around the construction site (plot). The new Engineer's Main Office building will be constructed along Phoenix Road in Dhaka on available BR land near Rail Bhaban. At present, the proposed EMO site/plot is occupied by a fairly large slum of illegal settlers. The site visit conducted by the social team of RCIP-Rail revealed that there are some 16 run down staff quarters for Class IV railway employees, a godown and an office building.

67. Initially the offices will house the Engineer and staff for the Construction of the Akhaura-Laksam Double Line Project. The building will later be utilised by other Construction Supervision Consultants of other rail projects. The Construction Contractor will have to design this EMO as an ultimate 10 storey building, and will have to clear the site of all buildings and utilities, and will have to construct the basement, ground floor, first floor, second and third floors of the building as part of the SP2 Construction Contract. The Contractor shall do all things necessary to design and construct this building including foundations for the ten storied office building, with basement ground floor parking, and offices on the other floors, with a footprint of approximately 3,237 m^2.[16] The design will incorporate current design thinking in office design including using design concepts that support environmentally sustainable design. The construction activities of the EMO are briefly described below that contractor will follow.

i. Demolish all the existing structures, and dispose of the materials arising in an approved disposal area;
ii. Undertake all necessary investigations to design and construct the building, including, but not limited to, the following:
    (a) Subsoil geotechnical investigations;
    (b) Topographic survey of the building site;
    (c) Water quality;

[16] RCIP-Rail, 2015. Section A: Brief and Scope of Works of Engineer's Main Offices; Sub Section E-4: Station and Buildings, Dhaka: RCIP-Rail.

(d) Environmental safeguards compliance; and

(e) Identify, locate and isolate all existing over ground and underground utilities.

iii. Prepare all necessary architectural plans including. finishes and landscaping, to be in keeping with the function of a prestigious Government office; the quality of all fixtures, furnishings and fittings should be at least equal to those currently in place in Floor 7, Rail Bhaban, Dhaka;

iv. Prepare foundation design for ten storied office building;

v. Prepare structural design for ten storied office building, allocating the basement and ground floor for covered parking;

vi. Prepare utility plans for all necessary utilities, compatible with the requirements of a 10 storied office building including a backup generator of sufficient capacity to cater for the power requirements of a 10 storied office building;

vii. Prepare office layouts complete with all necessary utility infrastructure;

viii. Obtain all necessary permits to construct said 10 storied office building;

ix. Obtain permits for and arrange connections to all necessary utilities;

x. Construct the basement, ground floor, first, second, and third floors with adequate provision for future construction of remaining floors; and

xi. Fully furnish the third floor offices according to the architectural plan approved by the Engineer.

68. To make the necessary step into an environmental sustainable future, BR want to have the building designed to be sensitive to environmentally sensitive design principles. BR is committed to protecting the environment throughout the construction of the Project. When carrying out construction the contractor must minimise the impact on the environment. The building design must include as a minimum the following environmentally sustainability features:

- LED energy efficient lighting Low energy light fittings
- Solar: Solar for the use of hot water and supplementary electric power
- rain water harvesting and re-use
- use of sustainable materials, including recycled materials
- High performance external glasing
- Orientation
- High quality Insulation
- Use of natural light
- Natural ventilation
- Low water flow fittings

69. **Architectural Concept** - Station buildings are to be designed to be shielded by a large-span modular set of repetitive trusses which would enhance the poise or state of equilibrium of the building and the services the building houses. It would serve as means to protect the station building from climatic adversities and provide sky light in an orderly manner.

Photo 5: Imambari Station, Nov 2012. Akhaura-Laksam Section

Photo 6: Lalmai Station, Nov 2012. Akhaura-Laksam Section

70. **Universal Design** - The detailed engineering/architectural design is to be carried out in accordance with BR's codes and universal design for the elderly and persons with disabilities. The Consultant has adopted these criteria and one such example is the access ramps which has a slope of 1:12, permitting wheelchair access to the stations.

4) Rail and Loop/Siding Development

71. The existing rail condition of Akhaura–Laksam section is poor given that rails are between 30 and 40 years old (**Photo 7** and **Photo 8**). On the whole, the existing track needs to be completely replaced as observed from the condition of rails and other components (personal communication 2013. Bridge engineering team). Therefore, upgrading of the Akhaura–Laksam section is needed.

Photo 7: Track at Sadar Rashulpur Station

Photo 8: Switch Expansion Joint, Akhaura - Laksam Section

72. Long welded rails with switch expansion joints (**Photo 8**) are proposed at locations permitted by Bangladesh Railway Way and Works Manual. Pre-stressed concrete sleepers with elastic fastenings will be provided. Thickness of ballast cushion will be to the standard required for the proposed axle loads and speeds on this section. Upgrading of the train control system is also proposed, making for a safer and better train line. Such an upgrading is also required as axle loads and train speeds will be increased. Improved train control systems are being considered for installation.

73. Loop/Siding positions of the proposed rail route will be determined based on the proposed detailed design criteria and also in discussion with BR. Loops are mainly used for crossing arrangements, wagon parking, loading/unloading and locomotive sidings which connect back to the main lines. To determine the best location, each

loop/siding was evaluated based on location, types of rolling stock, earthworks, and drainage requirements.

5) Station Access Roads

74. Of the total 11 stations along the alignment, seven (i.e., Gangasagar, Imambari, Quasba, Mandabag, Salda Nadi, Shashidal, and Rajapur) (**Table 9**) will be rebuilt replacing the existing buildings. In 5 of 7 stations, a total of 350 m of improvements in the access roads outside the stations' construction right-of-way was envisaged affecting some roadside structures as per the survey conducted in March 2014. In 5-6 April, a team of BR engineers and the Consultant undertook a joint site inspection of all the station locations, and revised the access roads provisions. The net results of the inspection led to redesigning the station areas and access ensuring that (a) existing access roads to the stations will be retained; and (b) no new access roads will be necessary. This was achieved in part by amending the sitting of some station buildings to eliminate the need for new access roads for station access. This has further reduced the impacts of the Project. As a result, there is no need for additional census and provisions for budget for access roads in the Project.

Table 9: The 11 Rebuilt Stations and Access Road Lengths

Sl. No.	Name of the Station	Chainage	Station Building
1	Alishahar	136.108	New Construction on West Side
2	Lalmai	141.627	New Construction on West Side
3	Mainamati	150.364	New Construction on East Side
4	Sadar Rashulpur	159.95	New Construction on West Side
5	Rajapur	167.276	New Construction on West Side
6	Shashidal	173.809	New Construction on East Side
7	Salda Nadi	177.276	New Construction on West Side
8	Mandabag	179.637	New Construction on West Side
9	Quasba	185.688	New Construction on West Side
10	Imambari	191.820	New Construction on West Side
11	Gangasagar	196.123	New Construction on West Side

6) Hydrology and River Training Works

75. **Hydrological Design** - Hydrological design criteria includes the frequency of floods and the return period of the flood for which the structure will be designed. The freeboard requirement above the design high water level is another essential criterion. Based on and best engineering practice[17], the following frequency and freeboard criteria have been established for the design of embankment formation, bridges and culverts (**Table 10**).

Table 10: Design Frequency and Bridge Freeboard[18]

Structure	Freeboard (m)	Design Frequency (Return Period in years)		
		Discharge	Water level	Velocity
Bridges (>30 m)	1.00	100	100	100
Bridges (<30 m)	0.50	50	50	50

[17] BR has not specific guidelines for this.

[18] Freeboard is the additional distance between the mandatory distance between the water surface and lowest bridge girder.

Structure	Freeboard (m)	Design Frequency (Return Period in years)		
		Discharge	Water level	Velocity
Culverts	0.20	50	50	50
Embankment Formation Level	0.60	20	20	20

Source: footnote 14

76. The 100 and 50-year model storm flows were applied to properly size culverts and establish a safe freeboard for bridges (**Table 10**).

77. **Navigation Clearance -** Most perennial rivers in Bangladesh are classified as navigable channels by the Bangladesh Inland Water Transport Authority (BIWTA). BIWTA has specified the horizontal and vertical clearance for various classes of navigation channels (**Table 11**) and which the Project designers are adhering to.

Table 11: Navigation Clearance Requirement

Navigation Class	Horizontal Clearance (m)	Vertical Clearance over SHWL (m)
Class I	76.22	18.30
Class II	76.22	12.20
Class III	30.48	7.62
Class IV	20.00	5.00

Source: (RCIP-Rail, 2013)

78. The datum for measuring the vertical clearance is Standard High Water Level. None of the rivers in this Project corridor are legally designated as navigable waters under any of the above four categories of navigable channels. However, local boats are used for crossing the rivers at many locations during floods. The freeboard provided, as shown in **Table 10**, provides the clearance for such “country boat” navigation even under a bridge.

79. **The Terrain and Hydrological Setting of the Area -** The Akhaura-Laksam rail line runs from north to south along the western boundary of Tripura State of India. At least at two points the rail line is within a few hundred metres from the India-Bangladesh border. Tripura State in India (also known as Hill Tripura) and the adjacent Comilla District in Bangladesh slope from east to west.

80. From Akhaura the elevation increases from eight metres to ten metres above sea level to sixteen metres around Comilla and then drops down to eight metres to ten metres around Laksam. All the rivers crossing the Akhaura-Laksam rail line originate in Hill Tripura at around 260 m and drop down to near sea level in 60 km, emptying into the Meghna River. They are flash-flood prone, thus the embankments ridges and culverts have been designed to accommodate expected flash-flooding.

81. For the design of bridges and culverts the extreme flows i.e., annual maximum floods and annual minimum flows were collected from the BWDB, then used to generate the 100-year return period flood which was the basis for the design of the Gumti and other bridges.

7) Bridges and Culverts

82. A total of 59 bridges and culverts exist along the Akhaura and Laksam rail corridor. The total length is about 925 m and the length varies from 3 m to 122.80 m.

Out of these 59 bridges, one is considered as a major bridge with a length more than 100 m, 12 are minor bridges with lengths less than 100 m, and 46 are culverts. The culverts will be of a single and multi-cell design.

83. The existing minor bridges and their lengths are Dakatia River (53.6 m), Gumti Spill (70 m), Sidai Khal (53.40 m), and Howrah River (86.80 m), plus another eight bridges between 20 m and 50 m in length. However, the lengths of the proposed bridges are longer than existing bridges, varying from 3 m to 20 m. The existing bridge over the Howrah River is around 87 metres in length and has been in existence for over 100 years, without any signs of hydraulic inadequacy. This bridge is being replaced by a new bridge made up of four 25 m spans, making the length of the new bridge at this location 104.2 m. However, this length is a result of standardisation of the bridge spans, rather than a hydraulic requirement. This bridge has therefore not been included as a major bridge, as length of the existing bridge is only 87 m and the width of the Howrah River, in existing rail bridge area, is less than 90 m. These bridges were constructed over 100 years up and will be replaced by new bridges.

84. **Major Bridges (≥100 m in length) -** Only the existing Gumti River bridge (122.80 m) has been identified as major using DoE's definition. The length of the proposed bridge over the Gumti River is 175.25 m.

85. **The Gumti River Bridge (Km 156.354)** - The Gumti River Bridge is the only large bridge needing work as a part of this Project. This bridge crosses the Gumti River approximately 2.5 km north of the Comilla Railway Station. The Gumti River flows in a westerly direction from the hilly areas of Tripura, India to the Upper Meghna River, entering Bangladesh near Katak Bazar, Comilla Sadar. The bridge was constructed in 1896 and consists of five spans. The first and fifth spans (of each abutment) are approximately 12.1 m (40 ft.) in length and flow only passes under these spans during floods. Spans 2, 3 and 4 pass over the present channel.

86. Temporary bank protection was placed in 2012, consisting of sand/earth filled plastic bags and timber stakes (**Photo 9** and **Photo 10**) along 85 m of the left bank to stop active lateral erosion and possible upstream propagation of the erosion towards Pier 1 and the abutment foundations (**Photo 9**).

Photo 9: Gumti River Bridge 243 Looking from Downstream

Photo 10: Shoreline Training Works; Nov 2013

87. Considering the age of the existing bridges and problems with the shore piers, and the many design issues with other bridges, the bridge engineers recommended that all existing bridges will be demolished and reconstructed. To minimise the construction costs, the on-going maintenance costs and to standardise the works, all bridges up to 17.2 m long will be replaced by single or multiple cell reinforced concrete box culvert structures with either three-metre or five-metre wide openings. The number and sizes of openings are determined by the hydraulic investigations that have been carried out.

88. **Substructure Arrangement** - Pier caps (pier crossheads) supporting the bearings and pier shall be of reinforced concrete construction and shall be wide enough to support the girders and provide room for jacking for bearing replacement, in the future, if required. Seismic restrains shall be cast after erection of beams to prevent dislocation of the deck during seismic events.

89. For the piers located in river channels, pier columns shall be circular so as to minimise the disruption to water flow. Abutments shall be wall type abutments. Dirt walls (Fender walls) will be provided above bearing shelf (See Feasibility Study for details).

D. Social and Resettlement Considerations

90. The safeguard work to be addressed under the Project was triggered due to (i) the impacts of land acquisition for doubling of the 72 km length of the railway track from Akhaura to Laksam, (ii) upgrading and improvements of existing railway stations, and (iii) relocation of houses, shops, and businesses from the existing BR RoW, as well as new acquisition. The total requirement for doubling is no more than 407.22 ha, of which around 37.38 ha will be acquired from private owners (see Project LA and RP reports). All technical efforts have been undertaken to minimise the impact by using the existing railway track, which is on average 30 m wide. The width of new acquisition is 10 m, taken from only one side of the track as a measure to minimise potential adverse impacts[19].

91. The scope of safeguard works for Project preparation thus include (i) consultation with affected communities and stakeholders; (ii) social surveys and census of all effected households and structures (residential, commercial, community structures), (iii) property valuation survey (land, structures, trees) for replacement value; (iv) preparation and disclosure of RP, including the Project entitlement policy and matrix; and (v) income and livelihood restoration of the affected households as well as vulnerable groups.

92. Despite the limited and linear acquisition, the number of affected households and shop/businesses is quite significant. This is because most affected households and businesses are in clusters and located close to railways stations, bazars and railway crossings, effectively inside the BR RoW. In the rural section of the railway track, the newly acquired lands are typically agricultural.

E. Project Implementation Schedule

93. The Consultant has prepared a detailed Work Programme, which indicates how and when key component of the works will be completed and the EIA delivered in the time allocated for the work. The main tasks necessary to complete the EIA were primary and secondary data collection, public consultation, impact assessment and analysis, cost estimation of mitigation and monitoring plan, preparation of EIA report including EMP, and institutional arrangements. The Project can be completed and commissioned in a period of 48 months (4 years) after the land acquisition process is substantially completed. The draft Construction Implementation Schedule is provided in (**Annex 7**) and arrangements are described in Chapter XI of this EIA.

[19] RCIP-Rail, 2015. Feasibility Study for the Construction of Dual Gauge Double Rail Line and Conversion of existing Rail Line into Dual Gauge between Akhaura and Laksam, Dhaka: Bangladesh Railway, Ministry of Railways.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Biophysical Environment

1) Climate

94. Like other parts of the country, the Project area has a tropical monsoon climate with four seasons namely: the dry or winter season (December-February); the pre-monsoon hot season (March-May); the monsoon or rainy season (June-September) and the post–monsoon or autumn season (October-November).

95. To define meteorological conditions in and around the proposed construction area of the Project, temperature, rainfall, humidity and wind data were collected. Within the Project corridor, one meteorological substation is located in Comilla, from which most of the meteorological data for the study area were obtained[20].

96. **Temperature** – **Table 12** shows average maximum and minimum temperature for the last five years (2008 to 2012) at the Comilla Meteorological substation. The five-yearly average of maximum temperature at Comilla is 29°C and 5-yearly average of minimum temperature is 20°C. The 5-yearly average temperature is recorded as 26°C.

97. **Rainfall -** Rainfall varies considerably from year to year and month to month. The highest rainfall recorded between 2008 and 2012 was in 2009 with peak in September is 1,244 mm. The five-yearly (2008-2012) maximum rainfall recorded was 612 mm/month and minimum recorded is 0 mm/month. The average rainfall at Comilla substation between 2008 and 2012 was is 182 mm/month. However no rainfall was recorded during the months of November, December and January. **Table 12** shows the yearly maximum, minimum and average rainfall of Comilla sub-station over last five years (2008-2012).

98. **Relative Humidity** - Humidity levels are consistently very high during the monsoon season, and drop significantly for a relatively short period at the end of the dry season. Sunshine levels are low during the monsoon, but from November to May are consistently high. The five-yearly average of maximum relative humidity at Comilla is 86% and five-yearly average of minimum relative humidity is 71%. The five-yearly average relative humidity was recorded as 80%. **Table 12** shows the yearly maximum, minimum and average relative humidity of Comilla substation over last five years (2008-2012).

99. **Wind** - Monthly wind data at Comilla sub-station show that wind speed is at a maximum in the early part of the monsoon, but drops substantially by the beginning of the dry season. The five-yearly average of maximum wind speed at Comilla is seven kilometres per hour and the five-yearly average of minimum wind speed is three kilometres per hour. The five-yearly average wind speed was recorded as four kilometres per hour. **Table 12** shows the yearly maximum, minimum and average wind speed of Comilla substation of last five year (2008-2012), and is assumed to reflect the Project corridor conditions.

100. Historical wind data (wind speed, wind direction) were collected from Comilla substation were used to construct a wind rose (**Figure 4**) that provides an overview of prevailing wind conditions within Comilla, and likely directions in which potential air pollutants would be blown. Around 60% of the year, wind blows from the south with wind speeds between three and six kilometres per hour (42%) and six and nine kilometres

[20] BMD, 2013. Meteorological Database 2013, s.l.: Bangladesh Meteorological Department, Ministry of Defence, GoB.

per hour (18%) and other 40% of the year, wind blows from north or northwest directions.

Table 12: Annual Average Climatic Conditions of Comilla Substation

Year	Air Temp (° C)			Rainfall (mm)			Relative Humidity (%)			Wind Speed (km/h)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
2008	20	29	26	0	457	171	73	86	81	4	8	6
2009	21	29	26	0	1,244	288	73	86	80	3	6	4
2010	20	29	26	0	417	132	71	86	80	3	8	4
2011	19	28	26	0	501	157	68	85	79	3	7	4
2012	20	29	26	1	442	188	70	85	80	3	5	4
2013	20	29	26	0	612	182	71	86	80	3	7	4

Source: footnote 15

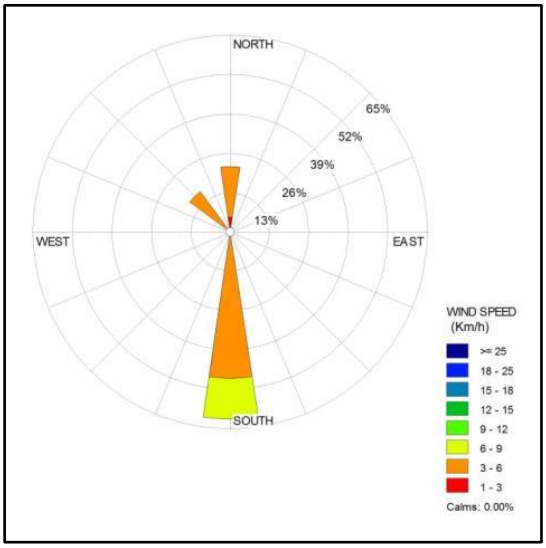


Figure 4: Distribution and Frequency of Wind Force within Comilla Substation

101. The Project location seems to be less affected by natural calamities like flood, cyclone or drought. The collected information regarding flooding situation of the Project corridor roads indicates that the corridor was not affected by the 2004 flood, which was the worst in recent years.

2) Air Quality and Noise

102. **Air Quality -** The air shed dimensions for assessment possible impacts were 50 m centred over the tracks along the line and 100 m as the line passed through a station. Air quality samples were taken at six sampling stations. Each sampling station had two test sites, one at sensitive receptors, such as settlement areas less than 50 m from track and the second at around 100 m distance from the proposed alignment. Tests were completed for carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), volatile organic compounds (VOC), large particulate matter (PM_{10}), and small particulate matter ($PM_{2.5}$) (**Table 13**).

Table 13: Pre-Monsoon Air Quality Condition along Project Corridor

Sampling ID	Sampling Location	CO µg/m³	NO µg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	VOC ppm	PM_{10} µg/m³	$PM_{2.5}$ µg/m³	Air Temp °C
AQ_01 3 m	Laksam	49	5	0	5	42	0	23	3	27
AQ_02 100 m	Laksam	10	0	0	11	45	0	14	0	24
AQ_03 2 m	Lalmai	95	4	0	11	46	0	15	3	26
AQ_04 100 m	Lalmai	39	1	0	27	58	0	11	0	20
AQ_05 3 m	Comilla	118	5	0	0	25	0	22	1	21
AQ_06 100 m	Comilla	57	4	0	1	48	0	14	3	29
AQ_07 2 m	Rajapur	239	2	0	0	29	0	20	2	18
AQ_08 50 m	Rajapur	14	9	0	18	46	0	11	3	31
AQ_09 4 m	Salda Nadi	83	8	0	81	36	0	11	2	26
AQ_10 50 m	Salda Nadi	273	0	0	71	41	0	19	0	27
AQ_11 3 m	Akhaura	398	6	3	26	48	0	14	2	32
AQ_12 50 m	Akhaura	3	1	2	39	56	0	11	0	31
DoE Standard (2006)		**40,000**	**100**	**100**	**365**	**235**	**NSE**	**150**	**65**	

NSE =No Standard Established; Sample stations are shown by ID number and sample location, GPS coordinates are marked on corridor maps in Annex 2, AQ=air quality. Source: Primary Data of RCIP-Rail (Annex 4)

103. Carbon monoxide ranged from 3 µg/m³ to 398 µg/m³, nitric oxide and nitrogen dioxide ranged from 0 µg/m³ to 9 µg/m³ and 0 µg/m³ to 3µg/m³ respectively. Sulphur dioxide ranged from 0 µg/m³ to 81 µg/m³, ground ozone ranges from 25 µg/m³ to 58 µg/m³. However, no VOC was detected in any of the 12 samples. Particulate matters PM_{10} and $PM_{2.5}$ ranges from 11 µg/m³ to 23 µg/m³ and 0 µg/m³ to 3 µg/m³ respectively. All parameters shown in **Table 13** were within the acceptable limits specified by DoE[21].

Table 14: Post-Monsoon Air Quality Condition along Project Corridor

Sampling ID	Sampling Location	CO µg/m³	NO µg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	VOC ppm	PM_{10} µg/m³	$PM_{2.5}$ µg/m³	Air Temp °C
AQ2_01 3 m	Laksam	2,737.84	33.28	26.71	249.98	209.57	0.97	148.09	78.54	20.15
AQ2_02 100 m	Laksam	3,197.64	47.02	32.75	262.77	223.91	2.07	153.35	86.31	19.50
AQ2_03 2 m	Lalmai	1,153.34	32.95	28.49	186.22	153.69	0.82	139	58.37	20.57
AQ2_04 100 m	Lalmai	1,622.98	36.94	32.92	278.45	196.20	1.98	145.54	64.18	21.12
AQ2_05 3 m	Comilla	389.27	5.87	3.82	24.13	29.30	1.02	25.65	12.18	14.69
AQ2_06 100 m	Comilla	310.95	5.38	3.17	17.77	17.89	0.77	20.70	11.14	16.44
AQ2_07 2 m	Rajapur	818.10	5.94	2.81	10.70	25.27	0.23	17.12	9.37	15.11
AQ2_08 50 m	Rajapur	343.48	5.26	1.28	5.26	10.90	0.15	11.59	6.91	14.79
AQ2_09 4 m	Salda Nadi	423.20	3.28	2.02	116.17	42.95	0.12	24.03	11.43	18.94
AQ2_10 50 m	Salda Nadi	660.48	5.04	2.18	121.22	42.37	0.21	27.60	13.59	18.43
AQ2_11 2 m	Akhaura	1,369.97	3.89	2.66	12.37	61.47	0.17	55.97	32.73	19.64
AQ2_12 50 m	Akhaura	69.92	2.14	1.18	8.22	44.97	0.06	21.35	15.85	19.88

[21] DoE, 2005. Amended by notification SRO 220-Law/2005, Dhaka: Department of Environment, Ministry of Environment and Forests, GoB.

Sampling ID	Sampling Location	CO µg/m³	NO µg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	VOC ppm	PM_{10} µg/m³	$PM_{2.5}$ µg/m³	Air Temp °C
DoE Standard (2006)		40,000	100	100	365	235	NSE	150	65	

NSE =No Standard Established; Sample stations are shown by ID number and sample location, GPS. Source: Primary Data of RCIP-Rail (Annex 4)

104. Carbon monoxide ranges from 69.92 µg/m^3 to 3197.64 µg/m^3, nitric oxide and nitrogen di-oxide ranges from 2.14 µg/m^3 to 47.02 µg/m^3 and 1.18 µg/m^3 to 32.92 µg/m^3 respectively. Sulphur di-oxide ranges from 5.26 µg/m^3 to 278.45 µg/m^3, ground ozone ranges from 10.90 µg/m^3 to 223.91 µg/m^3 and volatile organic compound ranges from 0.06 µg/m^3 to 2.07 ppm. However, particulate matter PM_{10} and $PM_{2.5}$ ranges from 11.59 µg/m^3 to 153.35 µg/m^3 and 6.91 µg/m^3 to 86.31 µg/m^3 respectively. All parameters shown in **Table 13** are within the acceptable limits specified by the DoE[22].

105. The results of the air quality monitoring in post-monsoon revealed relatively higher pollution level than pre-monsoon monitoring. This could be due to brick kilns and movement of diesel vehicles. Likewise, at sampling point, Project_AQ2_02_50 m in Laksam area, particulate matter PM_{10} and $PM_{2.5}$ exceeded the standard set by DoE. The possible reason of these exceedances could be the brick kiln located close to sampling point and the Comilla-Laksam highway.

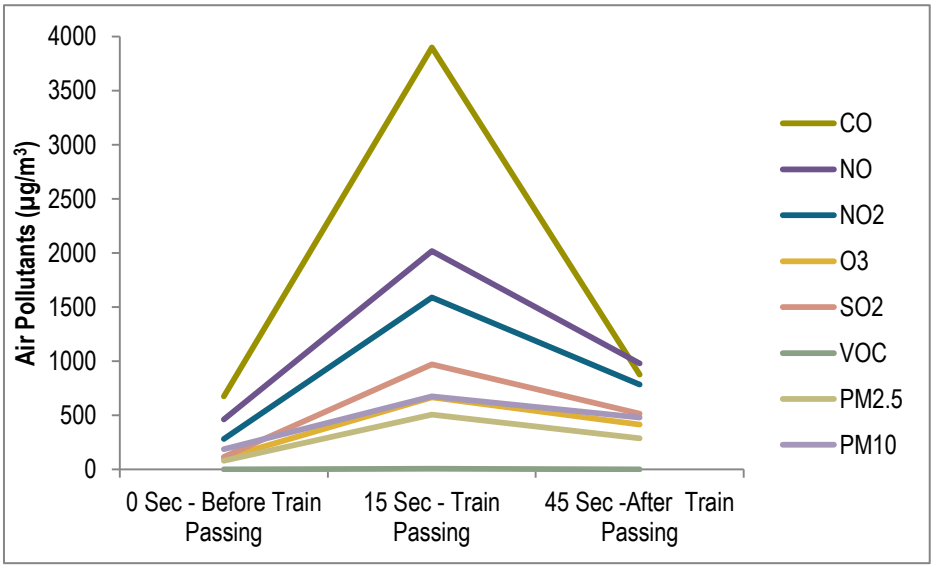


Figure 5: Changes of Air Quality Due to Train Movement

106. According to the sampling design, there were 12 air samples, each for one hour duration, taken within the 100 m wide Project corridor. A day time air (Project_AQ2_04_100 m) quality sample was taken to analyse the change in air quality as a train passed. The selected sample location was 100 m away from the existing rail track and adjacent to the closest sensitive receptor in Lalmai area. To observe the changes in air quality during a train passage and immediately after three one minute samples were taken without a train passing and three one minute samples with the train passing. **Figure 5** shows the concentration of all the air pollutants were lower before the train passing, and then increased immediately after the train passed, but then dropped back to pre-train passing levels within minutes.

[22] DoE, 1997. Environmental Conservation Rules. s.l.:Department of Environment, Ministry of Environment and Forestry, GoB.

107. **Noise** - Other than the existing train movements of approximately 31 pairs (62 movements) per 24 hours, there are no major noise pollution sources in the Project areas. The existing ambient noise level at 50 m distance from the track, without any train passing, at 50 m and 100 m distance from the tracks averaged between 48 and 62 dBA during the daytime which is within the DoE standard for commercial land use zones (the zoning for the railway RoW). **Annex 13** shows a 1 km stretch each for three typical types of land use or noise environment in the Project area representing predominantly agricultural areas, settlement areas without a rail station and settlement areas with a rail station.

Table 15: Noise Level in Pre-monsoon Season (within 100 m of RoW)

Sampling ID and distance from centreline	Sampling Location	Sampling Date	Noise level (Laeq) dB	
			Day	Night
NM_1,3_3 m	Laksam	15/6/2013	57	51
NM_2,4_100 m		15/6/2013	48	47
NM_5,7_2 m	Lalmai	17/6/2013	57	51
NM_6,8_100 m		17/6/2013	53	47
NM_9,11_3 m	Comilla Rail Station	18/6/2013	74	No measurement taken
NM_10,12_100 m		19/6/2013	60	No measurement taken
NM_13,15_2 m	Rajapur Rail Station	17/6/2013	78	49
NM_12,16_50 m		18/6/2013	60	51
NM_17,19_4 m	Salda Nadi Rail Station	18/6/2013	54	No measurement taken
NM_18,20_50 m		18/6/2013	53	No measurement taken
NM_21,23_2 m	Akhaura Rail Station	16/6/2013	58	52
NM_22,24_50 m		16/6/2013	62	53
BD Noise standard (2006)			**Day**	**Night**
		Silent areas	45	35
		Residential	50	40
		Mixed	60	50
		Commercial	70	60
		Industrial	70	70

Note: Some night measurements were not taken due to security concerns. Cells shaded in light grey show readings taken as a train passed the sampling point.
Source: Primary Data of RCIP-Rail (Annex 4)

108. Night time noise levels were measured at between 47 and 51 dBA; well within DoE's standard for commercial land use areas, and in fact for mixed use zoning conditions. These conditions remained consistent for both sample cycles (**Table 15** and **Table 16)**.

Table 16: Noise Level in Post-monsoon Season (within 100 m of RoW)

Sampling ID	Sampling Location	Sampling Date	Noise level (L_{eq}) dB	
			Day	Night
NM2_1,3_3 m	Laksam	17/01/2014	53.32	44.9
NM2_2,4_100 m		17/01/2014	58.13	58.8
NM2_5,7_2 m	Lalmai	17/01/2014	46.50	53.7
NM2_6,8_ 100 m		17/01/2014	55.03	53.7
NM2_9,11_3 m	Comilla Rail Station	17/01/2014	74.71	64.2
NM2_10,12_ 100 m		17/01/2014	58.12	57.6
NM2_13,15_2 m	Rajapur Rail Station	18/01/2014	49.90	55
NM2_12,16_50 m		18/01/2014	53.50	51
NM2_17,19_4 m	Salda Nadi Rail Station	18/01/2014	61.80	59.8
NM2_18,20_50 m		18/01/2014	59.69	64.8
NM2_21,23_2 m	Akhaura Rail Station	18/01/2014	63.93	58.9
NM2_22,24_50 m		18/01/2014	69.25	52.2
BD Noise standard (2006)			Day	Night

Sampling ID	Sampling Location	Sampling Date	Noise level (L_{eq}) dB	
			Day	Night
		Silent areas	45	35
		Residential	50	40
		Mixed	60	50
		Commercial	70	60
		Industrial	70	70

Note: Cells shaded in light grey show readings taken immediately after a train passed.
Source: Primary Data of RCIP-Rail Annex 4)

109. These noise readings are A-weighted sound levels at the particular moment of measurement. Sound levels are described in this report in several ways as single momentary noise exposure is less important than cumulative exposures. Sound levels can be described as hourly equivalent sound level or Leq (h) which is an accumulation of one-hour exposure and accounts for moment-to-moment fluctuations in A-weighted scale. Hourly equivalent sound level Leq (h) is used in this study to concentrate cumulative noise contributions of individual noise events. The Leq (h) is an important measure to assess impacts on non-residential areas where sleep is not involved as it correlates significantly with conversation interference and enjoyment of TV, radio, and music. Train noise usually ranges in the 80s dB (A). Another noise descriptor used is Ldn which is a cumulative 24-hour exposure from all events that correlates well with attitudinal surveys of residential noise and therefore a useful measure to assess impact on residential areas.

110. Noise readings provided in **Table 15** and **Table 16**, provides the day (Ld) and night (Ln) noise levels. These readings were cumulated and disaggregated into two categories to compare mixed from open/agricultural land uses. Measurements from Comilla, Rajapur, Salda Nadi, Akhaura stations represent mixed land use with a computed Ldn of 61 dB(A). Noise readings from Laksam and Lalmai to represent open areas had a computed Ldn of 53 dB (A). These figures are important in assessing the impacts of predicted noise levels.

111. Noise measurements while a train was passing were also recorded and showed a consistent rise by as much as 25 dBA as the train passed and then within seconds a reduction back down to pre-train movement levels (**Figure 6**). Noise levels in rail station were consistently high due to use of road vehicle horns and music at high volume from roadside traders (**Annex 4**).

112. A special set of measurements was taken to record noise levels before during and after a train passed at station number NM2_6, the Lalmai site, at 100 m distance from the tracks. In order to capture the full noise pulse measurement were taken continuously for six minutes. A plot of these data (**Figure 6**) shows the noise pulse and the momentary exceedance of the mixed zone standard, however not the standard for commercial use zoned land.

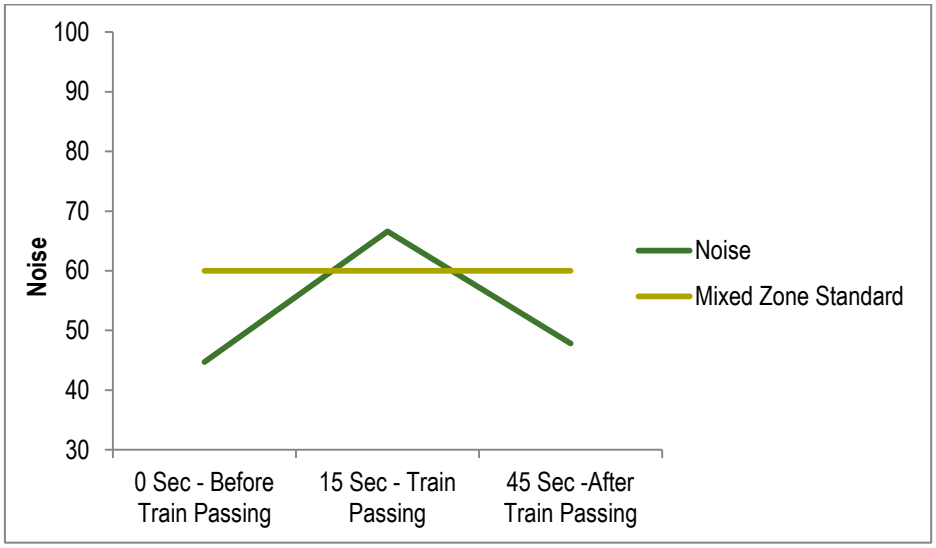


Figure 6: Noise Level Variation 100 m from Track, Before During and After Train Passage near Lalmai Station

3) Topography, Geology, Soils and Existing Erosion

113. **Topography -** The area is mainly flat agricultural land crisscrossed by rivers and canals. The elevation varies from one metre to two metres above mean sea level. Loamy soils are predominant in the study area, and organic matter content of the soils is moderate. Soils are usually deficient in nitrogen, phosphorus, and sulphur but contain reasonable amounts of potassium and zinc[23]. These conditions were also identified during public consultation sessions.

114. Between Akhaura and Comilla the land level at and around Akhaura ranges from eight metres to ten metres above sea level and gradually rises to about sixteen metres near Comilla and then drops down to about eight metres to ten metres at and around Laksam. From the India - Bangladesh Border to about 60 km inside Hill Tripura in India the level rises to about 250 m. All the rivers crossing Akhaura-Laksam rail line originate in Hill Tripura and as such have high velocity and ultimately drain into the Meghna River (**Photo 11** and **Photo 12**), and are not affected by the tidal cycle.

115. The majority of the study area's (100 m of either side) land use is agriculture (956 ha), brick field (9 ha), rail station (10 ha), settlement (380 ha) including educational institutes (school and madrasa), worship places, graveyards, post offices, industries and water body (105 ha). Surface water bodies – streams, ponds, and several rivers also comprise 105 ha of the land surface. The total area within 100 m on either side of the existing rail line is approximately 1460 ha. In addition, the total available area of BR land is around 0.76 ha for the proposed EMO building in Phoenix Road, Dhaka near Rail Bhaban.This area is currently occupied by a fairly large slum of illegal settlers and staff quarters for Class IV railway employees, a godown and an office building.

116. The Project area passes through Gumti River basin and tributary sub-basins. As there is an operational rail line in the Project area and the proposed work activities will be limited to within the existing BR RoW.

[23] SRDI, 1997. *Physiography of Bangladesh,* Dhaka: Soil Resource Development Institute, Ministry of Agriculture, GoB

Photo 11: Overview of Typical Floodplain

Photo 12: Topography Exposed Topsoil of the Study Area

117. **Geology –** The geology of the Project area can be classified into four geological units, alluvial sand, alluvial silt, alluvial silt and clay and deltaic sand. The alignment passes through active and nearly level floodplain, located in the Akhaura and Quasba Upazilas of Brahmanbaria District; and Brahmanpara, Burichang, Comilla Sadar North, Comilla Sadar South and Laksam Upazilas of Comilla District. The geological profile along the proposed alignment consists of alluvial deposits, underlain by deltaic deposits of the Brahmaputra-Ganges-Jamuna River systems. These deposits include mostly fine sandy, silt and clay materials. Quite a number of incised channels and depressions within the alignment area are lined with recent alluvial deposits comprising Lowland Alluviums.

118. The Consultant conducted geotechnical investigations in 140 borehole locations along the proposed alignment RoW. Based on the findings of the site investigation, generally the top 10 m to 15 m of the alignment consists of relatively weak compressible soft clayey silt layer of variable thickness which is then underlain by soft to stiff clay layers and medium, dense to very dense silty fine sand deposits[14].

119. **Soils and Erosion** - In accordance with[18], only the Old Meghna Estuarine Flood Plain soils within the Study Area, which is classified as meander floodplain and is silty and loamy.

120. The sediments are predominantly deep and silty, but a shallow clay layer overlies them in some basin centres. Seasonal flooding is severe in the north, but it is much less so in the southeast. This flooding is by rainwater ponded on the land when rivers are flowing at high levels; the exceptions are the narrow floodplains alongside small rivers (such as the Gumti) which cross the alignment from the Tripura hills in India. Given its very flat topography the Project area is not prone to erosion hazards, and actually receives a few centimetres of sediment during each flood season (see **Photo 9)**.

4) Hydrology, Drainage and Surface Water Quality

121. **Hydrology and Drainage** - The surface water along the proposed alignment is dominated by the Dakatia (Bridge 231), Gumti (Bridge 243), Salda Nadi (Bridge 249), Bijni (Bridge 261), Howrah (Bridge 276) Rivers, all originating in the Tripura hills of India. These rivers, especially the Gumti exhibit flash flooding during heavy monsoon rain. The Gumti and its tributaries are virtually dry during the dry season, due to withdrawal of water for irrigation by low-lift pumps. Generally, ponds remain unchanged from year to year due to rejuvenation during the rainy season. No protected wetlands were found in the rail corridor.

122. **Water Levels and Discharge Rate** – Water levels and discharge rates of the following five rivers (**Table 17**) suggest very shallow and mostly seasonal rivers.

Table 17: River Hydrology (2004-2008)

River	Bridge No.	Avg. Water Depth (m)	Discharge (m^3/Sec)	RLFL (m)	RHFL (m)	Scour depth (m)
Howrah	276	4.70	23.93	2.47	7.23	2.48
Bijni	261	5.17	16.99	1.67	8.80	2.35
Salda Nadi	249	3.61	22.13	0.82	7.78	2.86
Gumti	243	7.91	95.28	6.56	13.55	5.99
Dakatia	231	2.63	21.59	0.22	5.70	2.10

RLFL = Recorded Lowest Flood Level; RHFL = Recorded Highest Flood Level. Source: (RCIP-Rail, 2013)

123. **Surface Water Quality** - People use the water from khal, canal and ponds for washing, bathing and for their livestock. In the dry season local canals and channels provide water for irrigated boro[24] cultivation and for growing winter crops. **Table 18** provides the quality of surface water of pre-monsoon season. A surface water sampling method is shown in **Photo 13**. pH, although measured, is not shown as it was always steady at around 7.1.

Table 18: Surface Water Quality in Pre-Monsoon Season

SAMPLE I.D. (UpS=upstream DnS = downstream)	Date	Water Body Crossed/Site Description	GPS Location		TOC (mg /L)	Tot. phos phate (mg/L)	TSS (mg/L)	Oil and Grease (mg/L)	DO (mg/L)
			Latitude	Longitude					
SW UpS_001	1/4/2013	Dakatia River	23°207"	91°8'50.6"	11	0.01	33	BDL	0.6
SW DnS_002	1/4/2013	Dakatia River	23°20'1'18.8.9"	91°8'49"	12.8	0.21	24	BDL	0.26
SW UpS_003	2/4/2013	Bijni River	23°40'17.9"	91°9'23"	3.8	0.14	69	BDL	6.13
SW DnS_004	2/4/2013	Bijni River	23°40'18.4"	91°9'22"	3.9	0.06	74	BDL	5.58
SW UpS_005	2/4/2013	Gumti River	23°29'8.7"	91°9'46.8"	3.2	<0.01	28	BDL	6.74
SW DnS_006	2/4/2013	Gumti River	23°29'10.7"	91°9'44.5"	2.8	0.11	80	BDL	6.51
SW DnS_007	3/4/2013	Sidai Khal	23°46'52.3"	91°9'57.3"	0.5	0.06	22	BDL	6.44
SW UpS_008	3/4/2013	Sidai Khal	23°46'51.1"	91°9'59.1"	0.6	0.02	6	BDL	6.45
SW UpS_009	3/4/2013	Howrah River	23°50'1.2"	91°11'52.8"	4.4	<0.01	26	BDL	4.79
SW DnS_010	3/4/2013	Howrah River	23°50'2.5"	91°11'51.5"	4.5	0.14	171	BDL	4.3
SW UpS_011	3/4/2013	Debgram	23°51'41.8"	91°12'18.7"	9.9	0.39	28	BDL	0.21
SW DnS_012	3/4/2013	Debgram	23°51'40.8"	91°12'16.8"	12.1	0.37	5	BDL	0.14
ECR Standard Limit for Potable Water					0.2	6	10	0.01	6
ECR Standard Limit for Pisciculture / Irrigation									≥5

Source: Primary Data of RCIP-Rail (Annex 4)

Note: Cells shaded in light grey show values exceeding the ECR PWQS. Upstream (UpS) and downstream (DnS); BDL = Below Detection Limit

[24] The boro rice is commonly known as winter rice. The term boro is Bengali originated from the Sanskrit word "Boro" which refers to a cultivation from Nov.-May under irrigated condition.

124. Existing concentrations of total organic carbon in all surface water samples collected during pre-monsoon season did not meet potable water quality standards but were adequate for aquaculture (**Table 18**).

125. Concentrations of total phosphate and dissolved oxygen in some of the samples also exceeded PWQS standards. However, all samples met the guideline for the concentrations of total phosphate and oil and grease.

126. Concentrations of total phosphate, oil and grease and pH in all surface water samples (SW2 UpS_001 to SW2 DnS_012) collected during post-monsoon season did not exceed GoB standards for potable water (Table 19). However, the concentration of total organic content and total suspended sediment levels in all surface water samples exceeded GoB standards. Dissolved oxygen level in all the samples except SW2 UpS_011 and SW2 DownS_012 were at acceptable levels. The concentration of oil and grease in all water samples was below the detection limit.

127. High concentrations of TOC and TSS were observed in the surface water samples at all times. pH and total phosphate concentrations were within the limit of the surface water quality standards of ECR 1997 of Bangladesh (DoE, 1997). The surface water is not potable, however is suitable for use as process water for crops and industry.

Table 19: Surface Water Quality in Post-monsoon Season

SAMPLE I.D	Date	Water Body Crossed/Site Description	GPS Location		TOC (mg/L)	Tot. phos-phate (mg/L)	TSS (mg/L)	Oil and Grease (mg/L)	DO (mg/L)
			Latitude	Longitude					
SW 2 UpS_001	15/01/2014	Dakatia River	23°20'18.7"	91°8'50.6"	2.6	0.20	28	BDL	6.16
SW 2_DnS_002	15/01/2014	Dakatia River	23°20'18.9"	91°8'49"	2.2	0.12	15	BDL	6.39
SW 2UpS_003	16/01/2014	Bijni River	23°40'17.9"	91°9'23"	2.3	0.10	45	BDL	6.31
SW2 DnS_004	16/01/2014	Bijni River	23°40'18.4"	91°9'22"	3.2	0.15	59	BDL	6.42
SW2 UpS_005	15/01/2014	Gumti River	23°29'8.7"	91°9'46.8"	2.1	0.09	13	BDL	6.42
SW2 DnS_006	15/01/2014	Gumti River	23°29'10.7"	91°9'44.5"	2.1	0.09	23	BDL	6.39
SW2 DnS_007	16/01/2014	Sidai Khal	23°46'52.3"	91°9'57.3"	4.5	0.11	83	BDL	6.20
SW2 UpS_008	16/01/2014	Sidai Khal	23°46'51.1"	91°9'59.1"	4.9	0.11	100	BDL	6.28
SW2 UpS_009	16/01/2014	Howrah River	23°50'1.2"	91°11'52.8"	2.6	0.15	30	BDL	6.05
SW2 DnS_010	16/01/2014	Howrah River	23°50'2.5"	91°11'51.5"	2.7	0.13	48	BDL	6.40
SW2 UpS_011	16/01/2014	Debgram	23°51'41.8"	91°12'18.7"	5.5	0.68	9	BDL	3.81
SW2 DnS_012	16/01/2014	Debgram	23°51'40.8"	91°12'16.8"	5.4	0.41	5	BDL	3.98
ECR Standard Limit for Potable Water					0.2	6	10	0.01	6
ECR Standard Limit for Pisciculture / Irrigation									≥5
BDL = Below Detection Limit									

Source: Primary Data of RCIP-Rail (Annex 4)
Note: Cells shaded in light grey show values exceeding the ECR PWQS.
Upstream (UpS) and downstream (DnS)

128. The surface water analytical results and the laboratory certificates are provided in detail in **Annex 4**.

5) Groundwater

129. Groundwater samples were collected on April 1-3, 2013 and January 15-16, 2014 for pre and post monsoon season respectively, from ten tube wells near the Project corridor. The samples were submitted to a laboratory and analysed for pH, total dissolved solids, arsenic, iron, manganese, sulphur and chloride. pH, total dissolved solids, arsenic, sulphur and chloride levels from stations GW01 to GW10 were satisfactory (DoE Schedule 3 (B) of ECR, 1997). However, the concentration of iron in samples GW01, GW04, GW06, and GW07 exceeded acceptable GoB standards. Concentration of manganese in GW01-04 and 07 were higher than DoE's potable water quality guideline.

130. During the post-monsoon season, total dissolved solids, arsenic, sulphur and chloride in groundwater samples collected from GW201 through 10 were all within acceptable limits for potable water (Schedule 3 (B) of ECR, 1997).

Table 20: Groundwater Quality within the RoW of the Project

Sample ID	Date	Water Body Crossed/Site Description	GPS Location		pH	TDS (mg/L)	As (mg/L)	Fe (mg/L)	Mn (mg/L)	S (mg/L)	Cl (mg/L)
			Latitude	Longitude							
Pre-Monsoon Period											
GW001	1/4/2013	Dakatia River Sayedpur	23°20'30.9"	91°8'49.9"	6.17	103	<0.001	4.28	2.37	1	5
GW002	2/4/2013	Koikhola Quasba	23°40'28.6"	91°9'25.8"	6.29	160	<0.001	<0.01	0.382	<1	10
GW003	2/4/2013	Uttar Shashidal	23°38'46.9"	91°8'49.2"	6.5	205	<0.001	0.21	1.72	<1	11
GW004	2/4/2013	Rajapur	23°34'32.4"	91°9'22.8"	6.32	138	<0.001	0.83	0.197	<1	11
GW005	2/4/2013	Sadar Rasulpur	23°31'13.4"	91°10'9.5"	6.13	98	<0.001	0.15	0.044	4	1
GW006	2/4/2013	Badarpur	23°29'03.2"	91°9'45.2"	6.28	130	0.001	1.68	0.155	5	4
GW007	3/4/2013	Rajballabpur	23°42'20.8"	91°8'43.3"	6.35	140	<0.001	1.42	0.788	2	9
GW008	3/4/2013	Quasba Chapia	23°46'11.2"	91°9'45.9"	6.17	179	<0.001	<0.01	0.032	4	9
GW009	3/4/2013	Mogra Gangasagar	23°49'57.8"	91°11'45.6"	6.66	227	0.001	<0.01	0.001	6	15
GW010	3/4/2013	Chandanshah Akhaura	23°51'53"	91°12'17.7"	6.1	100	<0.001	0.1	0.144	8	3
Post Monsoon Period											
GW201	15/01/2014	Sayedpur, Laksam	23°20'30.9"	91°8'49.9"	6.27	97	<0.001	0.41	2.21	<1	4
GW202	16/01/2014	Koikhola, Quasba	23°40'28.6"	91°9'25.8"	6.35	190	<0.001	9.14	0.427	<1	14
GW203	15/01/2014	Uttar Shashidal	23°38'46.9"	91°8'49.2"	6.56	245	<0.001	0.05	4.45	<1	17
GW204	15/01/2014	Rajapur	23°34'32.4"	91°9'22.8"	6.47	155	<0.001	0.35	0.199	<1	11
GW205	15/01/2014	Sadar Rasulpur	23°31'13.4"	91°10'9.5"	6.24	97	<0.001	0.37	0.063	<1	<1
GW206	15/01/2014	Badarpur	23°29'03.2"	91°9'45.2"	6.37	141	<0.001	0.82	0.031	<1	2
GW207	16/01/2014	Rajballabpur	23°42'20.8"	91°8'43.3"	6.41	152	<0.001	0.25	0.404	<1	1
GW208	16/01/2014	Chapia, Quasba	23°46'11.2"	91°9'45.9"	6.18	175	<0.001	0.39	0.014	2	8
GW209	16/01/2014	Mogra, Gangasagar	23°49'57.8"	91°11'45.6"	6.78	242	0.002	0.03	0.001	2	19
GW210	16/01/2014	Chandanshah, Akhaura	23°51'53"	91°12'17.7"	6.28	102	<0.001	0.39	0.230	2	3
ECR Standard Limits for Potable Water Quality				6.5 to 8.5		1000	0.05	0.3	0.1	100	600

Note: Cells shaded in light grey show values exceeding the ECR PWQS.
Source: Primary Data of RCIP-Rail (Annex 4)

131. Iron levels in all the groundwater samples except GW2_03, 07 and 09 exceeded acceptable levels for potable water quality standards. Concentrations of manganese in GW2_01-04, 07 and 10 were also higher than DoE standards for potable water. This is due to natural subsurface conditions (see **Table 20** and **Photo 14**).

Photo 13: Surface Water Sampling at Howrah River

Photo 14: Ground Water Sampling at Laksam

6) Flora and Fauna

132. **Terrestrial Flora** – The most common terrestrial flora around homesteads and settlements are Rain tree (*Albizia saman*), Mango (*Mangifera indica*), Coconut (*Cocos nucifera*), Mehogani (*Swietenia mahogany)*, Banana (*Musa sp.*), Gogon Siris (*Albizia richardiana*), Rain tree (*Samanea saman*), and Betel Palm (*Areca catechu*), Guava *(Psidium guajava), etc*. Among crop-field vegetation, Aman grown during summer rains and Boro cultivated by irrigation in winter are the major rice crops. Rabi crops like mustard, lentils are also grown. Sessile joy weed (*Alternanthera sessilis),* thorny Amaranth (*Amaranthus spinosus*), Bermuda grass *(Cynodon dactylon),* Smartweed *(Polygonum sp),* Creeping oxalis *(Oxalis corniculata),* etc., are the common weed species. Plant species within alignment are mehgani, arjun, pitali, eucalyptus, bot, jam, akashmoni, auricoliformis, am, kadam, shisoo, koroi, krishna chura, babla, ipil-ipil, shimul, shirish, etc. (See **Photo 15**).

133. **Terrestrial Fauna** – Along the railroad alignment there is nowhere that could be called undisturbed habitat. There is some wetland and some avifauna in around these areas as well as in agricultural fields which reach almost to the tracks. The common birds species are crow, myna, cuckoo, king fisher, pigeon and dove satare, drongo, weaver bird choroi, babui, dahuk, etc. The mammals include shial, monkey, begi, bhodar, heza, various rodents, guishap, baghdash, badur, etc. and there are also several species of frog, lizard and snake.

134. **Fisheries** – Local villagers reported catching fish in all the water bodies in the Project area. The major species of fish are carp, of which several species live in the local waters. Major fishes in the rivers and canals in the Project area are carp (Rui, Catla, Mrigal, Ghania, Kalbaus, Kalia), catfish (Boal, Pangas, Silon, Ayeir, Bacha) and snake head (Shol, Gazar, Taki), freshwater shrimp and several other tropical whitefish species. These species are well adapted to the silt-load extreme water temperature and low DO level rivers found in the Project corridor. Fish are often cultivated in the rail side pond and are usually carp and catfish.

135. **Aquatic Flora and Fauna** - The aquatic environment includes rivers, canals, water bodies and ponds. The rail side agricultural land is inundated during the monsoon season and dries up in the dry season every year. The biological characteristics indicated the presence of a moderate variety of species and aquatic plants. A list of wet land flora as found in the Project area are (Bengali) *Helencha, Hejol, Kudipana, Kuchuripana, Shapla, Shaluk, Lotus, Nol, Sola, Kalmi etc.* Aquatic fauna reported area includes crabs and oyster/ear shell (See **Photo 16**).

Photo 15: Terrestrial Flora of (Mature Tree)

Photo 16: Aquatic Fauna in Sidai Khal

7) Agricultural and Mineral Development

136. Agriculture is the dominant sector of employment for the people living along the RoW. Around 2,614.72 ha lands exist within 100 m either side of the RoW. Out of this around 18.30 ha of crop lands will be acquired for the Project. Crops grown include a variety of rice and other vegetables including potato, cauliflower, cabbage and tomatoes. The basin lands are used for irrigated High Yield Variety (HYV) paddy cultivation during the early Amon[13] season. Boro (winter rice) – is grown from February through July and Rabi[25], the cooler season rice, between November - April. Two other rice varieties, Amon and Aus[26], are grown throughout the summer. Around 7.2% of all villagers grow some type of crops. It is noted that the Akhaura and Laksam corridor passes through urban areas, where land is used for housing, industrial, institutional, rice husking and other purposes.

B. Social Environment

137. A Socio-economic Survey completed by Social Safeguard group of the Consultant for Project has been considered as the primary data source. These data were used to prepare the land acquisition and resettlement plan for the Project. However, the present resettlement plan (RP) is prepared for an area of 37.38 ha of acquisition of private land, which is a reduced area from that in the original RP submitted on June 2014. The area of land has been reduced due to reducing the CRoW of the Project. The proposed RoW runs through some 84 mouzas (land revenue unit) of two Districts and three survey sections, i.e., (i) Laksam to Comilla, (ii) Comilla to Salda Nadi, and (iii) Salda Nadi to Akhaura.

138. A separate socio-economic survey and an Addendum to the Resettlement Plan for the Project are being undertaken for the EMO site. This report should be read in conjunction with the Addendum to the Resettlement Plan, incorporating the EMO site, which is expected to be completed by mid-2015.

1) Socio-Economic Profile[27]

139. Data on population, age/sex composition, household patterns, and sources of drinking water, sanitation facility, and ownership of agricultural land were enumerated

[25] Rabi crops or Rabi harvest refers to agricultural crops sown in winter and harvested in the spring.

[26] Amon is a term used in Bangladesh and east India for lowland rice, grown in the wet season during June to November. Aus is rice, grown in Bangladesh during the early part of the wet season from March to September.

[27] Data presented in this section is based on revised RP prepared on 11 February 2015.

from the field survey as well as latest community series census data published by the Bangladesh Bureau of Statistics 2010[28].

140. **Population and Household** - In the study area, there are 2,004 households (HHs) including squatters with a total population of 9,626 that will be affected by the implementation of the Project. As per the household census, 54.55% of the population is male and 45.55% female. The average household size is 4.5 people. The Salda Nadi Akhaura area, located near Mandabag rail station has the highest population with 4,663 people and a household size of 5.33) while Laksam-Comilla has a smaller population and household size (respectively 2,527 and 4.56). There are 0.42% (43 in number) physically challenged population are living in the Project areas of which 63% of them are male and the remaining 37% are female[14,29,30]

141. **Education -** Census findings in the Project areas show that concentration of literate people is higher in primary up to class five (26.44%), and secondary education up to grade 10 (30.84%). In these two levels of education the percentage points of males and females are closer to each other. Beside this, 11.93% are educated up to secondary school level (SSC) or equivalent. Education beyond the secondary level up to Masters or equivalent (11.73%), due to a lack of opportunity and interest of the people. The illiteracy rate in the Project areas is 7.90%, which is much lower than that at national average of 42.1%[14].

