

Environmental Assessment Report

Initial Environmental Examination for West Bengal
Project Number: 37066
June 2009

India: Rural Roads Sector II Investment Program (Project 4)

Prepared by Ministry of Rural Development for the Asian Development Bank (ADB).

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

RURAL ROADS SECTOR II INVESTMENT PROGRAMME
WEST BENGAL, INDIA
INITIAL ENVIRONMENTAL EXAMINATION REPORT
BATCH III ROADS



June 2009

MINISTRY OF RURAL DEVELOPMENT

Acronyms and Abbreviations

ADB	:	Asian Development Bank
BIS	:	Bureau of Indian Standards
CD	:	Cross Drainage
CGWB	:	Central Ground Water Board
CO	:	Carbon Monoxide
COI	:	Corridor of Impact
DM	:	District Magistrate
EA	:	Executing Agency
EAF	:	Environment Assessment Framework
ECOP	:	Environmental Codes of Practice
EIA	:	Environmental Impact Assessment
EMAP	:	Environmental Management Action Plan
EO	:	Environmental Officer
FEO	:	Field Environmental Officer
FGD	:	Focus Group Discussion
FFA	:	Framework Financing Agreement
GOI	:	Government of India
GP	:	Gram panchyat
GSB	:	Granular Sub Base
HA	:	Hectare
HC	:	Hydro Carbon
IA	:	Implementing Agency
IEE	:	Initial Environmental Examination
IRC	:	Indian Road Congress
LPG	:	Liquefied Petroleum Gas
MFF	:	Multitranch Financing Facility
MORD	:	Ministry of Rural Development
MORTH	:	Ministry of Road Transport and Highways
MOU	:	Memorandum of Understanding
NAAQS	:	National Ambient Air Quality Standards
NGO	:	Non Governmental Organisation
NOx	:	Nitrogen Oxide
NC	:	Not Connected
NGO	:	Non-Government Organization
NRRDA	:	National Rural Road Development Agency
PIU	:	Project Implementation Unit
PIC	:	Project Implementation Consultants
PRIs	:	Panchyati Raj Institutions
PMGSY	:	Pradhan Mantri Gram Sadak Yojana
POL	:	Petroleum, Oil and Lubricants
PPTA	:	Project Preparation Technical Assistance
ROW	:	Right-of-Way
RPM	:	Respirable Particulate Matter
RRP	:	Report and Recommendation of the President
RRSIP II	:	Rural Roads Sector II Investment Program
SRRDA	:	State Rural Road Development Agency
SBD	:	Standard Bidding Documents
SO ₂	:	Sulphur di-Oxide
SPM	:	Suspended Particulate Matter
TA	:	Technical Assistance
TOR	:	Terms of Reference
TSC	:	Technical Support Consultants
UG	:	Upgradation
US	:	United States
WBM	:	Water Bound Macadam
WBSRRDA	:	West Bengal State Rural Road Development Agency
ZP	:	Zilla Parisad

TABLE OF CONTENTS

Section - 1	INTRODUCTION	1-1
1-1	GENERAL	1-1
1-2	PROJECT IDENTIFICATION AND LOCATION	1-1
1-3	RURAL ROAD CONSTRUCTION PROPOSALS	1-1
1.4	INITIAL ENVIRONMENTAL EXAMINATION	1-2
1-4.1	Corridor of Impact and Study Area	1-2
1-4.2	Field Visits	1-3
1-4.3	Secondary Data Collection	1-3
1-4.4	Primary Data Collection	1-3
1-5	Purpose of the Report	1-3
Section - 2	DESCRIPTION OF PROJECT	2-1
2.1	Type of Project	2-1
2.2	Category of Project	2-1
2.3	Need For Project	2-1
2.4	Location and Selection Criteria of Roads for IEE	2-1
2.5	Size or Magnitude of Operation	2-3
2.6	Schedule for Implementation	2-3
2.7	Description of Project	2-3
2.7.1	Rural Road Construction Proposals	2-3
2.7.2	Present Condition	2-4
2.7.3	Available Right of Way (ROW)	2-11
2.7.4	Alignment and Profile	2-12
2.7.5	Traffic	2-12
2.7.6	Economic Assessment	2-12
Section - 3	DESCRIPTION OF ENVIRONMENT	3-1
3.1	GENERAL	3-1
3.2	PHYSICAL RESOURCES	3-1
3.2.1	Geology	3-1
3.2.2	Earthquake Zone / Sensitivity	3-3
3.2.3	Geohydrology	3-5
3.2.4	Physiography and Relief	3-7
3.2.5	Drainage	3-9
3.2.6	Climate	3-13
3.2.7	Flood Affected and Drought Prone areas	3-17
3.2.8	Soil	3-19
3.2.9	Land use	3-22
3.2.10	Water Quality	3-24