142. **Occupation** - Major occupations of the affected household heads are business (33.38 %) and farming (20.39%) and they are male. There are also day labourers, and transport sector workers, such as drivers. About 3.24% male heads also work abroad and they send remittance to their households. No female heads work abroad and more than 7.6% (housewife) do not work outside the home, where they are responsible for all household tasks including cleaning, cooking, washing and running the home[14].

143. **Income and Expenditure –** The income in the Project area comes from private businesses, pensions/gratuities, remittances, services, farming, driving, house rental income, cobblers, day labouring, barbers, medical profession, rickshaw pullers, masons, mechanics, carpenters, teachers, and cottage industries. The highest income comes from businesses (23.4%) followed by pensions/gratuity (11.8%) and remittances (11.7%). Most of the annual expenditure goes toward payment of employees (74%) with food second (7.5%) [24, 31].

144. **Electricity** is an important indicator for measuring the quality of life in the Project area. In the Project areas, 86% of the households have grid electricity connection. This coverage is significantly higher than that at national level (55.26%)[15]. In the context of sub-section wise distribution, it is found that Laksam-Comilla has the highest connection (96%) whereas Comilla-Salda Nadi has the lowest (45%). A few of the households (about 1%) use non- grid (solar) electricity. In accordance with the local people, the reasons for less use of non- grid electricity are: (i) availability of grid

[28] BBS, 2013. Bangladesh Population Census 2010, s.l.: Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, GoB .

[29] RCIP-Rail, 2013. *Initial Poverty and Social Assessment for Construction of Double Line and Upgrade of Existing Rail Line between Akhaura and Laksam - 72 Km,* Dhaka: Bangladesh Railway, Ministry of Railways.

[30] BBS, 2013. Report of the Household, Income & Expenditure survey 2010, s.l.: Bangladesh Bureau of Statistics Division, Ministry of Planning, GoB.

[31] RCIP-Rail, 2015. Resettlement Plan for Construction of Double Line and Upgrade of Existing Rail Line between Akhaura to Laksam -72 km, Dhaka: Bangladesh Railway, Ministry of Railways.

connection, and (ii) higher instalment cost of solar panel. People, however, in the study area mostly use the electricity for lighting and fanning purposes (81%)[24].

145. **Drinking Water -** Access to drinking water is another main indicator for measuring quality of life. Like other parts of the country, people in the Project area also use tube well water for drinking (97%), which is higher than the national average of 85.37%[15]. About 3% of the households currently have the source of running water (tap), as these households are located in urban areas[24]

146. **Sanitation and Waste Management** - In the Project corridor about 86% of people use latrines and 12% have indoor plumbing. The 2% who tend to defecate in open places are mostly in poorer rural areas, with no access to hygienic latrine facilities[24]. The coverage of sanitary latrine is higher in the Project areas than that at national level (51.05%)[15].

147. **Solid Waste Management** - Uncontrolled waste generation coupled with inadequate collection and disposal systems have the potential to give rise to pollution and environmental degradation as well as disease. There is a garbage collection system in the main cities fall within the Study Area, but none in the small villages and towns. Whilst no specific data on local waste management was collected from the Study Area, it is likely that – as with many other parts of rural Bangladesh – the villages within the Study Area have no formal waste management facilities, and that in general people dispose of their waste in landfills or in fallow land.

2) Human Settlement in the RoW

148. The Study area consists of linear markets and business places with tin shed shops that are common here and there and locally some pucca structures with reinforced concrete roof are also common. There is housing areas in blocks that occur scattered within the Project site. The rural people along the alignment are involved in agriculture, day labour, fishing, and transportation workers. Most of the land required for the double line Project is owned by Bangladesh Railway (369.84 ha out of 407.22 ha) and human settlements within the RoW are unauthorised. Most of these structures are temporary and mostly built with tin, earth and bricks[25].

3) Community Safety

149. Community safety is a significant concern for BR. At present during any 24 hour period about 62 trains pass between Akhaura and Laksam, passing a level crossing every 20 minutes. Safety features consist of manually operated gates. Currently there are few level crossing incidents recorded by BR staff of Comilla and Sadar Rasulpur. There are 15 authorised crossings identified between Akhaura and Laksam rail corridor. Besides these authorised level crossings, 60 unauthorised level crossings were identified within the Project area[14].

4) Heritage and Culture

150. In the study area, three Physical Cultural Resources (PCRs)[32] were identified within the Project corridor (**Table 21** and **Photo 17**). These sites were confirmed during the public consultation sessions and also through resettlement planning work completed by the Consultant[25].

[32] PCR – a regionally important cultural/historical feature

Table 21: Physical Cultural Resources (PCRs) in the Project Corridor

Sl. No.	Name of the PCRs	Chainage (km)	Name of Owner/ President/ Secretary	Village	Union	Upazila	District
1	Hazrat Shah Sufi Riasat Ali Fakir (R) Mazar Sharif	161.100	Md. Shah Alam	Pitamber	Baksimail	Burichang	Comilla
2	Sree Nandoram Goshwami Moth	167.000	Sree Bikas Chandra Roy	Rajapur	Rajapur	Burichang	Comilla
3	Doso Vhuja Kalibari Mandir	196.850	Babu Ratun Kumar Pal	Mogra	Mogra	Akhaura	Brahmanbaria

Source: footnote 25

Sree Nandoram Goshwami Moth Doso Vhuja Kalibari Mandir

Hazrat Shah Sufi Riasat Ali Fakir (R) Mazar Sharif

Photo 17: Important Physical Cultural Resources in the Project Areas

151. The social safeguards team also identified 46 Community Property Resources (CPRs)[33] which have local religious, educational, and socio-cultural value. In addition, 1,259 settlement units comprised of 850 residential, 730 commercial facilities and 183 residential and commercial facilities are in the RoW[25]. A list of all CPRs is provided in **Annex 8**.

5) Archaeological, Historical Treasures and Scenic Areas

152. There are no declared (by the authority concerned) archaeological or paleontological sites or structures within the RoW, but, there are some historical and religious structures locally significant and were identified during the consultations (See **Table 21**).

C. The Gumti River Bridge

153. As agreed with DoE, this EIA addresses all river crossings where bridges more than 100 m long spans are to be built, providing details on all aspects of the natural environment, the work, impacts and mitigative and monitoring measures throughout the construction period and into the operating life of the structure

1) Description of Gumti River and Existing Rail Bridge (176 m and 156.354 km)

154. This bridge crosses the Gumti River approximately 2.5 km north of the Comilla Railway Station and flows in a westerly direction from the hilly areas of Tripura, India to

[33] CPR - site or feature that is important in a local community such as a school or mosque

the Upper Meghna River. The length of the river in Bangladesh is approximately 135 km and the bridge is located approximately 9 km (straight line distance) downstream of where the river enters Bangladesh. For approximately 65 kilometres downstream of the India border, the river, in the Bangladesh side is flanked by flood control embankments creating a confined floodway. Flood control embankments were initially constructed in the early 1700s and were reconstructed between 1986/87 and 1991/92. Since the reconstruction, the embankments have been breached a number of times near or upstream of the railway crossing, most recently in 1999 and 2011.

155. The existing railway bridge was constructed in 1896 and consists of five spans. Of these spans only 2 and 3 pass over the present channel. Span 1, 4 and 5 primarily cross the floodplain which presently flows only during the monsoon season.

2) Geotechnical Investigations

156. No specific geotechnical investigations have been undertaken for the river training works at Bridge 243 (Gumti Bridge). The geotechnical investigation report of Rail Embankment and Bridge Piers did not identify any unusual sub-surface conditions at the site. The banks are primarily comprised of sandy and silty-sand materials. The average size of the bed materials (D50 from local Borehole 2) is 0.008 mm taken at a depth of about 2-2.5 m below the river bed.

157. Temporary bank protection consisting of sand/earth filled plastic bags and timber stakes (**Photo 9**) were placed along 85 m of the left bank after the 2012 floods to stop active lateral erosion and possible upstream propagation of the erosion towards Pier 1 and the abutment foundations. Based on the proximity to the deepest scour in the channel, it is suspected that the bank erosion is a result to the decades of high localised velocity and back eddies along the left bank, due to poor bridge pier placement.

158. Basic construction features of the proposed major bridge of the Project will include i) ballasted decks, ii) continuous welded rail where possible, iii) minimum structural difference between existing and new tracks; and finally that iv) proposed track will be offset around 12 m from centreline of existing track.

V. ANALYSIS OF ALTERNATIVES

A. Alternative to the Project

159. Little consideration was given to planning road or air options to meeting the transportation demand. Not only is the requirement of land for a new or a doubled road very costly, but it would eliminate many hectares of productive agricultural lands, require massive bridge projects, much larger than railway bridges, as well as long and disruptive construction periods. It is also an environmentally unacceptable trade-off.

B. Without the Project Alternative

160. Without the Project, the trains that have operated for the last decade will continue to be operated without any increase in the level of service or capacity. Running longer trains has been considered, but issues of safety and locomotive capacity, as well as siding capacity come into play. Passengers demand will continue to be met by buses.

161. Without a second set of tracks, the current level of three container trains per day cannot be increased. Most containerised cargo using the port at Chittagong will continue to transport by road. If the planned diesel multiple unit services between Dhaka and Brahmanbaria go into service they will displace more important Intercity (IC) trains, exacerbating the track capacity problem. Without the Project, passenger as well as freight transport capacity will be constrained to that of a single metre gauge line, with slower speed, but with a continued reduction in performance due to ageing infrastructure.

C. Alternative Alignments

162. Bangladesh Railway and its Consultant initially considered two options for route investigation; both within the BR's Right of Way (RoW). These are:

- *Option 1*: approximately six metres west of existing rail line.
- *Option 2*: approximately six metres east of existing rail line.

163. In determining the environmentally and socially preferred rail alignment, the BR survey team examined technical, safety, and environmental degradation and community disruption issues. The two options were compared based on the following nine specific factors:

i) level of environmental disturbance, including physical, chemical and biological impacts;
ii) interference to the human settlements, and economic activities and structures;
iii) Interference to the social structures e.g., schools, hospitals, primary health clinics, playgrounds and other public facilities;
iv) minimal interference to the cultural structures e.g., places of worship and cemeteries;
v) compliance with the railway standards for curvature and grading;
vi) following river crossing and adjusting position of bridges to facilitate compliance with alignment criteria for curvature and grading, avoiding interference to sensitive receivers and preventing increased siltation;
vii) direct and indirect impacts on households, and on the integrity of communities;
viii) obstructions to flood flow; and
ix) availability of BR lands.

164. A summary (**Table 22**) of potential negative environmental impacts stemming from the two options was completed, and the likelihood of negative environmental

impacts affecting 18 indicators was calculated and the summary of weighted scores of both alternative alignments listed (**Table 22**). The likelihood of a significant impact was scored on a scale between 1 and 5, based on the likely impact of the route, with 5 being the impact most likely to be felt.

Table 22: Environmental Screening Matrix for Comparative Environmental Assessment of Alternatives

Environmental and Social Indicators Affected	Option 1			Option 2		
	Impact	Likeli-hood	Total weighted score	Impact	Likeli-hood	Total weighted score
Environment						
Land Use	5	5	25	5	4	20
Air Quality	3	2	6	3	2	6
Biodiversity	4	3	12	4	3	12
Natural Hazards	3	2	6	3	3	9
Hazardous Materials	3	3	9	3	3	9
Waste Management	3	2	6	3	2	6
Water Quality and Hydrology	4	4	16	4	4	16
Natural Resources	2	2	4	2	2	4
Noise	3	3	9	3	3	9
Aesthetics	3	2	6	3	2	6
Social Aspects						
Social and Cultural Resources	4	3	12	3	3	9
Population, Housing and Employment	3	2	6	3	3	9
Transportation and Traffic	3	2	6	3	3	9
Total Score	117			124		
Priority Rating	1			2		

Impact	Likelihood
1 = very minor impact	1 = very low likelihood of the E. Aspect causing the E. impact
2 = Minor impact	2 = low likelihood of the E. Aspect causing the E. impact
3 = Moderate impact	3 = Moderate likelihood of the E. Aspect causing the E. impact
4 = Major, but reversible impact	4 = Above average likelihood of the E. Aspect causing the E. impact
5 = Major irreversible impact	5 = High likelihood of the E. Aspect causing the E. impact

Source: Scoring done Environment team of RCIP-Rail

165. BR generally has additional 4.27 m land on the west side of the existing RoW, which will reduce social issues (land acquisition, trees and structures removal) if Option 1 is selected. It is determined that land requirements of Option 1 will be almost 328 ha less than for Option 2. Although the numbers of affected settlements are more in Option 1, they can be rearranged or rehabilitated without any major land acquisition problems. As listed in **Table 22**, environmental and resettlement impacts were important criteria and judged to be fewer on the west side of the existing track, i.e., Option 1. No single route has advantages over the other, given that there is ten points difference between Options 1 and 2. The much clearer difference is when one examines the social impacts which are very significant with Option 2. Therefore, the preferred option is Option 1. The EIA Study henceforth refers to this option.

166. **Description of the Preferred Alignment (Option 1) -** The new track will be laid about 7-12 m generally to the west of the existing rail line. The new line will be the system's "Up Line"[34], and the existing track will be future "Down Line." The centreline of the new track is proposed to be between 5.3 m to 6 m from the centreline of the existing track up to 12 m distant at the large bridges. A detailed description of the preferred alignment is provided in Chapter III.C. After stakeholder consultations, the proposed alignment has been realigned at Mogra Bazar and temple area, since it is a physical cultural resource.

[34] The term "up line and down line" describes train direction on railroad systems. Going "up" refers to the direction with increasing elevation or "Down" toward lower elevation.

VI. IMPACTS AND MITIGATIVE MEASURES

167. An environmental impact is defined as any change to an existing condition of the environment. Findings of the assessment are presented according to pre-construction, construction and operational periods. The impacts will be determined as significant, positive or negative, direct or indirect, long term or short term. The magnitudes of environmental effects have been expressed quantitatively where possible, but in most cases qualitative evaluations are made based on past experience. This Chapter of the Environmental Impact Assessment report describes the probable environmental effects resulting from Project implementation during the pre-construction, construction and operating period of the Project.

168. Reliable assessment of potential impacts necessitated a multi-disciplinary approach in which a wide range of issues were taken into consideration. The activities of the Project have the potential to impact the environment, society and economy in both positive and negative ways, and these were identified and assessed in this Chapter of the report. There shall be strict guidelines to manage environmental and social aspects during implementation of the Project. The Contractor will consider the environmental implications of all components incorporated into the Project. A detailed schedule of the environmental initiatives is to be prepared by the Contractor in accordance with this EMP. The Contractor is to prepare an Environmental Management Plan inclusive of construction activities control for the construction phase of the project, for approval by the BR Review Team.The physical, biological, socio-economic and health aspects have been categorised into the following:

A. Pre-Construction Period: Project Location and Design

1) Terrestrial Flora and Fauna

169. Major impact will be from the Project activities of rail alignment, land acquisition, associated facilities, and demolition of some existing buildings and construction of station buildings and the EMO. The alignment will require the removal of 55,342 trees, out of which 31,749 are timber trees, 13,546 fruit trees, 188 trees used in the production of medicines, 4,166 banana plants, and 5,693 bamboo thickets, each with their own economic, biological, eco-functional and aesthetic significance[18]. These trees were enumerated on both sides of the proposed new alignment, proposed station building areas, EMO building, and new station access roads. The mitigative measures in relation to the tree management have been defined in detail in **Annex 9**.

2) Land Use

170. The most significant potential impacts on land use in the Project area will be encroachment, acquisition of approximately 15.75 ha of agricultural land (primarily rice paddy) and its permanent loss to the new railway line. The potential secondary impacts are likely to be trimming of roadside vegetation such as fences and temporary relocation of fence lines at station areas and EMO, neither of which would be expected to constitute a significant and permanent impact to land use. In order to mitigate this impact, land acquisition has been minimised as much as possible, through careful design, as defined in the LAP[35].

3) Employment and Livelihood

171. In order to build the line, 850 residential structures will have to be acquired and relocated. These structures range from kacha (earthen house) to three storied

[35] RCIP-Rail, 2013. Land Acquisition Plan for Construction of Double Line and Upgrade of Existing Rail Line between Akhaura and Laksam - 72 Km, Dhaka: Bangladesh Railway, Ministry of Railways.

structures. 183 residential and commercial structures have to be acquired throughout the rural and semi-urban areas of alignment. Along the proposed new alignment, 730 commercial buildings will be required to be relocated. There is a market place in Mogra in Gangasagar which may partially be affected by the new rail alignment. There might be some other rural markets and shops along the proposed alignment, which will also be relocated[25].

172. There are several run down railway staff quarters and many squatters/shops are currently occupired the proposed EMO site which is belongs to Bangladesh Railway. It is estimated that around 400 to 500 units of temporary shacks are currently inhabited on the EMO site. The slum reportedly is 40 years old, and grew gradually since 1971. The slum dwellers are very poor and mostly work as day labourers. Women also work as maids, in garments and some have small home-based businesses. These temporary shops and settlements have to be removed in order to construct the EMO building.

173. The livelihoods of individuals and communities may be impacted by the Project, through the loss of productive agricultural and loss of income. In addition, displacement from ancestral homes and loss of employment due to demolition of industrial and commercial structures will be important impacts to mitigate. BR is minimising the loss of these structures through careful realignments at sensitive sites throughout the corridor.

4) Heritage and Culture

174. In the Project area (see Chapter III C) three PCRs and 46 CPRs have been identified as being affected by the construction of the proposed second rail line. The CPRs included 29 religious institutions or structures, 11 community based associations or institutions, 6 educational institutions[25]. Of the three PCRs, one will only lose an enclosure wall; with the other two will be relocated.

175. The 46 CPRs were identified by local community and Project designers are working to avoid impacting as many as possible, through adjustments to the alignment. The CPRs might be relocated and reconstructed by BR according to local wishes. Compensation will be provided according to the guidelines specified in the RP prepared by the Consultant.

5) Infrastructure and Utility Relocation

176. **Overhead Power Lines, Telecommunications and Gas Pipelines** – A number of overhead power lines cross the rail corridor; of which six will be relocated. BR will request the electrical authority to undertake this work and will cover all costs. These lines and other utilities affected are defined in detail in the engineering reports.

177. **Safety and Level Crossings** - Operations of at-grade crossings have frequently caused major accidents resulting in severe injuries. They regularly cause serious traffic jams regardless of location, sometimes blocking traffic even after the train has passed. To mitigate these problems grade separations are being built at two of the 25 planned authorised crossings. The other crossings will be assessed in term of provision of maximum line of sight and moved where possible. These design changes will be completed during the pre-construction period and implemented by the contractor. Vehicular traffic management systems at level crossings will also be upgraded. Several level crossings will be upgraded and provided with round the clock manned barriers, to improve the safety at these locations. Warning signs will be installed at all unauthorised crossings, indicating the increased traffic, and the danger involved. BR is already undertaken work in this regard and will be addressing the crossing issue in great depth and applying findings to this Project.

178. The work by Pajunen (2000) showed that the design measures defined above, are effective in managing level crossing accident issues and that these are the most practical and economical, without compromising the operation of the line.

6) Construction Materials Transportation Plan

179. This will cause unnecessary degradation of roads and areas surrounding along haul routes, due to dust traffic congestion and safety. A checklist and guideline for handling of all construction materials and the designation of roads not suited for hauling materials will be prepared by BR in consultation with local police and enforced.

7) Environmental Clauses in Contract and Covenants in Loan Agreements

180. To make sure the contractors address environmental safeguard measures, BR has integrated environmental clauses into the construction contracts, referred to as Subsection H of the technical specifications of the tender documents.

8) Safeguard Documents, Training in EA and EMP to Contractors and Engineer

181. Starting work without the EIA and its EMP will not provide the intended safeguards to the environment. Therefore BR will confirm that an electronic and hard copy of the EIA documentation is distributed to the contractors, Upazilas and the Engineer for use during the construction years and beyond.

9) Environmentally Responsive Design Considerations

182. Failure of the design engineers to consider environmentally responsible design that minimises immediate as well as long term impact during the construction and operating periods will jeopardise the implementation. Focus design work on minimising intrusion into natural waters, timing of work to minimise wildlife interference, maintenance of surface runoff and planning location of work camps that minimises short and long term negative effects.

10) Station and Building Design

183. Inadequate provisions for sewage, sanitation and garbage management may lead to chronic problems. The design shall consider estimated passenger throughput at each station and waste facilities to manage all conditions. A conceptual design for the EMO building has been developed for foundations, structural systems, utility areas and mechanical/electrical services concepts and will be further developed by the Contractor.

11) The Bridge Sites

184. There will be only one major bridge (>100 m span), and it will be constructed over Gumti River. The existing bridge (which will be fully reconstructed) is a single track steel girder rail bridge and the new structure will be constructed on the west side of the existing bridge. The pre-construction activities in and around bridge sites include topographic surveys, geotechnical investigations including boring under water. Every effort has been taken to design the crossing alignment such that it minimally impacts people and existing infrastructure, the flow of the river, and at the same time meeting the rail engineering specifications.

B. Construction Period Environmental Effects and Proposed Mitigation

185. Construction period effects are those resulting directly or indirectly from a construction activity; be it site clearing or hauling material along a public road or dredging sand from a river. The construction period section of the EMP lists the impacts which require mitigation, the mitigative measures to be used, where they need to be applied, when and by whom. This Chapter of the EIA identifies how construction-related impacts affect the key components of the environment. Secondly, a set of mitigative measures describe proposed actions to be taken by the contractor so as to avoid or

minimise negative impacts to these components of the environment. (See the EMP for a summary of all mitigative and monitoring measures proposed). There are 21 effects listed in the EMP, some are discussed in the following sub-sections.

1) Air Quality and Dust

186. Baseline air quality sampling was undertaken along the Project corridor at 12 stations providing the baseline against which construction period monitoring will be measured. These results are provided in Chapter IV-A-16 of this EIA.

187. All earthworks construction, site clearing, dry materials stockpiling, station and small structures demolition, operation of batch plants, and hauling of materials will generate dust and affect the local air shed. Road dust from the construction of rail line and upgrading of station access roads is likely to be the most significant direct potential impact on the local community. The mitigative measures required of the contractor will include:

- Trucks transporting fine materials, soil and waste to and from the Project site will be covered to reduce the release of dust;
- Generators, compressors, and other equipment to be shut down when not in use;
- Air emission monitoring programme to be undertaken quarterly by the contractor, according to the design specified in the EMP and the contract specifications. The programme mush include, as a minimum monitoring of NO_2, SO_2, $PM_{2.5}$, and PM_{10};
- Site and station access roads, construction and other disturbed areas to be stabilised e.g., with crushed concrete/brick or regularly wet down along heavily used haul roads to reduce dust generation in populated areas; and
- Section on compliance monitoring checklist to be completed.

2) Topography and Landscape

188. The impacts to site topography will be due to the construction of the rail embankment, the access roads and station buildings which will rise above known landmarks by as much as seven metres. Given that the majority of the surrounding land is in flat topography, is under cultivation with rice and is used for grazing, the visual intrusion of large piles of embankment materials and ballast obstructing views may be considerable but temporary. Given that an elevated embankment already exists, these temporary added obstructions will not seem so out of place and material storage areas will be cleared as soon as they are no longer needed. The pre-construction line of sight will be restored. The key mitigative measure will be:

- Restored landscape with planting of trees and understory vegetation, as part of the tree planting programme described earlier in Chapter IV, Section D, and **Annex 9**.

3) Surface Water Quality and Hydrology

189. To establish existing water quality in the corridor, baseline surface water quality sampling in water courses crossed by the new line was completed. The results showed that for the most part surface water quality was within DoE standards, with a number of parameters exceeding recommended levels (See **Annex 4**).

190. Reduction of natural surface water drainage and degradation of surface water quality is common at construction sites, and since the Project corridor cuts across a mostly wet area with many rivers, creeks and canals, the likelihood of a negative effect is high. Surface water at Project sites may be polluted due to faecal runoff, erosion,

spilled lubricants and fuels and other contamination from work camps and the construction operations.

191. The contractor will be required to carefully control all wastes and manage the use of petroleum products and implement, inter alia, mitigative actions 2.4.1 and 2.5.1. A construction period water quality monitoring programme will be undertaken during the construction years, and a large set of actions addressing these possible effects are dealt with in the EMP (see Chapter IX).

4) Groundwater

192. The Project will require very limited groundwater for batch plant operations for the structural elements of the Gumti Bridge as well as the foundations of the new stations. It is estimated that a large volume of water/day will be required for concrete production, and that at least 3-4 wells will be accessed. Twenty work camps will be built to house the 2,500-2,900 workers. For these a set of at least 60 pit privies will be constructed. These have the potential for leaching pollutants, mostly nutrients, bacteria and viruses into nearby tube wells.

193. Implementation of the following mitigation measures will reduce both the risk, as well as the potential severity of each these predicted impacts:

- Installation groundwater wells to a depth (generally >100 m) typical for deep water tube wells in the area in order to reduce the potential for depleting shallow aquifers.
- Design and construct all latrines at construction camps and any contractor facility with extra cautions concerning locations in relation to water wells and to lining and sealing of ring slabs, to minimise the risk of sewage contaminating the groundwater aquifer.

5) Noise

194. Potential noise impacts vary, and are based on the noise amplitude, frequency, distance from receivers, site landscape features, topography, presence of obstacles, and meteorological effects. The severity of potential noise and vibration impacts is also linked to the typical background noise and vibration environment e.g., urban or rural. Key Project-related noise sources are the existing train traffic, generators, vehicles, construction equipment, and people.

195. **Screening of noise sources and receptors.** The succeeding Table presents the list of Project related construction activities. Discussion with the design engineers identified the following activities that have potential to generate significant noise and these are:

- Construction of the Gumti River Bridge that requires sheet piling, new embankment formation, demolition of existing pier and abutment below the ground level, excavation, and compaction;
- Construction of 11 new railway stations in Alishahar, Lalmai, Mainamati, Sadar Rashulpur, Rajapur, Shoshidal, Salda Nadi, Mandabhag, Quasab, Imambari, and Gungasagar while the railway continues to operate.

Table 23: Construction Activities for the Double Tracking of the Akhaura-Laksam

Proposed Activity
Site Mobilisation
Preliminary Works (access)
Demolition and reconstruction of culverts (Km 130,842, 131,857, 135,338, 136,605, 138,159, 142,394, 150,873, 151,767, 152,746, 152,833, 153,446, 154,530, 157,508, 158,383, 159,619, 160,692, 163,385, 164,557, 166,293, 168,611, 170,039, 171,643, 173,006, 174,718, 176,219, 180,557, 181,866, 182,395, 183,743, 184,409, 184,573, 185,139, 188,597, 194,605, 196,421, 197,929, 198,322, 198,410, 198,471, 198,987, 199,432, 200,327) and bridges (Km 139,597, 140,335, 144,383, 145,557, 147,763, 156,352, 158,916, 160,758, 188,585, 175,492, 177,620, 177,985, 178,698, 190,403, 195,825, 197,093)
Diversion of canals
Lining of canals
Overhead electric line modification
Realignment of existing tracks
New embankment construction (1:2 side slope, embankment filling, subgrade filling, capping, sub-ballast
Major bridge approaches (terraced berm, embankment filling, prepared sub-grade, sub-ballast, ballast cushion, grouted brick soling)
Bridge piling
Track laying (station yards inside/outside platforms, normal and fish plated tracks on curves,
Install signalling infrastructure
Construction of 11 new stations and other buildings (platform, ramp, guardhouse, electric sub-station, water tank, parking, driveways, station yards)
Ancillary works (road crossings with speed breakers, gates, guard rails, guard house/equipment room, lifting barriers, traffic signs)

196. **Noise Propagation During the Gumti Bridge Construction -** The Gumti Bridge (Bridge No. 243) reconstruction requires 2x25+3x4.0 m steel plated girders and 3x30.48+2x12.19 steel girders. It is assumed that peak noise will be generated during bridge piling occurring at the same time as excavation, bulldozer, filling, and compaction activities. The assumed equipment needed and rated noise and vibration levels are provided in **Table 24**.

Table 24: **Noise rating of bridge construction activities and equipment**

Activity	Plant/Equipment Requirement	No	Noise Rating (dBA)	% Operating Time
Excavation	32 ton tipper	2	80	75
	20t tracked excavators	2	80	75
	20T wheeled excavator	1	80	75
Bulldozer	3T Mini Digger	1	85	75
Filling	5T Dumper and Side Tipping Dumpers	1	88	20
	25T Dumpers	3	88	20
Compaction	15T Vibratory Roller	1	82	80
Piling	35T CFA Piling Rig	1	101	50

197. The equivalent noise level for a 10 hour period that corresponds to the total working hours for the Gumti bridge construction was computed using the equation:

$$L_{AEq,T} = 10 \times \text{Log } 10 \left(\sum p_i x 10^{0.1Li}\right)/T_p$$

Where:

LAeq, T - the equivalent (energy averaged) continuous A-weighted sound pressure level obtained over the measurement time interval

Li – is the noise level over that duration, in seconds

Tp – is the duration of total assessment period, in seconds

198. The predicted equivalent continuous A-weighted sound pressure over 10 hour is **92.93 dB(A) at 50 feet from the sources and diverges to 60dB(A),** equivalent to

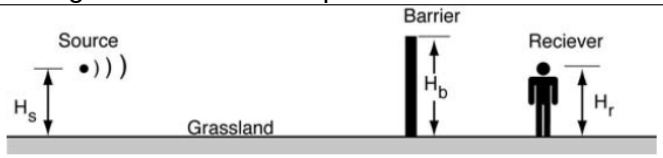
the daytime noise standard for mixed area, at around 667 meters including the background noise of 57 dB(A).

199. **Construction of new stations** - The construction of new stations and other buildings will introduce new noise sources from the use of powered mechanical equipment and the carrying out of the construction activities (e.g. erection or dismantling of formwork and hammering) in addition to slowing of trains passing by as it approaches the construction area and the ambient noise. **Table 25** provides the noise rating of construction activities for new stations.

Table 25: **Noise rating for station construction activities and equipment**

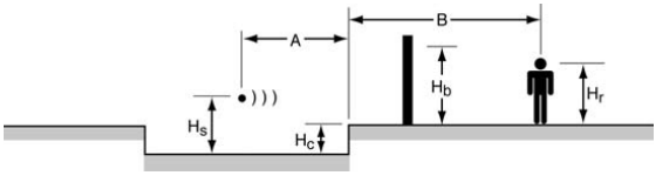
Equipment/Activity	No.	Noise Level	% Acoustical Usage Factor
Concrete Mixer Truck	1	81	15
Dump Truck	2	76	40
Generator	1	73	50
Welder	1	74	40
Formworks	1	88	30
Carpentry	1	90	20
Train passing 8 hours daytime	18		

The equivalent noise level of these equipment and activities during the 15-hour daytime period from 7:00 am to 10:00 pm was estimated using equation (1) at 86 dB (A) at 50 feet. This noise level will diverge at periphery of the station at 50 meters from the rail tracks where a 3 meter perimeter wall will be constructed providing further noise shielding as depicted in the following Figure 7



$$H_{eff} = \frac{H_s + 2H_b + H_r}{2} \quad (1)$$

Example 1: Source in shallow cut



$$For B \le A/2,$$

$$H_{eff} = \frac{H_S + 2H_b + H_c + H_r}{2}$$

* Otherwise use Equation (1)

Note: Hs = 1m; Hb=3m; A = 3.025m; Hr=1.5m

Figure 7: **Computing for Ground Factor for G Ground Attenuation**

200. For the above Figure above, B>A/2 and Heff was computed at 13.925 and ground factor G, was 2.50 using the following equation (2):

Ground Factor

For soft ground:

$$G = \begin{cases} 0.66 & H_{eff} \le 5 \\ 0.75\left(1 - \frac{H_{eff}}{42}\right) & 5 \le H_{eff} \le 42 \\ 0 & H_{eff} \ge 42 \end{cases}$$

201. Noise level with ground attenuation from a 50m distance was computed at 73.7 dB (A) using the equation (3).

$$L_{dn} \text{ or } L_{eq} = (L_{dn} or L_{eq})\big|_{at50\,ft} - 20\log\left(\frac{D}{50}\right) - 10G\log\left(\frac{D}{50}\right) \quad \text{for stationary sources}$$

202. While station construction is on-going, the existing train passby will continue. A train with 2 locomotives and 58 cars at a slow speed of 20 km/hr approaching the terminal construction site is expected to generate 68.52 dB (A) and 41.9 dB (A), respectively using the following equations (4) and (5).

$$L_{eqL}\,(h) = SEL_{ref} + 10\log\,(N_{locos}) + K\log\left(\frac{S}{50}\right) + 10\log\,(V) - 35.6$$

$$L_{eqC}\,(h) = SEL_{ref} + 10\log\,(N_{cars}) + 20\log\left(\frac{S}{50}\right) + 10\log\,(V) - 35.6$$

203. Locomotive SELref was assumed at 85 dB(A) for 1,200 diesel multiple unit and cars SELref is 82 dB(A) travelling over ballast welded rail as the rubber padded rail may not be installed as the terminals are being constructed. Daytime (7:00 am-10:00 pm) average hourly train traffic was assumed at 1.2. LeqL(h) and Leqc(h) were computed 60.2 dB (A) and 60.92 dB(A), respectively. Combined hourly average noise level from these sources is expected at 63.58 dB(A) using the following equation (6).

$$L_{eq}\,(h) = 10\log\left[10^{\left(L_{eqL}/10\right)} + 10^{\left(L_{eqC}/10\right)}\right]$$

204. Immediately outside the perimeter wall of the train station or 50 m from the tracks, noise from train pass by is estimated at 45.62 dB(A) with ground attenuation a using the following equation (6):

$$= (L_{dn} or L_{eq})\Big|_{at50\,ft} - 10\log\left(\frac{D}{50}\right) - 10G\log\left(\frac{D}{42}\right)$$

205. The combined noise from train pass by and construction activities immediately outside the terminal boundary wall with background of 57 dB (A)[36] is **73.80 dB (A**). Considering the shielding effect of the 3 meter perimeter wall, shielding of 33 dB (A) can be achieved based on the following illustration and equation However, to be on the conservative side a minimum shielding of 10 dB (A) was utilised and the expected noise level immediately outside the perimeter wall is **58.80 dB (A)** which is within the day time noise standard of 70 dB (A) for commercial areas.

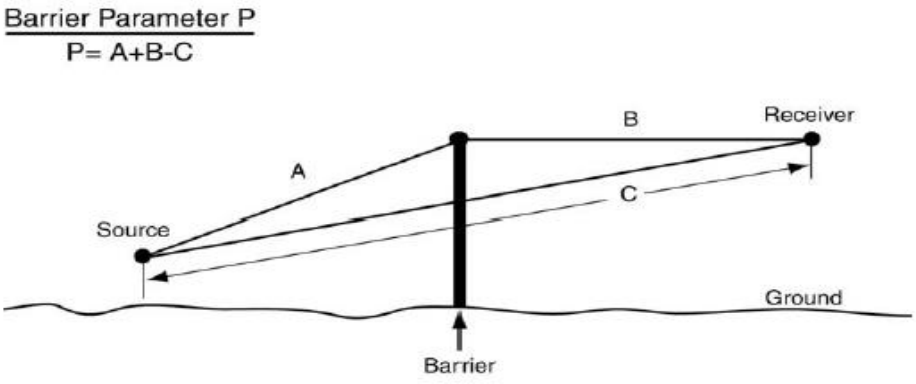


Figure 8: **Sketch Showing the Noise Barrier Parameter "P"**

[36] The highest reading in Lalmai and Laksam

For all other barriers, and for protrusion of terrain above the line of sight:	$A_{barrier} = \min\left\{15 or \left[20 \times \log\left(\frac{2.51\sqrt{P}}{\tanh\left[4.46\sqrt{P}\right]}\right) + 5\right]\right\}$

206. **Findings and Recommendations During Project Construction** - **Figure 8** presents a noise risk map centred at the Gumti bridge as noise attenuates due to distance alone where the outer most boundary represents the free-field noise attenuation to 60 dB(A). However, Gumti bridge site is very sparsely populated comprising mostly agricultural areas on two ends of the bridge. The existing vegetation, shown in yellow polygons, can provide noise adsorption of at least 10 dB (A) where at least 100 feet of trees intervening between the source and receiver and no clear line of site exist[37]. Further noise attenuation is achieved as sound waves travels over soft ground similar to the open agricultural areas that surrounds the Gumti Bridge and as much as 10 dB(A)/1000 ft. reduction. With the natural noise adsorption and diffusion, areas that will experience higher than standards noise level is encompassed in the red shaded polygon which contains the receptors and predicted noise levels as given in Table 26.

Table 26: Sensitive Receptors at the Gumti Bridge Site

Receptor Location/ Description	Free field Distance from Centre of Gumti Bridge (m)	Predicted Noise Level without mitigation measure	Proposed mitigation measure	Predicted Noise Level with mitigation measure
23°29'12.8N 91°09'54,23E 6 structures	272	67.8	Consultation and information dissemination of potential elevated noise level. Installation of non-absorptive temporary/ mobile walls near the group of structures	55 dB (reduction of at least 12 dB)
23o29'46.04 91o09'46.04 1 structure	80	78.6	Within the RoW, relocation prior to bridge construction	N/A
Palpara Bus Station	600	61	None	Existing ambient

[37] Table 6-10. Computation of Shielding: Rows of Buildings and Dense Tree Zones. Transit Noise and Vibration Impact Assessment. Office of Planning and Environment. Federal Transit Administration.

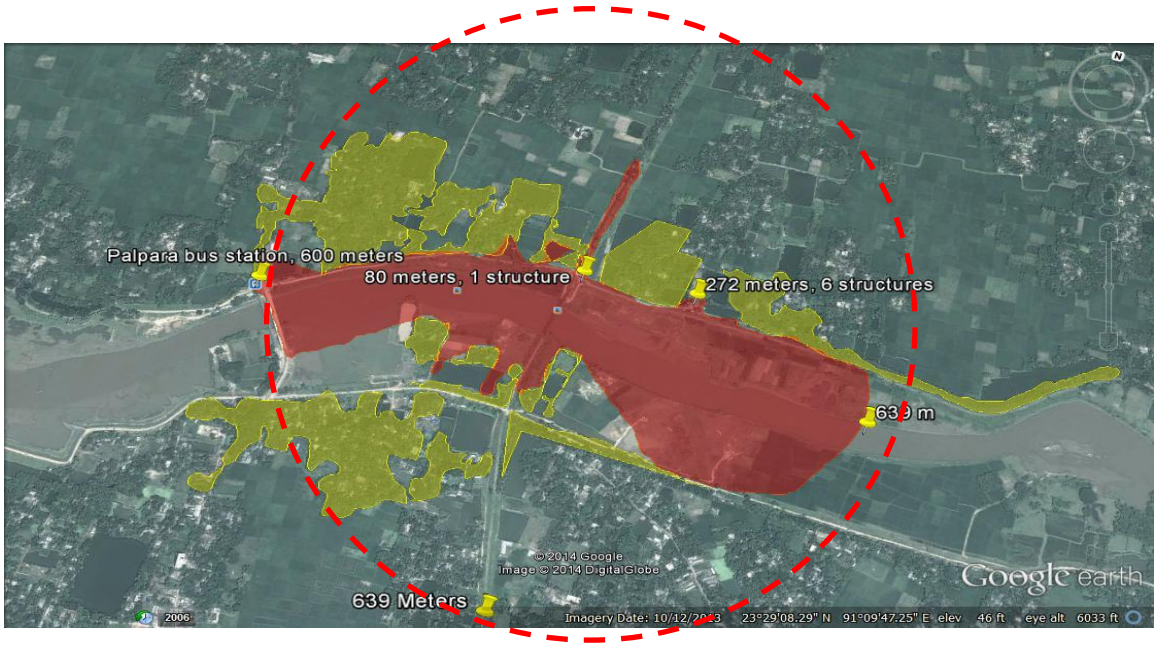


Figure 9: Noise Risk Map for the Gumti Bridge Construction

207. The construction of the railway stations will have no impact immediately outside the perimeter of the station even with the noise generated from train pass by. The 50 m separating distance between the tracks with a 3 meter wall are enough to attenuate and shield noise to **within +2 dB(A) of the baseline level**. This assessment is graphically presented below.

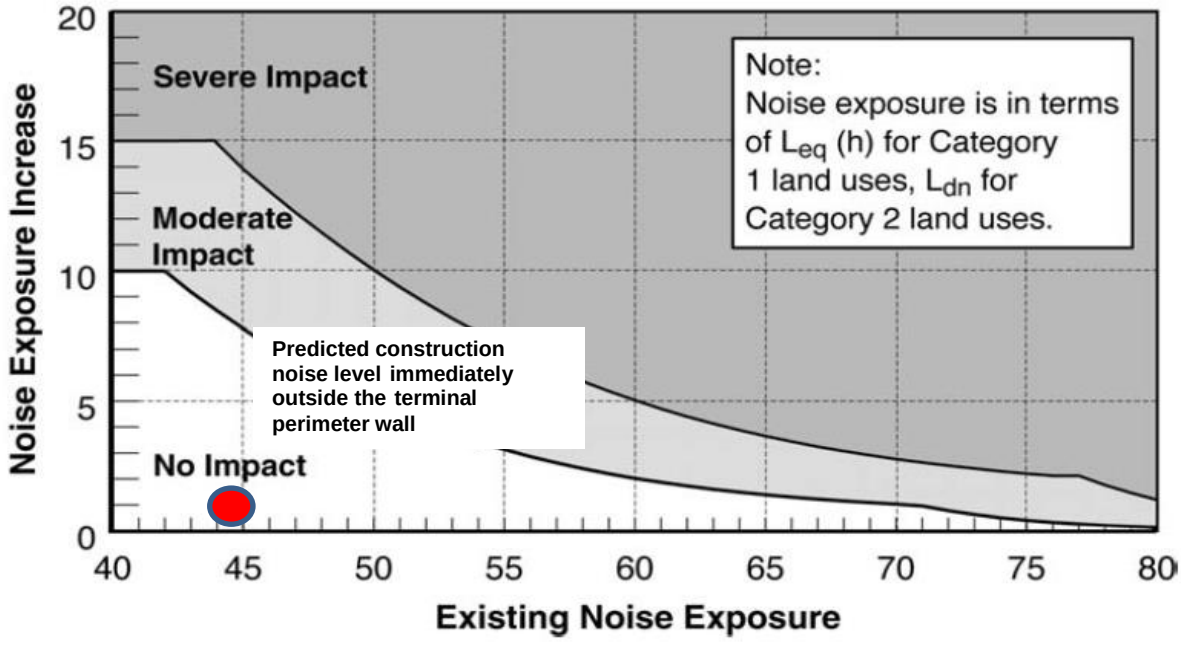


Figure 10: **Increase in Cumulative Noise Levels Allowed by Criteria for Land Uses Cat. 1 and 2**[38]

208. Noise will be measured by the contractor at all sensitive locations quarterly[39] and exceedances will require noise attenuation measures such as temporary baffles or changes to the construction method. However, it must not be forgotten that this area is

[38] US DOT (2006)
[39] Based BR's experience after two years of sampling for the Tongi-Bhairab double tracking Project, and the fact that it is an existing noisy environment, quarterly sampling is all that BR is recommending.

subject to the noise of 62 trains passing each work site every 24 hours, i.e. a train every 20 minutes.

209. Implementation of the following appropriate mitigative measures by the contractor will reduce the impact on sensitive receptors:

- Investigate any noise-related complaints, record its location and file a single-sheet report with the Engineer. If the complaint is found to be legitimate, i.e. the noise levels measured exceed GoB standards for the land use designation in the area, the contractor must take action to reduce noise, such as posting reduced speed and quite zone signs, diverting haul routes to less densely population roads, erect temporary baffles to reduce construction noise; and
- Undertake noisy (known to exceed standards, such as pile driving) or vibration intensive works during the daytime, where close to settlements.

210. The movement of the embankment materials from the dredge deposit sites to the embankment will involve many loads but very short distances since the dredging pipeline is positioned beside the embankment, depositing the sand slurry vary close to where it is needed. Using this method the noise associated with the movement of large numbers of trucks at no more than 25 km/h is not relevant, The noisy work will come mainly from the construction of embankment, the dredging and transport of embankment materials, station and building construction and from the upgrading existing rail superstructures such as bridges, and may affect sensitive residential receivers. Where works are required within close vicinity of settlements, it will be undertaken during the daytime. In some cases, some work will have to take place during the night in order to reduce disruption to local traffic.

6) Terrestrial and Aquatic Flora and Fauna

211. None of Bangladesh's endangered species and indeed much wildlife beyond the pests found near populated were seen in the Project construction corridor during several field surveys.

212. Key potential impacts on flora and fauna will be the clearing of around 55,000 trees and associated understory vegetation, reduction in available habitat, possible dredging activities potentially impacting on aquatic habitats within the Gumti and other rivers, accidental release of waste or hazardous substances impacting on aquatic and terrestrial habitats or siltation of aquatic or terrestrial habitats due to earthworks or dredging activities.

213. The most effective mitigative measure will be keeping the disturbance to natural vegetation to a minimum, cutting or clearing trees where it is absolutely necessary and having contractors work in among the trees, not to clear all trees and then work. No herbicides will be used for clearing of vegetation and trees. This approach will be defined in considerable detail during the mandatory 1-1.5 day contractor safeguards training session delivered by BR and the Engineer, within the first week of construction mobilisation.

7) Land Use

214. There is a need to acquire about 37.38 ha land and relocate of 850 residential households, 730 commercial structures, and 183 residential and commercial facilities. Total number of dwellers requiring relocation from the proposed EMO site will be finalised when the Addendum to the Resettlement Plan is completed. The other potential impacts are likely to be trimming of roadside vegetation and temporary relocation of fence lines (mostly fences), neither of which would be expected to

constitute a significant and permanent impact to land use. To address these impacts the following mitigative measures are proposed:

- Undertake land acquisition/requisition of land, and compensation in accordance with the laws and as defined in the Project LAP; and,
- Clearly mark a work area to prevent unnecessary or careless clearing by the contractor and explain the severe penalties to be applied, at the contractor training workshop.

8) Contractor Camp Management

215. Environmental health issues and disease contamination are common in labour camps. This would stem from poor work camp conditions, inadequate and unsanitary toilet facilities, lack of potable water and sanitary washing areas. Mitigation, as defined in the EMP will involve:

- Weekly compliance checks by BR (its ESSU) and the Engineer.
- The contractor will be required to post a cleaning schedule at each toilet and washing facility which Engineer will inspect weekly.
- The contractor will be required to provide potable water (based on WQ tests), sanitary toilet and hygienic accommodation for workers at camp sites at all times and ensure that these facilities are cleaned and disinfected regularly.
- Provide a garbage disposal service such that no garbage or food waste is dumped in the contractor's yard or work camp at any time. There should be no litter or food scraps dumped anywhere but in appropriate bins that are collected and cleaned at least weekly.
- Ensure provision of PSEs and First-Aid facility at each work camp.

216. The work camps and/or construction yards often include fuelling areas which will have to comply with GoB, fuel storage and handling standards. In addition, all fuelling areas will be required to be equipped with drip pans, proper fuelling nozzles and crank pumps if fuel is dispensed from barrels. Fuelling areas must be located at least 500 m from any housing area.

217. **Vector-borne diseases** - Construction leaves depressions in the ground that allow stagnant puddles to form which are ideal breeding areas for malaria and dengue carrying mosquitoes. This includes outdoor equipment storage, including used tyres. Stagnant water and puddles, as well as stored construction materials, tyres and empty storage drums are to be inspected every three days to prevent water ponding. This will be required during the entire rainy season and within three days of every major rainfall.

218. **Rail traffic disruption** - The Project activities such as the construction of stations, platforms and platform sheds may temporarily disrupt access paths at railway stations. The Contractor shall construct fences separating the sites at rail stations from public access, and manage passenger movements collaborating with BR dispatch staff.

9) Occupational Health and Safety

219. BR will ensure that the contractor and any subcontractors implement the following mitigative measures:

- Construction workers will be trained in general health and safety matters and on specific hazards of their work;

- Workers will be provided with appropriate personal protective equipment, such as safety boots, helmets, gloves, protective clothing, goggles and ear protection;
- Safe drinking water will be provided to all workers, as confirmed by independent water quality testing and submission or lab results to the Engineer; and
- Contractors are to inform their drivers of the location of noise and safety sensitive areas, as defined in **Annex 8**, indicating the 48 sensitive sites identified. In these areas, speed limits will be restricted to 40 km/h and use of vehicle horns and engine breaking will not be permitted at all times, unless in emergency situations.

220. Labour Standards will need to be enforced -

- **Hire, use or benefit from child labour** - Child labour (as defined by ILO Conventions 138 and 182) means that no workers under the age of 14 may be hired as general labours, and no workers under the age of 17 are to be hired for hazardous jobs such work on scaffolding, an structures elevated above the ground, etc.
- **Bonded labour** - All forms of bonded labour and forced labour, as defined by ILO Conventions 29 and 105 will not be permitted. Forced labour, including prison or debt bondage labour; lending of money (debt slavery) or withholding of remuneration or identity papers by employers or outside recruiters, will be not be permitted on any work sites.
- **Equal treatment, equal opportunity** - BR expects the contractors to hire workers on the basis of skill and ability to work. There must be equal treatment and equal opportunity (ILO Conventions 100 and 111, and ILO Code of Practice for HIV/AIDS 85) for all who seek employment. No discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; no sexual harassment.
- **Minimum wage** - BR expects the contractor to pay all labourers and employees according to minimum wage standards as defined in the Bangladesh Labour Act.

221. To that end, the contractor will be required to provide each person hired with a written contract, stating the above and confirming that these conditions are being upheld and include the names and contact information of people to contact within the contractor's organisation, BR and with the Engineer, that any person wishing to file a complaint or table a concern can reach without fear of retribution.

222. BR will instruct the Engineer to undertake a random check of these documents on a monthly basis, report this to BR and take immediate, on-the-spot action if non-compliance is identified.

10) Heritage and Culture

223. There will be some impact on the existing regionally and locally important structures and monuments such as mosques and graveyards. A social survey of RCIP identified 49 structures, of which three are physically and culturally important.

224. Replacement and relocation to a suitable location will be carried out with the help and consent of the affected local community. Local community and religious leaders will be consulted to determine what modifications may be applied to the works scheduling and methodology to limit these potential impacts. Mitigative measures applied will be based on the joint decision by BR and the local community involved.

11) Environmental Management Implementation Work Schedule (EMWS)

225. If contractor does not prepare a work plan defining details on when mitigation and monitoring actions are to take place, then the EMP requirements will not be implemented properly. The Engineer will assist contractor in preparing the EMWS before the commencement of construction works and monitor compliance with the schedule during construction.

12) The Gumti River Bridge

226. The Gumti River Bridge will be 175.25 m long. In addition 58 other smaller bridges and culverts will be required. The Gumti is a tributary of the Meghna River and is being designed to accommodate horizontal and vertical clearance for navigation. Only two of seven piers will be placed in the channel with year round water, which effectively means that, no significant obstruction of the movement of fishes will be created by the construction.

227. **Noise and Vibration-** Noise levels will rise due to other construction activities, transportation, loading and unloading of construction materials, dredging and electricity generation. It is expected that the noise caused by these activities will still be within acceptable levels. The detail substructure arrangements are described in 7.D of Chapter III.

228. **Fish** - The Gumti River bridge construction activities, particularly the in-river pile driving operations, could temporarily impact the capture fisheries at the bridge site. The environmental monitoring during 2013 and 2014 of the Tongi Bhairab Double Tracking Project, which included intensive in-river pile driving at a number of bridges, showed no significant change in water quality and no change in the diversity of and quantity of fish taken is fishers upstream and downstream of the four bridge construction sites. Therefore the impact on fish is likely be marginal.

229. **Hydrology, Bank Erosion and Navigational Channel** - River bank erosion is possible if the river width is constricted due to wrong design, incorrect design flows and inappropriate shore pier placement. The Gumti River Bridge has been designed using the river's estimated 100-year flood volume. Such a design will minimise erosion at the bridge and accommodate flash floods and catastrophic events (if any). The Gumti River at the proposed bridge site has an uncharted navigation channel which must be kept clear for the movement of country cargo vessels, passenger boats, barges, engine boats, small fishing vessels, and etc.

230. Therefore, the mitigative measures BR will instruct the contractor to implement when working on the Gumti River Bridge construction will be:

- BR will ensure that the Gumti River channel width at the crossing point will not be narrowed and corrective actions to mitigate the existing erosion problems will be addressed, through careful redesign of shore erosion prevention structures;
- The portion of the rail alignment that is in contact with river, channel and canal will be provided with slope protection measures.
- Proper river training measures at the upstream and downstream sides of the bridge crossings, will designed such that they do not narrow the channel; and
- The contractor will be required to monitor and manage river traffic at all times-when working on the bridge spans over the open channel used by country vessel traffic.

13) River Dredging

231. River dredging will be undertaken to provide much of the sub-base material for the 70 km long rail embankment. In fact, it is expected that 1.3 million cubic metres will be dredged. The material shall be dredged from Government-approved sites (permits provided by the Ministry of Water Resources) using a suction dredger. The dredged sand shall be pumped to the embankment sites in a pipeline (OD 15-25 cm) and discharged onto the ground within the boundary of the embankment, allowed to drain and dry, forming a solid base. Given the high TSS levels in these rivers and that fact that all fish species are well adapted to zero visibility waters, the dredging operation which will temporarily and locally elevate TSS levels downstream of the dredging site by no more than 15% is not considered an impact requiring any mitigative action[40]. The rivers supplying the material for the Project embankment will likely be the Gumti, Howrah and Bijni, but will ultimately depend on the permits received by the contractor.

C. Operating Period

232. Major activities during this stage of the Project involve operation and maintenance to ensure smooth service of the railway and associated structures.

1) Environmental Completion Report

233. Failure to adopt measures and continue mitigation actions defined in the Environmental Completion Report. Assign environmental expertise to obtain, examine and take necessary actions defined in the Construction Period Environmental Completion Report.

2) Air Quality and Dust

234. The main atmospheric pollution during the operating period will come from the operation of more locomotive, as their number operating on the line grows from 72/day in 2019 to 124/day in 2034. However, the emissions from the railway operation are not expected to result in the Project air shed exceeding National Air Quality Standards. The combination of better equipment, more pollution control devices on the locomotives as the fleet is renewed and cleaner fuel will help to further reduce any air pollution effect due to additional train operations. As discussed in Section VI (F), the considerable fuel saving resulting from the diversion of road traffic to rail will help to improve air quality conditions. Nevertheless, an air quality monitoring programme will be undertaken to establish changes in emissions as the train traffic increases over the first 4 operating years. Air quality sampling will therefore take place during Years 1, 3 and 5 of the operating period, and at the same stations a defined in this EIA.

3) Surface and Groundwater Quality

235. Surface water pollution during the operating period comes primarily from untreated sewage effluent discharged by passing trains, which then washes into local surface waters. There is also some risk of spillage of fuel and other chemicals from freight trains; however this latter pollution has not been an issue. There is of course the issue of accidental spillage of oil and other noxious chemicals, after a train accident, and the leakage of materials into rail side ponds and canals. A spill contingency plan and good maintenance of track and rolling stock will help reduce the risk of such accidental spills, and permit rapid action if an accident does occur.

236. Groundwater contamination could result from poorly dug and inadequately sealed tube wells allowing polluted surface drainage to enter the well and reach the

[40] The common practice of taking material from a river and allowing the dredge water to immediately drain back into the river, does not happen, since the liquid is essential for transporting the sand slurry to the embankment sites often kilometres away from the dredger.

aquifer below. The contamination from train operations would be mostly bacteria, viruses and nutrients from the sewage-laden track runoff leaking into the well. BR may investigate retrofitting existing cars with holding tanks in order to collect sewage and dispose of it at treatment facilities, and also will inspect that all wells established during construction are secure.

4) Noise and Vibration

237. Train noise along this corridor has been a fact of life for generations and for that reason it was not raised as a significant issue during the public consultations. At 100 m from trackside the existing noise levels along the line average around 55 dBA during the day and 48 dBA at night. However when a train passes the noise spikes, lasting up to 18 seconds, and was recorded as high as 78 to 82 dBA. These noise spikes will likely increase noticeably once the new line is in operation, i.e., almost doubling in ten years.

238. A strip of land with a width of approximately 25 m from the edge of the proposed rail line will be cleared and acquired for the project rail. Considering this the structures and houses remaining immediately outside the 25 m boundary were identified to be the ones most susceptible to noise issues during operation. The Technical Drawings[41] prepared during the feasibility study was used to preliminary screen sensitive and was able to identify 305 structures at risk of mostly residential and commercial uses. A detailed inspection of these structures revealed the existence of seven sensitive structures including two madrasas, one hospital, and four mosques as depicted in the **Figures 11, 12** and **13** while the succeeding Table provides the details of these receptors and potential noise sources.

239. Other important sensitive receptors identified along the alignment, and included in the list of 45 sites defined earlier (see **Annex 8** for full list) and are located within 50 m from the source. The nine noise sensitive sites are listed below:

- Settlements immediately adjacent to the West and East of the existing rail track;
- Mosque near Alisohor rail station;
- Bijoypur High school near Comilla Sadar Upazila;
- Mosque at Shashidal union of Brahman Para Upazila;
- Primary school at Shashidal union of Brahman Para Upazila;
- Mosque at Quasba;
- Primary school near Gangasagar rail station, Akhaura Upazila;
- Mosque at Mogra Union of Akhaura Upazila; and
- Debgram school at Dakshin Akhaura.

Table 27: Sensitive Receptors Located at the 25 m Boundary

Location/Chainage	Description of Noise Receptors	Potential Sources of Noise
153300-155100 (2 kilometer stretch)	99 structures along the 25 metres RoW. This includes 1 Eidgah (outdoor mosque) and 1 hospital 25 meters from track, unshielded	Train pass by Comilla Railway Operation (horn blowing)
18+4500	12 structures including a primary school and mosque	Train pass by

[41] Chanarail (2013). Subproject 2: Feasibility Study, Detailed Design and Tendering Services for Construction of Double Line and Upgrading of Existing Rail Line Between Akhaura and Laksam. Bangladesh Railway. Government of the People's Republic of Bangladesh and Asian Development Bank. Regional Cooperation and Integration Project-Rail Component Consultant's Services. ADB Loan No. 2688-BAN (SF).

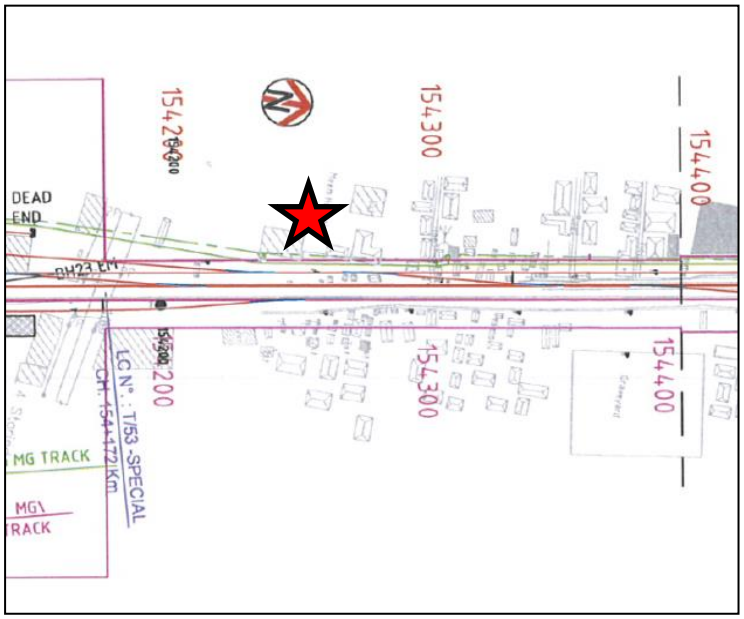


Figure 11: Location of General Hospital between Chainage 154200-154300

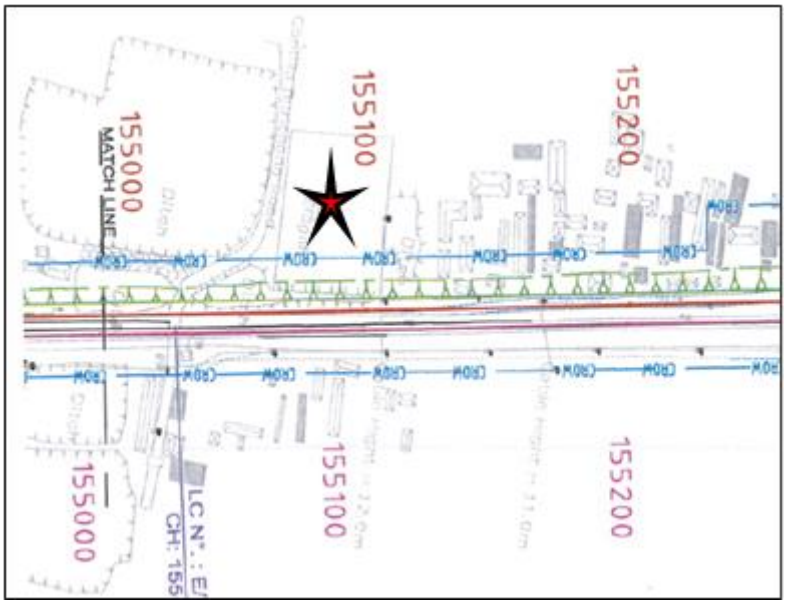


Figure 12: Location of Eidgah between Chainage 155000-155100

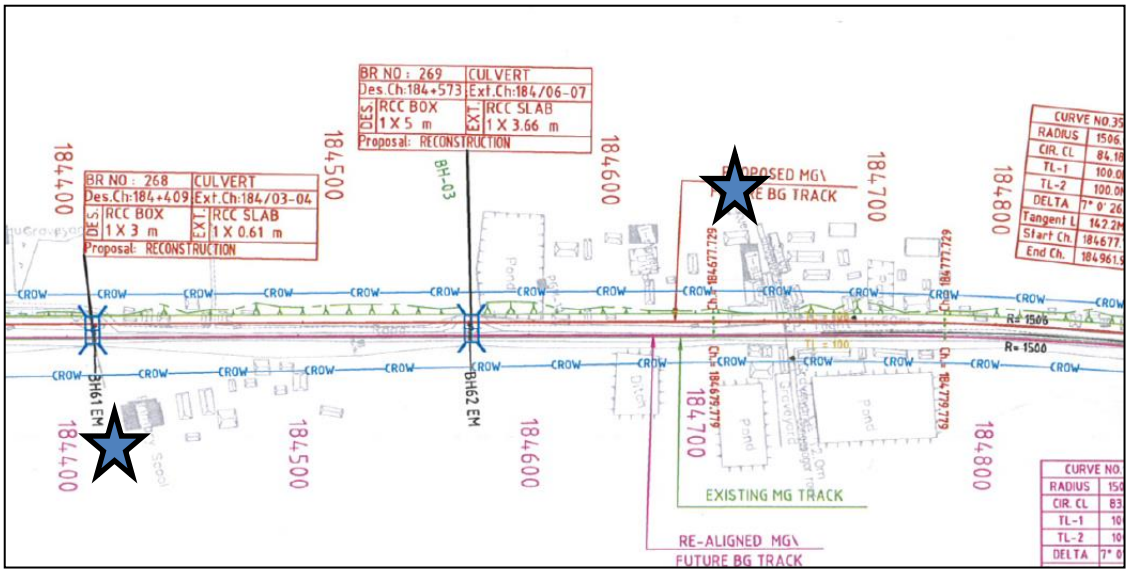


Figure 13: Locations of Primary School (Ch.184, 400, 40 m from track) and Mosque (Ch.184, 700, 60 m from track)

240. **Noise from Train Pass-by -** Noise from train pass by was estimated using the following equations based on the train design of having 2 locomotives and 58 cars traveling at 80 km/h. Projected day and night traffics were based on the Draft Feasibility Study Report for Subproject 2[42].

$$L_{eqL}\,(h) = SEL_{ref} + 10\log\,(N_{locos}) + K\log\left(\frac{S}{50}\right) + 10\log\,(V) - 35.6$$

$$L_{eqC}\,(h) = SEL_{ref} + 10\log\,(N_{cars}) + 20\log\left(\frac{S}{50}\right) + 10\log\,(V) - 35.6$$

$$L_{eq}\,(h) = 10\log\left[10^{\left(L_{eqL}/10\right)} + 10^{\left(L_{eqC}/10\right)}\right]$$

$$L_{dn} = 10\log\left[(15)\times 10^{\left(L_{eq}(day)/10\right)} + (9)\times 10^{\left(L_{eq}(night)+10/10\right)}\right] - 13.8$$

Where: SELref = for locomotive, 85 dB (A) for diesel multiple units
= for cars 75 dB(A) (NOTE: 82 for ballast, welded rail, -3 dB(A) for rubber padding under the rail, -2 dB(A) for continuous jointed track, and -2 for The open structure of coarse aggregate ballast gives noise absorption (of perhaps 2 dB) compared with slab track, in which rails are attached to a solid concrete slab)[43].

241. Locomotives warning horns were estimated using the equation.

$$L_{eqH}\,(h) = SEL_{ref} + 10\log(V) - 35.6$$

Where: SELref = 113 dB (A)
V = average hourly train traffic

[42] Section 15. Rolling Stock. RCIP-Rail Component. Draft Feasibility Study Report. Subproject 2. Prepared by Canarail. June 2013.
[43] http://static.london.gov.uk/mayor/strategies/noise/docs/004bnoise.pdf

242. **Table 28** presents the summary of expected noise levels in Ldn from train bypass and train warning horns.

Table 28: Predicted Mitigated Noise Levels from Train Pass by and Blowing Horn for 2015, 2025 and 2035 (dB (A)

Year	Train Traffic		Predicted Noise Level (Ldn)	
	Day time, Vd (7Am-10PM)	Night time, Vn[44] (10PM-7AM)	Train Pass-by 1/	Blowing of Horn
2015	1.2	2.78	62.3	80.0
2025	1.6	2.9	62.4	80.6
2035	2.1	3.9	62.9	81.9

Note: includes Ldn of 61 dB (A)

243. **Findings and Recommendations** - **Table 29** presents the noise levels at sensitive receptors without Project (baseline), with Project and additional noise generated by the Project rail. There are 2 sets of criterion that were used to evaluate the impacts, first against Department of Environment Noise Standards and second with the US Department of Transport to evaluate predicted noise against existing background.

Table 29: Predicted Noise Level from Train Pass By

Selected Sensitive Receptors	Existing noise levels Ldn (dBA) (2013)	Predicted Noise Level including background Ldn (dBA), 2015, 2025, 2035	Additional noise due to Project rail Ldn (dBA), 2015, 2025, 2035
General Hospital Between Ch 154200-154200 @ 25 m	61	62.3, 62.4, 62.9	1.3, 1.4, 1.9
Location of an Eidgah located between 155000 and 155100 @ 25 m	61	62.3, 62.4, 62.9	1.3, 1.4, 1.9
Primary School Ch.184400 @40m clear field	61	62.3, 62.4, 62.9	1.3, 1.4, 1.9
Mosque 184700, 60 m. obstructed by 3 rows of house	53	54.3, 54.4, 54.9	1.3, 1.4, 1.9

244. From the baseline noise survey, the equivalent Ldn of background noise near existing stations like Comilla at 61 dB(A) is already higher than the applicable DoE standards by as much as Ldn 18 db(A). While with the Project the noise level will increase due to increased frequency of trains, the incremental impact over the baseline level is very little and ranges between 1.3 dBA to 1.9 dBA. Relevant studies on community reaction to new noise, relative to existing noise in urban environment and community annoyance due to noise indicated a 2 dB (A) increase will generate either no reaction to sporadic complaints and at 63 dB (A) Ldn about 5-20% with an average of 10% of the people will be highly annoyed.

245. In open areas where background noise level of 53 dB(A) was recorded, sensitive receptors like mardasas and eidgahs that are sporadically located within 40 meters from the rail track having a clear line-of-site may be subjected to more than + 2 dB(A) increase. In between these areas and along the 25 m RoW, avenue trees should be established at least 12 m thick to absorb and attenuate noise level to within + 2 dB (A) of the baseline noise to avoid adverse impacts.

246. It can be concluded that no significant impacts on sensitive receptors located in commercial land uses like existing train stations are expected during Project construction and operation. During construction, the perimeter wall that will be

[44] Assumed that 70% of the commuter rail traffic occurs during the night time

constructed at least 50 m from the tracks is enough to attenuate and shield receptors from adverse noise levels. No further mitigation measures are needed during train operation as noise reducing features incorporated in the design like the relocation of all structures within the 25 m width from the edge of proposed rail line, the use of rubber padding under the rail, installation of continuously welded rail, and maintenance of good track quality are enough to maintain less than Ldn 2 dB (A) increase from baseline noise level. However, avenue plantation will be required in-between the rail track and sensitive receptors like madrasas and eidgahs located within 40 metres and having a clear line-of-site to the tracks to avoid adverse impacts.

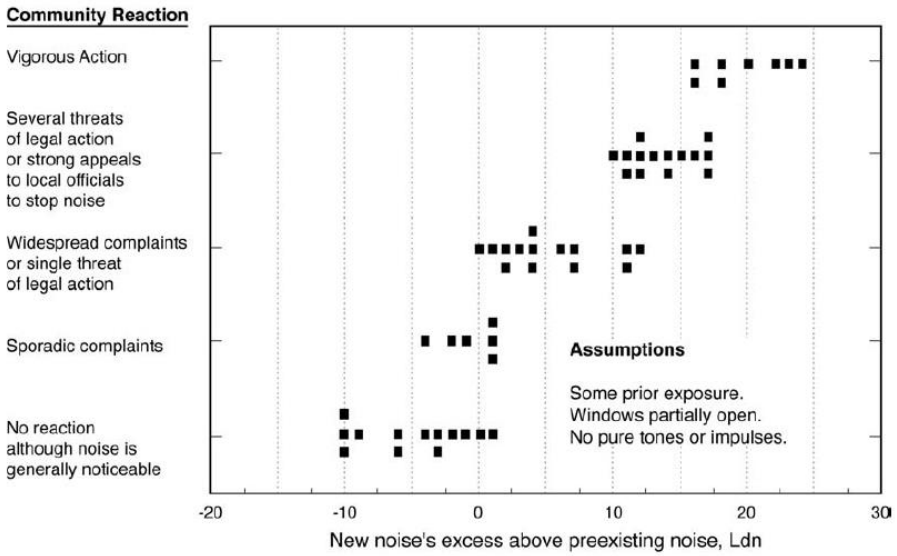


Figure 14: Community Reaction to New Noise, Relative to Existing Noise in a Residential Urban Environment

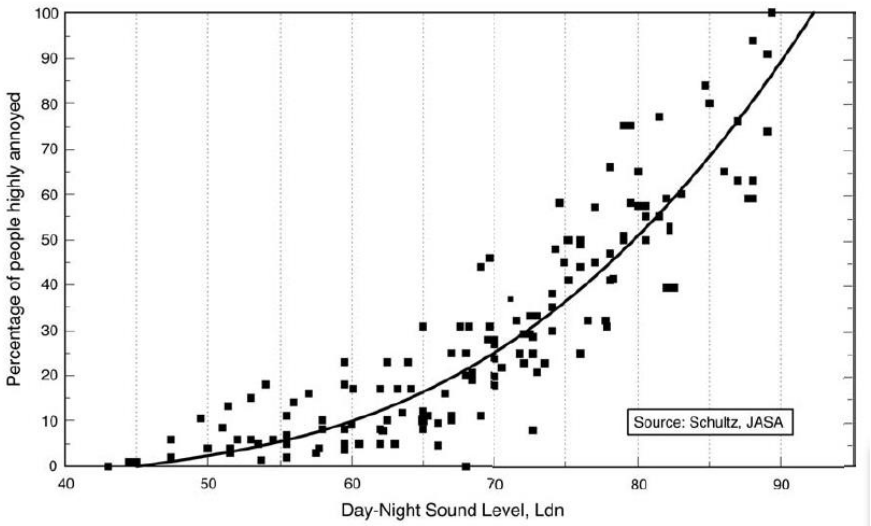


Figure 15: Community Annoyance Due to Noise

5) Terrestrial Fauna

247. The implementation of the Project will result in the loss of tree and understory vegetation within the BR RoW. The aggressive replanting programme (see **Annex 9**), will, over several years, restores this habitat and attract birds and insects.

6) Health and Safety

248. **Level Crossing** - Operations of at-grade crossings present a risk caused major accidents resulting in severe injuries and even deaths. Operation of at-grade rail

crossings often creates serious traffic congestion regardless of location, sometimes blocking traffic even after the train has passed. Problems at level crossings are increased number of trains running over the existing unimproved facility aggravating traffic congestion, increased annoying vibration and noise inadequate road traffic/lane control structures on either side of the level crossings, permitting chaotic queuing and lane blockages and long delays once a train passes.

249. To mitigate these problems grade separations will be built at two of the 25 planned authorised crossings. The other crossings will be assessed in term of provision of maximum line of sight and moved where possible, Vehicular traffic management systems at level crossings will also be upgraded. Eight unauthorised level crossings will likely be authorised and upgraded. Warning signs and gate lights will be installed and warning bell will be operated by approaching train. Warning sign and disclaimers will be posted at all unauthorised crossings.

250. **Accidents involving Hazardous Materials** – At present and for at least the next decade, BR will not likely transport hazardous materials on this rail line. None are carried at the moment. However, BR's hazardous materials transport protocol (Spill Contingency Plan) will be in force and updated as required to improve the emergency response in the event of a spill. BR will undertake this work.

7) Heritage and Culture

251. Loss of some ancestral property, graveyards and mosques may stress the communities affected. Proper protection, restoration and rehabilitation of the religious and cultural monuments and structures, based on focused discussion with local authorities, should minimise the impact of these losses.

8) Construction Work Areas Decommissioning

252. The clean up by the contractor or their work camps, operating yards, borrow sites, materials storage areas, etc. is often not carried out carefully which leads to chronic contamination problems, long term erosion and safety issues. Before the final payment is made to the contractor a decommissioning audit will be conducted by BR, working jointly with the contractor. At that time all non-compliant work will need to be brought into compliance, and payment will be released only after BR is satisfied with the contractor's clean-up.

9) Station Operations

253. New or upgraded stations will attract more passengers and more waste to manage. Poor waste management will lead to polluted conditions. Designs will have properly sized facilities for sewage, waste management and utility services. The design criteria are to be checked against the actual versus estimated station through-put of people. BR will also coordinate with other utility agencies to provide connection for improved station buildings, as required.

10) Cumulative Effects

254. The addition of the second line will lead to more noise, and air pollution, specifically trackside noise pulses as trains pass, and total particulate matter in the air from diesel combustion. This will be in addition to that generated by the existing line. The doubling in the frequency of train movements will also increase the dust during the dry season from December through mid-April, since trains moving at speed raise dust clouds along the alignment and as far as 25 m on either side of the tracks. The increase in train movement will of course also result in more passengers travelling to the train stations, hence increased traffic of vehicles coming to drop and pick passengers. The cumulative effect will therefore be more frequent noise events, increased air quality degradation and dustier rail corridor, roads and parking areas near the stations during

the dry season. Mitigation of these effects will be carried out by improved track maintenance, vegetation planting and placement of gravel at trackside to reduce the dust and improved locomotive maintenance and replacement of ageing units. Further, the diversion of thousands of vehicle trips to the railway will significantly offset the added pollution from increased rail traffic. Finally BR's ongoing work to relocate dwellings and inhabited structures out of the BR RoW (as per the LAP and RP) will take most people out of the higher noise zone, which is within about 50 m of trackside.

11) The Gumti Bridge

255. During the operational phase the only impact associated with the bridges will be during repair and repainting, as well as discharge of any raw sewage from the train as it passes across the bridge. BR is looking into stopping the sewage discharge by installing sewage holding tanks. The maintenance work will be very infrequent and will minimally affect the water since most components of new bridges do not need painting. However, any maintenance will be planned to take place during the driest part of the year when much of the Gumti River channel is dry.

D. Climate Risks

256. The Akhaura-Laksam railway line passes along the western border of India's Tripura Hills, 150 m above the Meghna floodplain. Six rivers originating in the Tripura Hills, and to be crossed by the new rail line, have Bangladesh Water Development Board hydrometric stations (**Table 30**).

257. The Southwest Monsoon (June to September) brings most of the annual rain (62%), proceeded by pre-monsoon summer (March to May) and followed by a dry cooler period (October to December); when the monsoon withdraws. During the pre-monsoon summer there are convective storms associated with strong winds, which at times turn into cyclones. At times these tropical cyclones, coming off the Bay of Bengal cross over the Akhaura-Laksam rail track, but with reduced violence.

258. **Temperature** A review of annual temperature variation at Dhaka and Comilla provided the temperature regime of the Project corridor, as there is not much difference in temperature at these two places. The mean monthly day temperature at Dhaka ranges from 25°C to 34°C whereas it ranges from 25.5°C to 33°C at Comilla. The lower value of the range occurs in January and the higher value occurs in April at both the places. Mean monthly night temperature at Dhaka ranges from 12°C to 26°C and 12^0C to 25^0C at Comilla. The lower value of the range occurs in January and the higher value occurs in July and August at both the places.

259. **Rainfall** - The entire corridor is in a high rainfall zone, with average annual precipitation of 2185 mm of which 1418 mm (64% of annual) occurs in the Monsoon months (J,J,A,S). During May to September average number of rainy days remains quite high and often impacts construction work. For the six crossing DL has been fixed only for the station SW110 over the Gumti River (**Table 30)**.

Table 30: Hydrometric Stations near the Project Corridor

WL Station	River crossings from north to south	HFL-PWD (m)	Average FL (m)	DL
SW296	Akhaura Rail bridge over River Titas	7.77	6.49	
SW123	Gangasagar Rail bridge over River Howrah	7.23	6.15	
SW330	Bijni Rail bridge over River Bijni	8.80	6.73	
SW339	Salda Nadi Rail bridge over River Salda	7.87	6.87	
SW110	Comilla Rail bridge over River Gumti	13.55	12.04	11.75

WL Station	River crossings from north to south	HFL-PWD (m)	Average FL (m)	DL
SW58A	Laksam Rail bridge over River Dakatia	5.70	4.99	

HFL=high flood level PWD=Predicted water depth, DL= Danger flood level

260. Of the six crossings, danger flood levels were predicted only for the station SW110 over the Gumti River, and **Table 31)** shows that days above average flood level for the Howrah, Bijni and Dakatia Rivers in some cases reach 50 days, thus have had design adjustments made and will require special arrangement during construction.

Table 31: Flood Statistics for Rivers Crossed by the Rail Line

WL Station	River crossings from north to south	HFL-PWD (m)	Average FL (m)	Days above Average FL
SW123	Gangasagar Rail bridge over River Howrah	7.23	6.15	28
SW330	Bijni Rail bridge over River Bijni	8.8	6.73	20
SW339	Salda Nadi Rail bridge over River Salda	10.07	6.87	7
SW110	Comilla over River Gumti	13.55	12.04	4
SW58A	Laksam over River Dakatia	5.7	4.99	50

HFL=High flood level, FL= flood level, PWD=predicted water depth

261. Measured extreme flows at the six stations (Table 32) indicated a flood elevation of between 0.6 and 3 m, with the Gumti River showing an average of only 1.3 m rise in water level.

Table 32: Recorded Extreme Water Levels at Five Rivers Crossed by the Rail Line

River	Station	HFL (m-PWD)			LWL (m-PWD)		
		Max	Median	Min	Max	Median	Min
Gangasagar	SW123 Gangasagar Rail Br.	7.23	6.02	5.44	3.87	3.36	3.12
Bijni	SW330 Bijni Rail bridge	8.80	6.64	5.00	5.36	4.16	3.77
Salda Nadi	SW339 Salda Nadi Rail Bridge	10.05	7.00	3.40	3.48	2.85	0.82
Gumti River	SW110 Gumti Rail Bridge	13.55	12.20	10.38	7.87	7.36	6.93
Dakatia	SW58A Laksam Rail Bridge	5.70	5.10	3.67	2.03	1.06	0.22

262. **Temperature Effects on River Flows and Bridge, Culvert Sizing -** Temperature is only one parameter among several that are proposed to affect climatic conditions[45] (IPCC, 2007) and Lethem 2009. The Gumti Bridge, the only one with a >100 m span is being designed for 100 year return period flows. The smaller bridges are being designed for 50 year return period.

[45] IPCC, 2007. Forth Assessment Report: Climate Change, Cambridge: Cambridge University Press.

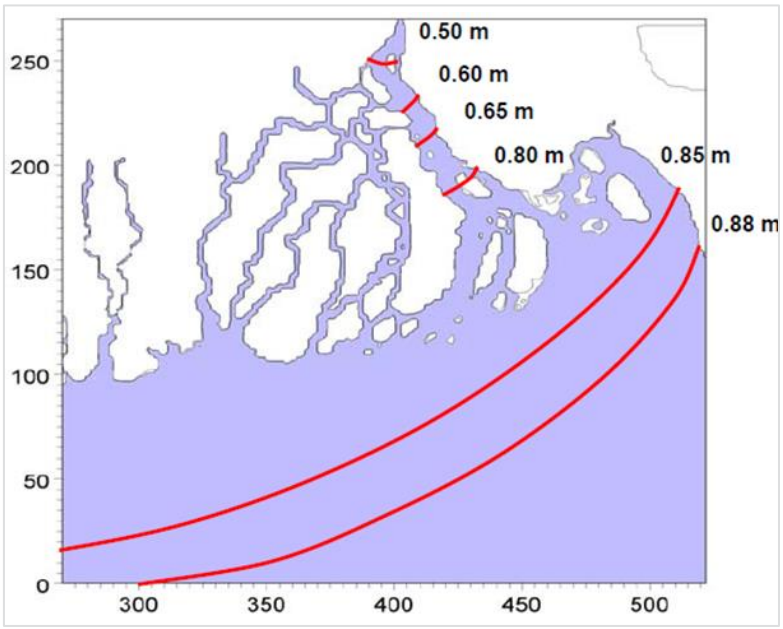


Figure 16: Predicted Water Level Rise in Meghna Estuary 88 cm Due to Climate Change Induced Sea Level Rise (Axes Units Are Km)

263. Bangladesh is a low lying country and sea level rise is likely to propagate upstream. The Padma Bridge environmental study included an extensive evaluation of possible climate change effects and the need to consider increasing the freeboard at the bridge (WARPO, 2005)[46]. The study concluded that the climate induced sea level rise (**Figure 16**) could be between 32 cm and 88 cm backing up the freshwater upstream. The study showed that at Daulatkhan in Shahabazpur channel, high tide levels were predicted to increase between 30 and 80 cm (but with a very low level of certainty). It was further estimated that such a predicted elevated sea level rise would lead to a 50 cm rise in the Shahabazpur channel, and 15-32 cm water level rise at the Padma Bridge.

264. The Gumti River empties into the Meghna at Daudkandi which is 46 km upstream of Chandpur, and the Gumti River rail bridge is a further 70 km upstream. Thus a sea level rise of 0.50 m at Chandpur will have negligible SLR impact at the Gumti River rail bridge some 116 km upstream of Chandpur (**Figure 17**). Therefore, climate risk for the Project is negligible.

265. The drainage from upstream has been accounted for by using as basis for the hydrological modelling, the rainfall statistics over the past 20 years, thus incorporating climate change effects, and plotting future trajectories. The bridge design engineers feel confident that climate risk has been accommodated, and BR does not need any further changes to bridge and culvert designs.

[46] WARPO. 2005. Impact Assessment of Climate Changes on the Coastal Zone of Bangladesh**.** Available with the Bangladesh Bridge Authority, Dhaka and BR Project offices."

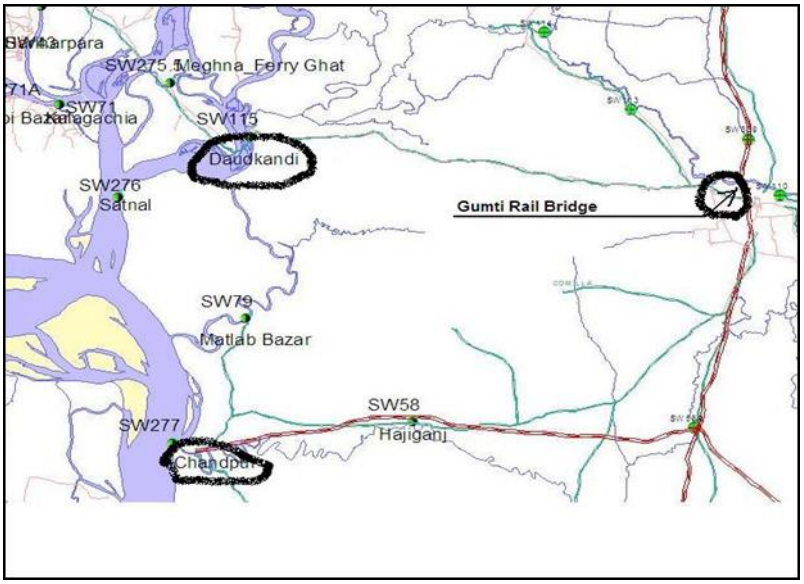


Figure 17: Distance of Chandpur, Daudkandi and Rail Bridge over Gumti River (116 km)

E. Summary of Potential Impacts

266. The EIA study revealed that the high impact areas of the proposed Project will be corridor air quality and dust, hydrology, visual intrusion; agriculture, tree felling and wildlife habitat loss, noise, waste mismanagement and drainage congestion. Social environment impacts will be extensive and will involve land acquisition, homestead loss, loss of agriculture production, income loss, split communities, cultural loss, and etc.[47]. All environmental impacts can be mitigated and in many cases avoided by careful planning and compliance with EMP actions during the construction period. BR will make every effort to ensure that this takes place and the EMP measures as defined in Chapter IX are implemented; and are maintained once the contractor and Engineer leave and full responsibility reverts back to BR.

F. Environmental Benefits and Enhancements

1) Traffic Diversion and Fuel Savings

267. The Project will divert road users to the improved train service. This should in turn reduce road traffic congestion and air pollution. Moreover, the increase in the number of people moving from one place to another per litre of fuel will also help reduce GHG emissions.

2) Reduction of Carbon Footprint

268. Carbon footprint is commonly described as the total amount of carbon dioxide (CO_2) and other greenhouse gases (GHG) emissions released per unit time during the operation of the Project. For this Project, the life cycle includes pre-construction through to the operating and maintenance phases[48].

269. Regional air quality may benefit since the added rail service will divert road traffic to rail[49]. However, during the operational stage of the Project, the localised air quality will be impacted due to the generation of air emissions by the added diesel train locomotive traffic. Locomotive emissions would result from the combustion of diesel fuel that will mainly generate particulate matters (TSP, PM_{10} and $PM_{2.5}$), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Nitric Oxide (NO), Nitrogen Dioxide (NO_2), Sulphur Dioxide

[47] Social Impacts are addressed in the Resettlement Plan of Project, RCIP 2013.

[48] ADB, 2010. *Methodology for Estimating Carbon Footprint of Road Projects-Case Study:India,* Mandaluyong, Philippines: Asian Development Bank

[49] Estimates of these potential transfers from road to rail has been discussed in the EIA report

(SO_2), Volatile Organic Compounds (VOCs), and trace levels of non-combustible VOCs (benzene)[50]. Using available BR and secondary sources, the emissions of the existing fleet of 31 locomotives and the increases in 2020 and 2023, operating along the 72 km line was based on an average consumption of 2.5 l/km per locomotive (**Table 33**).

Table 33: Estimated Fuel Consumption of Locomotives

Operating on the Akhaura and Laksam Line

Loco Type (1100hp)♦♦	No of Train[51]	Avg. Annual Diesel Consumed –DC (Litre/km)	Emission Factor* – EF (g/Litre)				Main Engine Annual Emission per year (tonnes/yr)			
			NOx	PM	CO	CO2	NOx	PM	CO	CO2
Passenger and Container	31 train sets	62 trips x72 km x360d x2.50 l/km♦♦ =4,017,600 l/yr	83.48	2.1	8.54	2.68	369	9	38	12
2020	37 train sets	74 trips x72 km x360d x2.50 l/km =9,590,400 l/yr	83.48	2.1	8.54	2.28	881	22	90	28
2023	44 train sets	88 trips x72 km x 360d x 2.5 l/km =11,404,800 l/yr	83.48	2.1	8.54	2.68	1048	26	107	34

♦ *estimated by Transport Economist of the Consultant*

♦♦ *gross main engine HP identified in Akhaura-Laksam section is from 550 to 1650 and average gross HP 1100 has been considered for the above calculations. The calculation of GHG emissions has not been adjusted to accommodate the change to dual gauge, since the locomotives to be used will be a new generation and, despite having 20% more horsepower, will emit about half the pollutants than the 25 year-old (average) locomotive fleet. These locomotives will be replacing the old units and since the traffic as projected will not change, there will be a net reduction in GHG emissions. Therefore the estimate are in fact conservative and on the high side*

** EF used for this study has been derived from NESCAUM study.*

270. Using 2020 as the first year of operation when about six additional train sets (total of 37) will be in service, the estimated fuel saving through the diversion of vehicle from road to rail is estimated to be at 10,743,000 litres per year[52]. During that same year the estimated consumption of the 37 train sets operating on the line is 9,590,400 litres per year. This translates into a net saving of >6.59 million litres of fuel per year when deducted from the estimated saving due to diversion. The diverted traffic in 2023, when 44 train sets are in operation would save an estimated 64.4 million litres of diesel fuel per with a net saving, once train consumption is deducted, of 53.78 million litres of fuel per year. After 2023 the diversion is expected to have peaked and no increase is predicted through 2044.

271. Based on these data, by 2023, the fuel saving of 53.78 million litres per year translates into a saving of 145,000 metric tons of equivalent CO_2/yr. (using an equivalent CO_2 emission factor of 2.68 kg CO_2 $^{-e}$per litre of diesel fuel consumed), and accounting for the fuel used for the additional train trips. By increasing locomotive efficiency or retiring the old locomotives for new ones, these already significant savings would be further increased.

[50] Transport for New South Wales, 2012. [Online] Available at: http://www.transport.nsw.gov.au/sites/default/files/b2b/projects/TP_NSFC_NSRU_REF_Tech_Paper_4.pdf [Accessed 24 February 2013].

[51] Numbers of trains are to be confirmed at the later stage of the Project

[52] Data on fuel consumption and diversion were obtained from Project economic analysis. . The calculation of GHG emissions has not been adjusted to accommodate the change to dual gauge, since the locomotives to be used will be a new generation and, despite having 20% more horsepower, will emit about half the pollutants than the 25 year-old (average) locomotive fleet. These locomotives will be replacing the old units and since the traffic as projected will not change, there will be a net reduction in GHG emissions. Therefore the estimate are in fact conservative and on the high side

3) Environment Friendly Stations and Buildings

272. **Solar panels -** Solar panels will partially power the cooling and electrical system of each station and building, reducing the carbon emission significantly, lowering the need to draw energy from the grid. This will reduce the carbon-footprint of each station and building by as much as 30%. The units will be placed on the station and building roofs.

273. **Rainwater harvesting** - The collected rainwater will be stored in a cistern or tank above the station and building, and used for all non-potable purposes. This will reduce the need for groundwater extraction and will provide savings on energy used to pump water.

4) Universal Design - Station Access

274. Universal design in building modern railway stations is to be applied wherever applicable for the benefit of elderly passengers and those with disabilities. The station sites should be landscaped and have optimum parking facilities and ramp access for people requiring access assistance. In addition, easy entry, ground level entrances without stairs, buttons and other controls that can be distinguished by touch, bright and appropriate lighting, etc., have been included in the designs for all new stations; in accordance with international universal design for the elderly and persons with disabilities.

VII. GRIEVANCE REDRESS MECHANISM

A. Introduction

275. As a partner in the delivery of this Project, ADB's environmental safeguard requirements were carefully considered during the preparation of this EIA. The description of a grievance redress mechanism (GRM) is not required under the GoB environmental legislation but is mandatory for any ADB-funded Project. To that end a step-by-step process is defined in this chapter.

276. Grievance redress is intended to provide a mechanism to anyone negatively impacted by the Project, enabling a grievance to be filed and prompt resolution obtained, using a pre-defined set of time-bounded steps. The overriding principle of the GRM is that it must be non-threatening, easily accessible, quick and impartial; delivering decisions to the complainant in an unbiased a-political manner. GRMs have been developed for many past donor-funded projects and have been accepted by the GoB and been reasonably successful in doing what they are supposed to do[53]. The GRM described in this chapter builds on that success.

B. The Grievance Redress Committee

277. Rather than suggesting a route normally taken when a citizen has a concern, namely the local administrative official route, grievance redress committees (GRCs) will be organised in each Upazila (UZs) through which the Project passes. This Project passes through six Upazilas within the Comilla and Brahmanbaria administrative areas. Each Project will likely trigger both environmental (as defined in this EIA) and social impacts (as defined in the Project's Resettlement Plan) and therefore the GRC will need to be able to address both. Prior to the start of construction, BR will meet with UZ heads to request each to nominate committee members who could form part of the GRC, and meet when complaints are received. Complaints from different UZs would trigger a change in the people involved, but generally with the same roles. As a minimum the composition of a GRC will be as follows:

- BR Regional Director or Representative
  GRC Chair and convener
- Upazila Parishad Chairman or Senior Representative
  GRC Committee member
- Female member of concerned ward(s) of the UP
  GRC Committee member
- Local NGO Representative
  GRC Committee member (Social)
- DoE representative from District
  GRC Committee member (Enviro)
- Representative from area where grievance was filed GRC Committee member

278. When dealing with environmental matters, the GRC should have five permanent members, with the DoE representative replacing the local NGO and a female representative of the affected people. In order to convene a GRC meeting a quorum of three people will be required. Further, the GRC would only be convened if direct communication between the contractor, the complainant and the Engineer cannot solve the issue quickly. Once the complaint reaches the GRC, the GRC has two weeks to

[53] Padma Bridge, Jamuna Multipurpose Bridge Project, Bhairab Bridge Project

render a decision, based on discussion with all parties involved. The GRC will be used as the third step when filing a complaint.

C. Steps to a Solution

279. **Step 1** - The complainant will be advised to first attempt to settle the complaint through direct communication with the either in person or by a phone, and a call to the local BR office. If the discussion with the Complainant/Community is successful, the contractor will be responsible for undertaking corrective measures as defined in the grievance decision and recording the decision and filing that with BR, via the Engineer or the BR ESSU.

280. **Step 2** – Should the complaint not be addressed within a week, the next level is to notify the Upazila office and BR of the unresolved issue. The Upazila official will then communicate either to the contractor or BR and a solution will be discussed with the complainant within one working week. If more time is required, The Upazila or BR should communicate directly with the complainant describing the reasons of the delay.

281. **Step 3** - If Step 2 fails to resolve the issue within two weeks of the receipt of the complaint the GRC should be formed and a formal hearing undertaken. At this point a decision must be rendered within two weeks or the complainants concerns will be deemed correct and immediate mitigative actions will be required and fully executed within five days of the end of the two-week period.

282. **Step 4** – If Step 3 fails to resolve the issue, the complainant may proceed to legal arbitration.

283. All GRC decisions will be recorded by the GRC, and sent to the local and head office of Bangladesh Railway.

D. Publicising the Grievance Redress Steps and the Committee

284. Prior the start of the construction, BR or its representative will publicise the establishments of the grievance redress steps and the process, and advertise all via contact information and the grievance redress steps posted at every UP office involved, as well as at every train station in the Project corridor. The poster(s) will be in the local language(s) and posted within 30 days of the start of construction. The BR representative will check at least monthly to insure that the posters are prominently displayed and provide clear contact instructions and numbers. This procedure and monitoring will be reported in the semi-annual monitoring report submitted to the ADB.

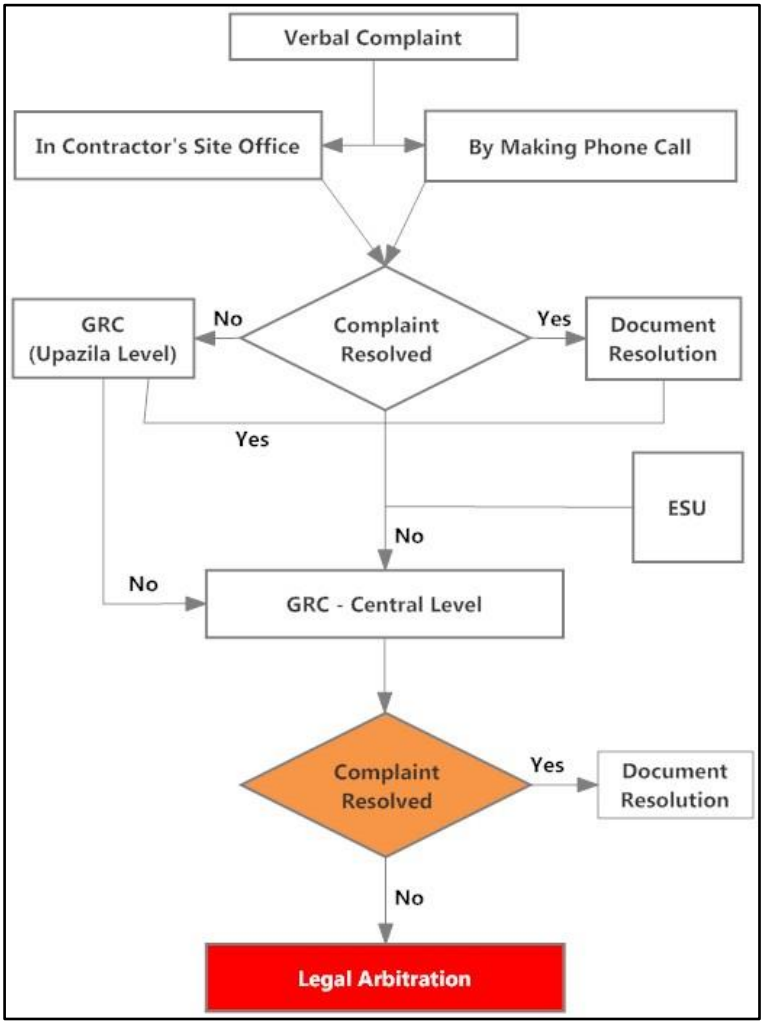


Figure 18: Proposed Grievance Redress Mechanism of the Project

E. Reporting

285. Any grievance filed with the GRC, must be reported in the Annual report to the Engineer who will then submit a consolidated report to ADB, via BR.

F. Construction Workers Grievance

286. At construction sites, work camps and on-the-job, labourers and other unskilled hired employees of the contractor have little recourse when either their living conditions are badly degraded, they are not paid according to agreement, or basics, such as potable water, are not supplied. Under this contract, as part of the written agreement with each hired worker, the contract or letter of assignment with the work, will include the name and contact information of who within BR and/or the Engineer the person can contact with their concerns and a second statement indicating that the contractor will not penalise the worker for reporting a complaint. If the worker is penalised, the Contractor will be levied with a fine equal in value to the worker's contract duration from the time of the incident to the end of the contract period. This fine will be paid to the complainant.

287. In the contractual agreement the employee will be provided specific contact information for a responsible person within BR and the Engineer who will address grievances.

VIII. INFORMATION DISCLOSURE, CONSULTATION, AND PUBLIC PARTICIPATION

A. General

288. The purpose of public consultation meetings was to invite comments and detailed suggestions on any environmental issues considered relevant by the people living in the area of the Project corridor. The public consultation programme is an essential part of the environmental assessment process and has been undertaken both formally and informally throughout the study to ensure that the knowledge, experience and views of stakeholders and the general public are taken into account during the EIA work. The information shared and recorded (See **Annex 5**) has, where relevant, been applied to justify design, alignment, construction methodology and timing changes, in order to reduce predicted negative effects. This approach satisfies statutory consultation requirements of the ADB and DoE.

289. In late April 2013, Bangladesh Railway sent invitation letters to relevant Upazila Nirbahi Officers (UNOs) requesting them to assist BR's Consultant with the organisation of public meetings at a number of locations in the relevant Project Upazilas (see **Annex 5**). The UNOs were also asked to actively participate in, and in most cases chair the consultations.

290. The copy of the draft and final EIA report and executive summary of the EIA report both English and Bengali will be placed at the following offices for the references to the general public:

- Local office of Bangladesh Railway, Laksam;
- Local office of Bangladesh Railway, Comilla;
- Local office of Bangladesh Railway, Sadar Rashulpur;
- Local office of Bangladesh Railway, Akhaura; and
- Head office of Bangladesh Railway, Rail Bhaban, Dhaka.

291. **Stakeholder identification process** - To insure that a broad spectrum of society was at least made aware of the consultations, BR sent letters of invitation to sixteen stakeholder groups. These included **Table 34**) staff of DoE, Local Government, Bangladesh Railway staff, local women's groups, farmers whose lands border the rail line, fishermen who use the rivers crossed by the proposed alignment, businessmen, transport workers. At least 30 were invited, but it was made known at the UNO's that anyone interested was welcome to any of the sessions. An attendance sheet of each consultation has been filled in and minutes was taken and summarised (see **Annex 5**).

Table 34: Stakeholders Identified

Regulatory Agencies	Primary Stakeholders
Department of Environment, Government of Bangladesh, Bangladesh Railway	Relevant union chairman Women's Group in Project area
Secondary Stakeholders	Teachers of Educational Institutes, Religious Leaders Villagers, especially those require involuntary resettlements Fishermen Group, Local Environmentalist Group Department of Forest Local Business Association Farmers Group
Local Government Engineering Department (LGED) Rural Electrification Board	

292. **Rationale of Selection of Public Consultation Locations -** During the field visit on 26-28 December 2012, four locations were selected, based on the significance of those areas in relation to resettlement issues, loss of agricultural lands, loss of trees, and disturbance to livelihoods. The final selection was made after discussion with local villagers within the corridor and local BR representatives. These locations for both consultation cycles were:

1. Bara Para union of Comilla Sadar (Kotwali) Upazila – near Lalmai rail station;
2. Amratali union of Comilla Sadar (Kotwali) Upazila – near Sadar Rashulpur rail station;
3. Quasba union of Quasba Upazila – near Quasba rail station; and
4. Mogra union of Akhaura Upazila – near Gangasagar rail station.

B. Consultation Methodology

293. The consultation methods adopted for these public meetings were a mixture of short presentations, using graphics, photos and maps and posters, accompanied with a hand-out folder (See **Annex 5**) followed by discussions and Q/A sessions. The use of these materials enabled the participants to comprehend the issues easily, encouraging them to participate in the discussions more effectively and provide informed comments and opinions[54].

294. **Public Consultation Approach** - During the first round of sessions in May 2013, area maps, drawings and photos of crossings as well as an implementation timetable were tabled and those attending were invited to make comments suggest changes or just raise issues, which were all recorded. BR assessed the inputs and took actions were relevant, adjusted the approach to the EIA and recorded all this in minutes and follow-up action tables. The continuation of the consultations, during which the focus was on the presentation of the environmental management plan and its mitigation measures, was undertaken between 11 and 15 March 2014.

295. **Consultation Delivery** - A range of stakeholder consultation and engagement methods have been used depending on the stakeholder type and the level of interest or concern. The key methods used during these consultation sessions were:

- Group discussions - stakeholders were provided with a Project briefing, given a chance to view posters and a PowerPoint presentation, followed by a question and answer period;
- Face-to-face individual interview with sector specific experts including Local Government Engineering Department (LGED), Department of Environment (DoE), and Department of Forest (DoF);
- Phone calls; and
- Letters/correspondence via regular mail and email.

296. Most of the public meetings were chaired by a UNO/UP representative or BR representative, with both taking leading roles in the delivery of the government and agency positions.

C. Information Provided

297. Project Disclosure Meetings - Part of the consultation process involved disseminating factual information regarding the Project, with the aim of developing

[54] The participants did not receive summary materials prior to the consultation sessions taking place

positive and constructive relationships with stakeholders and decreasing the likelihood of incorrect perceptions. A variety of methods and materials were utilised, including:

- Technical meetings with key government stakeholders including the Department of Environment;
- Written and visual information, including maps, drawings and diagrams, detailing the Project staging; and
- A presentation of the Project to DoE.

Bara Para union of Comilla Sadar Upazila – PC 1

Women's Participation in PC 1

Amratali union of Comilla Sadar Upazila – PC 2

Peoples participation in PC of Quasba union – PC 3

Quasba union of Quasba Upazila – near Quasba Rail Station – PC 3

Peoples Participation in Mogra Public Consultation – PC 4

Figure 19: Focus Group Discussions at Various Locations of Project

298. **EMP Disclosure Meetings** – Prior to commencement of the EMP meetings the following materials were disseminated, with the aim of developing positive and constructive relationships with stakeholders and improving their knowledge about the Project and therefore their ability to ask informed questions. These materials were:

- Summary of the mitigations proposed during Project Disclosure meetings
- Written and visual information, including brochure in Bangla, maps, drawings and diagrams, detailing the Project activities; and
- The draft EMP.

Peoples participation in PC 1 of Quasba union

Women Participation in PC 1

Barapara union of Comilla Sadar Upazila – PC 2

Amratali union of Comilla Sadar Upazila – PC 3

Figure 20: EMP Disclosure Meetings at Barapara, Amratali and Quasba Unions

D. Information Recording and Responsibility

299. The Consultant assigned a dedicated secretary for each consultation, whose responsibility was to record participant comments and submit a report. The Consultant provided answers of most of the queries and concern arose by the participants and specifies actions to be taken. Each consultation had minutes recorded and attendance taken with signatures (**Annex 5**). A brochure also prepared both in English and Bangla to share with the participants (**Annex 5**).

E. Summary of Comments by Participants

300. The comments raised during public consultation at four locations of Project and replied by Project proponent are summarised in (Table 35).

Table 35: Summary of Public Hearing Issues and Proponent's Response

Issue No.	Issue Raised	Reply from BR/Consultant
Project Disclosure Meeting		
01.	Environmental affect will be minor.	Consultant noted the positive opinion. Hence the participants were encouraged to discuss on the possible effects due to the Project.
02.	New track will cause relocation problem of the private lands.	Issues of rehabilitation and compensation to PAPs will be referred to the Social Safeguard Team
03.	Addition to the rail traffic will cause extra noise. Sound pollution during construction period should be minimised.	The solution will be prescribed in Environmental Management Plan (EMP)
04.	Extended traffic should not be problem for this region. We all should welcome the proposed rail line but local people must not be harmed.	Consultant noted the point of optimism.
05.	The existing roads are not enough to support the extended traffic carrying construction materials during Project implementation.	Existing road transport development will be recommended prior to the rail construction.
06.	What will be the source of land filling works?	According to the Project policy, the source of the land filling will be mostly the river dredging materials
07.	Construction sound / vibration will hamper local market, household, etc. How we are planning to compensate on that?	The solution will be prescribed in Environmental Management Plan (EMP)
08.	Due to the construction of the rail Project, existing environment will be imbalance	It is true that existing environment will be affected but it is manageable through implementation of appropriate mitigative measures. EMP will be consisting of all aspects of existing environmental issues.
09.	Developed countries always protect their environment. We have to save our natural resources including water bodies, rivers and biodiversity.	Proper suggestion will be given to minimise the effects on local hydrology, Biodiversity and other natural resources.
10.	Most of the people welcome the rail improvement Project.	Consultant noted the positive opinion.
11.	Hill cutting should be avoided especially in Lalmai Hills.	According to the Project policy, there will be no hill cutting
12.	Traffic congestion will increase. Traffic signalling system must be developed in busy rail crossings.	Traffic safety will be considered in EMP
13.	This Project will be very positive for the local people. Development brings betterment to our life.	Consultant noted the positive opinion.
14.	Long-time construction will cause air pollution, soil pollution, water pollution and sound pollution. Social forestation will be hampered.	Proper suggestion will be given to minimise the environmental effects
15.	Fast construction is expected.	Consultant noted the point of optimism.
16.	Road communication will be hampered during the bridge construction period	Existing road transport development will be recommended prior to the rail construction.
17.	Long term construction camps may cause health hazards	A waste management plan will be developed for the camps to ensure little impacts from construction camps. Details will be prescribed in Environmental Management Plan (EMP).
18.	Very impressive Project connecting international boundaries	Consultant noted the positive opinion.

Issue No.	Issue Raised	Reply from BR/Consultant
19.	Unnecessary land should not be acquired by railway and existing agricultural lands should be protected during construction	The least possible land will be acquired.
20.	Chittagong-Comilla four lane road Project, already acquired much land. If we can use that will save a lot of money and also the environmental damage will be less	As BR has lands on both side of existing track, land acquisition will be less than four lane road Project area. However, this will be discussed with technical teams of RCIP.
21.	There are some sensitive structures in the western side of the track.	Sensitive structures especially archaeological sites will be protected during final alignment and construction works.
22.	Government must ensure proper compensation for Project affected people.	Issues of rehabilitation and compensation to PAPs will be referred to the Social Safeguard Team
23.	We should not compromise possible environmental issues in the name of development.	Consultant is well aware that and the meeting is also one of the approaches to identify the issues.
24.	The proposed alignment will cross Mogra and Gangasagar markets causing massive property loss to the people.	Consultant assured participants that concern alignment area will be re-inspected by both social and environment teams of RCIP and will propose alternative route alignment on that section of alignment if necessary.
25.	Increasing train –vehicle, train-livestock and train pedestrian accidents due to doubling of train traffic	Consultant will develop a Traffic Management Plan to be used during operational phase of the Project. Rail traffic signalling system will be proposed in EMP to be implemented during construction of the signalling and communication systems.
26.	Blocking farmers' access to agricultural production areas and livestock	Sufficient access will be proposed.
27.	Flooding do to improper removal of cofferdams and clearing new culverts of construction debris	Hydrology team of the RCIP is currently studying last 100 years flooding patterns and also investigating current drainage channel and water flow during flooding. Based on the results of the investigation, sufficient culverts will be proposed to be constructed to reduce water clogging.
EMP Disclosure Meeting		
01.	The busy level crossing near the Mandabag rail station needs attention. Signalling system must be developed.	Consultant has identified 75 level crossings including 15 authorised and 60 unauthorised level crossings. Out of 60 unauthorised 10 will be formalised. For these 10 unauthorised crossings, different safety measures including barricade, warning light and underpass have been suggested by the Consultant which will minimise the risk for the local transport.
02.	Quasba Road Bridge is very weak for the heavy construction vehicles. Participant suggested to use alternative road, the road from Akhaura, for construction purpose.	The road bridges will be assessed before the heavy construction vehicles pass through them and will also suggest BR to use the proposed alternative road.
03.	Because of over withdrawn of ground water, local people are suffering from ground water especially during dry season. Participants suggested reducing ground water use for the construction.	Groundwater will be used as an alternative option for the construction. However some specific regions like the work camps where workers will be in need of drinking water, a limited tube wells will be bored with prior approval from authority.
04.	Consultant tree plantation plan is very appreciable	Consultant noted the positive opinion
05.	Using Gumti and Titas river water for the construction to reduce ground water demand.	Consultant noted the suggestion

Issue No.	Issue Raised	Reply from BR/Consultant
06.	Environmental issues are negligible compared to compensation and resettlement issues.	Issues of rehabilitation and compensation to PAPs will be referred to the Social Safeguard Team
07.	During construction, surface runoff from the proposed embankment area would impact the adjoining agricultural lands. Therefore, the impacted lands will lose its fertility and it will not possible to grow anything after few years.	EMP adequately addresses this issue and proposed to plant grasses on embankment slope. However, if construction activities affect the adjoining agricultural lands, it is requested to place a complaint through GRC.

F. Consultation Outcomes

301. Four public consultations were arranged to disclose the Project as identified in **Annex 10** and three consultations were arranged for EMP disclosure. The number of participants in four Project disclosures were 21 (85.7% male and 14.3% female), 32 (87.5% male and 12.5% female), 42 (92.9% male and 7.1% female) and 41 (95.1% male and 4.9% female) and 23 (82.6% male and 17.4% female), 60 83.3% male and 16.7% female), 27 (85.2% male and 14.8% female) people in three EMP disclosure meeting. In relation to the groups invited the attendance was reasonably successful. **Table 36** shows that 9 of the 16 groups attended in Project disclosure meetings and 10 groups attended in EMP disclosure meetings.

Table 36: Stakeholder Attendance (male/female) Project Disclosure Consultations

Agency or Participant Affiliation	Location							
	Barapara		Amratali		Quasba		Mogra	
Consultations on Project Disclosure	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Department of Environment, Government of Bangladesh	0	0	0	0	0	0	0	0
Bangladesh Railway (BR)	1	0	1	0	1	0	1	0
Local Government Engineering Department (LGED)	0	0	0	0	0	0	0	0
Rural Electrification Board	0	0	2	0	0	0	0	0
Elected representatives/ Government official	3	2	6	3	13	0	2	0
Women's Group in Project area	0	1	0	1	0	1	0	1
Teachers of Educational Institutes/ Students	0	0	5	0	9	2	4	0
Doctor/ Engineer/ other profession	2	0	2	0	7	0	2	0
Newspaper/ Media personnel	0	0	0	0	2	0	2	0
Religious Leaders	0	0	0	0	0	0	0	0
Villagers, especially those require involuntary resettlements	0	0	1	0	1	0	0	0
Fishermen Group	0	0	0	0	0	0	0	0
Local Environmentalist Group	0	0	0	0	0	0	0	0
Department of Forest	0	0	0	0	0	0	0	0
Local Business Association	9	0	10	0	5	0	27	1
Farmers Group	3	0	1	0	1	0	1	0
Sub-total (gender wise)	18	3	28	4	39	3	39	2
Total	**21**		**32**		**42**		**41**	

Agency or Participant Affiliation	Location					
	Barapara		Amratali		Quasba	Mogra
Consultations on EMP Disclosure	**M**	**F**	**M**	**F**	**M**	**F**
Department of Environment, Government of Bangladesh	0	0	0	0	0	0
Bangladesh Railway (BR)	0	0	0	0	1	0
Local Government Engineering Department (LGED)	0	0	0	0	0	0
Rural Electrification Board	0	0	0	0	0	0
Elected representatives/ Government official	11	4	6	3	8	3
Women's Group in Project area	0	0	0	7	0	1
Teachers of Educational Institutes/ Students	0	0	12	0	1	0
Doctor/ Engineer/ other profession	3	0	8	0	1	0
Newspaper/ Media personnel	0	0	0	0	1	0
Religious Leaders	1	0	1	0	1	0
Villagers, especially those require involuntary resettlements	0	0	0	0	0	0
Fishermen Group	0	0	0	0	1	0
Local Environmentalist Group	0	0	0	0	0	0
Department of Forest	0	0	0	0	0	0
Local Business Association	1	0	16	0	3	0
Farmers Group	3	0	7	0	6	0
Sub-total (gender wise)	19	4	50	10	23	4
Total	**23**		**60**		**27**	

302. Overall, participants were supportive of the Project and recognised the need for the Project given the current demand of double line in the study area. They feel the Project has national and international interest that will bring economic development to their area and to the country. The summary of the consultation outcome is provided below

- Most people will be benefited;
- Employment opportunities will be created;
- Market enhancement;
- Better lifestyle;
- Air pollution, soil pollution, water pollution and sound pollution;
- Damage to property during construction period due to work encroaching on private land;
- Heavy vehicles will cause road damage;
- Natural resources including water bodies, rivers and biodiversity will be affected;
- Resettlement problems;
- Road traffic will increase;
- Construction camps may cause health hazards;
- Sensitive structures will be affected;

- Alignment through residential and commercial area will cause much property loss; and
- Excessive surface run off from the construction of proposed embankment may affect the adjoining agricultural lands.

G. Follow-Up Programme

303. **Follow-up to Project Disclosure** - participants were fully aware that this Project was a kind of upgrading and that not the same as a totally new line. During four public consultations, a number of issues were raised by the participants, and Bangladesh Railway and the Consultant assured them that BR would follow-up the following issues provide all environmental documentation and address the issues stressed at the sessions. The information to be passed and issues to be addressed were, inter alia:

- Provide details on how river bank erosion along the Gumti River has been mitigated by the Project's hydrologists; and
- Relate to the Social Safeguards team concerns provision of more specific information on the rehabilitation of private property likely damaged during construction and compensation to Project Affected People.

304. Follow up to EMP Disclosure

- Provide Final version of EIA report along with EMP and Executive Summary (Bangla) to relevant UNOs; and
- Involve Project Affected Persons (PAPs) to the Project (employment, business, kind, and etc.) first during implementation.

1) Use of Consultation Results

305. Key issues and concerns identified through the consultation process, and the means by which they have been assessed and addressed in this EIA report is provided in **Table 37** below. These matters have also been translated in practical actions which are contained in the associated Environmental Management Plan (refer to Chapter IX).

Table 37: Addressing Key Stakeholder Concerns

Key Stakeholder Concerns	Addressing Stakeholders Concerns
In Project Disclosure Meetings	
Potential impacts to the existing environment.	A detailed Environmental Impact Assessment has been undertaken investigating potential impacts to all aspects of the existing environment including surface and groundwater, flora and fauna, air quality and noise. Mitigation measures have been proposed for all Project activities which have the potential for significant negative impacts on the existing environment. Chapter IV of this report provides baseline information for the existing environmental conditions Chapter VI provides a detailed assessment of potential impacts and mitigation measures Chapter IX provides an EMP where practical actions are proposed in order to reduce potential impacts
Potential impacts of noise and vibration on the community.	48 noise readings were recorded to assess the existing noise conditions. It was observed that noise impacts will be much lesser than any greenfield Project as the study area already has an operating rail line. However, potential impacts have been assessed, and mitigation measures have been provided in **Chapter VI** including: • Undertaking noise-generating construction works during the daytime (rather than night-time) whenever possible • Liaising with local community leaders to negotiate specific mitigation

Key Stakeholder Concerns	Addressing Stakeholders Concerns
In Project Disclosure Meetings	
	measures for sensitive areas such as mosques or schools which are within the potential noise impact zone • Investigating any noise-related complaints and – if complaints are valid – providing mitigation measures on a case-by-case basis
Potential impacts on land, crop production and surface water bodies.	Chapter VI provides potential significant negative impacts on agriculture and water bodies, and provides specific mitigation measure to reduce the pollution for impacts to occur. This includes: • Installing effective sanitation and waste management systems • Applying appropriate protocols for the safe transport, handling, use and storage of hazardous substances such as fuels • Clearly delineating the Project sites in order to reduce the potential for over-clearing of crop land • Managing dredging material to reduce the potential for sedimentation/siltation of surrounding cropland • Land filling materials – dredge materials - will be imported from outside of the Project area Chapter VI also provides an assessment of potential impacts to site surface water bodies, including relevant mitigation measures. These include: • Utilising groundwater bores as a water source, rather than pumping from surface water bodies • Complying with the requirements of Schedule 10 of the ECR regarding discharge of wastewater from the Project sites • Monitoring water quality within the Study Area on an ongoing basis. • Managing potential erosion in order to reduce the potential for sedimentation of waterways. • Designing sufficient culverts and bridges to reduce water clogging during flooding.
Potential impact on livelihoods for farmers and sharecroppers currently using land to be acquired.	All landholders and sharecroppers will be provided with compensation in accordance with – at a minimum – relevant Bangladesh legislation such as the Acquisition and Requisition of Immovable Property Ordinance 1982.
Potential for the utilisation of local labour and local business	Local labour and local businesses will be engaged wherever possible. Consultant will suggest Bangladesh Railway to utilise local labour pool at maximum during both construction and operational phase of the Project.
Potential compensation process: Adherence to laws; and Fair, timely and adequate compensation for loss of land, crops, livelihood, etc.	The requirements of relevant Bangladesh legislation such as the *Acquisition and Requisition of Immovable Property Ordinance 1982* set the minimum requirements for the compensation process. BR will adhere to this process to provide fair, timely and adequate compensation for loss of land, impacts to livelihood, damage to property etc.
Concerns were raised over safety and security of the local community both during construction and operational phase of the Project. Increasing train – vehicle, train-livestock and train pedestrian accidents due to doubling of train traffic	Potential impacts to the health and safety of the local community, and relevant mitigation measures, are provided in Chapter VI. Proper traffic sings and signals will be developed in construction areas Visible signs and vest will be worn at all times when construction goes on at night. Work camps will be under periodic monitoring to reduce any health concern. Sprinklers will be used for dust suppression. Proper safety equipment will be used for staff safety.
Flooding do to improper removal of cofferdams and clearing new culverts of construction debris. Blocking farmers' access to agricultural production areas and livestock	Proper and sufficient culverts and bridges will be construction for water flow especially for flooding prone areas. Sufficient access route to crop lands will be constructed if proposed rail alignment split the lands of mass community.

Key Stakeholder Concerns	Addressing Stakeholders Concerns
In Project Disclosure Meetings	
Protection of archaeological sites and heritage during construction	Archaeological sites and cultural places will be protected as much as possible during finalisation of the rail alignment based on the importance of the site.
In EMP Disclosure Meetings	
Potential risk at level crossings	Proper and sufficient measure will be taken to reduce any potential accidental risks at the level crossing areas. Details impact and mitigation measures are discussed in Pre-Construction (A.5), Operational Period (C.6) of Chapter VI.
Existing roads and road bridges condition	All existing roads and road bridges that will be used during construction period will be assessed during pre-construction period.
Abduction of Ground water level	It is proposed in EIA and EMP to use surface water first and not to disturb the groundwater. However, a limited tube wells will be bored in workers' camp areas (B.4 of Chapter VI).
Potential damage to the adjoining agricultural lands of the embankment construction areas	It is proposed in EMP (2.3.2) to plant Vetiver/ Napitar grasses to reduce the surface soil run off from the embankment areas.

H. EIB Document Disclosure Requirement

306. As a co-financer of this Project, the EIB requires environmental safeguard documents on projects of this scale to be available for public scrutiny for at least 14 to 21 days. At the same time the EIA is submitted to DoE for review, BR will post the draft final EIA report (English only) and Executive Summary (both Bangla and English) on BR's website and also publish an announcement in local Upazila newspapers, inviting comments and informing the public that the full report is available for review at the local Upazila office. BR will provide a specific name of a contact person to whom people wanting to comment can call or write. BR will then record the incident and follow up with the person commenting, making that record available to EIB if requested. After 21 days the comments received will be incorporated into the EIA (if relevant) and the disclosure period will end.

IX. THE ENVIRONMENTAL MANAGEMENT PLAN AND COSTS

307. This Chapter of the EIA report presents the Environmental Management Plan (EMP) for this Project (**Table 38**, **Table 39**, **Table 40** and **Table 41**). The EMP defines a set of mitigation and monitoring actions to be taken, in response to potential impacts predicted to take place during the pre-construction, construction and operating period of the Project. The sources of the impacts and the impacts were identified during the EIA study. The EMP is presented as two tables, defining not only impacts and mitigative and monitoring actions to be implemented, but also, where, when and who will be responsible for implementing them. The EMP describes well known and best practice mitigative actions to be taken to prevent negative impacts from taking place and if that is not possible to mitigate them to an acceptable[55] level. In addition this EMP will:

- define measures to off-set or compensate irreversible[56] negative impacts;
- specify the institutional arrangement for the implementation of the EMP; and
- identify means to enhance and maximise positive impacts.

308. The EMP (**Table 38** and **Table 39**) will be the main tool with which BR will manage environment impacts by applying both mitigative and monitoring measures in a technically credible and timely manner. The mitigative measures are considered successful when the impacts have either been eliminated or the residual effect complies with the environmental quality standards, policies, and legal requirements set by DoE. Mitigative measures are tracked via the monitoring programme, which is described in the second of two EMP tables, and focuses on construction and operating period impacts.

309. As agreed with DoE, the construction of any large bridge (>100 m spans) which under DoE regulations would normally require their own EIA, and which DoE has exempted BR from doing, will be presented in more detail and with its own mitigative and monitoring requirements. These details for the Gumti River Bridge are provided in Chapter VI and Chapter IX.

310. The Contractor shall be responsible for preparing detailed documentation related to implementing this EMP. This should include information regarding scheduling, personnel, reporting and auditing requirements, training and detailed procedures for implementing the EMP. The Contractor's EMP and associated documentation shall be approved by BR prior to construction commences.

A. Environmental Management Plan - Project Phases

1) Pre-Construction Period

311. BR identified eight impacts which if not properly addressed could lead to impact during the other two Project phases or totally eliminate the objective of completing an EIA. These included, having a tree replacement plan in place, minimising land requirements by fine tuning where the new alignment is placed, and having a process in place that protects the three identified PCRs and the 46 community-level sites (CPR) identified during consultations as needing protection.

312. The Project will require the construction of several new stations as well as improved access. The EMP underscores BR's actions to make sure the designs and alignments are sensitive to local conditions and wishes.

[55] Acceptable is defined as an impact that is within GoB permissible standards
[56] an impact that the environment cannot return to its original state from, e.g. the extinction of an animal or plant species

2) Construction Period

313. BR identified 20 mitigative and monitoring actions that will need to be implemented if significant construction-related effects are to be minimised (see EMP **Table 32** and **Table 33**). The following nine construction activities are likely to trigger negative effects which have been addressed in the EMP:

- Unrestricted movement of construction, machinery and vehicles;
- Railway embankments construction;
- Earthworks including rail embankment;
- Construction of station buildings and EMO building;
- Rail and loop/siding development;
- Station access road construction;
- Bridges crossing structures, culverts and any training works;
- Installation of signalling and interlocking system, platforms, foot over bridges at stations, platform sheds and level crossing safety facilities; and
- Poor good housekeeping practices by the contractor and failure to properly implement an occupational health and safety programme.

314. Of these, the most important will be the effects stemming from the placement of the two-six metre high embankment paralleling the existing rail line for around 70 km. The movement of around 56,000 truck-loads of material and pumping of dredged sand, generating noise and dust as well as traffic bottlenecks, will need to be properly managed. Dust suppression, and limits to truck traffic during low noise periods, as well as care with fleet maintenance will be important. Insuring the trucks and construction machinery do not idle for more than three minutes if not in use will markedly reduce the emissions and provide considerable fuel savings.

315. The embankment slopes will easily erode if not revegetated quickly. Therefore, the contractor will implement a rehabilitation programme as the work is completed

316. To better track the air and noise pollution the contractor will be required to undertake a compliance monitoring programme, testing the parameters defined in Chapter IV and at the same stations as shown in the strip maps (**Annex 2**) Noise monitoring will be completed at the three PCRs and selected CPRs (closest schools, mosques and residences). The schedule will be more or less the same as the sampling completed during the field work for this EIA.

317. Another common impact involves the failure of contractors to properly maintain work camps, allowing sewage to leak, garbage to be left unmanaged, fuel to leak and even bitumen to spill over the ground near the asphalt batch plant[57] occupational health and safety (OHS) practices are often ignored, the contractor either not providing adequate safety equipment or not enforcing its use. Contractors will be required to provide hard hats, ear plugs, dust masks and eye protection, and deliver OHS training sessions at least once a year.

318. Construction of one large bridge, 11 medium bridges and 47 culverts could result in impacts on surface water quality and to that end the Gumti River crossing work will undertake water quality monitoring, according to the design used in this EIA. This is particularly true if bentonite drilling mud is used during the pile boring operations on the six larger rivers. Contractors will be required to provide a bentonite recovery plan, should this material be used.

[57] The batch plant will only be necessary for the access roads to the stations and for the restoration of the level crossings

319. Finally, the Project will require concrete since all piles; piers and large culverts will be cast at casting yards requiring the establishment of a mobile concrete batch plant, generating noise and dust. The contractor will be required to have dust and noise suppression features built into any concrete batch plant. The plant will need to be located at a DoE approved site, at least 500 m from the nearest occupied dwelling.

3) Operating Period

320. Since the existing line has been in operation for over 100 years, producing noise, dust and air pollution, there will be added impact from the operation of a second line, but the extent of this impact should be compared with the establishment of a new railway line. Eight mitigative and monitoring actions will need to be implemented during the operating period. Three important impacts that BR will address are:

- Possible inadequate clean up and rehabilitation of contractors camps and yards and borrow areas;
- Added noise and air pollution from a doubling of the rail traffic, impacting on local sensitive receptors; and
- Lack of adequate new safety measures/equipment accounting for the large increase in train traffic across the level crossing.

321. These impacts, mitigative measures and monitoring requirements are listed in detail in the EMP**.**

4) Institutional Arrangements

322. At all times during the preparation and construction of the Project, BR's Project Director will give the final approval for all administrative and technical decisions. The key agencies or units which will play major roles in the implementation of the EMP are:

- Bangladesh Railway's newly proposed Environmental and Social Safeguards Unit (ESSU)[58];
- The Contractor;
- Engineer (usually an international firm); and
- Bangladesh Department of Environment (DoE).

323. The implementation oversight of all safeguard items in the EMP and indeed the construction contract will be with BR and its ESSU. When the Engineer is appointed BR's technical management of the work will be delegated to the Engineer, but with final approval always passing through BR (**Figure 21**) with annual audit reports submitted to ADB and EIB, who may undertake periodic inspection trips to confirm that safeguards are being fully implemented.

[58] Until a fully functional ESSU is established, BR may hire contractors to perform duties of the ESSU

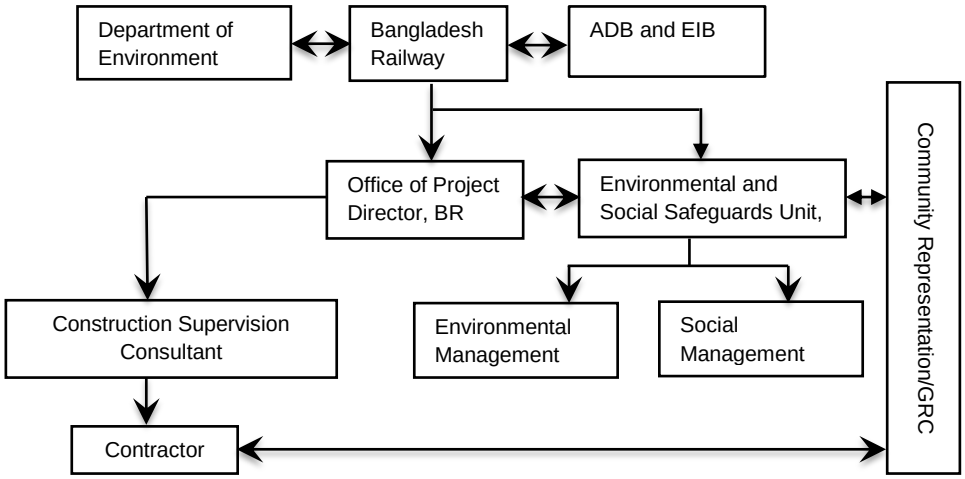


Figure 21: Safeguards Implementation and Reporting Work Flow

324. **BR's Environmental and Social Safeguards Unit (ESSU)** - The objective of an ESSU is to build enough technical capacity within BR to permit it to oversee environmental and social safeguard matters arising from donor projects and to respond with technical knowledge to specific safeguard issues triggered by Project activities, or community complaints. Secondly, the ESSU should be able to manage Consultant and oversee the Consultant's deliverables. Thirdly it will need to be able to fully address EIA requirements of the Project when the Engineer is no longer on the job. The ESSU will have to be able to assess environmental data, analyse it and define actions required to address non-compliant findings in a credible and timely manner. Finally the ESSU should be able to provide training as needed to both contractors and BR staff in all aspects of environmental and social safeguards management. Therefore the ESSU's main tasks will be:

- Oversee the implementation of the LAP and RP;
- Implementing the EMP;
- Supervise and monitor the progress of the Consultant engaged by BR, for addressing safeguard requirements, such as air quality or resettlement plan implementation monitoring;
- Liaise with all regulatory agencies, including DoE and the public;
- Prepare all manner of safeguard monitoring and compliance reports; and
- Providing training to contractors and BR staff.

325. At this time BR is in the early stages of planning such a unit within its organisation. During this planning stage BR will appoint at least one safeguards person to look after the Project safeguard needs, and be the direct contact for safeguard matters between stakeholders, regulators, donors and BR.

326. **BR's Regional Offices and Staff** - The day-to-day oversight of the construction work on this Project has not been decided but will likely be done by the Regional BR Office and its Chief Engineer in charge. Therefore, the Engineer will work closely with the BR's Regional office.

327. **Construction Supervision Consultant/The Engineer** - The proposed framework for implementation of the Project shall utilise consultancy services from both international and national companies for the overall management and supervision of construction work and for preparation of the associated documents.

328. **Contractor(s)** - A contractor selected on the basis of international competitive bidding shall carry out construction work based on a contract containing a set of environmental clauses, conditions and/or specifications (Section 6, Subsection H of

contract technical specifications and **Annex 11**). The contractor will need to demonstrate environmental capacity in the proposal submitted to BR, and be prepared to have that person(s) participate in the mandatory pre-construction training exercise delivered by BR's ESSU or its Consultant.

329. **Other GoB Organisations** - The organisations involved in regulating the Project are Department of Environment (DoE), Bangladesh Water Development Board (BWDB), Roads and Highways Department (RHD) and Department of Forest (DF), Local Government Engineering Department (LGED), Bangladesh Inland Water Transport Authority (BIWTA), and local administration (UNO, DC, Police, etc.). They will provide supporting services as required.

5) EMP Implementation Arrangements

330. The approved EIA and the certificate from DoE will trigger the implementation phase for the EIA, i.e. the actions to mitigate and monitor the predicted impacts resulting from the building and operation of the Project.

331. BR is committed to exploring the establishment of an ESSU and has included that as an action item in the Project's feasibility study. BR will address this internally, to establish if such a staff compliment is available. The EMP has been integrated into the contract specifications, making it a mandatory set of task for the contractor to implement. By preparing and approving the EIA and its EMP, BR has already confirmed its commitment to following through on the EMP. Until an ESSU is established BR will assign at least one safeguards specialist to deal with Project safeguard matters.

332. During the pre-construction period BR will be responsible for implementing the seven mitigative and monitoring measures, according the timetable defined in the EMP and submitting a final monitoring checklist - prior to the start of construction. BR will insure that the contractors receive all relevant safeguard documents and that a training workshop be held to help the contractors understand the EMP, how to prepare their mandatory work plan, and deliver the required documentation.

333. The contractors will implement all 20 mitigative and monitoring actions (See EMP), providing environmental safeguard compliance update as a section of the overall Project monthly progress report. The contractor will also submit semi-annual summaries of surveys, findings and compliance. During the pre-mobilisation workshop BR or its Engineer will review all these requirements (which are all defined in the EIA and its EMP). Construction bid documents have been prepared with a specific environmental bill of quantity section, allowing for unambiguous calculation of environmental penalties.

334. Monthly and quarterly progress reports on EMP implementation shall be prepared by the Contractor in cooperation with the Engineer appointed by BR. All reports to be submitted to BR via the Engineer. The quarterly reports will include a compliance monitoring checklist reporting (see **Annex 12**) on the progress of all 20 construction period actions. Incidents of significant contamination/pollution caused by the Contractor's activities shall be reported. Recommendation shall be made for mitigation of environmental damage and for prevention of any recurrences.

335. During the construction period (four years) the Engineer will prepare annual environmental due diligence reports, based on the monthly and quarterly submissions by the contractor. Additional details describing the Implementation arrangements are provided in Chapter XI.

Table 38: Environmental Management Plan: Mitigative Table (EMiT)

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
1.0 PRE-CONSTRUCTION (PC) PERIOD : major input from BR's new Environmental and Social Safeguard Unit (ESSU)						
1.1 Trees and Landscape	Around 55,000 trees and saplings within 50 m RoW of proposed alignment, workers camp setting, and station areas will be cut down during pre-construction period resulting in potential ecological and economic loss.	Notice of removal of trees and proper compensation to affected people as mentioned in RP should be provided. BR or local NGOs will ensure planting of at least three trees for every one cut. A tree replacement plan has been prepared and is included as **Annex 9**. As each section of the construction work is completed, trees and understory vegetation must be planted, in order to help the cleared areas in an effort to attract some wildlife such as birds.	At all Project sites, particularly new rail embankments, rebuilt stations and at temporary sub grade storage areas	The replanting programme, as defined in Annex 9 will be updated and completed early during the PC period. Cutting will take place throughout the pre-construction period and replanting immediately after each section of rail line is completed	BR, Local NGOs and BR's ESSU if available	BR
1.2 Land acquisition	Design encroaches on private land. Based on preliminary topographical and social survey data of the Project, the Project involves land acquisition of around 37.38 hectares along the proposed alignment and station areas. As per the findings of the RP survey, a total of 2,004 households will be affected. Among these 1,820 households will be displaced and 184 households will be economically affected. In addition, 3 PCRs and 46 CPRs will also be directly affected by the Project.	The detailed guidelines for land acquisition and compensation are found in the LAP and RP, which must be applied. BR is making very significant efforts to minimise resettlement but some is unavoidable due to the opportunistic use of BR owned land. BR has revised the alignment at least 4 times to reduce land requirements.	At all Project sites, particularly land acquisition areas and affected agricultural land embankments, rebuilt stations and at temporary sub grade storage areas	Throughout the pre-construction period	BR, Local NGOs and BR's ESSU if available	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
1.3 Employment and Livelihood	By the acquisition of 37.38 ha lands, a number of people will lose their income and employment	Direct and indirect loss of income will be compensated as prescribed in the LAP and RP and must be implemented prior to construction taking place.	Along the alignment	Early during the Feasibility Study work, During detailed design stage and implementation stage	BR, Local NGOs and BR's ESSU if available	BR
1.4 Heritage and Culture	As mentioned in RP and section 4 H of Chapter IV of EIA, three physical cultural resources (PCR) and 45 community property resources (CPRs) were identified within the Project corridor and may be affected by construction, and are in danger of negative impacts.	Of the 3 PCRs, one required the movement of a single wall and the remaining two will be relocated in a staged reconstruction process, in consultation with local people. The 45 CPRs to be relocated in stages after consultation with local communities.	Along the alignment at 3 major and 45 CPR sites	Early during the Feasibility Study work, During detailed design stage; always prior to construction starting in the area where the site is located	LNGO and BR's ESSU. See Details in LAP and RP	BR
1.5 Infrastructure - Utility Relocation	Some utility lines such as electric transmission lines, gas pipelines, and water supply pipelines are shifted or accessed without proper approval or knowledge, leading to damage.	Utilities will only be removed and relocated with proper agency approvals and permits.	Along the alignment	Permits and locations will be established and included in construction drawing and relocation will take place prior to construction	BR, Utility agencies and possibly the ESSU	BR
1.6 Safety and level crossings	Inadequate planning and design consideration could add to the risk of accidents at level crossings and even cause train operating problems.	The level crossing issue will be carefully examined by BR and 3 grade separated crossings will be built, as well as line of sight improvement and aggregation of crossings considered. At the unauthorised crossings (mostly footpaths) BR will erect warning and safety signs. The construction of grade separated crossings will continue as local communities express the need to BR.	All level crossings	Design and decision during the pre-construction period and later as traffic builds and problems arise, grade separations will be added by BR	BR and Local officials, as well as the Engineer	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
1.7 Station Design	Inadequate sizing of station sewage and garbage management facilities, leading to chronic problems during the operation of the new and upgraded stations.	The design of all waste, water and access for each station and building will be designed using the estimated passenger through-put at each station.	For All stations and buildings	During the Project feasibility or design stages	The Engineer	BR
1.8 Labour Standards	Poorly prepared labour standards, leading to infractions regarding child labour, minimum wage, forced labour, and unsanitary working conditions and unsafe water supplies	BR will strictly adhere to ILO conventions concerning these issues, i.e. Conventions C182, C138, C131 and C105	At all construction sites, and at all times	At all times and for the entire construction period	BR. The Engineer and Contractor	BR and its ESSU-if in place
2.0 CONSTRUCTION PERIOD						
2.1 The Environmental Management Implementation Work Schedule (EMWS)	Contractor does not prepare a work plan defining details on when mitigation and monitoring actions are to take place, in relation to the work and then the EMP requirements are not implemented properly.	The Engineer will assist contractor prepare the EMWS before the commencement of construction works and monitor compliance with the schedule during construction.	N/A	Within 1 month of the successful contractor mobilising	Contractor, with help from Engineer	Engineer
2.2 Air Quality and Dust	The ambient levels of COx, NOx, SOx, $PM_{2.5}$, and PM_{10} may increase at busy stations and construction areas leading to temporary and localised air pollution.	A dust suppression programme will be used at all times during construction of embankment, stations, buildings and placement of ballast. Dust suppression to include watering and suppression equipment on batch plant, as well as vehicle speed restrictions to ≤35km/h., and finally rapid revegetation including grass seeding. Ambient air quality for SO_2, NO_2 and $PM_{2.5}$, PM_{10} at busy stations, buildings and construction sites will be conducted quarterly throughout the construction period at sensitive receptors, and immediate remedial	All sites , as identified in the monitoring table of this EMP	One sampling station per location. Each sampling station will include two sampling points per station. Quarterly monitoring over the four years construction period	Contractor	Engineer

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		actions taken if 2 exceedance s occur at any one site.				
2.3 Topography, Landscape and Soils						
2.3.1 Erosion	Clearing topsoil in proposed embankment area can lead to erosion and dust from unprotected storage sites. The erosion risk at embankment slopes is possible. Gully erosion along the exposed track slope during rainy season may damage field crops in adjacent areas.	Topsoil storage areas must be protected during the dry season from wind erosion by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections.	At all work sites, in the impact corridor	Inspection as part of the engineering inspection cycle and reporting to Engineer	Contractor	Engineer
2.3.2 Topography and Landscape changes	Visual intrusion from large piles of embankment materials and ballast obstructing views and excavation along the edge of the alignment leaving large unsafe holes is possible.	Embankment site to be planted with trees to promote natural vegetation; as well as fast growing grasses such as Vetiver/Napitar. Material stockpiles will be removed as soon as work is completed and the area re-landscaped. Same applies to borrow areas.	Embankment areas of the proposed alignment area as well as at all borrow areas used during construction	Throughout the construction period.	Contractor	Engineer
2.4 Water Resources						
2.4.1 Hydrology and Surface Water Quality	i) Earthwork activities during construction of embankment may result in drainage congestion ii) The surface water at workers camp and Project site areas may be pollute due to faecal, organic and other contamination. Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	i) Ensure all earthworks are constructed according to design and specifications. ii) Wastes, effluents and other contaminant materials at camp/work sites to be stored, handled, transported and disposed in planned manners. Garbage disposal service to be provided, Concrete refuse reused or disposed of without habitat loss. All	Throughout alignment earthworks inspection at all work camps and major construction sites such as bridges and embankments as well as at culvert construction sites. WQ sampling at all bridge construction sites-upstream and downstream—See EMP	Inspect weekly to ensure that drainage is properly maintained at earthworks. WQ sampling to be conducted quarterly or as agreed jointly between the engineer and the contractor	Contractor	Engineer

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. A quarterly surface water quality testing programme will be completed during the construction period.	monitoring Table and Contract specifications Section H. for details			
2.4.2 Groundwater	The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers' camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).	Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. Wells used for drinking will be tested every year to ensure portability.	Throughout the alignment, especially where the pile drilling to 30 m depth is conducted, and where any new wells were dug.	If new wells are dug and toilet facilities built near wells	Specialised subcontract or to collect and test samples	Engineer
2.5 Waste Management						
2.5.1 Waste Management	Construction camp wastes are often poorly managed and can lead to chronic pollution of surface and groundwater.	Contain all solid wastes at designated location within construction sites. Service machinery and vehicles strictly at designated maintenance workshops where waste oils and lubricants be collected and recycled. The monthly monitoring report will provide compliance update.	All construction camp and contractor operations areas, such as batch plants and maintenance yards	Complete monthly and submit to Engineer	Contractor	Engineer
2.5.2 Train Station and Building Demolition Waste Materials	11 stations and small structures in the Project site will need to be demolished and reconstructed. Waste material piles, dust and noise from such operations will be significant.	Waste materials will be recycled/reused where possible, and then sold if remaining waste cannot be used. And dust and noise will be minimised by using methods	Each station and building during the demolition and construction time.	Prior to start of demolition of any station and building	Contractor	Engineer

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		that generate the least amount of dust, i.e., as much manual labour as possible and equipment will be operated only between 07:00 and 18:30. A record of the construction waste disposal will be prepared for each station and building.				
2.6 Noise	Work sites will be noisy due to pile driving, operation, power generator, rock crushing/ batch plants and movement of construction vehicles, as well as the constant movement of trains along the existing line.	Keep noise pollution at ≤ 60 dB (Bangladesh standard) levels at mosque, school, populated area and other sensitive sites by erection of temporary baffles if needed. Work timing restrictions if noise levels, based on field measures indicate exceedances. Contractor will also be required to use only well maintained functioning equipment.	Three sensitive sites (PRCs) within 50 m of rail RoW in the vicinity of the sensitive receptors.	Throughout the construction period, and based on noise measurement surveys	Contractor	Engineer
2.7 Terrestrial and Aquatic Flora and Fauna	The clearing of about 55,000 trees and associated understory vegetation and construction of a 2-6 m high and 70 km long embankment will reduce the habitat for mostly birdlife, given that the aquatic and terrestrial faunal is limited to common and pest species. Small patches of wetland will be covered by the embankment.	A rapid revegetation/tree replanting programme will permit the rail-side habitat to recover quickly. The rapid reestablishment of pre-construction surface draining will help to bring wet areas, somewhat reduced (marginally) by the new embankment to re-establish pre-construction habitat conditions.	Along the alignment, trees cutting, camp areas and River site areas	Throughout the construction period	Contractor	Engineer
2.8. Land Use	The most significant potential impacts on land use in the study area will be the removal of around 60 ha of agricultural land (primarily rice paddy) for the construction of the proposed rail embankment, station access roads and associated facilities.	Land acquisition / requisition will be in accordance with the laws of Bangladesh and as defined in the Project LAP and RP, which specifies a grievance mechanism and timetable for implementation.	At all Project sites, particularly land acquisition areas and affected agricultural land embankments, rebuilt stations, buildings, and at temporary sub grade	Throughout the construction period	Contractor	Engineer

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
			storage areas			
2.9 Heritage and Culture	3 PCR's and 45 CPRs could be affected by the rail line construction	BR has defined a plan to prevent undue damage to these sites and the contractor must follow this plan closely (see Item 1.4 above). RP also outlines procedures to relocate sensitive CPRs like grave yards. These procedures are to be followed during construction.	At all heritage and cultural sites	Throughout the construction period	Contractor	Engineer
2.10 Health , Safety and Contractor Camp						
2.10.1 Health and vector borne diseases	Personal and occupational health issues, stemming from unsanitary toilet facilities, lack of potable water and sanitary washing areas can lead to common disease outbreaks in work camps. Construction work creates areas for water to form stagnant puddles; Also, water can collect in old equipment waste tire dump stored outside, ideal breeding areas for malaria and dengue mosquitoes.	Undertake checks and cleaning at all sites and areas where clean conditions should exist. Provision of potable water, sanitary toilet facilities and hygienic accommodation for workers at camp sites. All potable water supplies will be tested semi-annually. Provision of First-Aid facility and ensure it is maintained cleaned and disinfected. Inspect for stagnant water and puddles every 3-days, including stored construction materials such as tires and old oil drums, and empty to prevent water ponding.	All work sites and particularly at Construction camps All work areas and camps	At least 2 times per week	Contractor	Engineer
2.10.2 Worksite safety management	Poor safety oversight and management of the worksites by the contractor leads to accidents and unsafe working conditions	Construct fences separating the construction sites at rail stations from public access, and manage train movements in collaboration with BR dispatch staff. Contractors must at all times insure the local people needing to move from one side of the construction	All construction areas	Conduct inspections as part of regular inspections or at least every 2 months	The Engineer	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		area to another can do so effectively and without undue delay.				
2.10.3 HIV awareness	Due to influx of workers in the Project area, AIDS/HIV may spread in local community	Workers health training programme will be organised during the construction period to be made aware of health and hygienic issues. Training to be provided by health specialist such as a local NGO.	All construction camps	Conduct at work camps every six months	Contractor	Engineer
2.11 Occupational Health and Safety at Construction Sites						
2.11.1-Personal Safety Equipment (PSE)	Contractor does not provide adequate PSE or properly enforces its use, leading to accidents	Workers will be provided with appropriate personal protection equipment, such as safety boots, helmets, gloves, protective clothing, goggles and ear protection, and contractor will enforce its use, so long as safety does not suffer due to this action	At all constriction sites	Continuously throughout the construction years	Contractor	Engineer
2.11.2-Safety Training	Lack of safety training by contractor can lead to accidents and lost productivity	Construction workers will be trained in general health and safety matters and on specific hazards (including train operation) of their work	All construction areas	At all times during construction	Contractor	Engineer
2.11.3-Labour Standards	Labour standards ignored or not complied with leading to infractions of basic labour standards as defined by ILO conventions as listed in Item 1.8 above.	*Hire, use of benefit from child labour*-Child labour (as defined by ILO Conventions 138 and 182) means that no workers under the age of 14 may be hired as general labours, and no workers under the age of 17 are to be hired for hazardous jobs such work on scaffolding, an structures elevated above the ground, etc. *Bonded labour*-All forms of bonded labour and forced labour, as defined	All work areas under the contractor and subcontractor control	Throughout the construction period	Contractor	Engineer and BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		by ILO Conventions 29 and 105 will not be permitted. Forced labour, including prison or debt bondage labour; lending of money (debt slavery) or withholding of remuneration or identity papers by employers or outside recruiters, will be not be permitted on any work sites. *Equal treatment, equal opportunity*- BR expects the contractors to hire workers on the basis of skill and ability to work. There must be equal treatment and equal opportunity (ILO Conventions 100 and 111, and ILO Code of Practice for HIV/AIDS 85) for all who seek employment. No discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; no sexual harassment Minimum wage- BR expects the contractor to pay all labourers and employees according to minimum wage standards as defined in the Bangladesh Labour Act.				
2.12 Construction Period Decommissioning	Inspection of sites to be decommissioned by contractor, are: • work camps; fuels storage areas • waste dump sites; construct access roads If not undertaken this would lead to chronic environmental problems due to	Undertaken a detailed inspection of the construction area after decommissioning to verify compliance with environmental safeguards.	The entire length of the line	Within the first quarter of operations and before final payment made to contractor.	Contractor BR or its ESSU if in place	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
	lack of proper clean-up.					
2.13 Environmental Monitoring and Completion Reporting	Contractor fails to prepare a summary report defining the mitigation and monitoring actions completed and what needs to be continued during the Operating period. The result is a failed or weakened environmental safeguards programme.	Prepare Monthly and Quarterly Monitoring Report. Prepare a completion report and deliver to the Engineer.	N/A	Monitoring Reports to be prepared monthly and quarterly; Completion Report to be completed within the last 4 months of the Project	Contractor and The Engineer	Engineer
3. OPERATING PERIOD						
3.1 The Construction Period Environ. Completion Report	Failure to adopt measures and continue mitigation actions defined in the Construction Period Environmental Completion report.	Assign environmental expertise to obtain, examine and take necessary actions defined in the Construction Period Environmental Completion Report.	For the entire construction area	Prior to the final payment to the contractor	Contractor BR or its ESSU if in place	BR
3.2 Air Quality and Dust	Degradation of local air quality due to increased train traffic.	Maintain locomotives according to factory specifications and accelerate decommissioning of > 20 year old locomotives.	N/A	Semi-annual air quality monitoring years 1, 3 and 5 of the operating period and if I regular exceedances are found remedial actions to improve air quality will be implemented.	BR or its ESSU if in place	BR
3.3 Spill Contingency Planning	Contamination of soil caused due to spillage of petroleum derivatives and other chemicals due to rail accidents	Rail accidents and spills will be managed through a spill contingency protocol.to be distributed to all BR management for implementation if a spill should occur.	Applicable to all rail line operations, not just this Project	To be developed during the pre-construction period and implemented as soon as it is completed used as a spill protection handbook	BR or its ESSU if in place	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
3.4 Noise	Noise monitoring has identified a number of sensitive sites where noise is already exceeding accepted levels and as such creating more discomfort for local people.	Install noise attenuation features at the sensitive sites - e.g. berms. Plantings and noise barriers-based on noise monitoring recognising existing train noise. Also noise attenuation equipment such as disk brakes rubber padding under the rail and a rail grinding schedule. If the noise level added from the operation of the second rail line exceeds 3 dBA (on top of background noise) immediate measures such as noise barriers, noise shielding window panes etc. must be taken.	To be determined, based on construction period measurements, but generally around schools close-by residences and hospitals and shops	Monitoring to be conducted during years 1,3 and 5 of the operating period, based on the sample design defined in this EIA	BR or its ESSU if in place	BR
3.5 Employment and Livelihood and ribbon settlement	The area along the rail line will attract settlements and undesired structures including commercial facilities particularly near the railway stations.	Since this is very difficult to control, BR will as a minimum post the area as private property and permitting only agricultural activities and no structures	Along the entire corridor	Posting at start of operating period in all areas were line passes through urban areas.	BR or its ESSU if in place	BR
3.6 Level crossings	Inadequate safety at level crossings and stations leading to more frequent accidents, with vehicles, people and livestock. Also see Item 1.6 in this table.	Reduce Vehicle - train and human and livestock train accident by implementing sufficient awareness programme. Identify known hotspots and improve signage and crossing structures/signalling. Installation of modern railway crossing and gate systems. Pedestrian foot over bridges will be building and increased as the need develops. Training to crossing guards will be enhanced	Mainly at authorised and unauthorised level crossing areas	Based on ongoing BR studies and consultation with local authorities	BR or its ESSU if in place	BR

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
3.7 Waste Management	Garbage is thrown and sewage discharged onto the tracks from trains leads to chronic contamination of the corridor and nearby drainage areas	Provide adequate waste bins and waste biodegradable waste bags on trains. Establish strict fines for garbage throwing and provide abundant bins on trains and signs. Initiate a programme of retrofitting trains with sewage collection tanks to be pumped out at collection stations for delivery to STPs.	Along the entire operating rail line	At all times	BR or its ESSU if in place	BR
3.8 Station Operations	New or upgraded stations will attract more passengers and as such more waste to manage. No sewage or waste management will quickly lead to highly polluted conditions in around the stations.	Waste management system will be inspected by BR weekly to ensure sanitary operations and each station will have janitorial staff. Problems identified will be immediately rectified by add services, upgraded waste management systems or both	At all stations	At all times with weekly inspection and dedicated janitorial services	BR or its ESSU if in place, and dedicated janitorial service at each station	BR

Table 39: Environmental Management Plan: Monitoring Table (EMoT)

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
1. PRE-CONSTRUCTION PERIOD					
1.1 Trees and Landscape	Confirm that a tree cutting and replanting programme is fully ready to implement when during the pre-construction period Confirm that this planting plan is in agreement with local people who lost food-trees.	During the pre-construction period and throughout the pre-construction and construction period	Tree replanting plan and record of compensation	BR, Local NGOs and BR's ESSU if available	BR
1.2 Land acquisition		During the design phase when final alignment is fixed	Revised alignment drawings at sensitive areas, as defined by local communities	BR, Local NGOs and BR's ESSU if available	BR
1.3 Employment and Livelihood				BR, Local NGOs and BR's ESSU if available	BR
1.4 Heritage and Culture	Inspect relocation and protection activates during this period and obtain written agreement from local communities	Inspect at least 2 times during relocation activities	Record of inspection on file	LNGO and BR's ESSU. See Details in LAP and RP	BR
1.5 Infrastructure - Utility Relocation	Confirm that permits. Location and relocation site plans have been approved	Prior to construction starting	Inspection report including copies of permits or records on file	BR, utility agencies and possibly the ESSU	BR
1.6 Safety and level crossings					
1.7 Station and Building Design	Compare the estimate of station passenger/user throughput for 2030 and check that sewage. Garbage and water system can cope with the discharges	Prior to final design being completed	A table showing each station, daily passenger loads. waste production and waste management capacity	The Engineer	BR

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
1.8 Labour Standards	Confirm that these standards are specifically incorporated into the contract documents either as clauses or by appending this EMP to the contract.	Once as contract documentation is being prepared	Copy of the contract section that has the labour standards section or a listing if the section and clause numbers on file	BR. The Engineer and Contractor	BR and its ESSU-if in place
2. CONSTRUCTION PERIOD					
2.1 The Environmental Management Implementation Work Schedule (EMWS)	Confirm that a EMWS has been prepared	Within 1 month of contractor mobilisation	EMWS-draft	Contractor, with help from Engineer	Engineer
2.2 Air Quality and Dust	Throughout the construction period: During dry season undertake air quality testing for CO, SO_2, NO_2, $PM_{2.5}$, and PM_{10} at major bridge and station and buildings construction sites.	At 10 construction sites, quarterly for four years	Completed data table and short analysis	Contractor	Engineer
2.3 Topography, Landscape and Soils					
2.3.1 Erosion	Inspect storage areas and record state of storage areas with 2 photos, and then report level of erosion and on-site dust. Inspect embankment construction areas for erosion and repair	As part of regular construction inspection, likely weekly	Description of status of erosion control measures being implemented	Contractor	Engineer
2.3.2 Topography and Landscape changes	Inspection/ consultation with adjacent households and railway authority to get opinion on work being completed.	Construction and operation stage/ Mthly inspection / Long term	Include as part of inspection report or checklist	Contractor	Engineer
2.4 Water Resources					
2.4.1 Hydrology and Surface Water Quality	Site inspection Inspect waste and field management at camps and record actions taken when non-compliance recorded	Construction and operation stage/ Monthly inspection/ Long term Complete WQ testing at stations	inspection reporting or checklist Include as part of inspection report or checklist	Contractor	Engineer

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
	Conduct surface water quality testing for pH, Turbidity, Temperature, DO, BOD5, COD, TSS, TDS, oil and grease	as defined in this EIA, quarterly for 4 years for the 9 parameters listed:	Test data., presented in tabular/organised form		
2.4.2 Groundwater	where the pile drilling to 30 m depth is conducted and/or where any new wells are dug or a well becomes a camp potable water supply , testing to be undertaken for pH, TP, Mn, Fe, As, Oil and Grease and E. Coli,.	Every 6 months or until difference over 1 years does not vary significantly, Reduced to once a year.	Completed data table and short analysis	Contractor	Engineer
2.5 Waste Management					
2.5.1 Waste Management	Undertake good housekeeping practices inspection at least every 2 months and report results and record what actions taken to mitigate	At all times	Weekly compliance checklist	Contractor	Engineer
2.5.2 Rail Station and Structure Demolition Waste Materials	Complete monitoring check for each station and structure demolition operation, comment on dust	Prior to start and during demolition of any station	Checklist report showing proper demolition waste management and control of haz. materials	Contractor	Engineer
2.6 Noise	Sample at least 6 sensitive sites within 50 m of rail RoW in the vicinity of the sensitive receptors. Take noise readings at sensitive receptors 2 times/day during full work activities, 2 times/month	Sample Quarterly for the construction period	Data summarised in to monthly data summary table (one row per date sampled)	Contractor	Engineer
2.7 Terrestrial and Aquatic Flora and Fauna	As part of the monthly site inspection, examine embankments, new stations and buildings, subgrade storage areas, to confirm these facilities are not contributing to environmental degradation	Monthly throughout the construction period	Checklist as part of the monthly reporting	Contractor	Engineer
2.8 Land Use	No action needed since this is being thoroughly monitored and completed by the social safeguards team and local NGOs	Prior to start of clearing work at any proposed construction area	Copy of reporting from social safeguards team	Local NGO and BR's ESSU if available and Engineer	BR

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
		where land acquisition is involved			
2.9 Heritage and Culture	For 3 PCRs, discuss actions taken with local officials and get agreement that this is appropriate. For 45 other sites visit each to establish that appropriate actions are being taken or planned	Prior to the start of construction	Inspection report or checklist	Contractor Engineer	BR
2.10 Health, Safety and Contractor Camp					
2.10.1 Health and vector borne diseases	Undertake checks at all sites and instruct contractors to take immediate action if non-compliance identified	Weekly inspection	Compliance checklist	Contractor Engineers BR's ESSU if operational	BR
2.10.2 Worksite safety management	Conduct regular inspection	Once a month	Record compliance for inclusion in audit report	Contractor Engineers BR's ESSU if operational	BR
2.10.3 HIV awareness	As part of monthly inspection review all OHS requirement looking for poor enforcement as well distribution of proper safety equipment	Every 6 months for the 4-year construction period	Record of compliance for inclusion in audit report	Contractor Engineers And health specialist	BR
2.11 Occupational Health and Safety					
2.11.1-Personal Safety Equipment (PSE)	Conduct monthly check to review PSE compliance.	Monthly at all work sites	Confirmation note in inspection reporting documentation	Contractor Engineer	Engineer
2.11.2-Safety Training					
2.11.3-Labour Standards	Random check of 10% of the labour force, and check that labourers have contract letters and check age, working conditions and documentation	At start of Construction period and complete every 6 months	Findings as a table of compliance— against the 4 main factors		

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
2.12 Construction Period Decommissioning	Inspect to be sure that work camps, fuel storage areas, waste dumps, toilet facilities, construction access roads have been properly decommissioned and no chronic contamination is likely.	Prior to contractors final payment	Decommissioning checklist	Contractor/Engineer and BR's ESSU if available	BR
2.13 Environmental Monitoring and Completion Reporting	Collect monitoring and completion reports and confirm compliance	Monitoring Report (every month and quarter) and Completion Report (Once at the end of construction period)	Report during and after completion of mitigation and monitoring actions specified in the EMP	Contractor	Engineer
3.0 OPERATING PERIOD					
3.1 The Construction Period Environmental Completion Report	Record that the report in in the hands those responsible for maintaining existing measures and completing those required	Once prior to final payment to contractor	Completion report in file	Contractor/Engineers and BR's ESSU	BR
3.2 Air Quality and Dust	Undertake air quality monitoring at 4 of stations sampled during the construction period and sample CO, SO_2, NO_2 and PM2.5 and PM10	Sample 2 times/year for years 1,3, and 5 two samples per station or 16 samples per year	Annual air quality table and analysis	BR or BR's ESSU if available	BR
3.3 Spill Contingency Planning	Prepare and implement Spill contingency plan in hand	Prepared as soon as operations begin	The spill contingency plan and distributed to rail operations units	BR or BR's ESSU if available	BR
3.4 Noise	Noise measurements to be continued at noise sensitive sites as defined during pre-construction and construction measurements—2 times/year at 8 sites along	2 times per year for operating years 1, 3 and 5.	Annual noise measurement tables, highlighting exceedances.	BR or BR's ESSU if available	BR
3.5 Employment and Livelihood and ribbon settlement	Inspect to be sure that basic actions as defined have been taken and that removed signs are replaced	As part of operating inspection by BR	Record of removal actions and photos	BR or its ESSU if in place	BR

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
3.6 Level crossings	Inspect crossings at least 1/yr to check operation and collect incident records for each crossing	Quarterly and for years 1,3 and 5	Inspection report/tables	BR or its ESSU if in place	BR
3.7 Waste Management	Count bins and extent of maintenance Record no of trains with Sewage tanks	Take annual inventory	Data table record of counts , location and time	BR or its ESSU if in place	BR
3.8 Station Operations	Inspect that station waste facilities; capable of handling user wastes and the services are being employed to maintain the stations. Collect 4-5 photo records	Semi annually	Inspection report and photo record for the new and remodelled stations	BR or its ESSU if in place, and dedicated janitorial service at each station	BR

6) The Gumti River Bridge

336. The Bridge alignment will be within 20 m of the existing bridge and will require new four new piers, two of them in water, the others on intermittent floodplain. The work will require the placement of bored piles, using drilling mud followed by the pile casings being filled with concrete in situ. All other elements of the bridge, namely the pile caps and piers will be fixed in place on top of the pile cap. The bridge deck, consisting or precast concrete lengths as well as steel girders will be set in place from the bridge as it is built and from the water using special cranes on a barge.

337. There therefore is danger that this work could result in temporary water pollution, temporary diversion of fish away from the construction activity, some erosion risk due to poorly designed shoreline erosion control features and shore pier design and placement and periodic disruption of river vessel traffic during hours when bridge sections are being placed over the navigable section of the river.

338. For the Tongi-Bhairab Railway Project now under way and with very similar conditions, the issue of fish displacement and effects was investigated by conducting a number of fisher interviews, or creel surveys, to establish if the fishing during construction had changed appreciably from pre-construction catches[59]. The interviews confirmed that there was no negative impact and in fact the numbers of fish caught increased marginally, likely stimulated by the disturbance of sediment, the release of nutrients and the attraction of phytoplankton and other food for a greater number of fish taken by the fishers. This finding will be monitored for the Gumti River crossing, by first determining if fishing takes place and if so, conducting the creel surveys.

339. The Gumti River Bridge EMP (**Table 40** and **Table 41**) lists each of these potential problem areas in detail and presents a set of mitigative actions and monitoring requirement that BR will include as part of the construction period monitoring programme.

[59] SMEC Ltd., 2013. Annual Environmental Due Diligence Audit of the Tongi-Bhairab Double Tracking Construction Project. Available from BR and Engineers, SMEC Pty, Ltd., Dhaka Project Office.

Table 40: Environmental Management Plan for Bridge Sites: Mitigative Table

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/Duration	Who will Implement	Who will Supervise
1.0 PRE-CONSTRUCTION PERIOD						
1.1 The Bridge siting	The impact at bridge site during pre-construction will be due to poor decisions about where to pace the work camps and the concrete and steel fabrication areas as well as the batch plant(s)	BR to consult with local communities and remain within all GoB standards re sighting and proper planning for work camp. Agreeing on sites based on these boundaries.	Along the alignment	Early during the Feasibility Study work or detailed design	BR	BR
1.2 Provision of Early Training	Contractor not given adequate training on environmental safeguards when working in and over flowing waters, leading to construction period impacts affecting river hydrology and water quality	BR to provide a training as part of the overall 1.5-day training workshop to be delivered before construction begins	Location to be confirmed	Prior to the contractor mobilising to the field	BR	BR
2.0 CONSTRUCTION PERIOD						
2.1 Navigation channel disruption	Temporary disruptions and navigation danger caused at bridge sites.	Movements of vessels in the nav. channel of the Gumti River will be maintained through careful planning of work in the span over the navigation channel to low traffic times and with traffic controls in place. The contractor will place channel boundary buoys in the water to guide vessels around danger areas.	Focused in the navigation channel of Gumti River Bridge, as it an important navigable waterway for local vessels, and is crossed by the rail line	Inspect weekly to ensure that navigability is properly maintained at earthworks do not interfere with water depth or channel width	Contractor	Engineer
2.2 Surface water quality and Hydrology	Construction of piers, especially in the permanent water sections could result on temporary erosion and deposition actions, potentially impacting shoreline and causing water pollution.	The bridges and culverts are to be designed and built properly in line with existing bridges and latest hydrological model results. The water quality testing will focus in sampling both upstream and downstream of the bridge construction site to establish change over time. Parameters to be tested as shown in main EMP	Take samples U/S and D/S of the Gumti Bridge,	Monthly during construction period at all pile drilling sites. After Yr. 1 the data will be assessed and if acceptable, the sampling will be reduced to quarterly, as for all other stations	Contractor	Engineer

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Location	Timing/Duration	Who will Implement	Who will Supervise
3.0 OPERATING PERIOD						
3.1 River trainings works (RTW)	Drainage congestion, soil erosion and siltation	Undertake visual inspection of erosion on embankment of RTW slopes particularly any gully erosion and formulate and implement erosion protection measures, such bioengineering techniques, fascines, as appropriate. Regular monitoring of morphological changes of river at the bridge locations due to RTW, rand formulate remedial bank protection work immediately for implementation, particularly during monsoon.	At Gumti Bridge	During and after construction of Bridge	BR	BR
3.2 Sewage disposal	Raw sewage disposed of directly from toilet onto tracks, and while over water into the river	Install holding tanks and dispose of sewage at pump-out facilities to STPs. This is being examined by BR	All trains operating on this line	At all times	BR	BR

Table 41: Environmental Management Plan for Bridge Sites: Monitoring Table (EMoT)

Monitoring Parameters	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Supervises
1. PRE-CONSTRUCTION PERIOD					
1.1 The Bridge siting	Examine site plans and establish if further protection of land and structures is possible	See Project LAP for details	See Project LAP for details	NOG and BR	BR
1.2 Provision of Early Training	Obtain record of training session and component dealing with bridges	Immediately after the workshop	Training material package on file with BR	BR	BR
2. CONSTRUCTION PERIOD					
2.1 Loss of navigation route	Visual inspection to confirm that alternative navigation channels are properly marked and maintained	Monthly	Include as part of inspection report or checklist	Contractor	Engineer
2.2 Surface water quality and Hydrology	Site inspection and include bridge U/S and D/S sample stations in the water quality testing for pH, Turbidity, Temperature, DO, BOD5, COD, TSS, TDS, oil and grease	Construction stage according to survey schedule defined in EIA	Monthly data tables and indication if any exceedances	Contractor	Engineers
3. OPERATING PERIOD					
3.1 river training works (RTW)				BR's ESSU	BR
3.2 Sewage disposal	NA	NA	NA	BR	BR

B. EMP Implementation Costs

340. The Cost of implementing the EMP mitigation and monitoring measures, including the tree replanting programme (account for >35% of the total cost) was estimated at USD 890,082 (**Table 42)**. The construction period with its tree planting programme, which is USD 252,500 will account for the majority of the cost, totalling USD 748,300 .

341. Once all engineering costs and other normal expenditures associated with the construction work are better identified, a recalculation of the costs will be undertaken and a revised figure applied to the work.

342. Pre-construction will result in land disturbance, demolision of existing buildings, and structures, dust suppression, debris management and tree clearing, however this will be mitigated by minimising disturbed areas and implementing an extensive tree planning programme. A lump sum budget of USD 5,000 has been allocated to manage the impacts during pre-construction period.

343. The cost of implementing the EMP monitoring measures, air quality and noise impacts, during the Operating Period was estimated at USD 86,400.

Table 42: Cost Estimate of an Environmental and Social Safeguards Unit within BR

		1st Year Monitoring with Cost Breakdown							Recurring Cost in Subsequent Years						
	Note: P=People														
EMP No.	**Mitigation and Monitoring Items As listed in the EMP**	No. Cycles	No. Days /cycle	No.P. BD	No. P Int'l.	Unit cost Int'l.	Unit Cost BD.	Total Cost for 1st Year	Total Cost for 2nd Year	Total Cost for 3rd Year	Total Cost for 4th Year	Total Cost for 5th Year	Total Cost for 6th Year	Total Cost for 7th Year	Total Costs for Mitigation and Monitoring
	Cost of Environmental Professionals	2	30	2	1	$10,000.00	$2,500.00	$12,500.00	$12,500.00	$12,500.00	$12,500.00				$50,000.00
1	**Pre-Construction Period**														
1.1	Tree planting - see below .	0	0	0	0	0	0	$0.00	$0.00	$0.00	$0.00				$0.00
1.2-1.8	Building demolision, debris mgt, dust suspension, and etc	Lump sum						$5,000.00							$5,000.00
	Other one-time costs	N. Stn.	No. of Samp./stn	No. of times/ yr.	Samp. Size	Unit cost									
	Other Expenses (workshop materials, particip. Costs & per diems)														
	Pre-construction Period Total							$5,000.00							$0.00
2	**Construction Period**														
2.2	Air quality monitoring	10	2	3	60	800		$48,000.00	$48,000.00	$48,000.00	$48,000.00				$192,000.00
2.3.1	Top soil stripping, storage and reuse for landscaping of resettlement areas	included in engineering costy													
2.3.2	Regular w atering, grass turfing	included in engineering costy													
2.4.1	Surface w ater monitoring	10	2	3	60	600		$36,000.00	$36,000.00	$36,000.00	$36,000.00				$144,000.00
2.4.2	Groundw ater quality monitoring	10	2	3	60	600		$36,000.00	$36,000.00	$36,000.00	$36,000.00				$144,000.00
2.6	Noise Quality Monitoring	10	2	3	60	100		$6,000.00	$6,000.00	$6,000.00	$6,000.00				$24,000.00
2.5	Waste Management							$5,000.00	$5,000.00	$5,000.00	$5,000.00				$20,000.00
2.7	Tree Replacement Program							$25,250.00	$60,750.00	$60,750.00	$60,750.00				$207,500.00
	Other Expenses														
	Transportation							$1,500.00	$1,500.00	$1,500.00	$1,500.00				$6,000.00
	Communication							$200.00	$200.00	$200.00	$200.00				$800.00
	Other Expenses														
	Reporting and Report Production							$2,500.00	$2,500.00	$2,500.00	$2,500.00				$10,000.00
	Construction Period Total							$160,450.00	$195,950.00	$195,950.00	$195,950.00				$748,300.0
	Operating Period														
3.3	Ambient Air Quality Monitoring (once at 1 site)	8	2	2	32	800						$25,600.00	$25,600.00	$25,600.00	$76,800.00
	Surface Water (once at 12 sites)														
3.6	Noise Level Monitoring (once at 3 sites)	8	2	2	32	100						$3,200.00	$3,200.00	$3,200.00	$9,600.00
	Misc														
	Expenses														
	Operation Period Total							$0.00				$28,800.00	$28,800.00	$28,800.00	$86,400.00
	Unusual Expenses							$0.00							$0.00
								$0.00							$0.00
	Total Unusual Expenses							$0.00							0.00
	Total Costs:														**884,700.00**
	All MITIGATION AND MONITORING		**Totals**												
	Pre Construction Period		**$5,000**												
	Construction		**$748,300**												
	Operating Period		**$86,400**												
	Total		**$839,700**												
	Contingency Costs @ 6% of total		**$50,382**												
	Grand Total		**$890,082**												

344. Once all engineering costs and other normal expenditures associated with the construction work are better identified, a recalculation of the costs will be undertaken and a revised figure applied to the work.

345. The other major cost not defined here is the cost of the establishment and operation of BR's ESSU, which is estimated at around USD 115,620 equivalent to BDT 9 million the first year of operations and around USD 101,600 equivalent to BDT 8 million annual operating costs (**Table 44**).

X. INSTITUTIONAL CAPACITY, NEEDS, AND PROPOSED STRENGTHENING

A. The Existing Conditions

346. Bangladesh Railway has at least ten large projects which will require the implementation of multi-year mitigative and monitoring actions, as defined in the Environmental Impact Assessments completed for each Project. BR will be responsible for insuring that pre-construction, construction and operating period mitigative and monitoring tasks defined the EIA's EMP are completed on time and in a technically sound manner. During pre-construction and construction a Consultant will assist, but during the operating period BR will be directly responsible. Operating period mitigation and monitoring will require field surveys, analyses and technical reporting to ADB and or DoE. Further, throughout the Project BR will be receiving environmental reports from the contractor as well as the Engineer, and will need to evaluate and comment on the technical content, etc. As of January 2014, BR had no such capability, and will fill this gap by upgrading of skills in all aspects of environmental management, environmental assessment, environmental sampling design, data collection, analysis, and reporting and EMP implementation.

B. BR's Environmental and Social Safeguards Unit (ESSU)

1) General

347. The Project loan has provision for the creation of an environmental safeguards unit within BR to manage the safeguard issues arising from the seven projects now underway. Given that other projects are in the pipeline, the intent is to integrate this unit into the operations of BR, making environmental safeguards a business-as-usual task; not an add-on.

348. BR will create at least one environmental safeguards staff position and two if its mitigation and monitoring duties will not be given to Consultant. In addition to staff, the ESSU will also need basic equipment to undertaken monitoring as well as staff training. It will be the staff's duty to monitor the contractors environmental compliance, complete all the operating period EMP requirements and insure that reporting is technically robust and meets ADB and GoB standards.

349. Generally, the 7 RCI-Rail subprojects will require between three and six years of construction mitigation and monitoring (undertaken mainly by the contractor(s) activity and the implementation of around three years during the operating period. The reporting requirements will also be considerable. Therefore, the unit must be trained and ready to take on varied tasks and be able to report to international donors.

350. In addition to basic equipment, a smoothly functioning ESSU will need a dedicated space/base within BR from which to undertake its work. To that end a set of tasks needs to be undertaken (**Table 43**) prior to the start of construction, to establish the ESSU with a view to having it operate for the duration of the RCI-Rail project's construction period and well into the operating period.

Table 43: Action Plan – Establishing an ESSU

Task No.	Task and Deliverable
i	Prepare a ToR for the ESSU and staff; then obtain approval of BR
ii	Establish a budget, provide basic set of equipment and assign staff to the ESSU.
iii	Train ESSU staff and key BR managers (1-2 months) in environmental management and all EIA-related tasks.
iv	Prepare training materials for contractor training and deliver 2 day workshop
v	With assistance from the Construction Supervision Consultant (The Engineer), appointed by BR, the ESSU must undertake operating-period compliance monitoring and reporting according to EMP specifications. For the construction period this involves only compliance monitoring of the contractor (s).
vi	Prepare and deliver annual training programme for contractors
vii	Prepare semi-annual and annual monitoring reporting during the construction and operating periods to ADB

Source: Prepared by the Environment team of RCIP-Rail

2) Estimated Costs

351. BR's present approach to loan implementation is to appoint an Engineer, (sometimes referred to as the Construction Supervision Engineer or Consultant) who handles all day-to day dealings with contractor(s), including enforcing the mitigative and monitoring tasks defined in the Project EMP and agreed to by the contractor in the contract specifications. The ESSU needs to be able to implement pre-construction period mitigative and monitoring measures as defined in the environmental documents and to guide the contractor(s) in preparing for the environmental work to be undertaken during the construction period. During the construction period the ESSU's would be required to participate in the compliance monitoring effort as the representative of the executing agency, albeit the majority of the work would be done by the Engineer and the Contractor.

352. An indicative budget for an ESSU, with environmental safeguards staff[60] of one, responsible for all RCIP Projects, and including the capital expenditures to provide the necessary gear, will be BDT 63.82 million for all seven projects and seven operating years (**Table 44**). The cost for an operating social safeguards cell within the ESSU has yet to be estimated.

Table 44: Establishment and Operation of ESSU for Seven Year (BDT)

Costs	Unit cost	The Unit	No Units	First Year Budget	Estimated 7 Years Input
Non-reoccurring, Entire ESSU					
Computers and software	79,000	Taka	3	237,000	79,000
Data storage system	31,600	Taka	1	31,600	
Laser Printer/scanner	47,400	Taka	1	47,400	94,800
Smart Phones with Digital camera, recording and GPS functions	52,350	Taka	3	157,050	
Other Technical Equipment	632,000	Taka	01-Jan	632,000	
SUBTOTAL				**1,105,050**	**173,800**
Reoccurring , (annual), all Projects					
ESSU Staff 1 (based on present	150,000	Months	12	1,800,000	

[60] Single staff members are very risky since if anything should happen or the situation changes and that staff member leaves, the ESSU will be left without any staff.

Costs	Unit cost	The Unit	No Units	First Year Budget	Estimated 7 Years Input
payments staff costs)					
Administrative support (annual)	-			Provided by BR	
EIA Field Survey and other assistance, Per Diem, etc. (all Projects)	100,000	trips	14	1,400,000	
Field audit trip; 4 /yr to 7 Subproject for one person and 5 days per Project	17,000	trips	196	3,332,000	
Per diems	1,975	Days	70	138,250	
Field Transportation Costs (Implementation)	47,400	Months	6	284,400	
Office Operation and consumables	125,000	No.	1	125,000	
Driver	300,000	yr	1	300,000	
Annual Training programme (without International involved)***	632,000	Lump sum all	1	632,000	
Vehicle rental/use (part time)	--	months	6	Provided by BR	
Annual Reoccurring Costs				8,011650	
First Year Total Budget				9,116,700	
Estimated TOTAL budget of 7 years for all Projects				63,817,900	

Source: RCIP-Rail estimates
Note: costs for the social safeguards staffing and expenses need to be added

3) Functions

353. All rail projects require the ESSU to deliver operating period monitoring, data analysis and reporting, and be able to present information to senior staff, etc. During the construction period, the ESSU will function in an oversight mode, supervising and interacting with the Consultant, contractors, and donors. Over time the ESSU will become the environmental decision point for all BR projects and will be the lease/ communicate most closely with DoE. The staff assigned to the ESSU will have a background in environmental management and assessment and be required to receive intensive training, and once trained deliver workshops etc. to staff and contractors.

354. **Content and Delivery of Training -** The ESSU will focus on building environmental awareness among the BR engineering staff running specific projects, provide technical advice on environmental issues, prepare screenings of proposed undertakings, giving BR managers early warnings on a red-flag issues. Once the ESSU has a technical staff of two or more. It will be expected to deliver this sort of awareness raising and decision shaping advice to Regions and UPs. A parallel and essential task will be to confirm the environmental and social safeguards capability of contractors and to assist them with implement EMPs, LAPs and RPs and making sure that they have all key documentation before mobilisation and that they are aware of the safeguard clauses in the contract(s) they have signed.

355. Finally the ESSU will need to monitor delivery of environmental safeguard requirements in relation to BOQ payments and provide this record to the Project's Chief Engineer.

C. Involvement of Local Government in Environmental Issues

356. The Project which will take four years to construct and will have ten monitoring stations, possibly two in prefabrication yards and two in proposed EMO building area. Therefore, it is essential to involve local government and other Divisional /District

agencies to support Bangladesh Railway for implementation of environmental management and monitoring plan of the Project. It was understand from the seven public consultation meetings that local government has limited capacity and knowledge on environmental issues. However, head of all local governments showed their interest to be involved in any environmental and social issues raised by local communities.

XI. IMPLEMENTATION ARRANGEMENTS

A. General

357. Environmental management involves highly specialised multidisciplinary and multi sectorial-activities different from construction of bridge, embankments, railway tracks and associated components. Therefore the implementation or execution of the mitigative and monitoring actions as defined in the environmental assessment's EMP needs to be well understood.

358. The EMP for this Project, a major deliverable of the EIA, has (Chapter IX) actions that must be undertaken starting during the pre-construction period through to the operating stage. The EMP contains an indication of who is responsible to execute and oversee each task but no specific implementation schedule. In this chapter the details of the implementation are presented. BR's Project Manager shall have the overall decision-making responsibility for EA studies, including the implementation of the EMP.

359. The BR's, Director General responsible for this Project will set the policies and strategies for all the environmental issues, with most decisions delegated to the Project's General Manager. These managers take advice from the TA Consultant and work jointly to deliver the environmental safeguards. In Chapter X, BR proposed to establish an internal Environmental and Social Safeguards Unit at BR Head Office in Dhaka, consisting of environmental and social safeguard specialist and other required personnel, taken from the available manpower under the existing setup of BR. These would them take over the monitoring role and deal directly with the Consultant and contractor.

B. Environmental Requirements and Implementation

360. During the construction period the work will be completed around 14 steps, and seven of them addressing environmental safeguards. The seven, shown in italics, and in green are:

1. Preparation of Tender Documents
2. *Completion of EIA and its EMP*
3. *Insertion of Environmental Clauses*
4. Invitation to bid using approved documentation
5. Bid Evaluation, Clarifications and Contract Award
6. Relocation of involuntary resettlement
7. *Environmental Safeguards briefing and training of contractors*
8. Construction mobilisation work commences
9. *Contractor prepares Construction Environment Work Plan*
10. Work continues for four years until completed
11. *Monthly environmental compliance reporting by contractor*
12. *Contract Supervision Consultant - working with ESSU prepares construction period semi-annual monitoring summary*
13. Testing and Commissioning-end of construction
14. *Construction period Safeguards completion report/checklist*

361. A typical construction programme is shown in **Annex 7**.

1) Pre-construction period

362. During the pre-construction period BR's GM has the final say when the pre-construction mitigative and monitoring actions defined in the EMP and any additional applicable environmental clauses listed in Section H of the Contract specifications are implemented by BR.

2) Construction period

363. The construction supervision Consultant (The Engineer) takes over the role of the TA Consultant and administers all aspects of the construction contract. The Engineer's environmental safeguards specialist would work with the Contractor to insure full compliance and delivery of construction period mitigation and monitoring measures. It is at this point that the ESSU's work begins and staff work closely with the Engineer to learn the compliance monitoring tasks and oversee the data analysis and report delivery. It is during this stage that BR's Comilla staff become directly involved and work with the Engineer and the ESSU to address any contractor non-compliance issues.

3) Operating period

364. Once the rail line becomes operational, BR retains the major responsibility for undertaking those tasks defined in the operating period section of the EMP. The day-to-day involvement of the Regional BR staff will be required at this stage. Environmental specialist (Manager, ESSU) of the ESSU will be responsible for approvals and follow up of any documents, compliance issues, and issues raised by local people.

C. Roles and Responsibilities

365. **BR's Environmental and Social Safeguards Unit (ESSU) -** If staff complement can be provided BR will establish the ESSU with major functions of overseeing the implementation of the EMP and the environmental clauses contained in the construction contract. The ESSU will be working alone during the pre-construction and operating periods and with the Engineer during the construction period.

366. **Construction Supervision Consultant (The Engineer) -** The proposed framework for implementation of the Project shall utilise consultancy services from both international and national companies for the overall management and supervision of construction work and for preparation of the EA documents.

367. **Contractor(s) -** International and national contractors shall carry out construction of double line and upgrade of existing line between Akhaura and Laksam under the specified contract agreements. The environmental awareness creation, particularly regarding the direct construction impacts and specifically for health, pollution, and safety issues will be needed. The need to develop self-regulation of the contractors will have to be emphasised, with the consultants' supervisory roles that to be in conformity with the relevant Environmental Clauses (Section 6, Subsection H of contract technical specifications) incorporated in the construction contracts and national legislation.

368. **Other GoB Organisations -** The organisations involved in implementing the Project are Department of Environment (DoE), Bangladesh Water Development Board (BWDB), Roads and Highways Department (RHD) and Department of Forest (DF), Local Government Engineering Department (LGED), Bangladesh Inland Water Transport Authority (BIWTA), and local administration (UNO, DC, Police, etc.). They will have only supporting roles as required.

369. **ADB and EIB -** ADB's and EIB's will carry out oversight, advisory, enforcement as well as periodic inspection and auditing roles relating to safeguards. Both donors will be expected to assist BR and the Engineer with underscoring the need for credible

environmental management to GoB officials when effort to improve performance is needed.

D. Reporting

370. Three types of environmental reports shall be prepared in English, containing air, noise, and water quality data, maps, diagrams, plans, tables etc. The following reports have to be prepared and submitted by Contractor and Engineer.

- Monthly Environmental Inspection Report;
- Quarterly Environmental Inspections and Reports; and
- Annual Monitoring Reports.

1) Monthly Environmental Inspection Report

371. During the construction period, environmental reporting will be required monthly, which will be prepared by the Contractor. The monthly reports will consist of a completed environmental compliance checklist developed using the EMP and approved by the Engineer such that actions necessary for each relevant mitigative action is identified and a summary of all actions recorded.

372. Where a monthly report is coincident with a quarterly and annual report, such monthly report shall be required but may be included with the respective quarterly and annual report.

2) Quarterly Environmental Inspections and Reports

373. During the construction period, environmental inspections and reporting will be required quarterly by the Contractor. The quarterly report shall consist of a completed environmental compliance checklist developed using the EMP and approved by the Engineer together with a summary of significant items from the current and previous two monthly reports with an indication of trends, either positively or negatively. This Project has 10 predefined stations for which environmental data have been collected during pre-construction and construction periods. The EIA contains mandatory sampling specifications that the Contractor will be required to adhere to. At the training workshop the Contractor will receive survey worksheets that will need to be completed for each sampling station and submitted to the Engineer.

374. Where a quarterly report is coincident with annual report, such quarterly report shall be required but may be included with the respective annual report.

375. The Engineer reserves the right to increase the frequency of sampling subject to a review, which may be carried out at any time during the Construction period of the results as an additional work. If the additional sampling indicates that the Contractor's activities have caused the need for additional sampling, then there will be no additional payment to the Contractor. If it is determined by the Engineer that the Contractor is not responsible for the need for additional sampling then payment will be made from EMP **monitoring budget.**

3) Quarterly Compliance Monitoring Checklist

376. This checklist consists of the slightly reworked EMoT table found with the EMP, with a couple of columns replaced requiring comment on actions taken, when and by whom and what the observable results have been during that quarter. A sample form is included as **Annex 12**.

4) Annual Monitoring Reports

377. The Engineer shall prepare an Annual Report to include details of all environment related activities together with a summary of all tests and monitoring activities and conclusions to include assessment of effectiveness of current monitoring activities, possible changes in construction methodologies and any other thing(s) which may contribute to a reduction in environmental impact.

XII. CONCLUSIONS AND RECOMMENDATIONS

378. The Project involves the doubling of an existing rail line, therefore new impacts are really the magnification of impacts taking place along the corridor for many decades given that it has been in operation since the late 19th Century.

379. Most of the impacts associated with the Project will occur during the construction period since a large and high embankment, between 2-6 m, will be put in place and requiring millions of tons of fill material. Much of that will be dredged from nearby rivers and pumped as slurry to the work sites. As much ballast as possible will be hauled on roads. The problems arising when the contractor does not follow environmentally responsible operating procedures or does not provide proper housing or clean, hygienic quarters for the workers is also addressed in detail.

380. The EIA identified eight mitigative actions needing to be addressed during the pre-construction period, another 20 during the construction period and eight during the operating period of the new rail line. To track the mitigation work an air, noise and surface water quality monitoring programme will be started during the construction period and carried through into the operating period for operating years 1, 3 and 5.

381. There is little chance that impacts will extend much beyond the 50 or 100 m wide corridor of impact centred over the rail line, given that all work will be strictly confined to the railways existing Right of Way.

382. Careful implementation of the pre-construction mitigative measure will make the likelihood or scale of the construction period impacts less.

383. The climate risk associated with sea level rise and the need to adjust bridge deck clearances was calculated and found to be negligible given the distance of the bridges to a location where sea level rise can be measured (Meghna River estuary).

384. The fuel saving, due to diversion of road use to rail travel during the first year of full operation, i.e., 2020, will be 10,743,000 litre of fuel, with 6 additional train sets operating on the new track. However by 2023, with 44 train sets in operation, estimated fuel saving will be around 54 million litres/year (including the added fuel used by the larger number of train sets. After 2023 the diversion is expected to have peaked and no increase is predicted through 2044.

385. Based on these data, the diverted traffic in 2023, when 44 train sets are in operation an estimated 64.4 million litres of diesel fuel per year would be saved, with a net benefit, once train consumption is deducted, of 53.78 million litres/year. A net fuel saving of 53.78 million litres per year, translates into a saving of 145,000 metric tonnes of equivalent CO_2 per year. (using an equivalent CO_2 emissions factor of 2.69 kg CO_2 per litre of diesel fuel consumed).

386. The establishment of BR's Environmental and Social Management Unit will be essential and will make the job of implementing environmental safeguards much easier and more credible, since some expertise will reside in BR, overseeing the entire EIA procedure, instead of it being only with outside Consultant.

387. Social impacts especially associated with land acquisition and the need to relocate people and to use productive agricultural lands, will be significant and will affect thousands of people. The procedure for determining entitlement and compensation is defined in the LAP and RP documents which the Project must follow closely. The actions defined in these two documents are being implemented by BR.

388. No red-flag environmental safeguard issues were identified and all likely impacts can be prevented or mitigated to an acceptable level.

389. BR will fully implement the EIA's environmental management plan and quarterly monitoring will be used to adjust the monitoring programme defined in the EIA. Should problems be noted with the data, BR will recommend immediate actions, and the annual reporting will be used to adjust mitigative actions. These activities, coupled with the timely reporting will provide the appropriate level of environmental oversight and demonstrate to the ADB that the natural environment is being protected while the rail line is built and the system becomes operational.

390. The potential impacts on the Gumti River Bridge were examined, focusing on pile driving in water, use of drilling lubricants, work camp operation near the shore and work over a navigation channel. To address these issues a separate EMP, designed to deal with all possible effects that might endanger the river's aquatic environment, was prepared and will be implemented.

391. The reconstruction of 11 stations and construction of other buildings will be managed through a programme of maximum recycling of materials and management of all wastes and dust suppression. The design of each station and building, to accommodate sewage, waste, water, lighting and universal design features has been completed as a separate report and will be verified as part of the pre-construction check by BR and its ESSU.

392. BR concludes that this EIA is complete and addresses all relevant likely impacts and proposes a full set of time-bounded mitigative and monitoring actions, including assignment of responsibility. The application of the detailed EMP will ensure that the nature and socio-cultural environment are not unduly affected by the work or the operation of the second line. Therefore BR recommends that an environmental approval be granted by DoE, and that no additional studies be required.

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Annexes

(320)

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

Memo No: DoE/Clearance/5209/2013/ 153-A Date: 08 July, 2013

Subject: Approval of Terms of Reference for Environmental Impact Assessment (EIA) in favour of Regional Cooperation and Integration Project : Rail Component.

Ref: Your application received on 06 May 2013.

With reference to your letter dated 06.05.2013 for the subject mentioned above, the Department of Environment hereby gives approval of TOR for Environmental Impact Assessment (EIA) in favour of Regional Cooperation and Integration Project (RCIP) : Rail Component subject to fulfilling the following terms and conditions.

i. Bangladesh Railway shall conduct a comprehensive Environmental Impact Assessment (EIA) study considering the overall activity of each sub-component under RCIP-Rail Component of the said Project in accordance with the TOR submitted to the DOE and additional suggestions provided herein.

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

1. Executive summary
2. Introduction: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)

4a. Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation.

4b. Project schedule: The phase and timing for development of the project.

4c. Resources and utilities demand: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

4d. Map and survey information
Location map, Cadastral map showing land plots (project and adjacent area), Geological map showing geological units, fault zone, and other natural features.

5. Baseline Environmental Condition should include, inter alia, following:
   - Physical Environment : Geology, Topology, Geomorphology, Soils, Meteorology, and Hydrology.
   - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
   - Environment Quality : Air, Water, Soil and Sediment Quality.

6. Socio-economic environment should include, inter alia, following:
   - Population: Demographic profile and ethnic composition
   - Settlement and housing
   - Traffic and transport
   - Public utilities: water supply, sanitation and solid waste
   - Economy and employment: employment structure and cultural issues in employment
   - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors.

1/2

7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).

   In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

8. Management Plan/Procedures:

   For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not capable of mitigation, will be identified as residual impacts Both technical and financial plans shall be incorporated for proposed mitigation measures..
   An outline of the Environmental Management Plan shall be developed for the project.
   In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).

9. Consultation with Stakeholders/Public Consultation (ensures that consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)

   Beneficial Impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)

10. Conclusion and Recommendations

iii. Without approval of EIA report by the Department of Environment, Bangladesh Railway shall not be able to open L/C in favor of importable machineries.

iv. Without obtaining Environmental Clearance, Bangladesh Railway shall not start operation of each sub-component under RCIP-Rail Component of this project.

v. Bangladesh Railway shall submit the EIA along with a filled-in application for Environmental Clearance in prescribed form, the applicable fee in a treasury chalan, the no objection certificates (NOCs) from the local authority, NOC from forest department (if it is required in case of cutting any forested plant/trees-private or public), NOC in favor of Cutting/Dressing (if it is required) of Hill/Hillock from the concerned authority and NOC from other relevant agencies for operational activity etc. for each sub-component under RCIP-Rail Component of this project to the Head office of DOE in Dhaka with a copy to the concerned Divisional offices of DOE.

08.07.2013

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
and
Member Secretary
Environmental Clearance Committee
Phone # 8181778

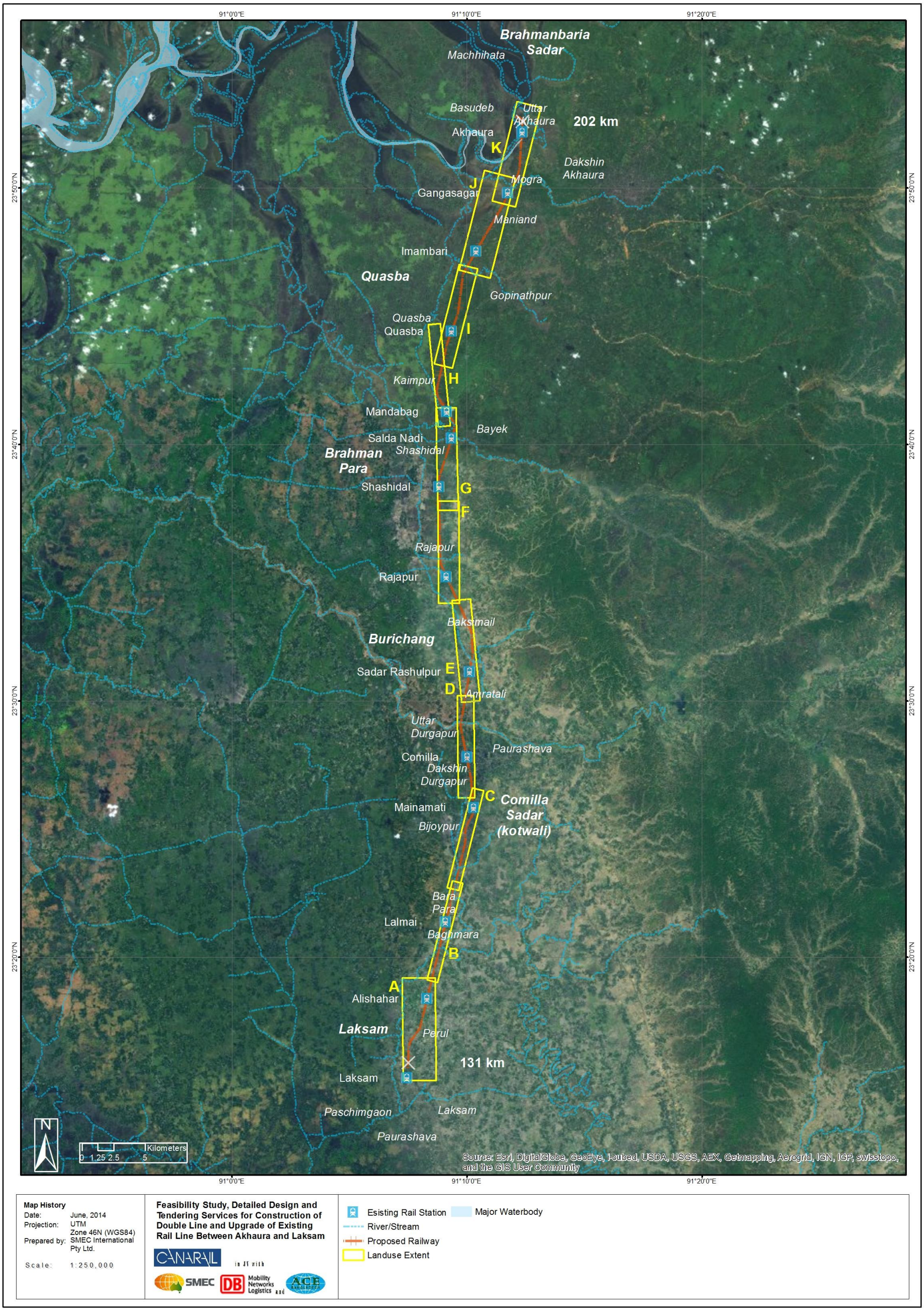
Mr. S. K. Chakraborty
Project Director & General Manage
Bangladesh Railway
Regional Cooperation and Integration Project (RCIP) : Rail Component
Rail Bhaba, 16, Abdul Gani Road, Dhaka.

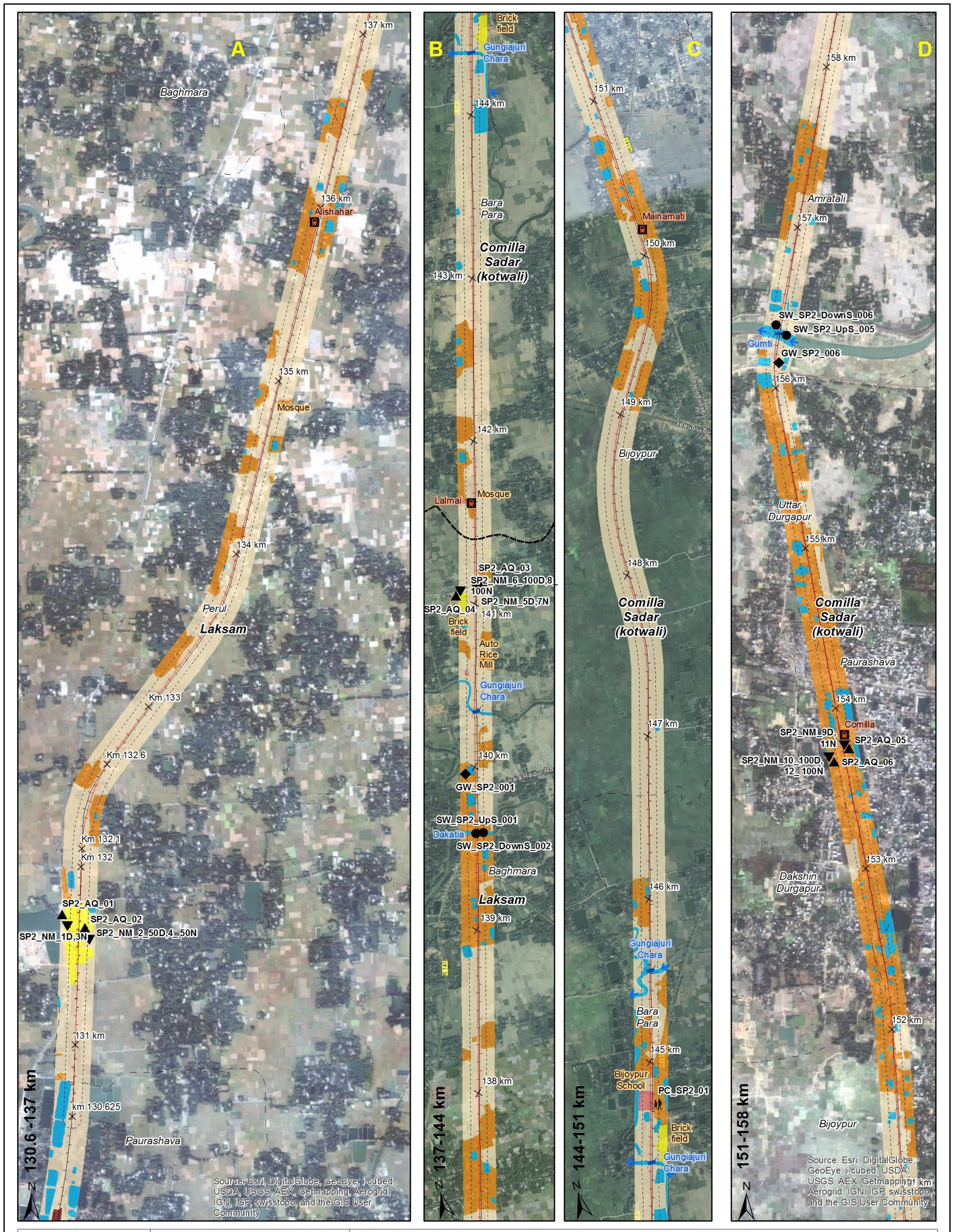
Copy Forwarded to :

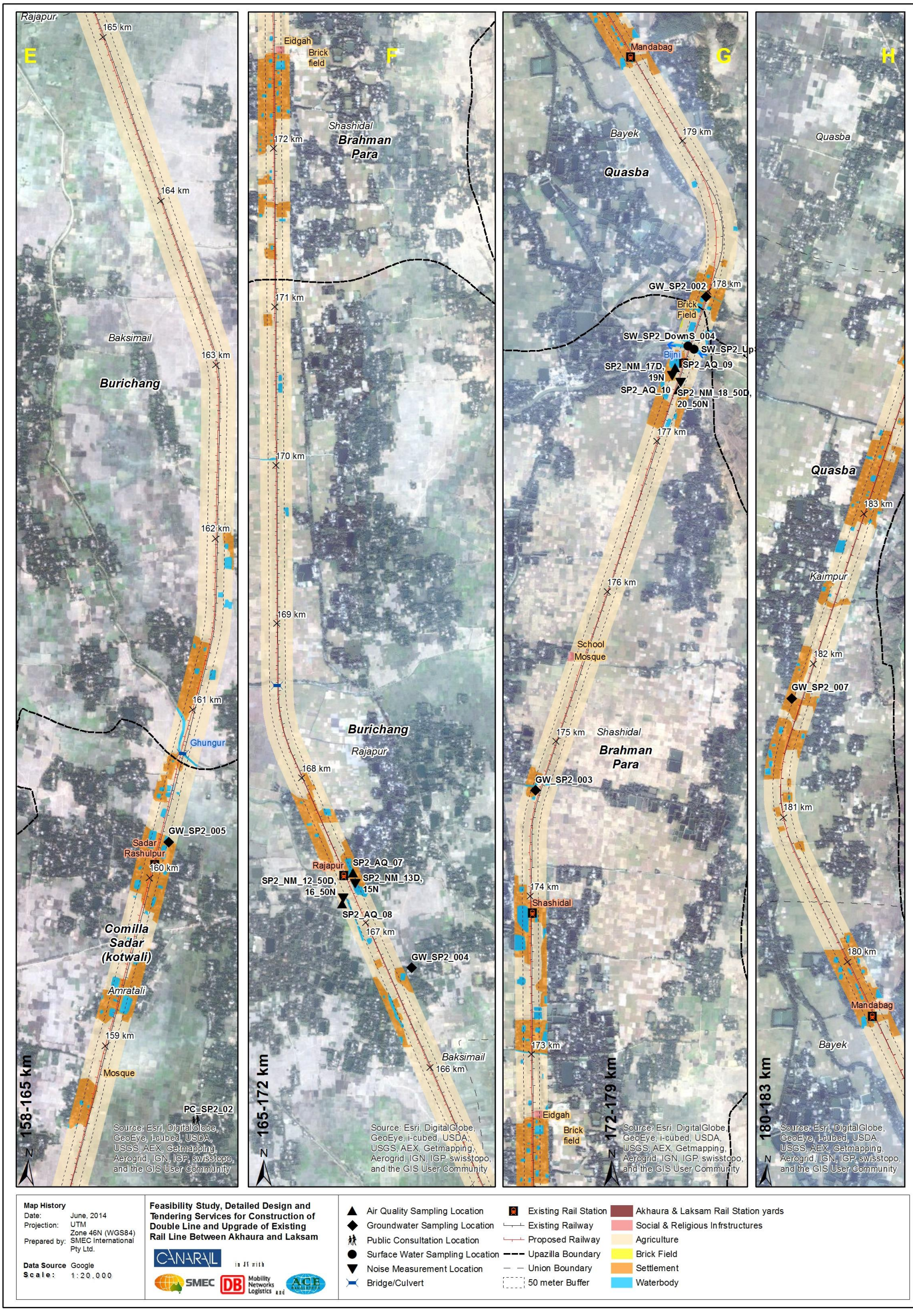
1) PS to Secretary, Ministry of Environment and Forest, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka/Chittagong/Rajshahi/Khulna Divisional Office, Dhaka/Chittagong/Rajshahi/Khulna.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

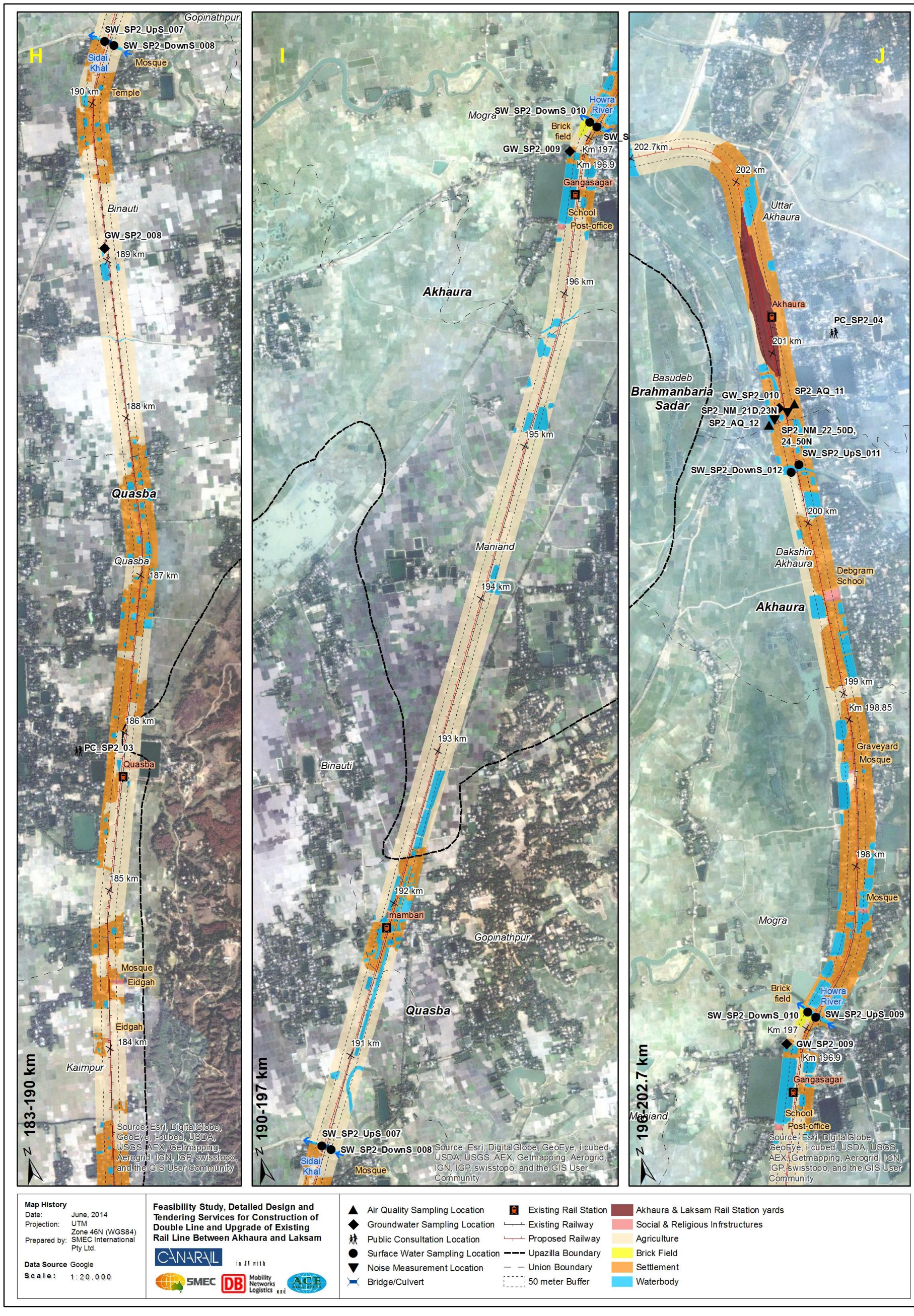
2/2

Annex 2: Land Use Strip Map Including Locations of Environmental Sampling and Public Consultations




A
B
C
D
137 km
136 km
Alishahar
135 km
Mosque
134 km
Perul
Laksam
Km 133
Km 132.6
Km 132.1
Km 132
SP2_AQ_01
SP2_AQ_02
SP2_NM_1D,3N
SP2_NM_2_50D,4_50N
131 km
km 130.625
Paurashava
130.6 -137 km
Brick field
Gungiajuri Chara
144 km
Bara Para
Comilla Sadar (kotwali)
143 km
142 km
Lalmai
Mosque
SP2_AQ_03
SP2_NM_6_100D,8_100N
SP2_AQ_04
SP2_NM_5D,7N
141 km
Brick field
Auto Rice Mill
Gungiajuri Chara
140 km
GW_SP2_001
SW_SP2_UpS_001
Dakatia
SW_SP2_DownS_002
Baghmara
Laksam
139 km
138 km
137-144 km
151 km
Mainamati
150 km
149 km
Bijoypur
148 km
Comilla Sadar (kotwali)
147 km
146 km
Gungiajuri Chara
Bara Para
145 km
Bijoypur School
PC_SP2_01
Brick field
Gungiajuri Chara
144-151 km
158 km
Amratali
157 km
SW_SP2_DownS_006
SW_SP2_UpS_005
Gumti
GW_SP2_006
156 km
Uttar Durgapur
155 km
Paurashava
154 km
Comilla
SP2_NM_9D,11N
SP2_AQ_05
SP2_NM_10_100D,12_100N
SP2_AQ_06
153 km
Dakshin Durgapur
152 km
Bijoypur
151-158 km
N
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Map History
Date: June, 2014
Projection: UTM Zone 46N (WGS84)
Prepared by: SMEC International Pty Ltd.
Data Source Google
Scale: 1:20,000
Feasibility Study, Detailed Design and Tendering Services for Construction of Double Line and Upgrade of Existing Rail Line Between Akhaura and Laksam
in JV with
Air Quality Sampling Location
Groundwater Sampling Location
Public Consultation Location
Surface Water Sampling Location
Noise Measurement Location
Bridge/Culvert
Esisting Rail Station
Existing Railway
Proposed Railway
Upazilla Boundary
Union Boundary
50 meter Buffer
Akhaura & Laksam Rail Station yards
Social & Religious Infrstructures
Agriculture
Brick Field
Settlement
Waterbody


E
Rajapur
165 km
164 km
Baksimail
163 km
Burichang
162 km
161 km
Ghungur
GW_SP2_005
Sadar
Rashulpur
160 km
Comilla
Sadar
(kotwali)
Amratali
159 km
Mosque
PC_SP2_02
158-165 km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
F
Eidgah
Brick field
Shashidal
Brahman Para
172 km
171 km
170 km
Burichang
Rajapur
169 km
168 km
Rajapur
SP2_AQ_07
SP2_NM_13D, 15N
SP2_NM_12_50D, 16_50N
SP2_AQ_08
167 km
GW_SP2_004
Baksimail
166 km
165-172 km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
G
Mandabag
Bayek
179 km
Quasba
GW_SP2_002
178 km
Brick Field
SW_SP2_DownS_004
SW_SP2_Up
Bijni
SP2_NM_17D, 19N
SP2_AQ_09
SP2_AQ_10
SP2_NM_18_50D, 20_50N
177 km
176 km
School
Mosque
175 km
Shashidal
Brahman Para
GW_SP2_003
174 km
Shashidal
173 km
Eidgah
Brick field
172-179 km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
H
Quasba
183 km
Quasba
Kaimpur
182 km
GW_SP2_007
181 km
180 km
Mandabag
Bayek
180-183 km
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
N
Map History
Date: June, 2014
Projection: UTM Zone 46N (WGS84)
Prepared by: SMEC International Pty Ltd.
Data Source Google
Scale: 1:20,000
Feasibility Study, Detailed Design and Tendering Services for Construction of Double Line and Upgrade of Existing Rail Line Between Akhaura and Laksam
in JV with
Air Quality Sampling Location
Groundwater Sampling Location
Public Consultation Location
Surface Water Sampling Location
Noise Measurement Location
Bridge/Culvert
Existing Rail Station
Existing Railway
Proposed Railway
Upazilla Boundary
Union Boundary
50 meter Buffer
Akhaura & Laksam Rail Station yards
Social & Religious Infrstructures
Agriculture
Brick Field
Settlement
Waterbody



Map History
Date: June, 2014
Projection: UTM Zone 46N (WGS84)
Prepared by: SMEC International Pty Ltd.

Data Source Google
Scale: 1:20,000

Feasibility Study, Detailed Design and Tendering Services for Construction of Double Line and Upgrade of Existing Rail Line Between Akhaura and Laksam

CANARAIL in JV with SMEC DB Mobility Networks Logistics and ACE BANGLADESH

- Air Quality Sampling Location
- Groundwater Sampling Location
- Public Consultation Location
- Surface Water Sampling Location
- Noise Measurement Location
- Bridge/Culvert
- Existing Rail Station
- Existing Railway
- Proposed Railway
- Upazilla Boundary
- Union Boundary
- 50 meter Buffer
- Akhaura & Laksam Rail Station yards
- Social & Religious Infrstructures
- Agriculture
- Brick Field
- Settlement
- Waterbody

CANARAIL in JV with SMEC DB Mobility Networks Logistics ACE BANGLADESH

Annex 3: Calibration Certificate of EPAS Air Quality Sampling Device

Certificate of Calibration

Certificate Number: EDCQP200-4.11.5

Environmental Devices Corporation certifies the EPAS is calibrated to publish specifications and NIST traceable.

Calibration Dust Specifications are NIST traceable using Coulter Mutisizer II e. ISO12103 –1 A2 Fine Test Dust.
Gas sensors are Calibrated against NIST/EPA traceable Calibration Gas using NIST primary Flow Standard: LFE774300.
Quality system standard to meet the requirements of ANSI/ASQC standard Q9000-1994 (ISO 9001), MIL-STD 45662A, and customer's specification if required.

Temperature = 22°C
Relative Humidity = 30%
Atmospheric Pressure = 760 mmHg
Measurement Uncertainty Estimated @ 95% Confidence Level (k=2)

Technician	Model	Serial Number	Date
Marc Blanchette	EPAS	913008	April 8, 2013

Next Calibration Due Date: April 2014

Checked By
Manager: Mark L. Sullivan

Calibration Span Accessory K 14,600 ug/m3 Model: CS-105

Environmental Devices Corporation
4 Wilder Drive Building #15
Plaistow, NH 03865
ISO-9001 Certified

PARTICULATES NOT OTHERWISE REGULATED, RESPIRABLE 0600

DEFINITION: aerosol collected by sampler with 4-µm median cut point | CAS: None | RTECS: None

METHOD: 0600, Issue 3 | **EVALUATION: FULL** | **Issue 1: 15 February 1984**
Issue 3: 15 January 1998

OSHA: 5 mg/m³
NIOSH: no REL
ACGIH: 3 mg/m³

PROPERTIES: contains no asbestos and quartz less than 1%; penetrates non-ciliated portions of respiratory system

SYNONYMS: nuisance dusts; particulates not otherwise classified

SAMPLING

SAMPLER: CYCLONE + FILTER (10-mm nylon cyclone, Higgins-Dewell [HD] cyclone, or Aluminum cyclone + tared 5-µm PVC membrane)

FLOW RATE: nylon cyclone: 1.7 L/min
HD cyclone: 2.2 L/min
Al cyclone: 2.5 L/min

VOL-MIN: 20 L @ 5 mg/m³
-MAX: 400 L

SHIPMENT: routine

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: 0.5 to 10 mg/m³ (lab and field)

BIAS: dependent on dust size distribution [1]

OVERALL PRECISION ($\hat{S}_{rT}$): dependent on size distribution [1,2]

ACCURACY: dependent on size distribution [1]

MEASUREMENT

TECHNIQUE: GRAVIMETRIC (FILTER WEIGHT)

ANALYTE: mass of respirable dust fraction

BALANCE: 0.001 mg sensitivity; use same balance before and after sample collection

CALIBRATION: National Institute of Standards and Technology Class S-1.1 or ASTM Class 1 weights

RANGE: 0.1 to 2 mg per sample

ESTIMATED LOD: 0.03 mg per sample

PRECISION: <10 µg with 0.001 mg sensitivity balance; <70 µg with 0.01 mg sensitivity balance [3]

APPLICABILITY: The working range is 0.5 to 10 mg/m³ for a 200-L air sample. The method measures the mass concentration of any non-volatile respirable dust. In addition to inert dusts [4], the method has been recommended for respirable coal dust. The method is biased in light of the recently adopted international definition of respirable dust, e.g., + +7% bias for non-diesel, coal mine dust [5].

INTERFERENCES: Larger than respirable particles (over 10 µm) have been found in some cases by microscopic analysis of cyclone filters. Over-sized particles in samples are known to be caused by inverting the cyclone assembly. Heavy dust loadings, fibers, and water-saturated dusts also interfere with the cyclone's size-selective properties. The use of conductive samplers is recommended to minimize particle charge effects.

OTHER METHODS: This method is based on and replaces Sampling Data Sheet #29.02 [6].

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.

PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)

ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh

HEADER/SAMPLE ID: 193166

SAMPLING AND TESTING DATE : 15/6/2013 (3:47 PM)

ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_01_ 3m (Lakhsam) 23°16'16.3"N 91°07'28.6"E	Instrument was set 3m and 100m away from the rail tracks and the highway road respectively which were very busy and noisy. Large number of vehices were passed the road and emited smoke. Besides this,there was a brick kiln which was closed due to rain.	Carbon Monoxide (CO)	$\mu g/m^3$	0	738	49	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	900	160	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	200	15.85	365
		Ozone (O_3)	$\mu g/m^3$	0	49	42	235
		Volatile Organic Compounds (VOC)	ppm	0	0.5	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	49	163	80.72	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	2	32	10.01	65
		Air Temperature	°C	20	35	27	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_1_ 3m	Day	45.1	65.4	57	50	60
SP2_NM_3_ 3m	Night	35.1	83.3	51	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 193170
SAMPLING AND TESTING DATE : 15/6/2013 (4:56 PM)
ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_02_ 100m (Lakhsam) 23°16'13.5"N 91°07'31.8"E	Instrument was set 100m away from the existing rail tracks. There were two trains were passed the instrument during data collection. Besides this,there was a brick kiln which was closed due to rain.	Carbon Monoxide (CO)	µg/m^3	0	41	10	40,000
		Nitric Oxide (NO)	µg/m^3	0	0	0	100
		Nitrogen Dioxide (NO_2)	µg/m^3	0	0	0	100
		Sulphur Dioxide (SO_2)	µg/m^3	0	137	37.14	365
		Ozone (O_3)	µg/m^3	39	49	45	235
		Volatile Organic Compounds (VOC)	ppm	0	0.28	0	NSE*
		Particulate Matter (PM_{10})	µg/m^3	40	55	48.12	150
		Particulate Matter ($PM_{2.5}$)	µg/m^3	0	3	0.57	65
		Air Temperature	°C	16	34	24	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_2_ 100m	Day	43.4	61.6	48	50	60
SP2_NM_4_ 100m	Night	37.5	74.4	47	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.

PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)

ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh

HEADER/SAMPLE ID: 193339

SAMPLING AND TESTING DATE : 17/6/2013 (9:27 AM)

ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_03_ 2m Lalmai) 23°21'06.2"N 91°09'02.2"E	Instrument was set within 2m of the existing rail tracks.There were two trains were passed the instrument during data acquisition. There was also a road intersection which was 2m away from the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	0	469	95	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	500	127	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	190	37.98	365
		Ozone (O_3)	$\mu g/m^3$	17	55	46	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	30	148	52.74	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	0	32	8.79	65
		Air Temperature	°C	22	29	26	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_5_ 2m	Day	44.3	73.5	57	50	60
SP2_NM_7_ 2m	Night	40.5	71.5	51	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan

Environmental Specialist

RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 193344
SAMPLING AND TESTING DATE : 17/6/2013 (10:35 AM)
ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_04_ 100m (Lalmai) 23°21'06.5"N 91°08'58.6"E	Instrument was set 100m away from the existing rail tracks. There were two trains were passed the instrument during data acquisition. There was also a brick kiln which was 50m away from the sampling location and it was closed due to rain.	Carbon Monoxide (CO)	$\mu g/m^3$	0	446	39	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	300	24	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	184	91.85	365
		Ozone (O_3)	$\mu g/m^3$	46	68	58	235
		Volatile Organic Compounds (VOC)	ppm	0	0.01	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	24	47	37.85	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	0	1	0.442	65
		Air Temperature	°C	15	25	20	

Noise Measurement Test Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_6_ 100m	Day	43.6	60.6	53	50	60
SP2_NM_8_ 100m	Night	38.4	67.7	47	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME:	A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME :	Regional Cooperation and Integration Project (Rail Component)
ADDRESS:	House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID:	193473
SAMPLING AND TESTING DATE :	18/6/2013 (5:25 PM)
ANALYSIS AND REPORTING DATE:	21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_05_3m (Comilla) 23 27'47.6"N 91 09'59.6"E	Instrument was set on the platform and 3m away from the existing railway tracks. It was a very busy and crowed place. However, there were two trains passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	0	530	118	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	600	157	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	64	1.25	365
		Ozone (O_3)	$\mu g/m^3$	0	49	25	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	45	172	76.95	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	0	20	5.04	65
		Air Temperature	°C	17	23	21	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_9_3m	Day	48.5	92.2	74	50	60
SP2_NM_11_3m	Night				40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME:	A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME :	Regional Cooperation and Integration Project (Rail Component)
ADDRESS:	House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID:	193547
SAMPLING AND TESTING DATE :	19/6/2013 (11:23 AM)
ANALYSIS AND REPORTING DATE:	21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_06_100m (Comilla) 23 27'44.7"N 91 09'57.1"E	Instrument was 100m away from the existing railway tracks and it was situated at the back side of station. However, there was a train passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	0	171	57	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	1000	135	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	49	2.7	365
		Ozone (O_3)	$\mu g/m^3$	29	62	48	235
		Volatile Organic Compounds (VOC)	ppm	0	0.14	0.018	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	30	105	48.45	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	2	25	8.64	65
		Air Temperature	°C	20	31	29	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_10_100m	Day	47.2	73.3	60	50	60
SP2_NM_12_100m	Night				40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.

PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)

ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh

HEADER/SAMPLE ID: 193377

SAMPLING AND TESTING DATE : 17/6/2013 (6:13 PM)

ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_07_2m (Rajapur) 23 34'50.9"N 91 09'08.5"E	Instrument was set at the station platform and 2m away from the existing railway tracks. However, there were three trains were passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	µg/m^3	0	538	239	40,000
		Nitric Oxide (NO)	µg/m^3	0	400	83	100
		Nitrogen Dioxide (NO_2)	µg/m^3	0	0	0	100
		Sulphur Dioxide (SO_2)	µg/m^3	0	0	0	365
		Ozone (O_3)	µg/m^3	20	36	29	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	µg/m^3	60	82	67.83	150
		Particulate Matter ($PM_{2.5}$)	µg/m^3	2	19	6.71	65
		Air Temperature	°C	13	20	18	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_13_2m	Day	45.1	86.4	78	50	60
SP2_NM_15_2m	Night	41	71.2	49	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME:	A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME :	Regional Cooperation and Integration Project (Rail Component)
ADDRESS:	House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID:	193441
SAMPLING AND TESTING DATE :	18/6/2013 (9:48 AM)
ANALYSIS AND REPORTING DATE:	21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_08_50m (Rajapur) 23 34'46.5"N 91 09'07.4"E	Instrument was set 50m and 3m away from the existing railway tracks and local sub-road respectively. However, there was a train passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	0	78	14	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	800	293	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	190	62.76	365
		Ozone (O_3)	$\mu g/m^3$	42	52	46	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	22	55	38.45	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	2	26	9.51	65
		Air Temperature	°C	26	35	31	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_12_50m	Day	44.1	86.7	60	50	60
SP2_NM_16_50m	Night	35.3	54.5	51	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME:	A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME :	Regional Cooperation and Integration Project (Rail Component)
ADDRESS:	House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID:	1934456
SAMPLING AND TESTING DATE :	18/6/2013 (1:33 PM)
ANALYSIS AND REPORTING DATE:	21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_09_4m (Salda Nadi) 23 40'10.6"N 91 09'19.6"E	Instrument was set 4m away from the existing railway tracks. However, there were two trains passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	0	448	83	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	1600	259	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	517	280.8	365
		Ozone (O_3)	$\mu g/m^3$	0	49	36	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	19	75	39.17	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	2	22	6.71	65
		Air Temperature	°C	22	28	26	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_17_4m	Day	47.7	57.1	54	50	60
SP2_NM_19_4m	Night				40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME:	A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME :	Regional Cooperation and Integration Project (Rail Component)
ADDRESS:	House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID:	1934451
SAMPLING AND TESTING DATE :	18/6/2013 (12:19 PM)
ANALYSIS AND REPORTING DATE:	21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_10_50m (Salda Nadi) 23 40'13.4"N 91 09'18.8"E	Instrument was set 50m and 2m away from the existing railway tracks and local sub-road respectively. process. There was a market place where tea stalls were emitted smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	0	2219	273	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	0	0	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	0	0	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	29	845	246.16	365
		Ozone (O_3)	$\mu g/m^3$	0	59	41	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	33	309	65.55	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	0	13	0.552	65
		Air Temperature	°C	26	28	27	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_18_50m	Day	50	60.1	53	50	60
SP2_NM_20_50m	Night				40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.

PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)

ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh

HEADER/SAMPLE ID: 193264

SAMPLING AND TESTING DATE : 16/6/2013 (3:23 PM)

ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_11_3m (Akhaura) 23°51'51.8"N 91°12'19.2"E	Instrument was set within 3m of the existing rail tracks. There were two trains were passed the instrument during data collection. Besides this,there was a small market nearby the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	0	1270	398	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	500	191	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	180	96.09	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	348	88.67	365
		Ozone (O_3)	$\mu g/m^3$	0	62	48	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	37	90	46.75	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	1	26	7.98	65
		Air Temperature	°C	29	35	32	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_21_3m	Day	46.6	76.3	58	50	60
SP2_NM_23_3m	Night	43.2	58	52	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.

PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)

ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh

HEADER/SAMPLE ID: 193271

SAMPLING AND TESTING DATE : 16/6/2013 (4:57 PM)

ANALYSIS AND REPORTING DATE: 21/07/2013

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ_12_50m (Akhaura) 23°51'50.6"N 91°12'16.6"E	Instrument was set on the storage building ground which was 50m away from the existing rail tracks. There was a small pond nearby the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	0	68	3	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	0	200	22	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	0	131	60.85	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	266	132.84	365
		Ozone (O_3)	$\mu g/m^3$	49	59	56	235
		Volatile Organic Compounds (VOC)	ppm	0	0	0	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	31	53	38.85	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	0	1	0.253	65
		Air Temperature	°C	30	32	31	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM_22_50m	Day	45.9	68.5	62	50	60
SP2_NM_24_50m	Night	41.7	72.4	53	40	50

* No standards established yet

Remarks*: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:

Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214764
SAMPLING AND TESTING DATE : 17/01/2014 (3:21 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_01_3m (Laksam) 23°16′16.3″N 91°07′28.6″E	Instrument was set 3m and 100m from the rail tracks and the highway road respectively which were very busy and noisy. Large number of vehices were passed the road and emited smoke. Besides this,there was a brick kiln which was functional and emitted black smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	674	4099	2737.84	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	128	1357	1109.22	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	117	1143	890.49	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	29	910	862.02	365
		Ozone (O_3)	$\mu g/m^3$	33	569	209.57	235
		Volatile Organic Compounds (VOC)	ppm	1	5.02	0.97	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	186	709	510.67	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	93	375	270.84	65
		Air Temperature	°C	17	23	20.15	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_1_3m	Day	46.2	69.2	53.32	50	60
SP2_NM2_3_3m	Night	34.6	71.7	44.9	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214769
SAMPLING AND TESTING DATE : 17/1/2014 (4:29 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_02_100m (Lakhsam) 23°16'13.5"N 91°07'31.8"E	Instrument was set 100m away from the existing rail tracks. There were two trains were passed the instrument during data collection. Besides this,there was a brick kiln which was functional and emitted black smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	976	5414	3197.64	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	164	1777	1567.21	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	121	1298	1091.83	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	67	1087	906.11	365
		Ozone (O_3)	$\mu g/m^3$	53	752	223.91	235
		Volatile Organic Compounds (VOC)	ppm	2	8.79	2.07	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	240	766	528.79	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	88	597	297.63	65
		Air Temperature	°C	15	23	19.50	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_2_100m	Day	47.2	72.7	58.13	50	60
SP2_NM2_4_100m	Night	52.7	76.9	58.8	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214752
SAMPLING AND TESTING DATE : 17/1/2014 (12:25 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_03 _2m (Lalmai) 23°21'06.2"N 91°09'02.2"E	Instrument was set within 2m of the existing rail tracks.There were two trains were passed the instrument during data acquisition. There was also a road intersection which was 2m away from the sampling location. Besides this,there was a brick kiln which was functional and emitted black smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	545	2960	1153.34	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	355	1861	1098.24	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	237	1407	949.52	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	89	810	642.13	365
		Ozone (O_3)	$\mu g/m^3$	59	465	153.69	235
		Volatile Organic Compounds (VOC)	ppm	1	3.96	0.82	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	146	510	479.32	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	96	384	201.29	65
		Air Temperature	°C	18	23	20.57	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_5_ _2m	Day	45.6	60.9	46.50	50	60
SP2_NM2_7_ _2m	Night	39.1	78.7	53.7	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214756
SAMPLING AND TESTING DATE : 17/1/2014 (1:32 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_04_ 100m (Lalmai) 23°21'06.5"N 91°08'58.6"E	Instrument was set 100m away from the existing rail tracks. There were two trains were passed the instrument during data acquisition. There was also a brick kiln which was 50m away from the sampling location and it was functional and emitted black smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	676	3899	1622.98	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	462	2017	1231.27	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	281	1588	1097.21	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	117	971	960.18	365
		Ozone (O_3)	$\mu g/m^3$	106	665	196.20	235
		Volatile Organic Compounds (VOC)	ppm	0.51	7.02	1.98	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	188	676	501.85	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	81	508	221.31	65
		Air Temperature	°C	19	24	21.12	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_6_ 100m	Day	44.7	66.6	55.03	50	60
SP2_NM2_8_ 100m	Night	39.8	81.6	53.7	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214737
SAMPLING AND TESTING DATE : 17/1/2014 (8:48 AM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_05_3m (Comilla) 23 27'47.6"N 91 09'59.6"E	Instrument was set on the platform and 3m away from the existing railway tracks. It was a very busy and crowed place. However, there were two trains passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	87	734	389.27	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	81	601	195.76	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	32	271	127.34	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	2	156	83.19	365
		Ozone (O_3)	$\mu g/m^3$	7	89	29.30	235
		Volatile Organic Compounds (VOC)	ppm	0	2.5	1.02	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	60	234	88.43	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	42	178	41.98	65
		Air Temperature	°C	12	17	14.69	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_9_3m	Day	51.4	91.7	74.71	50	60
SP2_NM2_11_3m	Night	49	83.3	64.2	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214741
SAMPLING AND TESTING DATE : 17/1/2014 (9:55 AM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_06o_100m (Comilla) 23 27'44.7"N 91 09'57.1"E	Instrument was 100m away from the existing railway tracks and it was situated at the back side of station. However, there was a train passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	96	708	310.95	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	57	514	179.34	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	27	201	105.73	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	1	147	61.29	365
		Ozone (O_3)	$\mu g/m^3$	5	33	17.89	235
		Volatile Organic Compounds (VOC)	ppm	0	2.23	0.77	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	45	140	71.37	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	37	129	38.42	65
		Air Temperature	°C	14	19	16.44	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_10_100m	Day	44.7	66.9	58.12	50	60
SP2_NM2_12_100m	Night	49.4	78.5	57.6	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214840
SAMPLING AND TESTING DATE : 18/01/2014 (9:38 AM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_07o 2m (Rajapur) 23 34'50.9"N 91 09'08.5"E	Instrument was set at the station platform and 2m away from the existing railway tracks. However, there were three trains were passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	716	1010	818.10	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	34	224	197.91	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	27	145	93.76	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	115	36.90	365
		Ozone (O_3)	$\mu g/m^3$	0	33	25.27	235
		Volatile Organic Compounds (VOC)	ppm	0	0.55	0.23	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	26	90	59.05	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	41	51	32.30	65
		Air Temperature	°C	13	17	15.11	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_13_2m	Day	46.6	53.5	49.90	50	60
SP2_NM2_15_2m	Night	33.1	77	55	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214835
SAMPLING AND TESTING DATE : 18/01/2014 (8:32 AM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_08_50m (Rajapur) 23 34'46.5"N 91 09'07.4"E	Instrument was set 50m and 3m away from the existing railway tracks and local sub-road respectively. However, there was a train passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	277	916	343.48	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	29	204	175.36	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	22	107	42.77	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	39	18.13	365
		Ozone (O_3)	$\mu g/m^3$	0	17	10.90	235
		Volatile Organic Compounds (VOC)	ppm	0	0.46	0.15	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	24	69	39.97	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	9	57	23.83	65
		Air Temperature	°C	12	16	14.79	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_12_50m	Day	49.3	57.5	53.50	50	60
SP2_NM2_16_50m	Night	37.8	69.3	51	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214854
SAMPLING AND TESTING DATE : 18/01/2014 (1:03 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_09_4m (Salda Nadi) 23 40'13.4"N 91 09'18.8"E	Instrument was set 4m away from the existing railway tracks. However, there were two trains passed through the sampling location during data acquisition process.	Carbon Monoxide (CO)	$\mu g/m^3$	90	1310	423.20	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	47	287	109.19	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	29	162	67.24	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	34	515	400.59	365
		Ozone (O_3)	$\mu g/m^3$	1	55	42.95	235
		Volatile Organic Compounds (VOC)	ppm	0	1.087	0.12	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	25	172	82.85	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	7	89	39.41	65
		Air Temperature	°C	15	24	18.94	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_17_4m	Day	47.3	74.4	61.80	50	60
SP2_NM2_19_4m	Night	42.1	80.8	59.8	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214850
SAMPLING AND TESTING DATE : 18/01/2014 (11:54 AM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_10_50m (Salda Nadi) 23 40'10.6"N 91 09'19.6"E	Instrument was set on the local sub-road and 50m away from the existing railway tracks. However, there were three trains passed through the sampling location during data acquisition process. Moreover, it was a market place where some restaurants were emitted smoke.	Carbon Monoxide (CO)	$\mu g/m^3$	74	1987	660.48	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	61	341	167.88	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	31	121	72.63	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	52	534	418.02	365
		Ozone (O_3)	$\mu g/m^3$	20	56	42.37	235
		Volatile Organic Compounds (VOC)	ppm	0	3.25	0.21	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	34	163	95.16	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	9	82	46.86	65
		Air Temperature	°C	15	23	18.43	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_18_50m	Day	45.3	79.4	59.69	50	60
SP2_NM2_20_50m	Night	44	85.8	64.8	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214871
SAMPLING AND TESTING DATE : 18/01/2014 (4:55 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_11_3m (Akhaura) 23°51'51.8"N 91°12'19.2"E	Instrument was set within 3m of the existing rail tracks. There were two trains were passed the instrument during data collection. Besides this,there was a small market nearby the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	822	1767	1369.97	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	67	348	129.73	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	30	171	88.51	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	164	42.67	365
		Ozone (O_3)	$\mu g/m^3$	0	101	61.47	235
		Volatile Organic Compounds (VOC)	ppm	0	0.36	0.17	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	136	337	192.98	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	52	204	112.85	65
		Air Temperature	°C	18	24	19.64	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_21_3m	Day	46.3	78.7	63.93	50	60
SP2_NM2_23_3m	Night	42.2	84.1	58.9	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

AMBIENT AIR (AA) QUALITY MONITORING AND TEST REPORT

COMPANY NAME: A Joint Venture of CANARAIL Consultants, SMEC International , DB International , ACE Consultants.
PROJECT NAME : Regional Cooperation and Integration Project (Rail Component)
ADDRESS: House 486, Lane 08 DOHS Baridhara, Dhaka, Bangladesh
HEADER/SAMPLE ID: 214866
SAMPLING AND TESTING DATE : 18/01/2014 (3:51 PM)
ANALYSIS AND REPORTING DATE: 28/01/2014

Ambient Air Quality Test Results of Subproject 2

Sampling ID and Location	Sampling Site Description	Description of Parameters	Unit	Concentration of Ambient Air Quality Parameters			DoE Standards
				Minimum	Maximum	Average	
SP2_AQ2_12_50m (Akhaura) 23°51'50.6"N 91°12'16.6"E	Instrument was set on the storage building ground which was 50m away from the existing rail tracks. There was a small pond nearby the sampling location.	Carbon Monoxide (CO)	$\mu g/m^3$	38	585	69.92	40,000
		Nitric Oxide (NO)	$\mu g/m^3$	35	162	71.37	100
		Nitrogen Dioxide (NO_2)	$\mu g/m^3$	21	104	39.22	100
		Sulphur Dioxide (SO_2)	$\mu g/m^3$	0	189	28.36	365
		Ozone (O_3)	$\mu g/m^3$	0	55	44.97	235
		Volatile Organic Compounds (VOC)	ppm	0	0.19	0.06	NSE*
		Particulate Matter (PM_{10})	$\mu g/m^3$	48	121	73.63	150
		Particulate Matter ($PM_{2.5}$)	$\mu g/m^3$	18	144	54.64	65
		Air Temperature	°C	19	25	19.88	

Noise Measurement Results

Sampling ID	Time	Noise Level (dB)			DoE Standards	
		Minimum	Maximum	Leq	Res. Zone	Mix. Zone
SP2_NM2_22_50m	Day	45.2	85.3	69.25	50	60
SP2_NM2_24_50m	Night	41.7	79.6	52.2	40	50

* No standards established yet

Remarks: Highest value from the amended schedule-2 of (Air Quality Standard) Environmental conservation Rules, 1997 has been adopted.

Remarks**: Highest value from the amended schedule-4 of (Noise Measurement Standard) Environmental conservation Rules, 1997 have been considered.

Report Reviewed and Approved by:
Mehedi Hasan
Environmental Specialist
RCIP

ALS TECHNICHEM (M) SDN BHD

(117964-P)
21, Jalan Astaka U8/84, Seksyen U8, Bukit Jelutong, 40150 Shah Alam, Selangor.
Tel: (603) 7845 8257 Fax: (603) 7845 8258 E-mail: info@alsglobal.com.my

CERTIFICATE OF ANALYSIS

DATE : 2 May 2013

ALS REF. : ALSM71099

ALS SAMPLE ID. : ALSM71099312800

MS ISO/IEC 17025
TESTING
SAMM No. 147

COMPANY : SMEC (BANGLADESH) LTD
Lane 6, House 374,
Doh S Baridhara,
Dhaka-1206,
Bangladesh.
Tel: +880(2) 8415330 Fax: +880(2) 8827545
(Attn.: Mr. Mehedi Hasan)

PROJECT : 5060089

DATE SAMPLE RECEIVED : 12 April 2013

SAMPLE DESCRIPTION : Forty four samples were received with the following references:

SAMPLE I.D	MATRIX	DATE	TIME (hrs)	REMARKS
SW_SP2_UpS_001	Water	1-Apr-13	1630	-
SW_SP2_DownS_002	Water	1-Apr-13	1642	-
SW_SP2_UpS_003	Water	2-Apr-13	1214	-
SW_SP2_DownS_004	Water	2-Apr-13	1204	-
SW_SP2_UpS_005	Water	2-Apr-13	1512	-
SW_SP2_DownS_006	Water	2-Apr-13	1520	-
SW_SP2_UpS_007	Water	3-Apr-13	1133	-
SW_SP2_DownS_008	Water	3-Apr-13	1123	-
SW_SP2_UpS_009	Water	3-Apr-13	1228	-
SW_SP2_DownS_010	Water	3-Apr-13	1235	-
SW_SP2_UpS_011	Water	3-Apr-13	1334	-
SW_SP2_DownS_012	Water	3-Apr-13	1339	-
SW_SP2_UpS_001	Water	1-Apr-13	1630	-
SW_SP2_DownS_002	Water	1-Apr-13	1642	-
SW_SP2_UpS_003	Water	2-Apr-13	1214	-
SW_SP2_DownS_004	Water	2-Apr-13	1204	-
SW_SP2_UpS_005	Water	2-Apr-13	1512	-
SW_SP2_DownS_006	Water	2-Apr-13	1520	-
SW_SP2_UpS_007	Water	3-Apr-13	1133	-
SW_SP2_DownS_008	Water	3-Apr-13	1123	-

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CERTIFICATE OF ANALYSIS

DATE : 2 May 2013

ALS REF. : ALSM71099

ALS SAMPLE ID. : ALSM71099312800

SAMPLE I.D	MATRIX	DATE	TIME (hrs)	REMARKS
SW_SP2_UpS_009	Water	3-Apr-13	1228	-
SW_SP2_DownS_010	Water	3-Apr-13	1235	-
SW_SP2_UpS_011	Water	3-Apr-13	1334	-
SW_SP2_DownS_012	Water	3-Apr-13	1339	-
GW_SP2_001	Water	1-Apr-13	1656	-
GW_SP2_002	Water	2-Apr-13	1140	-
GW_SP2_003	Water	2-Apr-13	1242	-
GW_SP2_004	Water	2-Apr-13	1319	-
GW_SP2_005	Water	2-Apr-13	1412	-
GW_SP2_006	Water	2-Apr-13	1546	-
GW_SP2_007	Water	3-Apr-13	1010	-
GW_SP2_008	Water	3-Apr-13	1053	-
GW_SP2_009	Water	3-Apr-13	1220	-
GW_SP2_010	Water	3-Apr-13	1319	-
GW_SP2_001	Water	1-Apr-13	1656	-
GW_SP2_002	Water	2-Apr-13	1140	-
GW_SP2_003	Water	2-Apr-13	1242	-
GW_SP2_004	Water	2-Apr-13	1319	-
GW_SP2_005	Water	2-Apr-13	1412	-
GW_SP2_006	Water	2-Apr-13	1546	-
GW_SP2_007	Water	3-Apr-13	1001	-
GW_SP2_008	Water	3-Apr-13	1053	-
GW_SP2_009	Water	3-Apr-13	1220	-
GW_SP2_010	Water	3-Apr-13	1319	-

Note : Results apply to sample(s) as submitted. This report supersedes any previous reports of the same reference number.

.....

Dr. Koh Yew Ming
BSc. (Hons), PhD (Chemistry), AMIC
IKM No.: A1713/4003/99
Technical Manager

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DATE : 2 May 2013
ALS SAMPLE ID. : ALSM71099312800
PROJECT : 5060089
Sample Type : Water

		Lab I.D		312800	312801	312802	312803	312804
		Sample I.D		SW_SP2_	SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_00	SW_SP2_
		Units	LOR	UpS_001	2	UpS_003	4	UpS_005
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	33	24	69	74	28
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.01	0.21	0.14	0.06	<0.01
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	0.60	0.26	6.13	5.58	6.74

		Lab I.D		312805	312806	312807	312808	312809
		Sample I.D		SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_01
		Units	LOR	6	UpS_007	8	UpS_009	0
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	80	22	6	26	171
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.11	0.06	0.02	<0.01	0.14
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	6.51	6.44	6.45	4.79	4.30

		Lab I.D		312810	312811			
		Sample I.D		SW_SP2_	SW_SP2_ DownS_01			
		Units	LOR	UpS_011	2			
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	28	5			
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.39	0.37			
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	0.21	0.14			

LOR: Level of Reporting

DATE : 2 May 2013
ALS SAMPLE ID. : ALSM71099312800
PROJECT : 5060089
Sample Type : Water

		Lab I.D		312812	312813	312814	312815	312816
		Sample I.D		SW_SP2_	SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_00	SW_SP2_
		Units	LOR	UpS_001	2	UpS_003	4	UpS_005
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	11.0	12.8	3.8	3.9	3.2
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1	<1	<1	<1

		Lab I.D		312817	312818	312819	312820	312821
		Sample I.D		SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_00	SW_SP2_	SW_SP2_ DownS_01
		Units	LOR	6	UpS_007	8	UpS_009	0
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	2.8	0.5	0.6	4.4	4.5
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1	<1	<1	<1

		Lab I.D		312822	312823			
		Sample I.D		SW_SP2_	SW_SP2_ DownS_01			
		Units	LOR	UpS_011	2			
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	9.9	12.1			
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1			

LOR: Level of Reporting

DATE : 2 May 2013
ALS SAMPLE ID. : ALSM71099312800
PROJECT : 5060089
Sample Type : Water

		Lab I.D		312824	312825	312826	312827	312828
		Sample I.D		GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_
		Units	LOR	001	002	003	004	005
Method Reference	**Analysis Description**							
In-House Method (QWI-CH/17-12)	Total Dissolved Solids	mg/l	1	103	160	205	138	98
APHA 4500-Cl⁻ E	Chloride	mg/l	1	5	10	11	11	1

		Lab I.D		312829	312830	312831	312832	312833
		Sample I.D		GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_
		Units	LOR	006	007	008	009	010
Method Reference	**Analysis Description**							
In-House Method (QWI-CH/17-12)	Total Dissolved Solids	mg/l	1	130	140	179	227	100
APHA 4500-Cl⁻ E	Chloride	mg/l	1	4	9	9	15	3

		Lab I.D		312834	312835	312836	312837	312838
		Sample I.D		GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_
		Units	LOR	001	002	003	004	005
Method Reference	**Analysis Description**							
USEPA 6020 A	Arsenic	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
USEPA 6020 A	Iron	mg/l	0.01	4.28	<0.01	0.21	0.83	0.15
USEPA 6020 A	Manganese	mg/l	0.001	2.370	0.382	1.720	0.197	0.044
USEPA 6010 B	Sulfur	mg/l	1	1	<1	<1	<1	4

		Lab I.D		312839	312840	312841	312842	312843
		Sample I.D		GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_	GW_SP2_
		Units	LOR	006	007	008	009	010
Method Reference	**Analysis Description**							
USEPA 6020 A	Arsenic	mg/l	0.001	0.001	<0.001	<0.001	0.001	<0.001
USEPA 6020 A	Iron	mg/l	0.01	1.68	1.42	<0.01	<0.01	0.10
USEPA 6020 A	Manganese	mg/l	0.001	0.155	0.788	0.032	0.001	0.144
USEPA 6010 B	Sulfur	mg/l	1	5	2	4	6	8

LOR: Level of Reporting

BATCH QUALITY CONTROL - LABORATORY CONTROL SAMPLE

ALS SAMPLE ID. : ALSM71099312800
Batch : INW130502(1)
Matrix : Water

Date of Digestion : -
Date of Analysis : 2/5/13

COMPOUND	Blank Conc.	Spike Conc.	QC SPIKE RESULTS				Control Limits		
			SCS Conc	DCS Conc	Ave Rec.	RPD	% Recovery		RPD
	mg/l	mg/l	mg/l	mg/l	%	%	Low	High	%
Arsenic	<LOR	0.0050	0.0042	0.0045	87	7	80	120	20
Iron	<LOR	0.0050	0.0059	0.0050	109	17	80	120	20
Manganese	<LOR	0.0050	0.0046	0.0048	94	4	80	120	20

COMMENTS :
1) LOR: level of reporting
2) The control limits are based on ALS laboratory statistical data.
3) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL - MATRIX SPIKE SAMPLE

ALS SAMPLE ID. : ALSM71099312800
Batch : INW130502(1)
Matrix : Water

Date of Digestion : -
Date of Analysis : 2/5/13
Spiked Sample : 312842

COMPOUND	Sample Results	Spike Conc.	QC SPIKE RESULTS				Control Limits
			MS Conc	MSD Conc	Ave Rec.	RPD	RPD
	mg/l	mg/l	mg/l	mg/l	%	%	%
Arsenic	0.001	0.010	0.010	0.010	100	0	20
Iron	<LOR	0.010	0.009	0.010	95	11	20
Manganese	0.001	0.010	0.010	0.010	100	0	20

COMMENTS :
1) LOR: level of reporting
2) The control limits are based on ALS laboratory statistical data.
3) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL - DUPLICATE SAMPLE

ALS SAMPLE ID. : ALSM71099312800		Date of Digestion :	-
Batch :	INW130502(1)	Date of Analysis :	2/5/13
Matrix :	Water	Duplicate sample:	312843

COMPOUND	QC DUPLICATE RESULTS		
	Sample Conc	Check Sample Conc	RPD
	mg/l	mg/l	%
Arsenic	<LOR	<LOR	-
Iron	0.10	0.10	0
Manganese	0.144	0.151	5

ALS TECHNICHEM (M) SDN BHD

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CERTIFICATE OF ANALYSIS

DATE : 7 February 2014 Page 1 of 4

ALS REF. : ALSM91175

ALS SAMPLE ID. : ALSM91175400311

MS ISO/IEC 17025
TESTING
SAMM No. 147

COMPANY : SMEC (BANGLADESH) LTD
Lane 6, House 374,
Doh S Baridhara,
Dhaka-1206,
Bangladesh.
Tel: +880(2) 8415330 Fax: +880(2) 8827545
(Attn.: Mr. Mehedi Hasan)

PROJECT : 7060542

DATE SAMPLE RECEIVED : 23 January 2014

SAMPLE DESCRIPTION : Twenty samples were received with the following references:

SAMPLE I.D	MATRIX	DATE	TIME (hrs)	REMARKS
SW2_SP2_UPS_001	Water	15-Jan-14	-	-
SW2_SP2_Downs_002	Water	15-Jan-14	-	-
SW2_SP2_UPS_003	Water	16-Jan-14	-	-
SW2_SP2_Downs_004	Water	16-Jan-14	-	-
SW2_SP2_UPS_005	Water	15-Jan-14	-	-
SW2_SP2_Downs_006	Water	15-Jan-14	-	-
SW2_SP2_UPS_007	Water	16-Jan-14	-	-
SW2_SP2_Downs_008	Water	16-Jan-14	-	-
SW2_SP2_UPS_009	Water	16-Jan-14	-	-
SW2_SP2_Downs_010	Water	16-Jan-14	-	-
SW2_SP2_UPS_011	Water	16-Jan-14	-	-
SW2_SP2_Downs_012	Water	16-Jan-14	-	-
SW2_SP2_UPS_001	Water	15-Jan-14	-	-
SW2_SP2_Downs_002	Water	15-Jan-14	-	-
SW2_SP2_UPS_003	Water	16-Jan-14	-	-
SW2_SP2_Downs_004	Water	16-Jan-14	-	-
SW2_SP2_UPS_005	Water	15-Jan-14	-	-
SW2_SP2_Downs_006	Water	15-Jan-14	-	-
SW2_SP2_UPS_007	Water	16-Jan-14	-	-
SW2_SP2_Downs_008	Water	16-Jan-14	-	-
SW2_SP2_UPS_009	Water	16-Jan-14	-	-
SW2_SP2_Downs_010	Water	16-Jan-14	-	-
SW2_SP2_UPS_011	Water	16-Jan-14	-	-
SW2_SP2_Downs_012	Water	16-Jan-14	-	-
GW2_SP2_001	Water	15-Jan-14	-	-
GW2_SP2_002	Water	16-Jan-14	-	-
GW2_SP2_003	Water	15-Jan-14	-	-
GW2_SP2_004	Water	15-Jan-14	-	-
GW2_SP2_005	Water	15-Jan-14	-	-

Note : Results apply to sample(s) as submitted. This report supersedes any previous reports of the same reference number.

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CERTIFICATE OF ANALYSIS

DATE : 7 February 2014

ALS REF. : ALSM91175

SAMPLE I.D	MATRIX	DATE	TIME (hrs)	REMARKS
GW2_SP2_006	Water	15-Jan-14	-	-
GW2_SP2_007	Water	16-Jan-14	-	-
GW2_SP2_008	Water	16-Jan-14	-	-
GW2_SP2_009	Water	16-Jan-14	-	-
GW2_SP2_010	Water	16-Jan-14	-	-
GW2_SP2_001	Water	15-Jan-14	-	-
GW2_SP2_002	Water	16-Jan-14	-	-
GW2_SP2_003	Water	15-Jan-14	-	-
GW2_SP2_004	Water	15-Jan-14	-	-
GW2_SP2_005	Water	15-Jan-14	-	-
GW2_SP2_006	Water	15-Jan-14	-	-
GW2_SP2_007	Water	16-Jan-14	-	-
GW2_SP2_008	Water	16-Jan-14	-	-
GW2_SP2_009	Water	16-Jan-14	-	-
GW2_SP2_010	Water	16-Jan-14	-	-

Note : Results apply to sample(s) as submitted. This report supersedes any previous reports of the same reference number.

.....

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DATE : 7 February 2014
ALS SAMPLE ID. : ALSM91175400311
PROJECT : 7060542
Sample Type : Water

		Lab I.D		400311	400312	400313	400314	400315
		Sample I.D		SW2_SP2_	SW2_SP2_ Downs_002	SW2_SP2_	SW2_SP2_ Downs_004	SW2_SP2_
		Units	LOR	UPS_001		UPS_003		UPS_005
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	28	15	45	59	13
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.20	0.12	0.10	0.15	0.09
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	6.16	6.39	6.31	6.42	6.42

		Lab I.D		400316	400317	400318	400319	400320
		Sample I.D		SW2_SP2_ Downs_006	SW2_SP2_	SW2_SP2_ Downs_008	SW2_SP2_	SW2_SP2_ Downs_010
		Units	LOR		UPS_007		UPS_009	
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	23	83	100	30	48
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.09	0.11	0.11	0.15	0.13
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	6.39	6.20	6.28	6.05	6.40

		Lab I.D		400321	400322			
		Sample I.D		SW2_SP2_	SW2_SP2_ Downs_012			
		Units	LOR	UPS_011				
Method Reference	**Analysis Description**							
APHA 2540 D	Total Suspended Solid	mg/l	1	9	5			
APHA 4500 P- B & F	Total Phosphorus	mg/l	0.01	0.68	0.41			
APHA 4500 O G	Dissolved Oxygen	mg/l	0.01	3.81	3.98			

		Lab I.D		400323	400324	400325	400326	400327
		Sample I.D		SW2_SP2_	SW2_SP2_ Downs_002	SW2_SP2_	SW2_SP2_ Downs_004	SW2_SP2_
		Units	LOR	UPS_001		UPS_003		UPS_005
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	2.6	2.2	2.3	3.2	2.1
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1	<1	<1	<1

		Lab I.D		400328	400329	400330	400331	400332
		Sample I.D		SW2_SP2_ Downs_006	SW2_SP2_	SW2_SP2_ Downs_008	SW2_SP2_	SW2_SP2_ Downs_010
		Units	LOR		UPS_007		UPS_009	
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	2.1	4.5	4.9	2.6	2.7
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1	<1	<1	<1

LOR: Level of Reporting

		Lab I.D		400333	400334			
		Sample I.D		SW2_SP2_	SW2_SP2_ Downs_01			
		Units	LOR	UPS_011	2			
Method Reference	**Analysis Description**							
APHA 5310 D	Total Organic Carbon	mg/l	0.1	5.5	5.4			
APHA 5520 B	Oil & Grease	mg/l	1	<1	<1			

		Lab I.D		400335	400336	400337	400338	400339
		Sample I.D		GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2
		Units	LOR	_001	_002	_003	_004	_005
Method Reference	**Analysis Description**							
In-House Method (QWI-CH/17-12)	Total Dissolved Solids	mg/l	1	97	190	245	155	97
APHA 4500-Cl⁻ E	Chloride	mg/l	1	4	14	17	11	<1

		Lab I.D		400340	400341	400342	400343	400344
		Sample I.D		GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2
		Units	LOR	_006	_007	_008	_009	_010
Method Reference	**Analysis Description**							
In-House Method (QWI-CH/17-12)	Total Dissolved Solids	mg/l	1	141	152	175	242	102
APHA 4500-Cl⁻ E	Chloride	mg/l	1	2	1	8	19	3

		Lab I.D		400345	400346	400347	400348	400349
		Sample I.D		GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2
		Units	LOR	_001	_002	_003	_004	_005
Method Reference	**Analysis Description**							
USEPA 6020 A	Arsenic	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
USEPA 6020 A	Iron	mg/l	0.01	0.41	9.14	0.05	0.35	0.37
USEPA 6020 A	Manganese	mg/l	0.001	2.21	0.427	4.45	0.199	0.063
USEPA 6010 B	Sulfur	mg/l	1	<1	<1	<1	<1	<1

		Lab I.D		400350	400351	400352	400353	400354
		Sample I.D		GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2	GW2_SP2
		Units	LOR	_006	_007	_008	_009	_010
Method Reference	**Analysis Description**							
USEPA 6020 A	Arsenic	mg/l	0.001	<0.001	<0.001	<0.001	0.002	<0.001
USEPA 6020 A	Iron	mg/l	0.01	0.82	0.25	0.39	0.03	0.39
USEPA 6020 A	Manganese	mg/l	0.001	0.031	0.404	0.014	0.001	0.230
USEPA 6010 B	Sulfur	mg/l	1	<1	<1	2	2	2

LOR: Level of Reporting

BATCH QUALITY CONTROL - LABORATORY CONTROL SAMPLE

ALS SAMPLE ID. : ALSM91175400311
Batch : INW140203(1)
Matrix : Water

Date of Digestion : -
Date of Analysis : 3/2/14

COMPOUND	Blank Conc.	Spike Conc.	QC SPIKE RESULTS				Control Limits		
			SCS Conc	DCS Conc	Ave Rec.	RPD	% Recovery		RPD
	mg/l	mg/l	mg/l	mg/l	%	%	Low	High	%
Arsenic	<LOR	0.0050	0.0048	0.0050	98	4	80	120	20
Iron	<LOR	0.0050	0.0051	0.0047	98	8	80	120	20
Manganese	<LOR	0.0050	0.0048	0.0051	99	6	80	120	20

COMMENTS :
1) LOR: level of reporting
2) The control limits are based on ALS laboratory statistical data.
3) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL - MATRIX SPIKE SAMPLE

ALS SAMPLE ID. : ALSM91175400311
Batch : INW140203(1)
Matrix : Water

Date of Digestion : -
Date of Analysis : 3/2/14
Spiked Sample : 402473

COMPOUND	Sample Results	Spike Conc.	QC SPIKE RESULTS				Control Limits
			MS Conc	MSD Conc	Ave Rec.	RPD	RPD
	mg/l	mg/l	mg/l	mg/l	%	%	%
Arsenic	<LOR	0.010	0.010	0.010	100	0	20
Iron	<LOR	0.010	0.010	0.010	100	0	20
Manganese	<LOR	0.010	0.010	0.010	100	0	20

COMMENTS :
1) LOR: level of reporting
2) The control limits are based on ALS laboratory statistical data.
3) * : Recovery or RPD falls outside of the recommended control limits.

BATCH QUALITY CONTROL - DUPLICATE SAMPLE

ALS SAMPLE ID. : ALSM91175400311
Batch : INW140203(1)
Matrix : Water

Date of Digestion : -
Date of Analysis : 3/2/14
Duplicate sample: 399212

COMPOUND	QC DUPLICATE RESULTS		
	Sample Conc	Check Sample Conc	RPD
	mg/l	mg/l	%
Arsenic	0.003	0.003	0
Iron	0.01	0.01	0
Manganese	<LOR	<LOR	-

প্রস্তাবিত প্রতিকার এবং পর্যবেক্ষণ

E.I.A এ প্রতিবেদনে একটি পরিবেশগত প্রতিকার এবং পর্যবেক্ষন পরিকল্পনা অন্তর্ভূক্ত থাকবে যা আখাউড়া হতে লাকসাম পর্যন্ত প্রস্তাবিত দ্বৈত রেললাইন নির্মান এবং কার্যকালীন সময়ে যাতে কোন মারাত্মক পরিবেশগত সমস্যা না ঘটে সে জন্য কি ধরনের পদক্ষেপ নেয়া হবে তা ঠিক করবে। এই পরিকল্পনা কার্যক্রমকে পরিবেশ ব্যবস্থাপনা পরিকল্পনা বলা হয় যা অংশগ্রহনকারীদের প্রকল্পের ব্যাপারে পূন: বিবেচনা করতে এবং স্থানীয় কর্মকর্তাগণ প্রতিকারের বিভিন্ন উপায় সমূহ স্ক্রিন কার্যক্রম পর্যবেক্ষনে ব্যবহার করতে পারবেন|

E.I.A এবং E.M.P প্রতিবেদনগুলো অবশ্যই তৈরী করতে হবে এবং এ,ডি,বি ও বাংলাদেশ সরকারের কাছে দাখিল করিতে হবে। এই প্রতিবেদনগুলো জনসাধারনের জন্য উন্মুক্ত থাকবে।

এই পরিপূর্ন E.I.A প্রতিবেদনটি এ,ডি,বি এর ওয়েব সাইটে (www.adb.org) প্রকাশ এবং নিম্ন লিখিত কার্য্যালয় গুলোতে প্রদান করতে হবে।

১। প্রধান ও আঞ্চলিক কার্যালয় সমূহ,বাংলাদেশ রেলওয়ে,রেলওয়ে মন্ত্রনালয়,বাংলাদেশ।

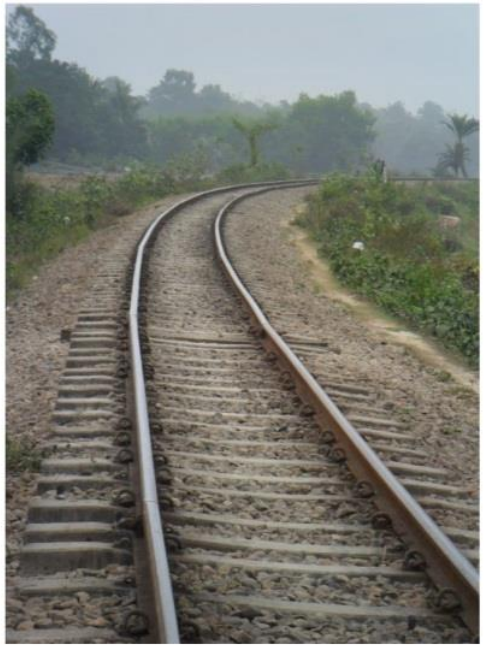
২। প্রধান কার্যালয়, পরিবেশ অধিদপ্তর, ঢাকা।

অনুসন্ধান, মতামত **এবং** পরামর্শের **জন্য দয়া করে নিম্ন লিখিত** কার্যালয়ে **যোগাযোগ করুন**।
১৬ আবদুল গনি রোড,রেল ভবন,ঢাকা-১০০০।
দুরালাপন : (+৮৮০) ২ ৮১২ ১৭৯৩
ফ্যাক্স : (+৮৮০) ২ ৯১১ ৮৬৮২

পরিবেশগত প্রভাব যাচাইকরন (ই.আই.এ.)
রেলপথ উন্নয়ন প্রকল্প

পরিবেশগত প্রভাব সম্পর্কে স্থানীয় জনগনের সাথে মতবিনিময় সভা

কার্যনির্বাহী প্রতিনিধি বাংলাদেশ রেলপথ মন্ত্রনালয়ে অন্তর্ভূক্ত বাংলাদেশ রেলওয়ে ফান্ড যৌথ প্রচেষ্টায় এশীয় উন্নয়ন ব্যাংক এবং পরামর্শক বৃন্দ ক্যানারেল সহযোগীতায় স্মেক, ডি.বি. এবং এ.সি.ই



জুন ২০১৩

প্রকল্পের ভূমিকা

বাংলাদেশ সরকার যোগাযোগ ব্যবস্থায় প্রভূত উন্নতির লক্ষে কাজ করছে। যা আঞ্চলিক তথা জাতীয় পর্যায়ে অর্থনৈতিক উন্নতি বয়ে আনবে। দেশের স্থল যোগাযোগের সর্বোত্তম মাধ্যম রেল যোগাযোগকে সর্বাপেক্ষা বেশী গুরুত্ব দেওয়া হয়েছে। দীর্ঘ যাত্রায় বাসের তুলনায় রেলওয়ে অধিক সাশ্রয়ী আরামদায়ক ও পরিবেশ বান্ধব হওয়ায় বিশ্বের অনেক দেশে পরিবহন সমস্যার সমাধানে রেলওয়েকে বেছে নেওয়া হয়েছে।

বাংলাদেশে রেল যোগাযোগ ব্যবস্থার আধুনিকায়ন ও প্রসারন প্রয়োজন যেন তা অন্ত ও আন্তদেশীয় যোগাযোগে গুরুত্বপূর্ন ভূমিকা রাখতে পারে। এ লক্ষে বাংলাদেশ সরকার কিছু পরিকল্পনা গ্রহন করেছে সরকারের ষষ্ঠ পঞ্চবর্ষিকী পরিকল্পনা ২০১১-২০১৫ তে ঢাকা চট্রগ্রাম দ্বৈত রেললাইন নির্মাণকে অগ্রাধিকার দেওয়া হয়েছে। গত ১২ জানুয়ারী ২০১০ইং তারিখে বাংলাদেশ ও ভারতের মধ্যে দ্বিপাক্ষিক সমঝোতা স্বাক্ষরের মধ্য দিয়ে সড়ক, রেল ও জলপথে আঞ্চলিক সহযোগীতা ও সমন্বিতকরন প্রকল্পের সূচনা ঘটে এবং এ প্রকল্পের অংশ হিসাবে রেল যোগাযোগে গুরুত্বপূর্ন সাতটি প্রকল্প নির্ধারন করা হয়। আজকের মত বিনিময় সভায় দ্বিতীয় উপপ্রকল্প আখাউড়া থেকে লাকসাম দ্বৈত রেললাইন নির্মাণ এবং বর্তমান রেলপথ উন্নয়ন সম্বন্ধে আলোচনা করা হবে।

আখাউড়া থেকে লাকসাম পর্যন্ড় রেল লাইনের উন্নয়নের ফলে এই ৭২ কি.মি. দীর্ঘ রেলপথের যাত্রী ও মালামাল পরিবহন ক্ষমতা দ্বিগুন হবে। আখাউড়া হতে দক্ষিনে যাত্রাপথে নতুন লাইনটি বর্তমান লাইনের সাথে সমান্তরালে এবং প্রধানত পশ্চিম পার্শ্বে স্থাপিত হবে। এ প্রকল্পের আওতায় নতুন করে সর্ব মোট ৫৭টি ব্রিজ নির্মিত হবে।

প্রকল্প বাস্ড়বায়নের প্রতিশ্রুতি অনুযায়ী নির্মান কাজের ফলে সৃষ্ট সম্ভাব্য পরিবেশের উপর বিরূপ প্রভাবগুলো চিহ্নিতকরন ও এর প্রতিকারের উপায়গুলো বিবেচনা করা হচ্ছে।

উপস্থিত সকলকে রেলপথ উন্নয়ন প্রকল্প সম্বন্ধে মতামত ও উপদেশ দেওয়ার জন্য আহবান করা যাচ্ছে।

পরিবেশগত প্রভাব যাচাই করন : কার্যক্রম এবং প্রধান প্রধান পরিবেশগত বিষয় সমূহ

উপরোক্ত প্রকল্প ২ এর দৈর্ঘ্য ৭২ কি.মি.। রেলপথ নির্মান কার্যপদ্ধতির মধ্যে রয়েছে ভূমি উন্নয়নে মাটি পরিবহন, ভূমি খনন, জলাধার খনন, ভূমি স্থিতিকরন, প্রকল্প এলাকায় উদ্ভুত পানি ও আবর্জনা ব্যবস্থাপনা, সেতু নির্মান, পাইল স্থাপন এবং বর্তমান রেলষ্টেশন পূন:নির্মান। প্রকল্পে একটি বড় ও কয়েকটি ছোট ছোট সেতু নির্মিত হবে। প্রস্তাবিত দ্বৈত লাইন কাজটির বেশির ভাগই বর্তমান লাইনের ৫০ মিটারের মধ্যে হবে।

রেলপথ নির্মানে উদ্ভুত ধুলাবালি,শব্দ এবং ট্রাক চলাচলের ফলে সৃষ্ট সমস্যাদির সুষ্ঠ ব্যবস্থাপনা নিখুত করা হবে। উপপ্রকল্প-২ সংলগ্ন পরিবেশ ও সংবেদনশীল প্রানীর যথা সম্ভব সীমিত ক্ষতি সাধনের জন্য সম্ভাব্য সকল ব্যবস্থা গ্রহন করা হবে। এছাড়াও নির্মানে পরবর্তী পূনর্বাসন পরিকল্পনাও গৃহীত হবে। চূড়ান্ত ই,আই,এ প্রতিবেদনে উপপ্রকল্পের বিস্ড়রিত প্রদর্শিত হবে, যা সকলের জন্য উম্মুক্ত।

সময়সুচী

লালমাই, সদর রসুলপুর, কসবা এবং গঙ্গাসাগর এলাকায় উপপ্রকল্প ২ এর পরিবেশ সংক্রান্ড় স্থানীয় জনগনের পরামর্শ গ্রহন প্রক্রিয়া দুই ধাপে সম্পন্ন হবে। যার প্রথম ধাপ জুন-২০১৩ এবং দ্বিতীয় ধাপ সেপ্টেম্বর-২০১৩ তে সম্পন্ন হবে। পরামর্শ গ্রহন প্রক্রিয়ার অন্ড়র্ভূক্ত থাকবে প্রকল্প উপস্থাপন এবং মতামত গ্রহন। সকল উপস্থিতিকে একটি করে উপস্থাপনের কপি দেওয়া হবে।

প্রকল্পের পরিবেশগত প্রভাব যাচাই করন প্রক্রিয়ার সময়সুচী নিম্নরূপ :

১। I.E.S.R গবেষনার সময়সীমা নভেম্বর ২০১২ হতে মার্চ ২০১৩।

২। E.I.A এর জন্য মাঠ পর্যায়ে গবেষনা ও অনুসন্ধান চলবে ফেব্রুয়ারী, জুন ও সেপ্টেম্বর ২০১৩।

৩। তথ্য সরবরাহ ও পরমর্শ গ্রহন জুন ২০১৩।

৪। প্রস্ড়াবিত পরিবেশ ব্যবস্থাপনা সম্পর্কে স্থানীয় জনগনের বক্তব্য ও মতামত গ্রহন সেপ্টেম্বর ২০১৩

৫। বাংলাদেশ সরকার ও এ,ডি,বি, এর রিভিউ এর জন্য ড্রাফট সম্পাদন সেপ্টেম্বর ২০১৩

৬। E.I.A সংক্ষেপ বাংলায় অক্টোবর ২০১৩।

৭। বাংলাদেশ রেলওয়ে ও পরিবেশ অধিদপ্তরকে চুড়ান্ড় প্রতিবেদন দাখিল জানুয়ারী ২০১৪।

৮। জুন ২০১৪ এর পর যে কোন সময় নির্মান কাজ শুরু হবে।

Minutes of Public Consultation Meeting 01

1. *Meeting Location*: Barapara, Lalmai (GPS: N 23^0 23′ 01″, E 91^0 09′ 34″)
2. *Meeting Date*: 17/ 06 /2013
3. *Project Name*: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam
4. *Presentation Given By*: Mehedi Hasan, Environment Specialist
5. *Environmental Consultant's Presentation Content*:
    - Project Description
    - Project progress
    - Construction Work
    - Proposed alignment
    - Probable Environmental Issues of the Project (Before, After and During the Construction)
    - Contact information for further queries
6. *Comments of Participants*:

Public Consultation 01 - Barapara, Lalmai

Sl. No.	Individual	Comments
1.	**Rosh Raj Pal** Businessman	He supported the proposed alignment and also said that most people in that area are living in the east side of the track, should not be concerned if the alignment goes through the west side. He also said there will be no environmental problem in this region. **Mehedi Hasan, Consultant replied:** There will be massive construction work during the Project implementation period and people may get affected directly or indirectly by the Project. This meeting is arranged to find out possible environmental issues.
2.	**Jafor Ahmed** Barapara UP Member	New track will cause relocation problems of the private lands **Shamsul Alam, CEGIS, Subcontractor replied:** He shared some views on land acquisition and resettlement issues.
3.	**Mst. Najma** Barapara UP Member	Concerned about sound pollution. She expected that sound will be less during the construction work
4.	**Md. Rafiqul Islam** Barapara UP Member	Some stations will be reconstructed. He was concerned about the station structure.
5.	**Zahangir Alam** Businessman	Extended traffic should not be problem for this region. We all should welcome the proposed rail line but he also emphasised again, local people must not be harmed. During construction work, heavy vehicles may cause damage to property.

Sl. No.	Individual	Comments
6.	**Md. Moniruzzaman** AC Land, Comilla Sadar South	He asked the 5% land, will be acquired as discussed in the presentation, how much it will be? Is there any school or college on that 5% land? What will be the source of land filling works? He mentioned the Lalmai hill will be destroyed if we collect through hill cutting, as being done during Chittagong- Comilla 4 lane road Project. He asked how much agriculture land will be affected due to the rail improvement Project. Construction sound / vibration will hamper local market, household, etc. How we are planning to compensate on that? Roads will be damaged if the rail construction starts. He suggested that we should do some environmental survey to clearly aware the people, how they might be affected by this Project. **Mehedi Hasan, Consultant replied:** We will give draft report with the comments of the local people. We will arrange another meeting later to discuss the mitigation measures. He added that according to the Project policy, the source of the land filling will be mostly the river dredging materials. It is also helpful to increase the navigation. There will be no hill cutting no borrow pit, collected soil will come from outside of the Project area.
7.	**Fatema Jahan** UNO	Developed countries always protect their environment. We should do the same. She expressed her optimism that the Consultant will consider the environment and minimise the harmful effects. We must welcome the rail improvement Project. The government emphasised on rail communication which should have been done long before. Hill cutting should be avoided. Chittagong- Comilla four lane road Project, already acquired much land. If we can use that will save a lot of money and also the environmental damage will be less
8.	**Md. Humayun Kabir** UP Chairman	Welcomed everyone joined the public consultation.
9.	**Md. Saiful Islam** UP Member, Patiyarkul	Railway Project will be very positive for the people
10.	**Sunil Baruya** Editor, Ramu Press club	Less damage to the environment should be done

7. Follow Up Actions Defined:

- Draft EIA report will be shared with the Project affected people.
- Detailed location map will be shared with Project land requirements.
- Tree plantation to replace felled trees during alignment construction and toward protecting built embankment will be prescribed.
- Issue of land acquisition and compensation will be referred to relevant team of experts (Social Safeguards).
- The issue of using the land already acquired during highway construction will be referred to the relevant team of experts of the Project.

8. Complete List of Attendees: See Attendance Sheet

Subproject No: 02 (Lakhsam - Akhaura)

Meeting Location: Barapara Union (Kalmai Mosque) **Date:** 17.06.2013

GPS: 23°23'[illegible]" N, 91°09'34"

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
১	[illegible]	01717378343	[illegible]	[illegible]	[illegible]
2	মো: [illegible]	01814298400	[illegible]	কৃষক	[illegible]
৩	[illegible]	[illegible]	[illegible]	ব্যবসা	[illegible]
৪	মো: [illegible]	01812888109	[illegible]	ব্যবসা	মো: [illegible]
৫	[illegible]	01817063919	[illegible]	[illegible]	[illegible]
৬	মো: রফিকুল ইসলাম মেম্বার	01716-085997	চন্ডিপুর	ব্যবসা	[illegible]
৭	[illegible]	01711327698	[illegible]	ব্যবসা	[illegible]
৮	নুরুল ইসলাম	01818 798923	[illegible]	কৃষি	[illegible]
৯	সাহাদেব মাল	০১৮৫০৯১৯১৭৮	[illegible]	কৃষি	সাহাদেব মাল
১০	[illegible]	01819111028	[illegible]	[illegible]	[illegible]
১১	মোঃ জাকির হোসেন	01719 655894	[illegible]	ব্যবসা	[illegible]
১২	মো: [illegible]	01814405480	[illegible]	[illegible]	[illegible]
১৩	মোসা: [illegible]	[illegible]		গৃহিনী	[illegible]
১৪	মোসা: [illegible]	01710305994	[illegible]	গৃহিনী	[illegible]
১৫	মোসা: [illegible]	01733842549			
	[illegible]			[illegible]	[illegible]
	[illegible]			[illegible]	[illegible]

Subproject No: 02 (Lakhsam to Akhaura)

Meeting Location: Basapara Union (Lalmai) **Date:** 17.06.2013

GPS: 23°23'01" N, 91°09'34"

Sl. No	Name	Occupation	Department	Sign
1	Fatima Jahan	UNO, Comilla Sadar South		17.06.13
2	Md. Maniruzzaman	AC (Land) Comilla Sadar South		17.06.13
3	[illegible]	[illegible]		[illegible]
4	[illegible]	[illegible]	[illegible]	17.06.13
5	Geza Teleki	Environmental Consultant	SMEC	
6	ATM Shamsul Alam	Principal Specialist	Social & Economic Div, CEGIS	
7	Mehedi Hasan	Env. Specialist	Consultant	
8	Md. Shahid Zaman	Jr. Env. Professional	SMEC	
9	Mustakim Masum	Jr. Env. Professional	SMEC	
10				
11				
12				

Minutes of Public Consultation Meeting 02

1. Meeting Location: Amratali, Sadar Rasulpur (GPS: N 22° 30´ 22´´, E 91° 10´ 20´´)
2. Meeting Date: 17/ 06 /2013
3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam
4. Presentation Given By: Mehedi Hasan, Environment Specialist
5. Environmental Consultant's Presentation Content:
    - Project Description
    - Project progress
    - Construction Work
    - Proposed alignment
    - Probable Environmental Issues of the Project (Before, After and During the Construction)
    - Contact information for further queries
6. Comments of Participants:

Public Consultation 02 - Amratali, Sadar Rashulpur

Sl. No.	Individual	Comments
1.	Md. Rashid Akter UP Member	Concerned about traffic jam after the Project implemented. He assumed that there will be no environmental problem in this Project area. Concerned about land acquisition issues. Mehedi Hasan, Consultant replied: There will be massive construction work during the Project implementation period and people may get affected directly or indirectly by the Project. This meeting is arranged to find out possible environmental issues.
2.	Jamir Uddin Freedom fighter	What is the compensation system will be followed in this Project? Shamsul Alam, CEGIS, Subcontractor replied: He shared some views on land acquisition and resettlement policy.
3.	Najma Akhter UP Member	Railway Project will be very positive for the people
4.	Md. A Motaleb Teacher	This Project will be very positive for the local people. Development brings betterment to our life. We have to protect our environment as well. Long-time construction will cause air pollution, soil pollution, water pollution and sound pollution.
5.	Shapna Rani Saha UP Member	Less damage to the environment should be done. Fast construction expected.
6.	Ayesha Akhter UNO, Sadar Comilla	Very impressive Project connecting international boundaries. Concerned about sound pollution. She expected that sound will be less during the construction work We have to save our natural resources including water bodies, rivers and

Sl. No.	Individual	Comments
		biodiversity. Long term construction camps may cause health hazards. She inspired the people to help the government to the success of this Project.

7. Follow Up Actions Defined:

- Draft EIA report will be shared with the Project affected people.
- Detailed location map will be shared with Project land requirements.
- Issue of river bank erosion will be referred to the relevant Team of Experts (Hydrology and RTW).
- Tree plantation to replace felled trees during alignment construction and toward protecting built embankment will be prescribed.
- Issue of land acquisition and compensation will be referred to relevant team of experts (Social Safeguards)

8. Complete List of Attendees: See Attendance Sheet

Subproject No: 02 (Laksam to Akhaura)

Meeting Location: Amratoli Union (Sadar Rasulpur) **Date:** 17.06.2013

GPS: 23°30′22″ N, 91°10′20″ E

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
১	মো: [illegible]	০১৭১৭-০২৪৬২০	আমড়াতলী	[illegible]	[signature]
২	[illegible]	01811918104	আমড়াতলী	মেম্বার	[signature]
৩	[illegible]	01772069736	আমড়াতলী	মেম্বার	[signature]
৪	[illegible]	01823418135	আমড়াতলী	মেম্বার	[signature]
৫	[illegible]	01910997949	৪নং আমড়াতলী	মেম্বার	[signature]
৬	মো: [illegible]	01817011879	৪নং আমড়াতলী	মেম্বার	[signature]
৭	মো: আব্দুল [illegible]	01712-746477	৪ আমড়াতলী	মেম্বার	[signature]
৮	হাজী মো: [illegible]	01814790205	৪নং আমড়াতলী	মেম্বার	[signature]
৯	[illegible]	01729512227	৪নং আমড়াতলী	মেম্বার	[signature]
১০	[illegible]	01826411786	[illegible]	ব্যবসায়ী	[signature]
১১	মো: আ: মোতালেব	01743938746	শিমপুর	শিক্ষক	[signature] 17.6.13
১২	মো: আবু তাহের	01819782962	ভুবনঘর	অব: প্রা: প্র: শি:	[signature] 17-6-13
১৩	মো: আব্দুল [illegible]	01914612875	ভুবনঘর	কৃষক	[signature]
	[signature]	০১৯৩৩২২[illegible]	"	"	[signature]
১৪	মো: [illegible]	01911-711007	[illegible]	[illegible]	[signature]
১৫	[illegible]	01766006684	"		[signature]
১৬	ABU Taher	01811335318	[illegible]		[signature]
১৭	[illegible]	01812702520	[illegible]	[illegible]	[signature]
১৮	মো: আবুল হোসেন	01814502711	[illegible]	[illegible]	[signature]
২০	মো: [illegible]	01712543400	[illegible]	[illegible]	[signature]

Subproject No: 2

Meeting Location: Amratoli Union Parishad (Sadar Rasulpur) **Date:** 17/06/2013

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
২১	মোঃ [illegible]	[illegible]	[illegible]	[illegible]	[signature]
22	মোঃ এমরান হোসেন	01845795877	শিবপুর	ব্যবসা	[signature]
২৩	[illegible]		শিবপুর	গৃহিণী	[signature]
২৪	মোঃ [illegible]	[illegible]	[illegible]	[illegible]	[signature]
২৫	মোঃ জুয়েল আহমেদ	[illegible]	[illegible]	প্রবাসী	[signature]
২৬	মোঃ আবুল মিয়া		[illegible]	প্রবাসী	[signature]
২৭	মোঃ [illegible]		[illegible]	[illegible]	[signature]

Subproject No: 02 (Lakhsam to Akhaura)

Meeting Location: Amratoli Union (Sadar Rasulpur) **Date:** 17.06.2013

GPS: 23° 30′ 22″ N, 91° 10′ 20″ E

Sl. No	Name	Occupation	Department	Sign
1	AYESHA AKTER	U.N.O. Sadar, Comilla.		[signature] 16.6.13
2	Md. Anower Hossain	Asst. Director	Bangladesh Rly	[signature] 17.06.13
3	Quazi Mozammal Haque	Chairman, No. 4 Amratali U.P. [illegible]	comilla	[signature] 17.06.13
4	Geza Teleki	Env. Spec.	SMEC	[signature]
5	ATM Shamsul Alam	Principal Specialist	CEGIS	[signature]
6				
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Minutes of Public Consultation Meeting 03

1. Meeting Location: Quasba Upazila (GPS: N 23° 44´ 54´´, E 91° 08´ 49´´)

2. Meeting Date: 18/ 06 /2013

3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam

4. Presentation Given By: Mehedi Hasan, Environment Specialist

5. Environmental Consultant's Presentation Content:

Project Description

Project progress

Construction Work

Proposed alignment

Probable Environmental Issues of the Project (Before, After and During the Construction)

Contact information for further queries

6. Comments of Participants:

Public Consultation 03 - Quasba Upazila

Sl. No.	Individual	Comments
1.	Alhaz Ruhul Amin Quasba Upazila Chairman	It is densely populated in the western side of the existing track. Therefore, the damage to the local people will be far less if the new line goes through the eastern side of the track. There are some sensitive structures in the western side of the track. Government must ensure proper compensation for Project affected people. Shamsul Alam, CEGIS, Subcontractor replied: He shared some views on land acquisition and resettlement issues.
2.	Md. Fulmiya Vuiya Secretary, Old Market Committee	Traffic signalling system must be developed in busy rail crossings. Social forestation will be hampered. Heavy rain causes flash flood. Massive amount of storm water comes from the neighbouring country India. Natural drainage system must be preserved.
3.	Majharul Islam College Principal	Despite enough free space present in the southern part of the alignment in Mandabag, the proposed rail station is in the northern part. The land surveyors have been marking 90 m from the alignment where initially they told it is only 63 m which causes massive confusion on the local people. The southern part of the alignment is more suitable for the new rail line.
4.	Nepal Chandra Shaha General Secretary Press Club	Land filling vehicles will cause damage to the local market and surrounding area. Extended traffic during construction work will create traffic jam in the busy roads.

Sl. No.	Individual	Comments
		Road communication will be hampered during the bridge construction period. The Consultant must recommend the best way that minimises the damage to the local people No harm to environment. Natural drainage system for the storm water must be preserved.
5.	Mokbul Hossain UP Member	Land Acquisition issues – proper compensation must be ensured. The existing roads are not enough to support the extended traffic carrying construction materials during Project implementation.
6.	Md. Mofijul Islam Vuiya Principal, Vuiya Degree college	Daytime working will hamper normal life in this area. He suggested if there is any option will can recommend construction work at night. The people near the alignment will suffer sound pollution.
7.	Abu Bakkor Shiddik School Principal	Water bodies may be harmed due to the new rail line. This Project will cause more soil pollution, sound pollution and air pollution. Local people must be protected from suffering health hazards.
8.	Jalal Saifur Rahman UNO, Quasba	Natural water ways and storm drainage system should be considered constructing new bridges. We should not compromise possible environmental issues in the name of development.

7. Follow Up Actions Defined:

- Draft EIA report will be shared with the Project affected people;
- Detailed location map will be shared with Project land requirements;
- Issue of river bank erosion will be referred to the relevant Team of Experts (Hydrology and RTW);
- Tree plantation to replace felled trees during alignment construction and toward protecting built embankment will be prescribed; and
- Issue of rehabilitation of and compensation to PAPs will be referred to the Social Safeguard Team.

8. Complete List of Attendees: See Attendance Sheet

Subproject No: 2

Meeting Location: Kaaba Upazilla **Date:** 18/06/2013

Sl. No	Name	Occupation	Department	Sign
1	[illegible]	[illegible]	[illegible]	
2	[illegible]	UNO, Kaaba.		
3	Abul Fate Mohammad Shafiqul Islam	AC land, Kaaba	Upzila land office	
4	Md. Anower Hossain	Asst. Director	Bangladesh Rly	
5	AT M Shamsul Alam	Principal Specialist	CEGIS	
6	Md. Shakul Islam	Secretary (C.P.C)		
7	Tafazzal Hossain	Principal	Kaaba T. Ali Degree college	18/6/13
8	Geza Teleki	ENV. Spec.	SMEC	
9	Mehedi Hasan	"	Consultant	
10	MD. Ahmedwzzaman	SI Kasbathana	Police	
11				
12				
13				
14				

Subproject No:

Meeting Location: Kasba **Date:** 17-6-13

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
১.	মো: এনামুল হক	01719-855611	আড়াইবাড়ী	শিক্ষক	[illegible]
২.	মোহাম্মদ [illegible] হোসেন	01722453564	[illegible]	[illegible]	[illegible]
৩.	মোঃ [illegible], 0১৮১৬৬৮৬০০		[illegible]	[illegible]	[illegible]
৪.	মো: আমিনুল ইসলাম আবুল	01915842057	কসবা	ব্যবসা	[illegible]
৫.	গোপাল চন্দ্র সরকার	01721-446482	কসবা	সাধারণ সম্পাদক কসবা প্রেস ক্লাব	[illegible]
৬.	মো: মোজাম্মেল হোসেন	01714098762	কসবা	[illegible]	[illegible]
৭	তাজমিনুর রহমান	01712-999363	[illegible] কসবা সদর	চাকুরী	[illegible]
৮	মো: আব্দুল [illegible]	01711-148416	[illegible]	”	[illegible]
৯	মো: আনোয়ার হোসেন	01922820860	[illegible]	ব্যবসা	[illegible]
১০	[illegible]	01924163339	[illegible]	মেম্বার	[illegible]
১১	মো: নবী [illegible]	01711237873	[illegible]	[illegible]	[illegible] 18/6/13
১২	মো: মকবুল হোসেন	01731144127	[illegible]	মেম্বার	[illegible]
১৩	[illegible] হোসেন	01729-167477	[illegible]	[illegible]	[illegible]
১৪	মো: আমানত [illegible]	01724092643	[illegible]	চেয়ারম্যান	[illegible]
১৫	মো: [illegible]	01828173814	[illegible]	মেম্বার	[illegible]
১৬	মো: [illegible]	01715536977	[illegible]	মেম্বার	[illegible]
১৭	[illegible] রহমান [illegible]	01728129397	[illegible]	মেম্বার	[illegible]
১৮	জহিরুল হক		[illegible]	মেম্বার	[illegible]
১৯	বকুল বেগম	01832572069	৭, ৮, ৯ [illegible]	মহিলা সদস্য	বকুল বেগম
২০	[illegible]	01711963972	কসবা	চাকুরী	[illegible]

Subproject No: 2

Meeting Location: kasba **Date:** 18/06/13

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
২১	মো: রফিকুল ইসলাম ভূঁইয়া	০১৭১৬-২৪৪৬৮৭	চরগাছ ইন. আই ভূঁইয়া বিল্ডিং গ্রুপ	অধিকর্তা চরগাছ ইন. আই ভূঁইয়া বিল্ডিং গ্রুপ	[illegible]
২২	মো: জুলফিকার ভূঁইয়া	০১৭১৬ ৯২৭৫৭৪	সভাপতি কসবা পুরাতন বাজার ব্যবসায়ী সমিতি	ব্যবসা	[illegible]
২৩	মো: সালাহ উদ্দিন	01724-332973	সহ: প্রধান শিক্ষক কসবা পৌর উ/বি	শিক্ষকতা	[illegible]
২৪	আবু বকর ছিদ্দিক	01190850796	প্রধান শিক্ষক কসবা সরকারি উচ্চ বি.	শিক্ষকতা	[illegible] 18/06/13
২৫	মাহবুবুল ইসলাম	01712513242	চান্দপুর কসবা-বি, বাড়ি	শিক্ষক	[illegible]
২৬	মো: মোসলিম মিয়া	01715077754	কসবা মহিলা ডিগ্রী কলেজ	প্রভাষক	[illegible]
২৭	মোহাম্মদ আবদুল আজিজ	01712856899	[illegible]	[illegible]	[illegible] 18/06/13
২৮	[illegible]	০১৬৫৭১৮০৪৪৪২	কাইমপুর	[illegible]	[illegible]
২৯	মতি হক্কানী	01711051956	কাইমপুর	ব্যবসা	মতি হক্কানী 18/6/13
৩০	আব্দুল মজিদ [illegible]	01715735699	[illegible]	শিক্ষকতা	[illegible] 18/6/13 01671868751
৩১	মো: ফারুক মিয়া	01711989853	”	ব্যবসা	[illegible]
৩২	মো: বদরুল আলম চৌধুরী	01819036288	[illegible]	[illegible]	[illegible]

CANARAIL in JV with SMEC DB Mobility Networks Logistics ACE BANGLADESH

Minutes of Public Consultation Meeting 04

1. Meeting Location: Mogra Union, Akhaura (GPS: N 23° 44´ 54.5´´, E 91° 8´ 49.07´´)

2. Meeting Date: 18/ 06 /2013

3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam

4. Presentation Given By: Mehedi Hasan, Environment Specialist

5. Environmental Consultant's Presentation Content:

Project Description

Project progress

Construction Work

Proposed alignment

Probable Environmental Issues of the Project (Before, After and During the Construction)

Contact information for further queries

6. Comments of Participants:

Public Consultation 04 - Mogra, Akhaura

Sl. No.	Individual	Comments
1.	Md. Jahangir Alam Vuiya Businessman	The new proposed alignment on the eastern side of the existing line causing mass confusion. Many people are confused due to lack of information. More detailed alignment is necessary.
2.	S. K. Borhan Uddin Chairman, Akhaura Shamsul Alam CEGIS Subcontractor	What is the compensation system will be followed in this Project? Government must consider the general people before deciding the alignment. For new line, Western side is very suitable not the eastern side. Residential area, markets and sensitive structures must be avoided. The proposed alignment will cross Mogra market and the Gangasagar market causing massive property loss to the people. People will stand against the decision if that goes against them. He shared some views on land acquisition and resettlement policy.
3.	Md. Ali	Unnecessary land should not be acquired by railway. Why the survey team marking 80 ft. on the both side of the track?
4.	Abdussamad Former Chairman	The alignment is not clear. More detailed alignment is necessary to give any comment on environmental issues. Mass people should not be harmed. Environmental, social problems should minimise. Consider the people's choice. People will help the Project that will go beyond the boundaries connecting us to many countries.
5.	Shakil Jaman Journalist	Land acquisition issues. He described his own home as a very ancient structure, established in British colonial period. This ancient building will be destroyed if the proposed line

Sl. No.	Individual	Comments
		becomes final.
6.	Md. Bashirul Haque Bhuiyan UNO, Akhaura	Land acquisition issues. Environmental issues are also important. People near the alignment will be affected to sound pollution. Long-time construction work will hamper public activities. We have to save our rivers and water bodies. The general people must not be harmed in the name of development.

7. Follow up Actions Defined:

- Draft EIA report will be shared with the Project affected people;
- Detailed location map will be shared with Project land requirements;
- Issue of river bank erosion will be referred to the relevant Team of Experts (Hydrology and RTW);
- Tree plantation to replace felled trees during alignment construction and toward protecting built embankment will be prescribed; and
- Issue of rehabilitation of and compensation to PAPs will be referred to the Social Safeguard Team.

8. Complete List of Attendees: See Attendance Sheet

Subproject No:

Meeting Location: ~~আখাউড়া~~ আখাউড়া ইউনিয়ন পরিষদ আখাউড়া **Date:** 18-6-13

Sl. No	Name	Occupation	Department	Sign
1	Sk. Burhan Uddin	U.C. Akhaura		
2	Md. Bashirul Haque Bhuiyan	UNO, AKhaura (Cont Service)	Administration	
3	Md. Anwar Hossain	Asst. Director	Bangladesh Rly	
4	~~Kamrul~~			
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Subproject No:

Meeting Location: **Date:**

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
	[illegible]	01726258583	[illegible]	ব্যবসা	
	[illegible]	01711002439	[illegible]	[illegible]	
	মো: [illegible]	01843604864	[illegible]	[illegible]	
	মো: [illegible]	01712052836	[illegible]	[illegible]	
	[illegible]	01729698434	[illegible]	[illegible]	
	[illegible]	01711463441	[illegible]	[illegible]	
	নির্মল কুমার পাল	01191080270	[illegible]	ব্যবসা	
	[illegible]	01710-639197	[illegible]	-	
	[illegible]	01716517004	[illegible]	[illegible]	
	[illegible]	01731921170	[illegible]	[illegible]	
	[illegible]	01724345706	[illegible]	[illegible]	Ashraf Ithan
	[illegible]	0916-61336	[illegible]	[illegible]	
	[illegible]	01766154423	[illegible]	[illegible]	
	[illegible]	01819-473119	[illegible]	[illegible]	
	[illegible]	01742966379	[illegible]	[illegible]	EARTHOSPH
	[illegible]	01672117359	[illegible]	[illegible]	
	[illegible]	01849901832	[illegible]	[illegible]	
	[illegible]	01822-279492	[illegible]	[illegible]	
	[illegible]	01838849266	[illegible]	[illegible]	
	[illegible]	01190742838	[illegible]	[illegible]	

Subproject No:

Meeting Location: **Date:**

Sl. No	নাম	মোবাইল	গ্রাম	পেশা	স্বাক্ষর
	[illegible]	01[illegible]2946678	[illegible]	[illegible]	[illegible]
	[illegible]	01837[illegible]	[illegible]	[illegible]	[illegible]
	সাইফুল ইসলাম	01751-415228	[illegible]	[illegible]	সাইফুল ইসলাম
	[illegible]	01[illegible]-312340	[illegible]	[illegible]	[illegible]
	[illegible]	01727109358	[illegible]	[illegible]	[illegible]
	[illegible]	01725655233	[illegible]	[illegible]	[illegible]
	Farlad	01721-818911	[illegible]	[illegible]	Farlad
	[illegible]	01819641268	[illegible]	[illegible]	[illegible]
	[illegible]	01819[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	01720268668	[illegible]	[illegible]	[illegible]
	[illegible]	01191 233221			[illegible]
	[illegible]	01912664209	[illegible]	[illegible]	[illegible]
	[illegible]	01711229533	[illegible]	[illegible]	[illegible]
	[illegible]	01[illegible]991661	[illegible]	[illegible]	[illegible]
	[illegible]	01819[illegible]	[illegible]		
	[illegible]	01819970151	[illegible]		
	[illegible]	01714295074	[illegible]	[illegible]	[illegible]
	[illegible]	01754398649	[illegible]	[illegible]	[illegible]

EMP Disclosure Meetings

Minutes of Public Consultation Meeting 01

1. Meeting Location: Quasba Upazila (GPS: N 23° 44´ 54´´, E 91° 08´ 49´´)
2. Meeting Date: 12/ 03 /2014
3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam
4. Presentation Given By: Mehedi Hasan, Environment Specialist
5. Environmental Consultant's Presentation Content:
    - Objective of the Meeting;
    - Project Progress;
    - Probable Environmental Issues of the Project (Before, After and During the Construction);
    - Environmental Management Plan – Mitigative and Monitoring;
    - Grievance Redress Mechanism; and
    - Project Benefits and Enhancements.
6. Comments of Participants:

Sl. No.	Individual	Comments
1.	**Humayun Kumar** Head Master	Land acquisition issues. People are very concerned because the new survey is committed within 50 m from the existing rail line where the previous survey marked different structures within 100 m. He asked about the validity of the new survey. **Consultant reply**: Land acquisition will be least as possible. The Government of Bangladesh is very strict to this issue and affected land area has been minimised to approximately 60 ha or less.
2.	**Md. Ali** Farmer	He wanted to know how the affected people will get the compensation. **Consultant reply:** Land acquisition issues will be discussed in details by the social team.
3.	**Md. Mokbul Hossain** U.P. Member	The busy level crossing near the Mandabag rail station needs attention. Signalling system must be developed. **Consultant reply:** Consultant has identified 25 authorised and unauthorised level crossings. Different safety measures including barricade, warning light and underpass have been suggested by the Consultant which will minimise the risk for the local transport.
4.	**Md. Amzad Hossain Sarkar** Chairman, Kayempur Union	Quasba Road Bridge is very weak for the heavy construction vehicles. He suggested using the road from Akhaura. Ground water reserve is decreasing day by day. People are using more powerful pumps to use underground water which means the local people are already suffering for ground water. He suggested reducing ground water use for the construction. He congratulated the Consultant for tree plantation plan. He suggested using the Gumti and Titas river water for the construction to reduce ground water demand.

Sl. No.	Individual	Comments
		He asked about the alignment, either it is going through the west or the east side of the existing rail line. If the alignment goes through the east side of the existing track it will cause less damage to the local people. He expected that the Government will consider the current market price for the acquired land rather than the locational price. Mandabag station mosque will be affected if the alignment goes through the west side of the existing rail line. **Consultant reply:** The road bridges will be assessed before the heavy construction vehicles pass through them. Moreover, the existing roads should be repaired and upgraded if necessary. Groundwater will be used as the second option for the construction. However some specific regions like the work camps where workers will be in need of drinking water, a very limited amount of ground water will be used with permission. Sensitive structures will be relocated with proper compensation.
5.	**Jalal Saifur Rahman** UNO, Quasba	Environmental issues are negligible compared to the relocation and compensation issues. He expressed his concern about the mosque near the Mandabag rail station. If the mosque is to be demolished then it may hurt the local people. He again asked the exact alignment direction either it is through the east side or the west side of the existing track.
6.	**Ruhul Amin Bhuiya** Upazila Chairman	He expected that the Government will demolish mosques considering the religious spirit of the local people. Educational institutes should be rebuilt if affected by the Project. Land rate will be fixed averaging the surrounding land prices. Finally, people should go under proper compensation process if affected by the Project.
7.	**Abul Kalam Azad** Member, Gopinathpur union	Railway development is for the welfare of the people. We must support the government to the success of this Project.
8.	**Md. Mofiz Uddin** Police Inspector, Quasba P/S	He requested the participants to stay calm and patient if faced any problem caused by the Project and to follow the Grievance Redress Mechanism proposed by the Consultant.

7. Follow Up Actions Defined:

   - Final version of EIA report along with EMP and Executive Summary (Bangla) should be placed at UNO office for future reference.

8. Complete List of Attendees: See Attendance Sheet

Subproject No: 2

Meeting Location: Quasba Upazila Complex **Date:** 12/03/2014

GPS: Do **N** - **E** -

Sl. No	Name	Mobile No.	Occupation	Department	Sign
1	[illegible]	01713002224	[illegible]	[illegible]	
2	[illegible]	01716875276	[illegible]	UNO OFFICE Quasba	
3	Sohel Ahmed	01716584645	AC(L)	Upz. land office	
4	Md. Mohsin Ali	01710870870	Consultant	SMEC	
5	S M. Ferdous Alam	01780-018750	Assistant Director Bangladesh Railway	Bangladesh Railway	
6	Md. Shahid Zaman	01715295920	Consultant	SMEC	
7	Mustakim Masum	01677400747	Consultant	SMEC	
8	Mehedi Hasan	01811446974	Env. RCIP Consultant	RCIP	
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Subproject No: 02

Meeting Location: Quasba Upazila Complex **Date:** 12/03/2014

GPS: DO **N** **E**

Sl. No	Name	Mobile No.	Town / village	Occupation	Sign
1	আহেলী আক্তার	01719708957	[illegible]	১,২,৩ নং ওয়ার্ড	আহেলী
2	বকুল বেগম	01832572069	ব্রাহ্মণগ্রাম	৭,৮,৯ সদস্য	বকুল বেগম
3	হামিদুজ্জামান কামাল	01771514242	গোপীনাথপুর	১,২,৩ ওয়ার্ড সদস্য	[illegible]
4	লুৎফা	01854825025	[illegible]	গৃহিণী	লুৎফা
5	মো: [illegible] ইসলাম	01726-798142	[illegible]	ব্যবসা	[illegible]
6	[illegible]	01821-446482	[illegible]		[illegible]
7	মো: হুমায়ুন কবির	01720073425	[illegible]	[illegible]	[illegible]
8	মো: [illegible]	01731149127	[illegible]	মেম্বার	[illegible]
9	মো: [illegible]	~~[illegible]~~ 01727156453	[illegible]	গৃহিণী	
10	মো: [illegible] মিয়া	01753135545	[illegible]	[illegible]	[illegible]
11	মো: শফিক	[illegible]		[illegible]	[illegible]
12	[illegible]	01747856334	[illegible]	[illegible]	
13	মো: আবুল [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	মো: আবুল কাশেম		[illegible]	চাকরী	কাশেম
15	[illegible]	01927429275	[illegible]	কৃষক	[illegible]
16	মো: [illegible] মিয়া				
17	মোহাম্মদ আলী	01726555553	[illegible]	কৃষক	[illegible]
18	মো: [illegible]	01726-110351	[illegible]	ব্যবসা	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	01715536977	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	কৃষি	[illegible]
22	[illegible]	01728129397	[illegible]	[illegible]	[illegible]
23	[illegible]	01927188433	[illegible]	[illegible]	[illegible]
24	মো: [illegible]	01922820860	[illegible]	[illegible]	[illegible]
25	Md: Hafiz uddin Bhuyan	01712-05 48 28	Inspector of Police	Kasba P/S	[illegible]

1. Meeting Location: Barapara, Lalmai (GPS: N 23^0 23′ 01″, E 91^0 09′ 34″)
2. Meeting Date: 12/ 03 /2014
3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam
4. Presentation Given By: Mehedi Hasan, Environment Specialist
5. Environmental Consultant's Presentation Content:
   - Objective of the Meeting
   - Project Progress
   - Probable Environmental Issues of the Project (Before, After and During the Construction)
   - Environmental Management Plan – Mitigative and Monitoring
   - Grievance Redress Mechanism
   - Project Benefits and Enhancements
6. Comments of Participants:

Sl. No.	Individual	Comments
1.	**Humayun Kabir** Chairman, Barapara Union	He welcomed all the participants for their presence. He requested the people to support the government spontaneously for the greater good. He reminded the previous meeting where the people of Barapara shared their concern about the Bijoypur high school and the market.
2.	**Jashim Uddin Majumdar** Teacher, Bijoypur High School	How far from the existing track will be acquired **Consultant reply:** Land acquisition will be very less. The final land survey has considered the least possible land to be acquired.
3.	**Goutam Saha** U P Member	Ground water should not be taken for construction work. Groundwater level has already decreased and people started to suffer. **Consultant reply:** Groundwater will be used as the second option for the construction. However some specific regions like the work camps where workers will be in need of drinking water, a very limited amount of ground water will be used with permission.
4.	**Sharif** U P Member	Lots of household will be affected if the alignment goes through the west side of the existing track **Consultant reply:** Railway acquired land is more on the west side of the existing track. Therefore west side has been taken into consideration to reduce private land acquisition.
7.	**Khaled Mahmud** UNO, Comilla Sadar Dakhin	He referred some other development Projects where local people initially raised against the land acquisition but at a later time they all got benefit from the Project. People must sacrifice for sake of the national development and as well as the local development. He appreciated the Consultant's approach to minimise the environmental issues.

7. Follow Up Actions Defined:
   - No follow up action recorded
8. Participants Attendance Sheet:

Subproject No: 2

Meeting Location: Barapara Union Complex **Date:** 12/03/2014

GPS: Do **N** **E**

Sl. No	Name	Mobile No.	Occupation	Department	Sign
1	Khaled Mahmud	01818331678	Service	Administration	
2		01776362636			
3		01717024648			
4	Md. Nayem Khan	01725-611823	S.A.A.O	DAE	
5	Mizanur Rahman	01817639144	S.A.A.O	D.A.E	
6		01716-085997			
7	Md. Shahid Zaman	01715295420	Consultant	SMEC	
8	Md. Mohsin Al	01710 876870		SMEC	
9	Mehedi Hasan	01811446974	Env. Specialist	RCIP	
10	Mustakim Masum	01671400747	Consultant	SMEC	
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Subproject No: 2

Meeting Location: Barapara Union Complex **Date:** 12/03/2014

GPS: DO **N** **E**

Sl. No	Name	Mobile No.	Town / village	Occupation	Sign
1	মোঃ রফিকুল ইসলাম	01716-085997	[illegible]	মেম্বার	[signature]
2	[illegible]	01710305994	[illegible]	মহিলা সদস্য	[signature]
3	[illegible]	01925266109	[illegible]	মহিলা সদস্য	[signature]
4	[illegible]	01733841254	[illegible]	মহিলা সদস্য	[signature]
5	মো: আলী আহম্মদ	018125[illegible]28	বারপাড়া	মেম্বার	[signature]
6	মো: এনামুল হক	01819509171	[illegible]	S.A.A.O	[signature]
7	[illegible]	01814405480	[illegible]	[illegible]	[signature]
8	[illegible]	01711343530	[illegible]	[illegible]	[signature]
9	মোঃ মফিজুল ইসলাম	01818579328	[illegible]	[illegible]	[signature]
10	[illegible]	01726-290094	[illegible]	[illegible]	[signature]
11	[illegible]	01813285680	[illegible]	[illegible]	[signature]
12	[illegible]	–	[illegible]	[illegible]	
13	[illegible]	–	[illegible]	[illegible]	
14	[illegible]	–	[illegible]	[illegible]	[signature]
15	[illegible]	01843[illegible]	[illegible]	[illegible]	[signature]
16	[illegible]	01817550283		[illegible]	
17	[illegible]	01817063919		[illegible]	[signature]
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Minutes of Public Consultation Meeting 03

1. Meeting Location: Amratali, Sadar Rashulpur (GPS: N 22° 30´ 22´´, E 91° 10´ 20´´)
2. Meeting Date: 13/ 03 /2014
3. Project Name: Construction of Double Line and upgrade of existing rail line between Akhaura and Laksam
4. Presentation Given By: Mehedi Hasan, Environment Specialist
5. Environmental Consultant's Presentation Content:
    - Objective of the Meeting;
    - Project Progress;
    - Probable Environmental Issues of the Project (Before, After and During the Construction);
    - Environmental Management Plan – Mitigative and Monitoring;
    - Grievance Redress Mechanism; and
    - Project Benefits and Enhancements.
6. Comments of Participants:

Sl. No.	Individual	Comments
1.	**Rafiqul Islam** Businessman	He said Union Parishad Chairman is well aware off about the construction and other relevant impacts. He believes that Chairman's speech will reflect all of their concerns. He is satisfied with the action described in environmental management plan and also the grievance redress mechanism. He wishes the EMP will be implemented throughout the Project implementation period. **Consultant reply:** Bangladesh Railway will ensure implementation of EMP throughout the Project period.
2.	**Quazi Mozammal** Haque Union Parishad Chairman, Amratali Union	He mentioned that land acquisition and resettlement is the most concern issue to implement the Project. He requested and demanded to provide adequate compensation to Project affected persons. As this meeting is not the right place to discuss on land acquisition, he will not elaborate this issue further. He said he is satisfied with all actions proposed to implement this Project. **Consultant reply:** Mehedi Hasan said he will inform social team of the Consultant to organise a meeting at this location once the land acquisition and resettlement plan of SP2 has been finalised. He said Bangladesh Railway inform the Consultant for minimum land acquisition. Recent social survey indicated that land acquisition will be reduced to almost 50% than previous acquisition plan
3.	**Khandkar Faruq Ahmed** Service	He mentioned that during construction, surface runoff from the proposed embankment area would impact the adjoining agricultural lands. Therefore, the impacted lands will lose its fertility and it will not possible to grow anything after few years. **Consultant reply:** EMP adequately addresses this issue and proposed to plant grasses on embankment slope. However, if construction activities affect the adjoining agricultural lands, it is requested to place a complaint through GRC.

7. Follow up Actions Defined:

- Final version of EIA report along with EMP and Executive Summary (Bangla) should be placed at UNO office for future reference.
- Project Affected Persons (PAPs) should obtain benefits first (employment, business, kind, and etc.) once the Project has been implemented.

8. Participants Attendance Sheet: See Attendance Sheet

Subproject No: 02

Meeting Location: Awaetoli Union Complex **Date:** 13/03/2014

GPS: N E

Sl. No	Name	Mobile No.	Town / village	Occupation	Sign
1	[illegible]	01819-135323	[illegible]	[illegible]	[illegible]
2	[illegible]	01961-499059	[illegible]	[illegible]	[illegible]
3	[illegible]	01814790205	[illegible]	[illegible]	[illegible]
4	[illegible]	01916075581	[illegible]	[illegible]	[illegible]
5	[illegible]	01731323680	[illegible]	[illegible]	[illegible]
6	[illegible]	01712-746477	[illegible]	[illegible]	[illegible]
7	[illegible]	01811335318	[illegible]	[illegible]	[illegible]
8	[illegible]	01711-710007	[illegible]	[illegible]	[illegible]
9	[illegible]	01772067736	[illegible]	[illegible]	[illegible]
10	[illegible]	01827478135	[illegible]	[illegible]	[illegible]
11	[illegible]	01811918104	[illegible]	[illegible]	[illegible]
12	[illegible]	0823-685426	[illegible]	[illegible]	[illegible]
13	[illegible]	01913166771	[illegible]	[illegible]	[illegible]
14	[illegible]	01940594782	[illegible]	[illegible]	[illegible]
15	[illegible]	01937157135	[illegible]	[illegible]	[illegible]
16	[illegible]	01937351458	[illegible]	[illegible]	[illegible]
17	[illegible]	01819 560953	[illegible]	[illegible]	[illegible]
18	[illegible]	01711023546	[illegible]	[illegible]	[illegible]
19	[illegible]	01818290668	[illegible]	[illegible]	[illegible]
20	[illegible]	01817011870	[illegible]	[illegible]	[illegible]
21	[illegible]	01715-298196	[illegible]	[illegible]	[illegible]
22	[illegible]	01816-929919	[illegible]	[illegible]	[illegible]
23	[illegible]	01716-122679	[illegible]	[illegible]	[illegible]
24					
25	[illegible]	01557000625	[illegible]		[illegible]

Subproject No: 02

Meeting Location: Amoatoli Union Complex   **Date:** 13/03/2014

GPS: N   E

Sl. No	Name	Mobile No.	Town / village	Occupation	Sign
1	Md. Hadyeat allah	01843-324464	Banashua	Teacher	[illegible]
2	Md. Abbo Mia	- - -	Banashua	Farmer	[illegible]
3	মো: আ: মান্নান	01726-233159	বানাসুয়া	ব্যবসায়	[illegible]
4	মোঃ রুহুল আমিন	01948597819	বানাসুয়া	Teacher	রুহুল
5	মো: মিজানুর রহমান	01752163694	বানাসুয়া	কৃষি	[illegible]
6	মোঃ মান্নান	———	মিরপুর	কৃষি	মান্নান
7	মো: শাহজাহান রানি	01814-748242	রসুলপুর	চুন	মোহান
8	মো: এনামুল হক	01843-555848	পাটোরা	ড্রাইভার	এনামুল হক
9	মো: ডি.এম. রকিবুল হাসান	01965-602495	চিতলতলা	চেয়ারম্যান	রকিবুল
10	মো: আহসান হাবিব	01717-024620	[illegible]	সচিব ইউপি	[illegible]
11	মোঃ নুরুল ইসলাম	01717-993325	বানাসুয়া	চাকুরী	[illegible]
12	মো: জলিল	01720, 370776	বানাসুয়া	দপ্তরি	জলিল
13	মো: সুমন	01913-290681	রসুলপুর	ব্যবসায়	সুমন
14	মো: আজিজুর আলী	[illegible]	ঐ	কৃষক	আলী
15	মো: হামিম হোসেন	01913303305	রসুলপুর	ছাত্র	[illegible]
16	শফিকুল ইসলাম	———	বানাসুয়া	ব্যবসায়ী	শফিক
17	আবদুল্লাহ মোতালেব ০১৭২০৬... বাজার				মোতালেব
18	মকবুল হক	01711329712	বানাসুয়া	ব্যবসায়ী	মক: হক
19	হেলেনা বেগম	০১৮-১৪২৭৫৫৫	রসুলপুর	স্বাস্থ্যকর্মী	
20	মমতাজ	01936501798	[illegible]	গৃহিনী	
21	তানজিনা রহমান উর্মি	01199011692	নন্দনগর	ছাত্রী	তানজিনা
22	তাহমিনা আক্তার		"	গৃহিনী	তাহমিনা
23	ইলা আক্তার	01964-420136	[illegible]	ছাত্রী	ইলা
24	তাহমিনা বেগম		[illegible]	গৃহিনী	তাহমিনা
25	মাসুমা বেগম	01737 873 354	যশপুর	গৃহিনী	মাসুমা

Subproject No: 02

Meeting Location: Amratoli Union Complex **Date:** 18/02/2014

GPS: N E

Sl. No.	Name	Mobile No.	Town / village	Occupation	Sign
1	[illegible]	01781225248	[illegible]	[illegible]	[illegible]
2	[illegible]	01[illegible]	[illegible]	[illegible]	[illegible]
3	Md. Abdul Mofalab	01743938746	Shimpur.	Teacher.	[illegible]
4	Md. Abul Bashar Sarker	01911043780	Chanakpur	Teachy	[illegible]
5	Md. Billal Hossain	01911-647107	shimPur	student	[illegible]
6	Md. Alla uddin Monir	01736-291658	ShimPur	student	Monir.
7	Md. Nabirul Islam	01819446063	teacher Elashpur	teacher	[illegible]
8	[illegible]	01917317112	Shimpur	Student	[illegible]
9	Shahjahan	01774984270	[illegible]	[illegible]	[illegible]
10	[illegible]	01817662514	[illegible]	[illegible]	[illegible]
11	[illegible]	01718688699	[illegible]	[illegible]	[illegible]
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Subproject No: 2

Meeting Location: Amratoli Union Complex **Date:** 13/03/2014

GPS: **N** **E**

Sl. No	Name	Mobile No.	Occupation	Department	Sign
1	Quazi Mozammel Hoque	01712-962557	Business	Chairman No.9, Amratali U.P. Adarsha Sadar	
2	Md. Mohsin Ali	01710876878,	Consultant	SMEC	
3	Mustakim Masum	01677400747	Consultant	SMEC	
4	Md. Shahid Jamal	01718-295720	Consultant	SMEC	
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Annex 6: National Legal Instruments Related to the Project

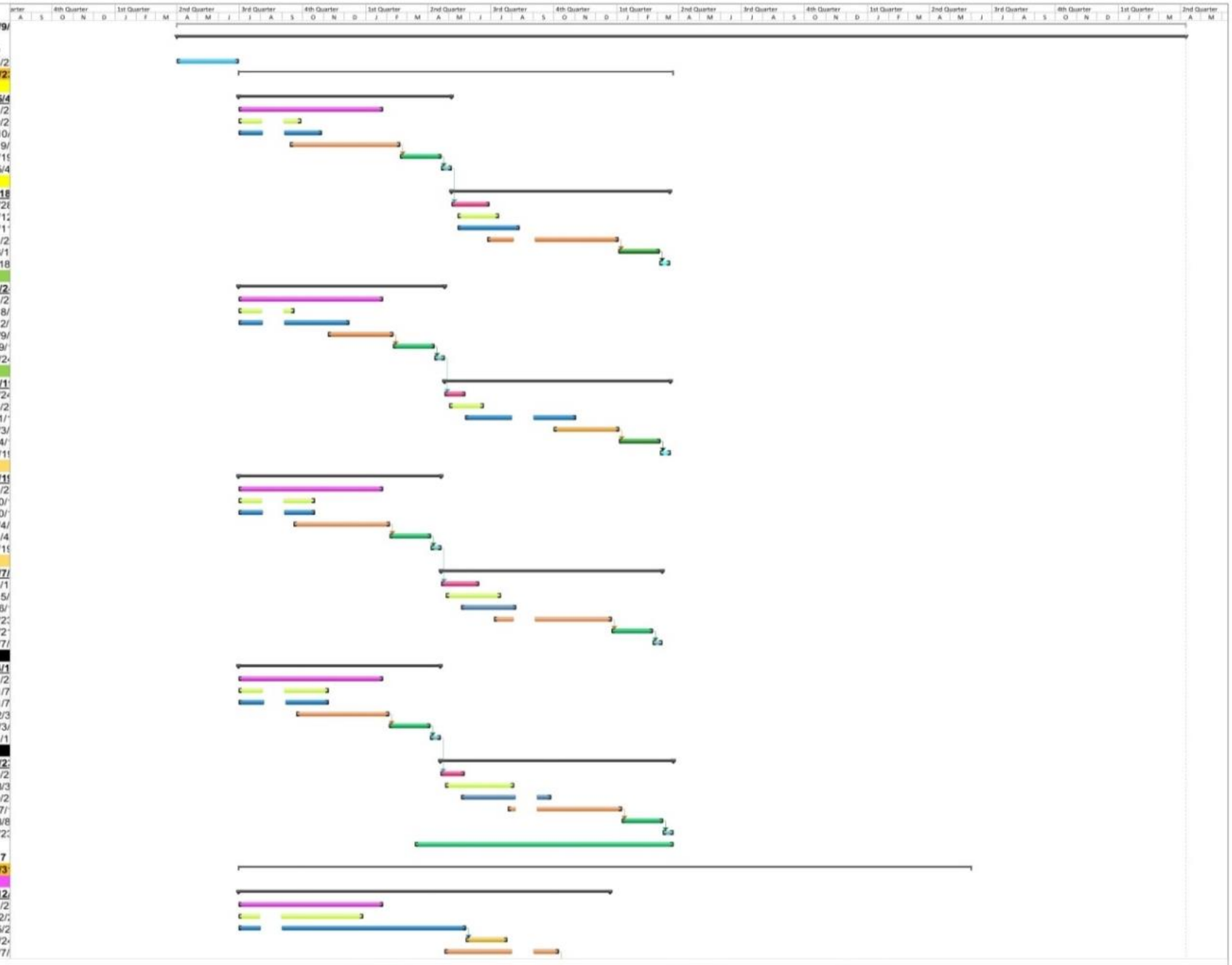
Ordinance/Act/Rules	Responsible Agency/Ministry/Authority	Key Features/Potential Applicability
Environment Court Act, 2000 and subsequent amendments	Ministry of Environment and Forest, Department of Environment	Effective pursuance and completion of legal proceedings related to environmental crimes.
National Land Transport Policy, 2004	Ministry of Communication Railway Division, Bangladesh Railway	Encouraging greater private sector participation in the provision of services. Enhancing the operational capacity of Railways. Obtaining a greater share of freight market. Pursuing management of Railway assets more efficiently. Ensuring improved Financial Efficiency. Ensuring more effective provision of services for social needs. Fostering International railway links. Reducing involvement in non-rail activities. Ensuring improvement in railway safety. Ensuring improvement in institutional capacity of Bangladesh Railway.
The National Water Policy, 1999	Ministry of Water Resources and Bangladesh Water Development Board (BWDB)	Protection, restoration and Enhancement of water resources; Protection of water quality, Including strengthening Regulations concerning agro- chemicals and industrial effluent; Sanitation and potable water; Fish and fisheries; and Participation of local communities in all development activities in the water sector.
The Brick Burning (Control) Act, 1989 5. The Brick Burning (Control) Amendment Act, 1992 and 2001	Ministry of Environment and Forest; DoE	Control of brick burning; Requires a license from the MoEF for operation; Restricts brick burning with fuel wood.
The Removal of Wrecks and Obstructions in Inland Navigable Waterways Rules 1973	Bangladesh Inland Water Transport Authority (BIWTA)	Removal of wrecks and obstructions in inland navigable waterways.
The Ground Water Management Ordinance 1985	Upazila Parishad	Management of groundwater resources Tube well shall not be installed in any place without the license granted by Upazila Parishad

Ordinance/Act/Rules	Responsible Agency/Ministry/Authority	Key Features/Potential Applicability
The Forest Act, 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment and Forest: Forest Department	Reserve Forests Protected Forests Village Forests
National Forest Policy, 1979 with amendment in 1994	Ministry of Environment and Forest; Forest Department	Afforestation of 20% land Protection of bio-diversity of the existing degraded forests Strengthening of agricultural sector Control of Global warming Desertification Control of trade in wild birds and animals Prevention illegal occupation of the forestlands, free felling and hunting of wild animals
The Private Forests Act, 1959	Forest Department; Regional Forest Officer.	Conservation of private forests Afforestation on wastelands
Bangladesh Wild Life (Preservation) Act, 1974	Ministry of Environment and Forest: Bangladesh Wildlife Advisory Board	Preservation of wildlife sanctuaries, parks and reserves
National Biodiversity Strategy and Action Plan (2004)	Ministry of Environment and Forest; Bangladesh Wildlife Advisory Board	Conservation and restoration of the biodiversity of the country for well-being of the present and future generations Maintaining and improving Environmental stability of ecosystems; Ensuring preservation of the unique biological heritage of the nation for the benefit of the present and future generations Guaranteeing safe passage and conservation of globally endangered migratory species, especially, birds and mammals in the country Stopping introduction of invasive alien species, genetically modified organisms.
The Protection and Conservation of Fish Act, 1950 and subsequent amendments in 1982	Ministry of Fisheries and Livestock; Department of Fisheries	Protection and Conservation of fishes in Government-owned water bodies.
National Fisheries Policy, 1998	Ministry of Fisheries and Livestock Department of Fisheries	Preservation, management and exploitation of fisheries resources in inland open water systems Fish cultivation and management in inland closed water systems Prawn and fish cultivation in coastal areas; Preservation, management and exploitation of sea fishery resources

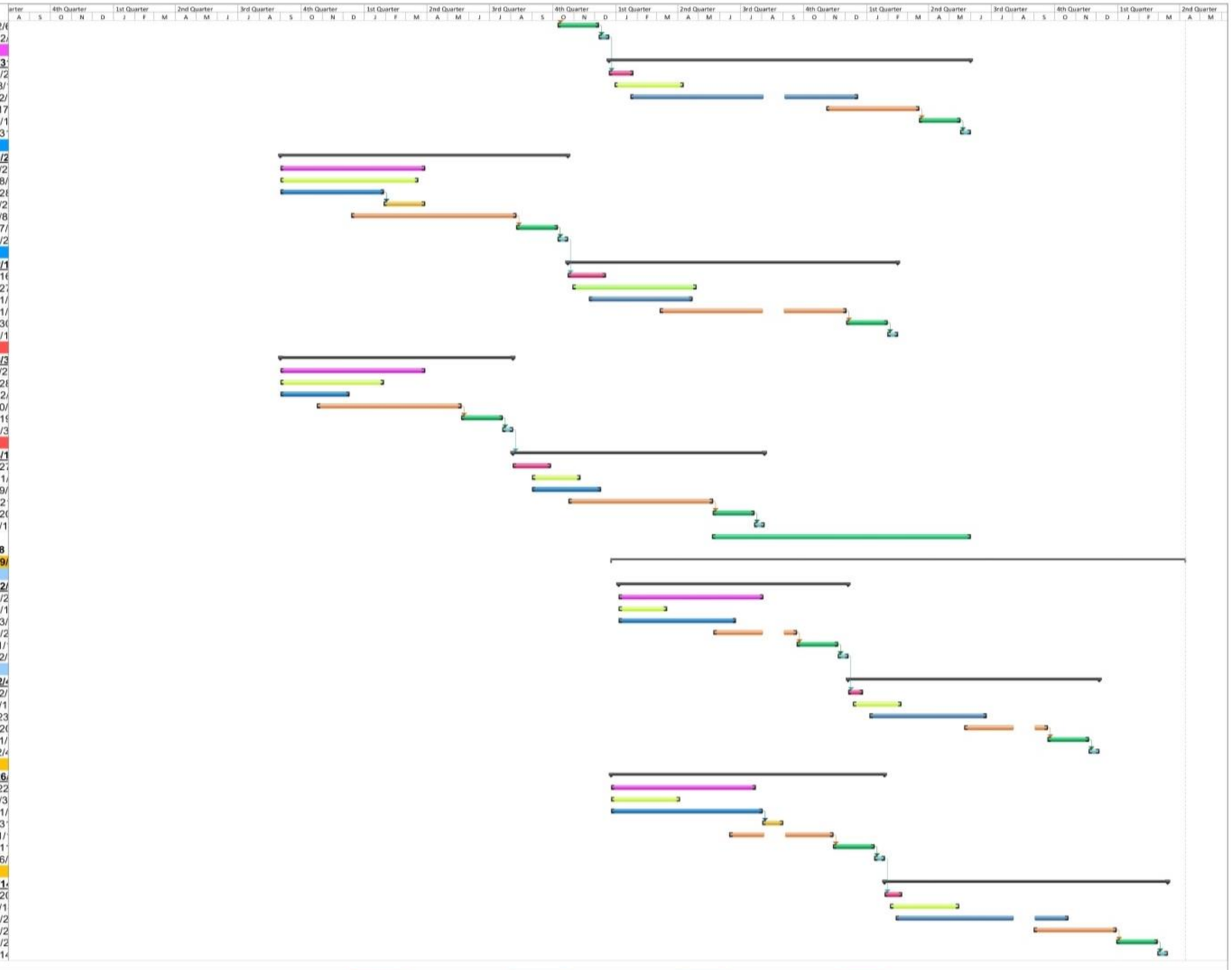
Ordinance/Act/Rules	Responsible Agency/Ministry/Authority	Key Features/Potential Applicability
The Embankment and Drainage Act, 1952	Ministry of Water Resources Bangladesh Water Development Board (BWDB)	Consolidating the laws relating to embankment and drainage Making better provision for construction, maintenance Management, removal and control of embankments and water courses for better drainage of lands and protection from floods, erosion and other damage by water.
Antiquities Act, 1968	Ministry of Cultural Affairs	Preserving national cultural heritage; Protecting and controlling ancient monuments and any activity that might harm these sites
The Acquisition and Requisition of Immovable Property Ordinance, 1982 (1994, 1995 and 2004)	Ministry of Land	Current GoB Act and Guidelines relating to acquisition and requisition of land.
National Land use Policy, 2001	Ministry of Land	The policy outlines land uses and constraints for several purposes including agriculture (crop production, fishery and livestock), housing, forestry, industrialisation, railways and roads, tea and rubber
National Agriculture Policy, 1999	Ministry of Agriculture	The policy for national self-sufficient in food through increasing production of all crops, including cereals, and toward ensuring dependable food security system for all.

Annex 7: Construction Programme of the Project

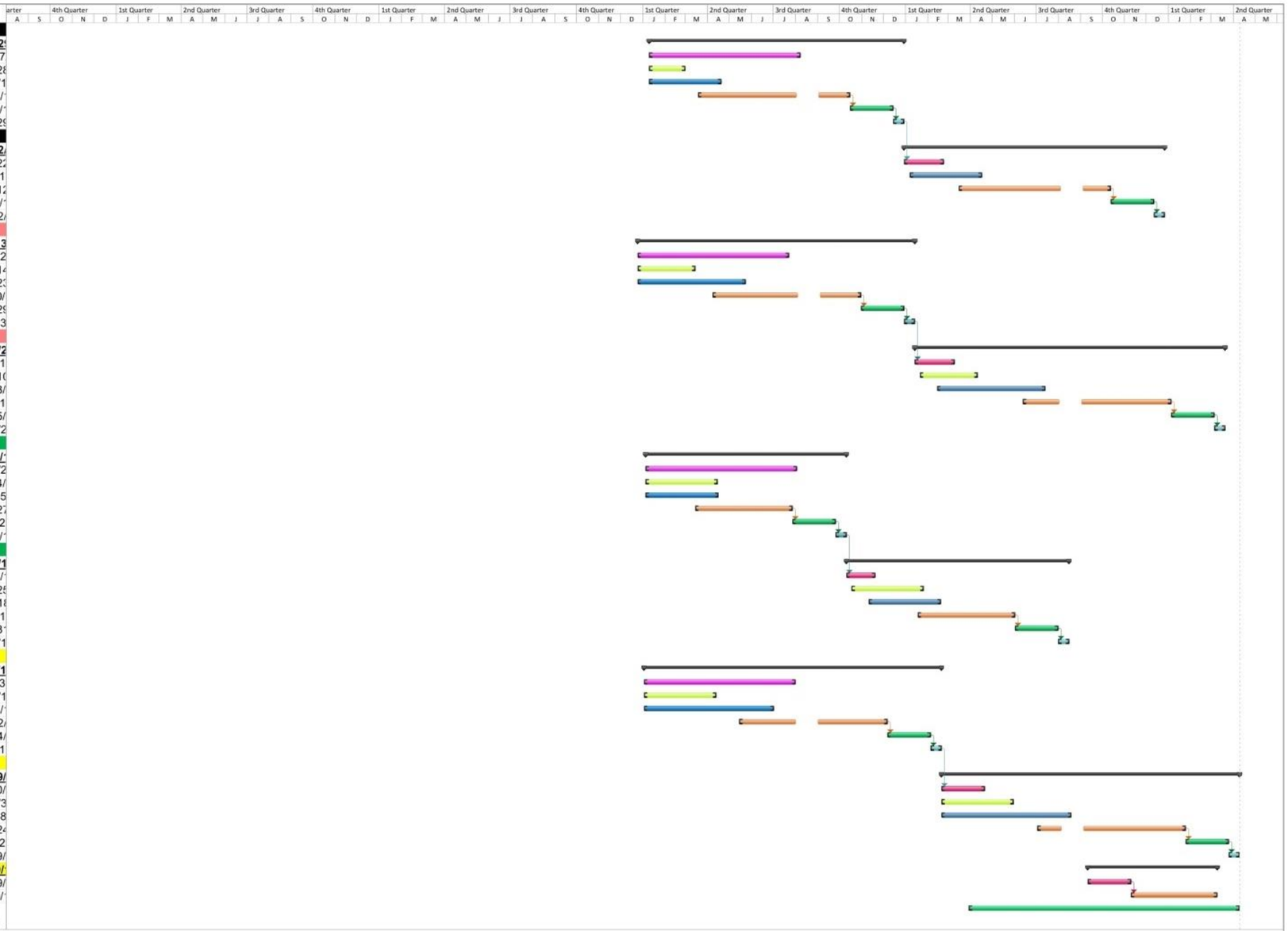
ID	Task Name	Team	Duration	Start	Finish
0	**Subproject No. 2**		**1470 da**	**Wed 4/1**	**Tue 4/9/**
1	**Construction of Double Line and Upgrade of Existing Rail Line**		**1470 days**	**Wed 4/1/15**	**Tue 4/9/19**
2	Mobilisation		90 days	Wed 4/1	Mon 6/2
3	**Section 1 (Laksam to Comilla)**		**633 da**	**Tue 6/3**	**Thu 3/2**
4	**NEW TRACK**	**Team 1**			
5	**Laksam to Alishahar**		**310 da**	**Tue 6/3**	**Wed 5/4**
6	Stations and Buildings		210 da	Tue 6/3	Mon 1/2
7	Earth Works		60 days	Tue 6/3	Mon 9/2
8	Bridges and Culverts		90 days	Tue 6/3	Wed 10/
9	Track Works		160 da	Sun 9/1	Fri 2/19/
10	Temporary Signalling and Telecom		60 days	Sat 2/20	Tue 4/1
11	Testing and Commissioning		15 days	Wed 4/2	Wed 5/4
12	**UPGRADING EXISTING TRACK**	**Team 1**			
13	**Laksam to Alishahar**		**318 da**	**Thu 5/5**	**Sat 3/18**
14	Dismantling Existing Track		55 days	Thu 5/5	Tue 6/2
15	Earth Works		60 days	Sat 5/14	Tue 7/1
16	Bridges and Culverts		90 days	Sat 5/14	Thu 8/1
17	Track Works		160 da	Sun 6/2	Mon 1/2
18	Temporary Signalling and Telecom		60 days	Tue 1/3	Fri 3/3/1
19	Testing and Commissioning		15 days	Sat 3/4	Sat 3/18
20	**NEW TRACK**	**Team 2**			
21	**Alishahar to Lalmai (2 - Teams)**		**300 da**	**Tue 6/3**	**Sun 4/2**
22	Stations and Buildings		210 da	Tue 6/3	Mon 1/2
23	Earth Works		50 days	Tue 6/3	Fri 9/18/
24	Bridges and Culverts		130 da	Tue 6/3	Mon 12/
25	Track Works		95 days	Sat 11/7	Tue 2/9/
26	Temporary Signalling and Telecom		60 days	Wed 2/1	Sat 4/9/
27	Testing and Commissioning		15 days	Sun 4/1	Sun 4/2
28	**UPGRADING EXISTING TRACK**	**Team 2**			
29	**Alishahar to Lalmai (2 - Teams)**		**329 da**	**Mon 4/2**	**Sun 3/1**
30	Dismantling Existing Track		30 days	Mon 4/2	Tue 5/2
31	Earth Works		50 days	Mon 5/2	Mon 6/2
32	Bridges and Culverts		130 da	Wed 5/2	Tue 11/
33	Track Works		95 days	Sat 10/1	Tue 1/3/
34	Temporary Signalling and Telecom		60 days	Wed 1/4	Sat 3/4/
35	Testing and Commissioning		15 days	Sun 3/5	Sun 3/1
36	**NEW TRACK**	**Team 4**			
37	**Lalmai to Mainamati (2 - Teams)**		**295 da**	**Tue 6/3**	**Tue 4/1**
38	Stations and Buildings		210 da	Tue 6/3	Mon 1/2
39	Earth Works		80 days	Tue 6/3	Sun 10/
40	Bridges and Culverts		80 days	Tue 6/3	Sun 10/
41	Track Works		140 da	Fri 9/18/	Thu 2/4/
42	Temporary Signalling and Telecom		60 days	Fri 2/5/1	Mon 4/4
43	Testing and Commissioning		15 days	Tue 4/5/	Tue 4/1
44	**UPGRADING EXISTING TRACK**	**Team 4**			
45	**Lalmai to Mainamati (2 - Teams)**		**322 da**	**Wed 4/2**	**Tue 3/7/**
46	Dismantling Existing Track		55 days	Wed 4/2	Mon 6/1
47	Earth Works		80 days	Wed 4/2	Fri 7/15/
48	Bridges and Culverts		80 days	Thu 5/1	Sat 8/6/
49	Track Works		140 da	Wed 7/6	Fri 12/2
50	Temporary Signalling and Telecom		60 days	Sat 12/2	Tue 2/2
51	Testing and Commissioning		14 days	Wed 2/2	Tue 3/7/
52	**NEW TRACK**	**Team 6**			
53	**Mainamati to Comilla**		**294 da**	**Tue 6/3**	**Mon 4/1**
54	Stations and Buildings		210 da	Tue 6/3	Mon 1/2
55	Earth Works		100 da	Tue 6/3	Sat 11/7
56	Bridges and Culverts		100 da	Tue 6/3	Sat 11/7
57	Track Works		135 da	Tue 9/22	Wed 2/3
58	Temporary Signalling and Telecom		60 days	Thu 2/4/	Sun 4/3/
59	Testing and Commissioning		15 days	Mon 4/4	Mon 4/1
60	**UPGRADING EXISTING TRACK**	**Team 6**			
61	**Mainamati to Comilla**		**339 da**	**Tue 4/1**	**Thu 3/2**
62	Dismantling Existing Track		35 days	Tue 4/1	Mon 5/2
63	Earth Works		100 da	Tue 4/2	Wed 8/3
64	Bridges and Culverts		100 da	Thu 5/1	Mon 9/2
65	Track Works		135 da	Tue 7/2	Sat 1/7/
66	Temporary Signalling and Telecom		60 days	Sun 1/8	Wed 3/8
67	Testing and Commissioning		15 days	Thu 3/9	Thu 3/2
68	**Signalling and Telecom (Final Install, Testing and**		**376 days**	**Sun 3/13/16**	**Thu 3/23/17**
69	**Section 2 (Comilla to Shashidal)**		**1067 da**	**Tue 6/3**	**Thu 5/3**
70	**NEW TRACK**	**Team 7**			
71	**Comilla to Sadar Rashulpur**		**541 da**	**Tue 6/3**	**Wed 12/**
72	Stations and Buildings		210 da	Tue 6/3	Mon 1/2
73	Earth Works		150 da	Tue 6/3	Sun 12/2
74	Bridges and Culverts		300 da	Tue 6/3	Wed 5/2
75	River Training works		60 days	Thu 5/2	Sun 7/2
76	Track Works		135 da	Mon 4/2	Fri 10/7/



ID	Task Name	Team	Duration	Start	Finish
77	Temporary Signalling and Telecom		60 days	Sat 10/8	Tue 12/6
78	Testing and Commissioning		15 days	Wed 12/	Wed 12/
79	**UPGRADING EXISTING TRACK**	**Team 7**			
80	**Comilla to Sadar Rashulpur**		**526 da**	**Thu 12/**	**Thu 5/3**
81	Dismantling Existing Track		35 days	Thu 12/	Wed 1/2
82	Earth Works		100 da	Fri 12/3	Sat 4/8/
83	Bridges and Culverts		300 da	Sun 1/2	Mon 12/
84	Track Works		135 da	Fri 11/3	Sat 3/17
85	Temporary Signalling and Telecom		60 days	Sun 3/1	Wed 5/1
86	Testing and Commissioning		15 days	Thu 5/1	Thu 5/3
87	**NEW TRACK**	**Team 8**			
88	**Sadar Rashulpur to Rajapur**		**418 da**	**Tue 9/1**	**Sat 10/2**
89	Stations and Buildings		210 da	Tue 9/1	Mon 3/2
90	Earth Works		200 da	Tue 9/1	Fri 3/18/
91	Bridges and Culverts		150 da	Tue 9/1	Thu 1/2
92	River Training works		60 days	Fri 1/29	Mon 3/2
93	Track Works		240 da	Sun 12/	Mon 8/8
94	Temporary Signalling and Telecom		60 days	Tue 8/9	Fri 10/7/
95	Testing and Commissioning		15 days	Sat 10/8	Sat 10/2
96	**UPGRADING EXISTING TRACK**	**Team 8**			
97	**Sadar Rashulpur to Rajapur**		**480 da**	**Sun 10/**	**Wed 2/1**
98	Dismantling Existing Track		55 days	Sun 10/	Fri 12/16
99	Earth Works		180 da	Sun 10/	Thu 4/2
100	Bridges and Culverts		150 da	Wed 11	Fri 4/21/
101	Track Works		240 da	Mon 3/6	Fri 12/1/
102	Temporary Signalling and Telecom		60 days	Sat 12/2	Tue 1/3
103	Testing and Commissioning		15 days	Wed 1/3	Wed 2/1
104	**NEW TRACK**	**Team 9**			
105	**Rajapur to Shashidal**		**338 da**	**Tue 9/1**	**Wed 8/3**
106	Stations and Buildings		210 da	Tue 9/1	Mon 3/2
107	Earth Works		150 da	Tue 9/1	Thu 1/2
108	Bridges and Culverts		100 da	Tue 9/1	Wed 12/
109	Track Works		210 da	Sat 10/2	Fri 5/20/
110	Temporary Signalling and Telecom		60 days	Sat 5/21	Tue 7/1
111	Testing and Commissioning		15 days	Wed 7/2	Wed 8/3
112	**UPGRADING EXISTING TRACK**	**Team 9**			
113	**Rajapur to Shashidal**		**366 da**	**Thu 8/4**	**Fri 8/4/1**
114	Dismantling Existing Track		55 days	Thu 8/4	Tue 9/2
115	Earth Works		70 days	Thu 9/1	Wed 11/
116	Bridges and Culverts		100 da	Thu 9/1	Fri 12/9/
117	Track Works		210 da	Mon 10/	Sun 5/2
118	Temporary Signalling and Telecom		60 days	Mon 5/2	Thu 7/2
119	Testing and Commissioning		15 days	Fri 7/21	Fri 8/4/1
120	**Signalling and Telecom (Final Install, Testing and**		**376 days**	**Sun 5/21/17**	**Thu 5/31/18**
121	**Section 3 (Shashidal to Akhaura)**		**836 da**	**Sun 12/**	**Tue 4/9/**
122	**NEW TRACK**	**Team 2**			
123	**Shashidal to Salda Nadi**		**334 da**	**Thu 1/5**	**Mon 12/**
124	Stations and Buildings		210 da	Thu 1/5/	Wed 8/2
125	Earth Works		70 days	Thu 1/5/	Wed 3/1
126	Bridges and Culverts		170 da	Thu 1/5/	Fri 6/23/
127	Track Works		90 days	Tue 5/2	Wed 9/2
128	Temporary Signalling and Telecom		60 days	Thu 9/2	Sun 11/
129	Testing and Commissioning		15 days	Mon 11/	Mon 12/
130	**UPGRADING EXISTING TRACK**	**Team 2**			
131	**Shashidal to Salda Nadi**		**365 da**	**Tue 12/**	**Tue 12/**
132	Dismantling Existing Track		21 days	Tue 12/	Mon 12/
133	Earth Works		70 days	Tue 12/	Mon 2/1
134	Bridges and Culverts		170 da	Fri 1/5/1	Sat 6/23
135	Track Works		90 days	Wed 5/2	Thu 9/2
136	Temporary Signalling and Telecom		60 days	Fri 9/21	Mon 11/
137	Testing and Commissioning		15 days	Tue 11/	Tue 12/
138	**NEW TRACK**	**Team 4**			
139	**Salda Nadi to Mandabag**		**398 da**	**Sun 12/**	**Fri 1/26/**
140	Stations and Buildings		210 da	Sun 12/	Sat 7/22
141	Earth Works		100 da	Sun 12/	Mon 4/3
142	Bridges and Culverts		220 da	Sun 12/	Tue 8/1/
143	River Training works		30 days	Wed 8/2	Thu 8/3
144	Track Works		120 da	Thu 6/1	Sun 11/
145	Temporary Signalling and Telecom		60 days	Mon 11/	Thu 1/1
146	Testing and Commissioning		15 days	Fri 1/12/	Fri 1/26/
147	**UPGRADING EXISTING TRACK**	**Team 4**			
148	**Salda Nadi to Mandabag**		**412 da**	**Sat 1/27**	**Thu 3/1**
149	Dismantling Existing Track		25 days	Sat 1/27	Tue 2/2
150	Earth Works		100 da	Sun 2/4/	Mon 5/1
151	Bridges and Culverts		220 da	Mon 2/1	Sat 10/2
152	Track Works		120 da	Sat 9/1/	Sat 12/2
153	Temporary Signalling and Telecom		60 days	Sun 12/	Wed 2/2
154	Testing and Commissioning		15 days	Thu 2/2	Thu 3/1



ID	Task Name	Team	Duration	Start	Finish
155	**NEW TRACK**	**Team 6**			
156	**Mandabag to Quasba**		**354 da**	**Tue 1/1**	**Fri 12/2**
157	Stations and Buildings		210 da	Tue 1/1	Mon 8/7
158	Earth Works		50 days	Tue 1/1	Tue 2/28
159	Bridges and Culverts		100 da	Tue 1/1	Wed 4/1
160	Track Works		180 da	Sun 3/1	Sun 10/
161	Temporary Signalling and Telecom		60 days	Mon 10/	Thu 12/
162	Testing and Commissioning		15 days	Fri 12/1	Fri 12/29
163	**UPGRADING EXISTING TRACK**	**Team 6**			
164	**Mandabag to Quasba**		**362 da**	**Sat 12/3**	**Wed 12/**
165	Dismantling Existing Track		55 days	Sat 12/3	Thu 2/2
166	Bridges and Culverts		100 da	Sun 1/7	Mon 4/1
167	Track Works		180 da	Fri 3/16	Fri 10/12
168	Temporary Signalling and Telecom		60 days	Sat 10/1	Tue 12/
169	Testing and Commissioning		15 days	Wed 12/	Wed 12/
170	**NEW TRACK**	**Team 5**			
171	**Quasba to Imambari**		**385 da**	**Sun 12/**	**Sat 1/13**
172	Stations and Buildings		210 da	Sun 12/	Sat 7/22
173	Earth Works		80 days	Sun 12/	Tue 3/14
174	Bridges and Culverts		150 da	Sun 12/	Tue 5/23
175	Track Works		175 da	Sat 4/8/	Mon 10/
176	Temporary Signalling and Telecom		60 days	Tue 10/	Fri 12/29
177	Testing and Commissioning		15 days	Sat 12/3	Sat 1/13
178	**UPGRADING EXISTING TRACK**	**Team 5**			
179	**Quasba to Imambari**		**431 da**	**Sun 1/1**	**Wed 3/2**
180	Dismantling Existing Track		55 days	Sun 1/1	Fri 3/9/1
181	Earth Works		80 days	Sun 1/2	Tue 4/1
182	Bridges and Culverts		150 da	Wed 2/1	Fri 7/13/
183	Track Works		175 da	Wed 6/1	Fri 1/4/1
184	Temporary Signalling and Telecom		60 days	Sat 1/5/	Tue 3/5/
185	Testing and Commissioning		15 days	Wed 3/6	Wed 3/2
186	**NEW TRACK**	**Team 3**			
187	**Imambari to Gangasagar**		**279 da**	**Thu 1/5/**	**Tue 10/**
188	Stations and Buildings		210 da	Thu 1/5/	Wed 8/2
189	Earth Works		100 da	Thu 1/5/	Fri 4/14/
190	Bridges and Culverts		100 da	Thu 1/5/	Sat 4/15
191	Track Works		135 da	Wed 3/1	Thu 7/27
192	Temporary Signalling and Telecom		60 days	Fri 7/28/	Mon 9/2
193	Testing and Commissioning		15 days	Tue 9/2	Tue 10/
194	**UPGRADING EXISTING TRACK**	**Team 3**			
195	**Imambari to Gangasagar**		**309 da**	**Wed 10/**	**Wed 8/1**
196	Dismantling Existing Track		40 days	Wed 10/	Sun 11/
197	Earth Works		100 da	Wed 10/	Thu 1/25
198	Bridges and Culverts		100 da	Sat 11/1	Sun 2/18
199	Track Works		135 da	Thu 1/1	Fri 6/1/1
200	Temporary Signalling and Telecom		60 days	Sat 6/2/	Tue 7/3
201	Testing and Commissioning		15 days	Wed 8/1	Wed 8/1
202	**NEW TRACK**	**Team 1**			
203	**Gangasagar to Akhaura**		**413 da**	**Tue 1/3/**	**Mon 2/1**
204	Stations and Buildings		210 da	Tue 1/3/	Mon 7/3
205	Earth Works		100 da	Tue 1/3/	Wed 4/1
206	Bridges and Culverts		180 da	Tue 1/3/	Sat 7/1/
207	Track Works		175 da	Mon 5/1	Wed 12/
208	Temporary Signalling and Telecom		60 days	Thu 12/	Sun 2/4/
209	Testing and Commissioning		15 days	Mon 2/5	Mon 2/1
210	**UPGRADING EXISTING TRACK**	**Team 1**			
211	**Gangasagar to Akhaura**		**414 da**	**Tue 2/2**	**Tue 4/9/**
212	Dismantling Existing Track		60 days	Tue 2/2	Fri 4/20/
213	Earth Works		100 da	Tue 2/2	Wed 5/3
214	Bridges and Culverts		180 da	Tue 2/2	Sat 8/18
215	Track Works		175 da	Tue 7/3/	Thu 1/24
216	Temporary Signalling and Telecom		60 days	Fri 1/25/	Mon 3/2
217	Testing and Commissioning		15 days	Tue 3/2	Tue 4/9/
218	**Gangasagar Station Yard**	**Team 1**	**180 da**	**Tue 9/1**	**Sat 3/9/**
219	Dismantling Existing Track		60 days	Tue 9/1	Fri 11/9/
220	Track Works		120 da	Sat 11/1	Sat 3/9/
221	**Signalling and Telecom (Final Install, Testing and**		**376 days**	**Fri 3/30/18**	**Tue 4/9/19**



Project: Subproject No. 2
Date: Tue 3/18/14

Task
Summary
Project Summary
Manual Task
Manual Summary
Summary
Stations and Buildings
Earth Works
Bridges and Culverts
Track Works
Temporary Signalling and Telecom
Testing and Commissioning
Dismantling Existing Track
Final Signalling and Telecom

Page 3

Annex 8: List of Sensitive Sites Identified During the Social Survey (PCR and CPR)[61]

Sl. No.	HHs #	Name of the CPRs	Owner/ President/ Secretary Name	Village	Union	Thana	District
Area: Laksam-Comilla							
1	10019	Alisor Mytar Para Zame Moszid	Md. Mukbul Hossain	Alissar	Uttar Perul	Sadar Dakshin	Comilla
2	10023	Bangladesh Asahly Shisu Complex		Baral	Bagmara	Sadar Dakshin	Comilla
3	10037	Eidgha	Md. Sekender Ali	Baral	Bagmara	Sadar Dakshin	Comilla
4	10053	Chad Kalomiah Jame Moshjid	Md. A. Rahim	Chand Kolmia	Bagmara	Sadar Dakshin	Comilla
5	10067	Bagmara CNG Driver Somiti	Md. Mofijul Islam	Bagmara	Bagmara	Sadar Dakshin	Comilla
6	10091	Sonar Bangal Multiparpas Cooperative Society	Md. Halim	Sayedpur	Bagmara	Sadar Dakshin	Comilla
7	10092	Universal Trust Multi-Purpose Co-Operative Society	Professor Jakir Hossain	Ashath Tola	Vuloin	Sadar Dakshin	Comilla
8	10093	Bagmara High School	Mostofa Kamal M.P	Sayedpur	Bagmara	Sadar Dakshin	Comilla
9	10094	Sayadpur Poschimpara Waktia Mozjid	Sirajul Haque	Sayedpur	Bagmara	Sadar Dakshin	Comilla
10	10119	Bijoypur Bazar Committee	Humayun Kobir	Bijoy Pur	Barpara	Sadar Dakshin	Comilla
11	10146	Daiwara Dipali Jubo Kollan Somobay Somiti	Hazi Joynal Abedin	Doiyara	Uttar Perul	Sadar Dakshin	Comilla
12	10147	Doiyari Daskinpara Jame Mosjid	Md. Harun Mia	Doiyara	Comilla City 22 No Word	Sadar Dakshin	Comilla
13	10151	Notun Shapath Shmobai Samiti	Md. Motiur Rahman	Jangalia	Comilla City 22 No Word	Sadar Dakshin	Comilla
14	10214	Daulatpur Purbopara Jame Moshjid	Harunur Rashid Bhaiyan	Dulotpur	Durgapur	Adarsa Sadar Thana	Comilla
15	10248	Bijoypur High School	Md. Josim Uddin Majumder	Dulotpur	Barpara	Sadar Dakshin	Comilla
16	10251	All Hera Samobai Somiti	Md. Faruk	Dulotpur	Durgapur	Adarsa Sadar Thana	Comilla
17	10253	Bytul Mamur Zame Moshzid		Dulotpur	Durgapur	Adarsa Sadar Thana	Comilla

[61] 45 CPRs have been listed in the resettlement plan but the specific list will be available after after recasting of resettlement plan. Therefore, old CPR list provided in Annex 8.

Sl. No.	HHs #	Name of the CPRs	Owner/ President/ Secretary Name	Village	Union	Thana	District
18	10391	Kakshar Hazibari Jame Moshjid	Md. Amir Hossain	Kaksar	Uttar Perul	Sadar Dakshin	Comilla
Area: Comilla-Salda Nadi							
1	20021	Comilla City Corporation	Md. Monirul Haque	Sasongasha	Comilla City 3 No Word	Adarsa Sadar Thana	Comilla
2	20031	Shashan Gasa Moktabo	Md. Badal Sikder	Sasongasha	Comilla City 3 No Word	Adarsa Sadar Thana	Comilla
3	20043	Shason Gasa Waktia Mosjid	Md. Robin	Sasongasha	Sadar Dakshim	Adarsa Sadar Thana	Comilla
4	20188	Shason Gasa Eidga	Md.Nurun Islam	Sasongasha	Durgapur	Adarsa Sadar Thana	Comilla
5	20216	Maulovi Nagor Jame Mosjid	Md. Abdul Gafur Hazi	Moulobi Nagar	Amratoli	Adarsa Sadar Thana	Comilla
6	20218	Katani Sar Jame Mosjid	Amran Hossain	Katari Sar	Amratoli	Sadar Dakshin	Comilla
7	20239	Rashulpur Uttar Para Kaborstan	Md. Aminul Islam	Rosul Pur	Amratoli	Adarsa Sadar Thana	Comilla
8	20240	Hazrat Shah Sufi Riasat Alo Fakir (R.) Mazar Shorif	Md. Shah Alam	Pitamber	Baksimail	Burichang	Comilla
9	20241	Paribarik Koborstan	Md. Sahin Member	Rajapur	Rajapur	Burichang	Comilla
10	20242	Sree Nandoram Goshamj Mot	Sree Bikas Chandra Roy	Rajapur	Rajapur	Burichang	Comilla
11	20250	Bangladesh Railway					Comilla
12	20254	Baytul Aman Jame Mosque	Md: Abdus Salam Bhuiya	Songkuchail	Rajapur	Burichang	Comilla
13	20262	Uttar Teta Bhume Anandpur Jame Moszid	Md: Ab. Maleak	Uttar Tota Bhumi	Sosidal	Brakhan Para	Comilla
14	20266	Uttar Teta Bhume Eidgha	Md. A. Malek Mohori	Uttar Tota Bhumi	Sosidal	Brakhan Para	Comilla
15	20289	Salda Nadi Precadat Academe	Lil Miah	Gonga Nagar	Sosidal	Brakhan Para	Comilla
Area: Salda Nadi-Akhaura							
1	30065	Chandgola Jame Mosque	Md. Humayen Kobir	Chand Khola	Bayek	Quasba	Brahmanbaria
2	30094	Uttor Chok Basta Zame Moszid and Madrasha		Uttar Chak Bosta	Koiumpur	Quasba	Brahmanbaria
3	30115	Ganga Nagar Jame Mosque	Abdur Rashid	Gonga Nagar	Koiumpur	Quasba	Brahmanbaria

Sl. No.	HHs #	Name of the CPRs	Owner/ President/ Secretary Name	Village	Union	Thana	District
4	30142	Club Of Bangladesh National Party	Ezaz Ahhaed Equebal	Hokar	Quasba Porashoba	Quasba	Brahmanbaria
5	30350	Dos Vhojo Kalibari Mandar	Babu Ratun Kumar Pal	Mogra	Mogra	Akhaura	Brahmanbaria
6	30423	Noyadil Modhopara Darus Salam Zame Masjid	Md. Muti Miah	Noya Dil	Mogra	Akhaura	Brahmanbaria
7	30432	Nayadil Madhapara Kobarstan	Md. Muti Miah	Noya Dil	Mogra	Akhaura	Brahmanbaria
8	30460	Khabari Paribarik Kaborsthan	Md. Hosen Ali	Dev Gram	Akhaura	Akhaura	Brahmanbaria
9	30516	Baitus Salam Jame Mosqe		Dev Gram	Akhaura	Akhaura	Brahmanbaria
10	30530	Pangery Zubo Sanggho	Raton Hazary	Dev Gram	Akhaura	Akhaura	Brahmanbaria
11	30540	Nur Madia Jami Mosque	Sheikh Md. Nizam Uddin	Dev Gram	Akhaura	Akhaura	Brahmanbaria
12	30607	Railway Sromik Lig Offic	Md. Kabir Hossain	Radha Nagar	Akhaura	Akhaura	Brahmanbaria
13	30647	Akhaura Khadda Gudam		Chandan Sar	Akhaura	Akhaura	Brahmanbaria
14	30673	Akhaura Upazila Nirman Shromik Union	Md. Jahangir	Radha Nagar	Akhaura	Akhaura	Brahmanbaria
15	30695	Koikhola Jame Mosjid	Jahangir Alam Bhuiyan	Koi Khola	Bayek	Quasba	Brahmanbaria

Annex 9: Tree Plantation and Replacement Programme

The objective of the tree plantation and replacement programme is to compensate for the loss of trees due to the proposed implementation of the Akhaura-Laksam double line railway Project. Other major objectives of the programme are to protect the affected cultural/sensitive areas (within 50 m from the RoW boundary) and to enhance the health of the existing ecosystem.

About 31,749 timber trees, 13,546 fruit trees, 188 medicinal trees, 4,166 banana trees, and 5,693 bamboo trees of different sizes will be cut due to the implementation of Project at pre-construction and construction periods. Approximately, 55,000 trees will be removed from the study area. The proposed Tree Plantation and Replacement Programme (TPRP) will suggest to plant at least three times of the actual fallen trees. These trees are calculated on both side of the proposed new alignment, proposed station building areas, and new station access road areas (associated facilities). Therefore, a total of 165,000 trees will be planted at post construction stage of the Project.

The following areas have been identified for development of plantation sites in the Project areas:

- Both side slopes of the constructed new railway embankment;
- Back side of the constructed new stations; and
- Along the affected cultural/sensitive areas (within 50 m from the RoW boundary).

1) Selection of Tree Species

The species for the proposed tree replacement have been selected based on the statistics of the lost vegetation and suitability for the intended purpose. This was done in consultation with retired railway officers of Bangladesh Railway, senior ecologist of RCIP and local communities. The main consideration for selection of species for the Project railway is to protect the railway embankment from erosion and habitat for biotic species, minimise visual impacts, improved aesthetics and ecological conservation as well as commercial benefits. Accordingly, the list of tree species proposed to be planted is as follows:

On the slope of railway embankment:

- Timber Trees: Garjan (*Dipterocarpus turbinatus*), Shal (*Shorea robusta*), Shilkoroi (*Albzia procera*), Akashmoni (*Acacia auricoliformis*), Kat badam (*Terminalia calappa*), and mehogani (Swietenia mahagoni);
- Fruit Trees: Date Tree (*Phoenix sylvestris*) and Date Palm;
- Medicinal Trees: Neem (*Azarlira chlaindica*) and Bohera (*Terminalia belliricha*), Horitoki, and Amloki; and
- Fuel Trees: Epil–epil (*Leucaena leucocephala*), Rain tree (*Samania saman*) and Koroi.

The list of tree species proposed for the plantation on the back side of railway station and along the affected cultural/sensitive areas are as follows:

- Timber Trees: Arjun (*Terminalia arjuna*), Garjan (*Dipterocarpus turbinatus*), Shal (*Shorea robusta*), Shilkoroi (*Albzia procera*), Akashmoni (*Acacia auricoliformis*), Kat badam (*Terminalia calappa*), mehogani (*Swietenia mahagoni*), Epil -epil (*Leucaena leucocephala*) and Rain tree (*Samania saman*);

- Fruit Trees: Date palm (*Phoenix sylvestris*), Olive (*Elaeocarpus floribundus*), Palm tree (*Borossus flabelliformis*);
- Medicine Trees: Neem (*Azadirachta indica*), Arjun (*Teominalia arjunna*), Bel (*Aegle marmelos*) and Bohera (*Terminalia belliricha*); and
- Fuel Wood Trees: Koromcha, Radhachura and Krishnochura (*Delonix regia*).

2) Guidelines of Tree Replacement

According to the prevailing practice in Bangladesh, Forest Department generally recommends to plant minimum 2 trees for each tree felled for any development Project. However, in consultation with BR, Consultant recommends to plant 3 saplings for each tree felled in order to implement Project. Total available space for the tree replacement on the side slopes of railway embankment and stations and cultural/sensitive areas is approximately 100 km, which is 50% of total length of 72 km alignment (72x2=144 km both side of the alignment) and station and cultural/sensitive areas.

Under the proposed tree replacement programme:

- timber tree species will cover 50% of the total area;
- fruit tree species will cover 30% of the total area;
- medicine tree species will cover 10% of the total area; and
- Fuel tree species will cover the rest 10% of the total area.

The estimated land area under each category of trees and the number of trees are given in **Table 1**.

Table 1: Estimated Land Area and Quantities of Trees to be Planted

On the slope of railway embankment – 75%		
Type of Tree	**Spacing between Trees**	**Total Number of Trees**
Timber (50%)	2.0	61,875
Fruit (30%)	2.0	37,125
Medicine (10%)	2.0	12,375
Fuel (10%)	2.0	12,375
Sub-Total		**123,750**
Along the stations and affected cultural/sensitive areas – 25%		
Timber (50%)	2.0	20,625
Fruit (30%)	2.0	12,375
Medicine (10%)	2.0	4,125
Fuel (10%)	2.0	4,125
Sub-Total		**41,250**

All saplings will be planted at least 2 m away from the new railway track with minimum distance between saplings is 2 m.

3) Implementation Agreement

The Forest Department (FD) is generally responsible for plantation of all government owned sites. It is a common practice in Bangladesh that the Forest Department performs the task by themselves. However, the FD will be encouraged to involve BR, PAPs, especially vulnerable poor and women, in the plant replacement programme. The Forest Department will provide all technical and other supports in planning and

developing the plantations. However, the implementation arrangement for Project is unique than any other tree replacement programme in country that was agreed in consultation with ADB, BR and Consultant. It was decided that BR will be responsible for the successful implementation of tree plantation and replacement programme without involving PAPs and FD.

The tasks of the BR are as follows:

- Training of the local BR staff on tree maintenance;
- Preparation of the tree replacement programmes in accordance with this plan and get them approved by the Forest Department if necessary;
- Coordination of sapling procurement process of approved species prescribed above; and
- Supervision of nurseries for raising saplings

4) Responsibility

It was decided that Contract will be responsible for tree plantation throughout the alignment and other areas as prescribed above. The Contractor will be responsible for procure and raise saplings until they survive. They can set up nurseries in consultation with BR and Engineer at the early stage of the Project. Alternatively, Contractor can purchase saplings from the local nursery.

The Environmental Officer of BR/Engineer will be responsible for overall coordination with the FD, PAPs, and destitute women (if necessary), and supervision of the programme. It is recommended that BR should start dialogue with the Forest Department if required for the tree replacement programme in the pre-construction stage, so that setting up of nurseries can be done in the early stages of the Project.

5) Budget and Payment Method

The budget for the proposed tree replacement programme is provided in **Table 2.** The budget also includes maintenance for first two years from the date of plantation to ensure that all planted saplings will survive and provision for an additional plantation. The plantation on the slopes of railway embankment, in the stations and along the affected cultural/sensitive areas will be taken up after completion of construction work. The budget also includes procurement and development of all facilities required to establish a nursery such as, collection of suitable soils, decomposing cow dung, procurement of fertilisers etc. The budget also includes measure required for maintenance of plantation, such as watering, weeding, fertilizer application, replacing of dead saplings (if any) etc. for first two years. Total estimated budget for tree replacement is USD 252,500.

Table 2: Cost Estimates for the Tree replacement Plan

Tree replacement Area	Unit	Rate (USD)	Quantity	Amount (USD)
Slope of the embankment	No.	1.50	123,750	185,625
Stations area and Cultural/sensitive areas	No.	1.50	41,250	61,875
Misc.	LS			5,000
Total				252,500

Contractor will be paid for the tree replacement programme after survival of each sapling at a rate mentioned in **Table 2.**

Annex 10: Request Letter to Local Government for Arrangement of Public Consultation Meeting

022.1

194

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16 ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI /Akhaura-Laksam/2012- 67 Dated: 11 -05-2013

To
Upazilla Nirbahi Officer (UNO)
Akhaura Upazilla
Brahmanbaria

Subject: Public Consultation Meeting

We are pleased to inform you that CANARAIL Consultants Inc. (CANARAIL), Canada, in Joint Venture with DB International GmbH (DBI), Germany, SMEC International Pty Ltd (SMEC), Australia, ACE Consultants Ltd. (ACE), Bangladesh (hereinafter called the Consultant), has been awarded Consultancy Services for "Feasibility Study and Detailed Design for Regional Cooperation and Integration Project : Rail Component" against Sub-regional Rail Transport Project Preparatory facility (hereinafter referred to as RCIP-Rail).

The Consultant is undertaking Environmental Impact Assessment (EIA) for the Subproject "Adding a Single Track and upgrading of existing Rail Line between Akhaura and Laksam"

The Consultant needs to hold Public Consultation meeting at Different Locations. Stakeholders comprising Project Affected Persons (PAPs), Local NGOs, related professional and expert groups, local administration, local leaders, women's groups, representatives of local professional groups like farmers, businessmen, doctors, teachers, etc., students of various educational institutions need to be present in the consultation.

The Consultant is planning to make a programme for consultation meeting in the area 'Gangasagar' under your Upazilla on 23th May, 2013. For the successful organization of this Public Consultation, we request your cooperation in all respects as necessary.

Mehedi Hasan, Environment Specialist has been authorized for this purpose on behalf of the Consultant. Your cooperation will be highly appreciated.

Yours faithfully,

12.5.13
(S.K. Chakraborty)
General Manager/ Project Director

REGIONAL COOPERATION AND INTEGRATION PROJECT-RAIL COMPONENT

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DATE 13-5-2013 at 2:00 PM			
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Core Team		✓	
Mehedi Hasan	✓		

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1. Deputy Commissioner, Brahmanbaria for information.
2. Mr. Jerome Fernandez, Team Leader, RCIP-Rail Component.

195

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16 ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI /Akhaura-Laksam/2012- 68 Dated: 11 -05-2013

To
Upazilla Nirbahi Officer (UNO)
Comilla Sadar Upazilla
Comilla

Subject: Public Consultation Meeting

We are pleased to inform you that CANARAIL Consultants Inc. (CANARAIL), Canada, in Joint Venture with DB International GmbH (DBI), Germany, SMEC International Pty Ltd (SMEC), Australia, ACE Consultants Ltd. (ACE), Bangladesh (hereinafter called the Consultant), has been awarded Consultancy Services for "Feasibility Study and Detailed Design for Regional Cooperation and Integration Project : Rail Component" against Sub-regional Rail Transport Project Preparatory facility (hereinafter referred to as RCIP-Rail).

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The Consultant needs to hold Public Consultation meeting at Different Locations. Stakeholders comprising Project Affected Persons (PAPs), Local NGOs, related professional and expert groups, local administration, local leaders, women's groups, representatives of local professional groups like farmers, businessmen, doctors, teachers, etc., students of various educational institutions need to be present in the consultation.

The Consultant is planning to make a programme for consultation meeting in the area 'Sadar Rasulpur' under your Upazilla on 22th May, 2013. For the successful organization of this Public Consultation, we request your cooperation in all respects as necessary.

Mehedi Hasan, Environment Specialist has been authorized for this purpose on behalf of the Consultant. Your cooperation will be highly appreciated.

Yours faithfully,

12.5.13
(S.K. Chakraborty)
General Manager/ Project Director

Copy to:
1. Deputy Commissioner, Comilla for information.
2. Mr. Jerome Fernandez, Team Leader, RCIP-Rail Component.

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DOC 195 FILE 02.2.1
DATE 13-5-2013 at 2:40 PM

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TL	✓	✓	13/5/13
NTL		✓	
Team Leader		✓	
Mehedi Hasan	✓		

196

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16 ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI /Akhaura-Laksam/2012- 69 Dated: 11 -05-2013

To
Upazilla Nirbahi Officer (UNO)
Comilla Sadar Daksin Upazilla
Comilla

Subject: Public Consultation Meeting

We are pleased to inform you that CANARAIL Consultants Inc. (CANARAIL), Canada, in Joint Venture with DB International GmbH (DBI), Germany, SMEC International Pty Ltd (SMEC), Australia, ACE Consultants Ltd. (ACE), Bangladesh (hereinafter called the Consultant), has been awarded Consultancy Services for "Feasibility Study and Detailed Design for Regional Cooperation and Integration Project : Rail Component" against Sub-regional Rail Transport Project Preparatory facility (hereinafter referred to as RCIP-Rail).

The Consultant is undertaking Environmental Impact Assessment (EIA) for the Subproject "Adding a Single Track and upgrading of existing Rail Line between Akhaura and Laksam"

The Consultant needs to hold Public Consultation meeting at Different Locations. Stakeholders comprising Project Affected Persons (PAPs), Local NGOs, related professional and expert groups, local administration, local leaders, women's groups, representatives of local professional groups like farmers, businessmen, doctors, teachers, etc., students of various educational institutions need to be present in the consultation.

The Consultant is planning to make a programme for consultation meeting in the area 'Lalmai' under your Upazilla on 21th May, 2013. For the successful organization of this Public Consultation, we request your cooperation in all respects as necessary.

Mehedi Hasan, Environment Specialist has been authorized for this purpose on behalf of the Consultant. Your cooperation will be highly appreciated.

Yours faithfully,

12.5.13
(S.K. Chakraborty)
General Manager/ Project Director

REGIONAL COOP... INTEGRATION PROJECT-RAIL COMPONENT
DOC. 196 FILE 02.2.1
DATE 13-5-2013 at 2:18 pm
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DTL | | ✓
Ecca Teekki | | ✓
Mehedi Hasan | ✓ | (TM)

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1. Deputy Commissioner, Comilla for information.
2. Mr. Jerome Fernandez, Team Leader, RCIP-Rail Component.

197

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16 ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI /Akhaura-Laksam/2012 -70 Dated: 11 -05-2013

To
Upazilla Nirbahi Officer (UNO)
Kasba Upazilla
Brahmanbaria

Subject: Public Consultation Meeting

We are pleased to inform you that CANARAIL Consultants Inc. (CANARAIL), Canada, in Joint Venture with DB International GmbH (DBI), Germany, SMEC International Pty Ltd (SMEC), Australia, ACE Consultants Ltd. (ACE), Bangladesh (hereinafter called the Consultant), has been awarded Consultancy Services for "Feasibility Study and Detailed Design for Regional Cooperation and Integration Project : Rail Component" against Sub-regional Rail Transport Project Preparatory facility (hereinafter referred to as RCIP-Rail).

The Consultant is undertaking Environmental Impact Assessment (EIA) for the Subproject "Adding a Single Track and upgrading of existing Rail Line between Akhaura and Laksam"

The Consultant needs to hold Public Consultation meeting at Different Locations. Stakeholders comprising Project Affected Persons (PAPs), Local NGOs, related professional and expert groups, local administration, local leaders, women's groups, representatives of local professional groups like farmers, businessmen, doctors, teachers, etc., students of various educational institutions need to be present in the consultation.

The Consultant is planning to make a programme for consultation meeting in your Upazilla on 22th May, 2013. For the successful organization of this Public Consultation, we request your cooperation in all respects as necessary.

Mehedi Hasan, Environment Specialist has been authorized for this purpose on behalf of the Consultant. Your cooperation will be highly appreciated.

Yours faithfully,

(S.K. Chakraborty)
General Manager/ Project Director

Copy to:
1. Deputy Commissioner, Brahmanbaria for information.
2. Mr. Jerome Fernandez, Team Leader, RCIP-Rail Component.

REGIONAL COOPERATION AND INTEGRATION PROJECT-RAIL COMPONENT

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TL	✓	✓	13/5/13
DTL		✓	
Ezra Tellei		✓	
Mehedi Hasan	✓		

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION AND INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16, ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI/Akhaura-Laksam/2012 (Part -2)- 255 Dated: 27-02-2014

Upazilla Nirbahi Officer (UNO)
Quasba Upazilla
Brahmanbaria

Subject: Environmental Management Plan (EMP) Disclosure Meeting regarding Akhaura to Laksam Double Line Rail Project.

Dear Sir,

Thank you for supporting us in organizing the environmental public consultation meeting at Quasba, 22 May in reference to our letter no. PD/RCI/Akhaura-Laksam/2012-70; dated on 11 May 2013.

During the consultations, local stakeholders provided valuable comments and suggestions on environment and safety issues and the Consultant prepared an Environmental Management Plan accordingly. In this connection, the Consultant needs to organize another public consultation meeting on Environmental Management Plan (EMP) disclosure at Quasba Upazilla to disseminate the implementation of their comments and suggestions provided to us in the consultation meeting.

Therefore, the Consultant would appreciate your assistance in organizing EMP disclosure meeting at Quasba Upazilla Complex on 5th March, 2014.

For the successful organization of this public consultation, we request your kind cooperation in all respects as necessary. The chairman, Quasba Upazilla may kindly be requested to cooperate with the Consultant for making the meeting a success.

Mehedi Hasan, Environmental Specialist has been authorized for this purpose on behalf of the Consultant.

Your cooperation will be highly appreciated.

Sincerely yours
Hossain 27/02/14
(Md. Anower Hossain)
Assistant Director (Track & Works)
On behalf of General Manager/Project Director

Copy: 1) Deputy Commissioner, Brahmanbaria for information
2) Jerome Fernandez, Team Leader, RCIP-Rail Component

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION AND INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16, ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI/Akhaura-Laksam/2012 (Part -2)- 255 Dated: 27-02-2014

Upazilla Nirbahi Officer (UNO)
Comilla Sadar Upazilla
Comilla

Subject: Environmental Management Plan (EMP) Disclosure Meeting regarding Akhaura to Laksam Double Line Rail Project.

Dear Sir,

Thank you for supporting us in organizing the environmental public consultation meeting at Amratoli, Sadar Rasulpur in reference to our letter no. PD/RCI/Akhaura-Laksam/2012-68; dated on 11 May 2013.

During the consultations, local stakeholders provided valuable comments and suggestions on environment and safety issues and the Consultant prepared an Environmental Management Plan accordingly. In this connection, the Consultant needs to organize another public consultation meeting on Environmental Management Plan (EMP) disclosure at Sadar Rasulpur under Comilla sadar Upazilla to disseminate the implementation of their comments and suggestions provided to us in the consultation meeting.

Therefore, the Consultant would appreciate your assistance in organizing EMP disclosure meeting at Amratoli Union Complex, Sadar Rasulpur under your Upazilla on 4th March, 2014.

For the successful organization of this public consultation, we request your kind cooperation in all respects as necessary. The Chairman, Amratoli Union may kindly be requested to cooperate with the Consultant for making the meeting a success.

Mehedi Hasan, Environmental Specialist has been authorized for this purpose on behalf of the Consultant.

Your cooperation will be highly appreciated.

Sincerely yours

27/02/14
(Md. Anower Hossain)
Assistant Director (Track & Works)
On behalf of General Manager/Project Director

Copy: 1) Deputy Commissioner, Comilla for information
2) Jerome Fernandez, Team Leader, RCIP-Rail Component

REGIONAL COOPERATION AND INTEGRATION PROJECT-RAIL COMPONENT
DOC: 647 FILE 02.2.20
DATE: 2/3/14

DISTRIBUTION	ACT	INFO	RECD
IL	✓	✓	2/3/14
DTL			
Mehedi Hasan	✓		
Gora Tebchi		✓	

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
OFFICE OF THE GENERAL MANAGER/PROJECT DIRECTOR
TA FOR SUB-REGIONAL RAIL TRANSPORT PROJECT PREPARATORY FACILITY
REGIONAL COOPERATION AND INTEGRATION: RAIL COMPONENT
BANGLADESH RAILWAY, RAIL BHABAN
16, ABDUL GANI ROAD, DHAKA, BANGLADESH

No. PD /RCI/Akhaura-Laksam/2012 (Part -2)- 255 Dated: 27-02-2014

Upazilla Nirbahi Officer (UNO)
Comilla Sadar Daksin Upazilla
Comilla

Subject: Environmental Management Plan (EMP) Disclosure Meeting regarding Akhaura to Laksam Double Line Rail Project.

Dear Sir,

Thank you for supporting us in organizing the environmental public consultation meeting at Baropara, Lalmai in reference to our letter no. PD/RCI/Akhaura-Laksam/2012-69; dated on 11 May 2013.

During the consultations, local stakeholders provided valuable comments and suggestions on environment and safety issues and the Consultant prepared an Environmental Management Plan accordingly. In this connection, the Consultant needs to organize another public consultation meeting on Environmental Management Plan (EMP) disclosure at Lalmai under Comilla sadar Daksin Upazilla to disseminate the implementation of their comments and suggestions provided to us in the consultation meeting.

Therefore, the Consultant would appreciate your assistance in organizing EMP disclosure meeting at Baropara Union Complex, Lalmai under your Upazilla on 4th March, 2014.

For the successful organization of this public consultation, we request your kind cooperation in all respects as necessary. The Chairman, Baropara Union may kindly be requested to cooperate with the Consultant for making the meeting a success.

Mehedi Hasan, Environmental Specialist has been authorized for this purpose on behalf of the Consultant.

Your cooperation will be highly appreciated.

Sincerely yours

27/02/14

(Md. Anower Hossain)
Assistant Director (Track & Works)
On behalf of General Manager/Project Director

Copy: 1) Deputy Commissioner, Comilla for information
2) Jerome Fernandez, Team Leader, RCIP-Rail Component

Annex 11: Summary of Key Contract Environmental Clauses

The Contractor and all Subcontractors shall carry out the Project related activities as specified in Contract Agreement with proper regard for all environment related considerations whether directly specified or implied in this Subsection, the EMP or the EIA. The EIA contains the Environmental Management Plan (EMP). This EMP defines the monitoring and mitigative steps required of the Contractor during the construction period. The actions defined in the EMP, shall be followed by the Contractor. The nine clauses listed below are in addition or complement what is defined in the EMP. If any overlaps appear, the more stringent action is to be followed. Environmental awareness creation, about the direct construction impacts and for the health, pollution, and safety issues generated by construction work will be Contractor's responsibility. The Engineer's supervisory role as defined in the Contract documents as well as the EMP. In particular, the Contractor shall take note of the following:

1. The Contractor shall be responsible for familiarising himself with the existing statutes and regulations relating to environmental protection and all environmental quality guidelines as well as Asian Development Bank's environmental guidelines.

2. During execution of the Works, the Contractor shall take all steps to protect the environment and avoid causing damage and public nuisances of all types during construction operations by full implementation of all actions defined in the EMP, DoE statutes and associated regulations as well as ADB guidelines

3. Contractor shall be responsible for and bear all costs of cleaning up any environmental damage or pollution resulting from construction activities, by applying methods that are tested and are known to be effective and that are approved by the Engineer.

4. All vehicles and facilities operated by the Contractor shall be maintained such that noise and air emission levels remain within standards as defined by the GoB and as listed in the EIA.

5. In case any traffic disruption is caused due to construction activities by the Contractor or subcontractors, in addition to any requirements of an approved Traffic Management Plan the Contractor shall be responsible for minimising traffic delays. The solutions implemented shall be such that neither the Contractor nor the vehicle operators are unduly disturbed.

6. In case of any road damage by Contractor, the Contractor shall repair the road to its original condition to the approval of the Engineer and at no charge to the Employer.

7. In case of any damage caused to agriculture or to the surrounding homesteads outside the RoW either permanently or temporarily by the Contractor's activities, the Contractor shall remain responsible to pay monetary compensation for the damage at going local market rates/value.

8. On completion of the construction, the Contractor shall remove the equipment, surplus materials, and rubbish and temporary structures of all types and shall leave sites in clean condition to the satisfaction of the Engineer.

Annex 12: Compliance Monitoring Checklist Template

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
2.0 CONSTRUCTION PERIOD						
2.1 The Environmental Management Implementation Work Schedule (EMWS)	Contractor does not prepare a work plan defining details on when mitigation and monitoring actions are to take place, in relation to the work and then the EMP requirements are not implemented properly.	The Engineer will assist contractor prepare the EMWS before the commencement of construction works and monitor compliance with the schedule during construction.	Confirm that a EMWS has been prepared			
2.2 Air Quality and Dust	The ambient levels of COx, NOx, SOx, $PM_{2.5}$, and PM_{10} may increase at busy stations, building, and construction areas leading to temporary and localised air pollution.	A dust suppression programme will be used at all times during construction of embankment, stations, building, and placement of ballast. Dust suppression to include watering and suppression equipment on batch plant, as well as vehicle speed restrictions to ≤35 km/h., and finally rapid revegetation including grass seeding. Ambient air quality for SO_2, NO_2 and $PM_{2.5}$, PM_{10} at busy stations and construction sites will be conducted quarterly throughout the construction period at sensitive receptors, and immediate remedial actions taken if 2 exceedance s occur at any one site.	Throughout the construction period: During dry season check for dust and undertake air quality testing for CO, SO_2, NO_2, PM2.5, and PM10 at major bridge and station construction sites.			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
2.3 Topography, Landscape and Soils						
2.3.1 Erosion	Clearing topsoil in proposed embankment area can lead to erosion and dust from unprotected storage sites. The erosion risk at embankment slopes is possible. Gully erosion along the exposed track slope during rainy season may damage field crops in adjacent areas.	Topsoil storage areas must be protected during the dry season from wind erosion by covering. Rapid revegetation and use of hydro-seeding and jute erosion protection mats will be applied in areas where erosion is noted during the regular monthly inspections				
2.3.2 Topography and Landscape changes	Visual intrusion from large piles of embankment materials and ballast obstructing views and excavation along the edge of the alignment leaving large unsafe holes is possible.	Embankment site to be planted with trees to promote natural vegetation; as well as fast growing grasses such as Vetiver/Napitar. Material stockpiles will be removed as soon as work is completed and the area re-landscaped. Same applies to borrow areas	Inspection/ consultation with adjacent households and railway authority.			
2.4 Water Resources						
2.4.1 Hydrology and Surface Water Quality	i) Earthwork activities during construction of embankment may result in drainage congestion ii) The surface water at workers camp and Project site areas may be pollute due to faecal, organic and other contamination. Disposed wastes and effluents from the construction sites may cause further degradation of surface water.	i) Prepare and implement water and soil erosion control plan (WSCP) for all earthworks; ii) Ensure all earthworks are constructed according to design and specifications. ii) Wastes, effluents and other contaminant materials at camp/work sites to be stored, handled, transported and disposed in planned manners. Garbage disposal service to be provided, Concrete refuse reused or	Site inspection Inspect the culvert/bridges just after heavy rainfall during monsoon and find the causes of drainage congestion if any. pH, Turbidity, Temperature, DO, BOD5, COD, TSS, TDS, oil and grease			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
		disposed of without habitat loss. All effluents not to be disposed of directly into natural waters, but via settling basins to allow suspended sediment to settle out. A quarterly surface water quality testing programme will be completed during the construction period.				
2.4.2 Groundwater	The potential exists for drinking water sources to be contaminated by the seepage of wastes from workers' camps through the soil profile into the GW aquifer (particularly if wells access the shallow aquifer).	Workforce camps will be located away from water resources. All practical measures such as provision of septic tanks, garbage bags, and other sanitation facilities will be implemented at the construction camps to prevent the wastewater and solid wastes from entering well and groundwater recharge areas. Wells used for drinking will be tested every year to ensure portability.	Throughout the alignment, especially where the pile drilling to 30 m depth is conducted, and where any new wells are dug. At new well sites test for pH, TP, Mn, Fe, As, Oil and Grease and E. Coli, when use begins and 6 months later, replicate sample.			
2.5 Waste Management						
2.5.1 Waste Management	Construction camp wastes are often poorly managed and can lead to chronic pollution of surface and groundwater.	Contain all solid wastes at designated location within construction sites. Service machinery and vehicles strictly at designated maintenance workshops where waste oils and lubricants be collected and recycled the monthly monitoring report will provide compliance update.	Undertake good housekeeping practices regularly and in a timely manner			
2.5.2 Train Station and Structure Demolition Waste Materials	11 stations and small structures will need to be demolished and reconstructed. Waste material piles,	Waste materials will be recycled/reused where possible, and then sold if remaining waste	Conduct monitoring check is station demolition operation			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
	dust and noise from such operations will be significant.	cannot be used. And dust and noise will be minimised by using methods that generate the least amount of dust and operating equipment only between 07:00 and 18:30. A record of the construction waste disposal will be prepare for each station	and complete monitoring checklist			
2.6 Noise	Work sites will be noisy due to pile driving, operation, power generator, rock crushing/ batch plants and movement of construction vehicles, as well as the constant movement of trains along the existing line.	Keep noise pollution at ≤ 60 dB (Bangladesh standard) levels at mosque, school, populated area and other sensitive sites by erection of temporary baffles. Work timing restrictions if noise levels, based on field measures indicate exceedances. Contractor will also be required to use only well maintained functioning equipment.	Sample Sensitive sites within 20 m of rail RoW in the vicinity of the sensitive receptors. Take noise readings at sensitive receptors 2X/day during full work activities, 2X/month			
2.7 Terrestrial and Aquatic Flora and Fauna	The clearing of 55,000 trees and associated understory vegetation and construction of a 2-6 m high and 70 km long embankment will reduce the habitat for mostly birdlife, given that the aquatic and terrestrial faunal is limited to common and pest species. Small patches of wetland will be covered by the embankment.	A rapid revegetation/tree replanting programme will permit the rail-side habitat to recover quickly. The rapid reestablishment of pre-construction surface draining will help to bring wet areas, somewhat reduced (marginally) by the new embankment to re-establish pre-construction habitat conditions.	As part of the monthly site inspection, examine embankments, new stations, building, subgrade storage areas, to confirm these facilities are not contributing to environmental degradation			
2.8 Land Use	The most significant potential impacts on land use in the study area will be the removal of around 60 ha of agricultural land (primarily rice paddy) for the construction of the proposed rail embankment, station access roads and associated facilities.	Land acquisition / requisition will be in accordance with the laws of Bangladesh and as defined in the Project LAP and RP, which specifies a grievance mechanism and timetable for implementation.	Inspection of land acquisition paperwork and compensation being completed in a timely fashion, and confirm this with PAPs			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
2.9 Heritage and Culture	3 PCR's and 46 CPRs could be affected by the rail line construction	BR has defined a plan to prevent undue damage to these sites and the contractor must follow this plan closely (see Item 1.4 above). RP also outlines procedures to relocate sensitive CPRs like grave yards. These procedures are to be followed during construction.	For 3 PCR, discuss actions taken with local officials and get agreement that this is appropriate. For 45 other sites visit each to establish that appropriate actions are being taken or planned			
2.10 Health, Safety and Contractor Camp						
2.10.1 Health and vector borne diseases	Personal and occupational health issues, stemming from unsanitary toilet facilities, lack of potable water and sanitary washing areas can lead to common disease outbreaks in work camps. Construction work creates areas for water to form stagnant puddles; Also, water can collect in old equipment waste tire dump stored outside, ideal breeding areas for malaria and dengue mosquitoes.	Undertake checks and cleaning at all sites and areas where clean conditions should exist. Provision of potable water, sanitary toilet facilities and hygienic accommodation for workers at camp sites. All potable water supplies will be tested semi-annually. Provision of First-Aid facility and ensure it is maintained cleaned and disinfected. Inspect for stagnant water and puddles every 3-days, including stored construction materials such as tires and old oil drums, and empty to prevent water ponding.	Undertake checks at all sites and instruct contractors to take immediate action if non-compliance identified			
2.10.2 Worksite safety management	Poor safety oversight and management of the worksites by the contractor leads to accidents and unsafe working conditions	Construct fences separating the construction sites at rail stations from public access, and manage train movements in collaboration with BR dispatch staff. Contractors must at all times insure the local people needing to move from one side of the construction area to another	Undertake checks at all sites and instruct contractors to take immediate action if non-compliance identified			

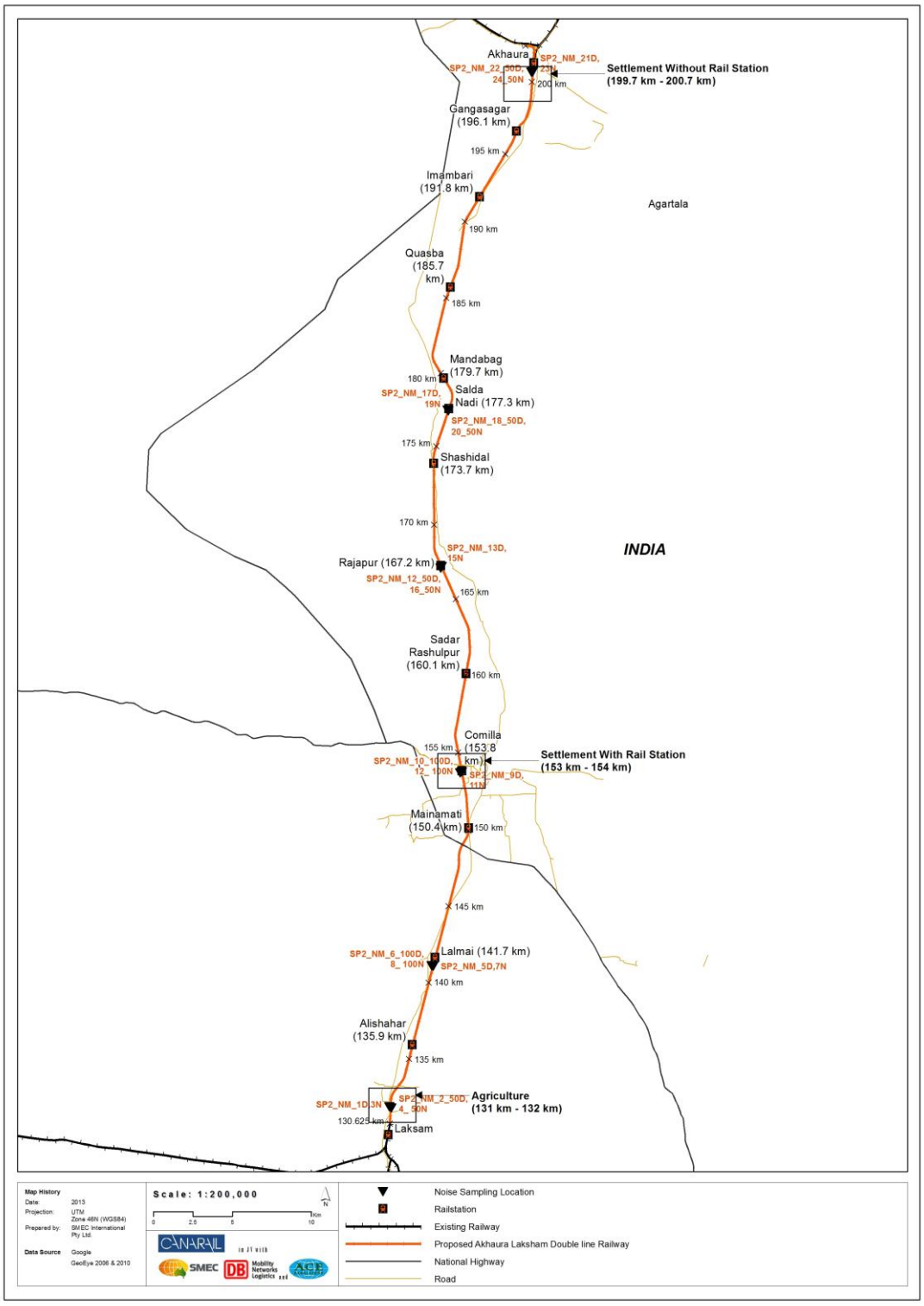
Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
		can do so effectively and without undue delay.				
2.10.3 HIV awareness	Due to influx of workers in the Project area, AIDS/HIV may spread in local community	Workers health training programme will be organised during the construction period to be made aware of health and hygienic issues. Training to be provided by health specialist such as a local NGO	Verify training records			
2.11 Occupational Health and Safety at Construction Sites						
2.11.1-Personal Safety Equipment (PSE)	Contractor does not provide adequate PSE or properly enforces its use, leading to accidents	Workers will be provided with appropriate personal protection equipment, such as safety boots, helmets, gloves, protective clothing, goggles and ear protection, and contractor will enforce its use, so long as safety does not suffer due to this action	As part of monthly inspection review all OHS requirement looking for poor enforcement as well distribution of proper safety equipment			
2.11.2-Safety Training	Lack of safety training by contractor can lead to accidents and lost productivity	Construction workers will be trained in general health and safety matters and on specific hazards (including train operation) of their work	Verify training records			
2.11.3-Labour Standards	Labour standards ignored or not complied with leading to infractions of basic labour standards as defined by ILO conventions as listed in Item 1.8 above.	*Hire, use of benefit from child labour*-Child labour (as defined by ILO Conventions 138 and 182) means that no workers under the age of 14 may be hired as general labours, and no workers under the age of 17 are to be hired for hazardous jobs such work on scaffolding, an structures elevated above the ground, etc. *Bonded labour*-All forms of bonded	Undertake checks at all sites and instruct contractors to take immediate action if non-compliance identified			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
		labour and forced labour, as defined by ILO Conventions 29 and 105 will not be permitted. Forced labour, including prison or debt bondage labour; lending of money (debt slavery) or withholding of remuneration or identity papers by employers or outside recruiters, will be not be permitted on any work sites. *Equal treatment, equal opportunity*- BR expects the contractors to hire workers on the basis of skill and ability to work. There must be equal treatment and equal opportunity (ILO Conventions 100 and 111, and ILO Code of Practice for HIV/AIDS 85) for all who seek employment. No discrimination based on race, caste, origin, religion, disability, gender, sexual orientation, union or political affiliation, or age; no sexual harassment Minimum wage- BR expects the contractor to pay all labourers and employees according to minimum wage standards as defined in the Bangladesh Labour Act.				
2.12 Construction Period Decommissioning	Inspection of sites to be decommissioned by contractor, are: • work camps; fuels storage areas • waste dump sites; construct access roads If not undertaken this would lead to chronic environmental problems due to	Undertaken a detailed inspection of the construction area after decommissioning to verify compliance with environmental safeguards.	Verify inspection records/reports			

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	D: Details of Monitoring Action to be Undertaken	What work was Undertaken/ and where	Specific Date(s) Matching "D"	Who Undertook the Work
	lack of proper clean-up.					
2.13 Environmental Monitoring and Completion Reporting	Contractor fails to prepare a summary report defining the mitigation and monitoring actions completed and what needs to be continued during the Operating period. The result is a failed or weakened environmental safeguards programme.	Prepare Quarterly Monitoring Report (Checklist). Prepare a completion report and deliver to the Engineer.	Verify monitoring and completion reports			

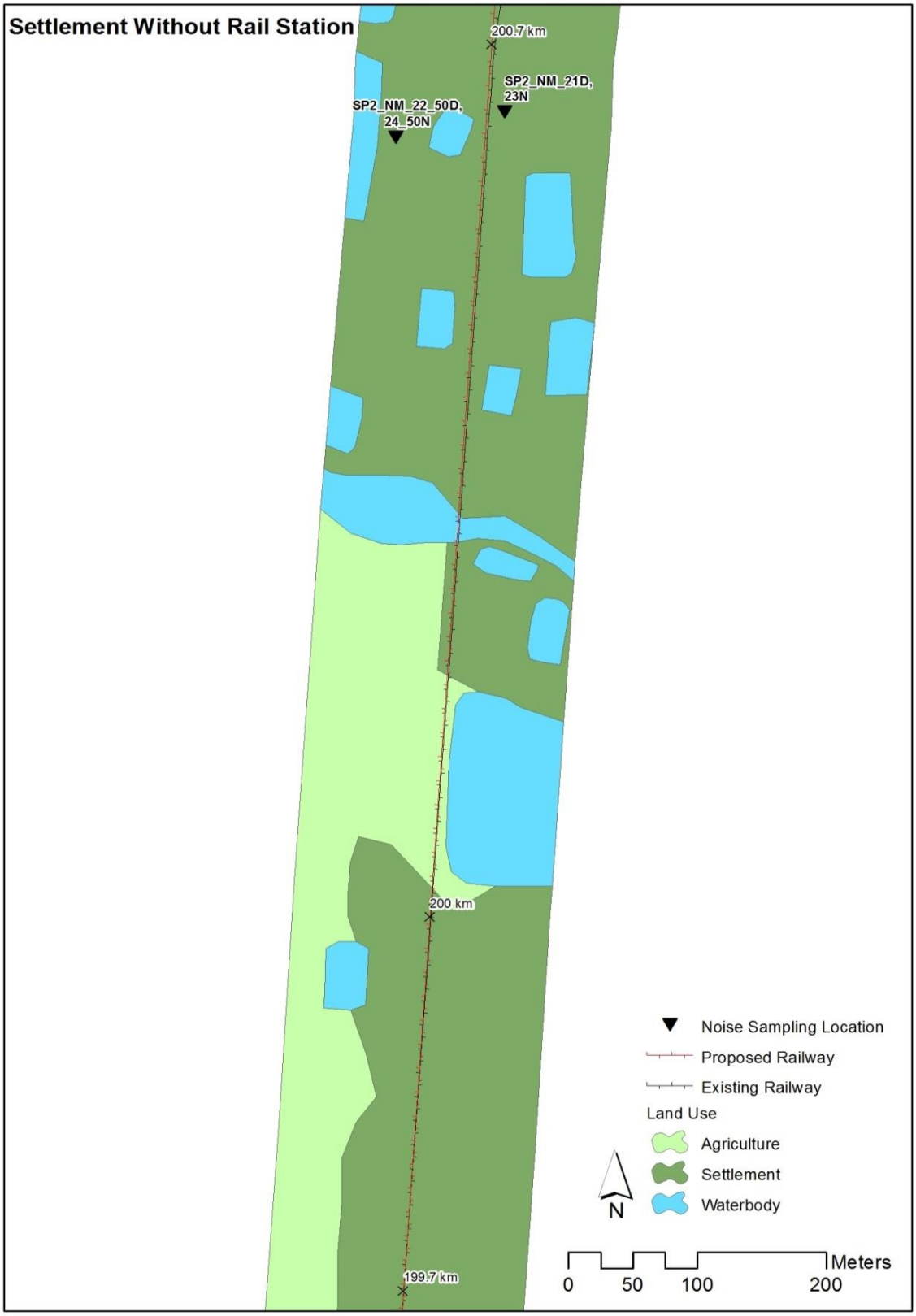
Annex 13: Noise Environment for three Representative Types of Land use

Key Map for Representative Sample of Noise Environment Areas



Representative Sample of Noise Environment – Agricultural Areas

Representative Sample of Noise Environment – Settlement Areas without Rail Station



Representative Sample of Noise Environment – Settlement Areas with rail Station