3.2.11	Ambient Air Quality	3-26
3.2.12	Ambient Noise Quality	3-28
3.3	ECOLOGICAL RESOURCES	3-30
3.3.1	Terrestrial Flora	3-30
3.3.2	Aquatic Flora and Fauna	3-32
3.3.3	Fauna	3-33
3.4	QUALITY OF LIFE VALUES	3-35
3.4.1	Archaeological/ Historical Monuments	3-35
3.4.2	Temples / Shrines / Idols	3-35
3.4.3	Roadside Sanitation	3-40
3.4.4	Road Cutting Along Rural Road Proposals	3-41
Section - 4	POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	4-1
4.1	GENERAL	4-1
4.2	ENVIRONMENTAL PROBLEMS DUE TO PROJECT (ROAD) LOCATION	4-1
4.2.1	National Parks/Wild Life Sanctuaries	4-1
4.2.2	Archaeological/ Heritage Monuments	4-2
4.2.3	Natural Habitat/Nature reserves	4-2
4.2.4	Reserve Forests/ Protected Forest and/or Unclassified Forest Areas/ Lands	4-2
4.3	ENVIRONMENTAL PROBLEMS DUE TO PROJECT (ROAD) DESIGN	4-3
4.3.1	Embankment construction	4-3
4.3.2	Soil erosion	4-3
4.3.3	Clearing of vegetation	4-3
4.3.4	Cross Drainage	4-4
4.3.5	Roadside Sanitation	4-4
4.3.6	Road cutting for Conveyance of Irrigation Pipes	4-4
4.4	ENVIRONMENTAL PROBLEMS ASSOCIATED WITH PROJECT (ROAD) CONSTRUCTION	4-5
4.4.1	Geology / Stone Quarries	4-5
4.4.2	Hydro-geology/Ground Water	4-5
4.4.3	Soil/ Borrow Areas	4-6
4.4.4	Land Use	4-8
4.4.5	Drainage	4-9
4.4.6	Water Quality	4-9
4.4.7	Terrestrial Flora & Fauna	4-10
4.4.8	Loss of Forest land/ Cover	4-10
4.4.9	Aquatic Flora & Fauna	4-11
4.4.10	Air quality	4-11
4.4.11	Noise	4-12
4.4.12	Vibration	4-12
4.4.13	Construction Debris	4-12

4.4.14	Archaeological/ Historical Monuments	4-12
4.4.15	Road Side Shrines/Temples	4-13
4.4.16	Road Side Sanitation	4-13
4.5	ENVIRONMENTAL PROBLEMS RESULTING FROM PROJECT OPERATIONS	4-13
4.6	SPECIFIC IMPACTS AND MITIGATION MEASURES OF THE PROJECT ROADS	4-14
4.7	POTENTIAL ENVIRONMENTAL ENHANCEMENT MEASURES	4-14
4.7.1	Retrieval of Green (Tree) Cover	4-17
4.7.2	Improvement in Air/Noise Quality	4-17
4.7.3	Improvement of Road Side Sanitation	4-17
4.7.4	Socio-economic Benefits	4-18
4.8	ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN	4-18
Section – 5	INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL AND MONITORING PLAN	5-1
5-1	GENERAL	5-1
5-2	ENVIRONMENTAL MANAGEMENT ACTION PLAN	5-1
5-2.1	Issues / Project Actions / Environmental Attributes	5-1
5-2.2	Mitigation Measures	5-1
5-3	RESPONSIBILITY FOR IMPLEMENTATION	5-1
5-4	EMAP IMPLEMENTATION MONITORING	5-1
5-5	INSTITUTIONAL REQUIREMENTS FOR IMPLEMENTATION OF EMAP	5-1
5-5.1	Institutional Requirements- Construction Stage	5-1
5-5.2	Institutional Requirements- Operation Stage	5-2
Section - 6	PUBLIC CONSULTATIONS AND INFORMATION DISCLOSURES	6-1
6-1	INTRODUCTION	6-1
6-2	OBJECTIVES	6-1
6-3	METHODOLOGY ADOPTED FOR PUBLIC CONSULTATIONS	6-1
6-3.1	Stages and Levels of Consultation	6-1
6-4	RESULTS OF THE CONSULTATION	6-2
6-4.1	Contents	6-2
6-4.2	Public Hearing, Schedule-IV, under EIA Notification of MoEF	6-2
6-4.3	Issues Raised and Community Perception	6-3
Section - 7	FINDINGS, RECOMMENDATIONS AND CONCLUSION	7-1
7-1	FINDINGS, RECOMMENDATIONS	7-1
7-2	CONCLUSION	7-1

APPENDICES

Appendix 1	List of 696 km of Rural Roads under Third Batch of ADB Loan Assistance – West Bengal
Appendix 2	Environmental Management Action Plan for Pre-Construction and Construction Phases
Appendix 3	Environmental Monitoring Control Matrix – Construction Phase
Appendix 4	List of persons interacted during Public Consultation

SECTION 1: INTRODUCTION

1.1 GENERAL BACKGROUND

The Government of India (GOI) is currently implementing the Pradhan Mantri Gram Sadak Yojana (PMGSY) Program in many states of India through the Ministry of Rural Development (MORD). The main objective of PMGSY is to connect the unconnected habitations with a population of 1000 or more (500 or more in the case of Hilly States, including North East, Desert and Tribal areas) in the first phase. The National Rural Roads Development Agency (NRRDA) under the Ministry of Rural Development, Government of India, is the Agency responsible for overall management, supervision and execution. NRRDA is a part of MORD. The West Bengal State Rural Road Development Agency (WBSRDA) is the implementation agency of PMGSY program in West Bengal.

The Asian Development Bank (ADB) is providing loan for the Rural Roads Sector II Investment Program (RRSIIP) to support the national rural roads program known as *Pradhan Mantri Gram Sadak Yojana* (PMGSY) in West Bengal and Orissa states. The ADB's loan assistance will be implemented in three batches. First batch consisted of 784.98 km rural roads covering 101 roads (Under Construction and Post Construction Phase), Second batch consisted of 908 km covering 109 roads (Preconstruction, Under Construction and Post Construction Phase), and Third batch consisted of 1000 km of which 696.124 km (phase 1 of Batch III) includes 126 roads are being considered at present stage (phase 1 of Batch III).

The Detailed Project Reports (DPRs) for third batch, which cover 126 roads for total 696.124 km length, have been prepared by the Project Implementation Consultants. The third batch project as per agreed Environmental Assessment Review Framework (EARF)¹ has to be categorized based on the ADB's Environmental Assessment Requirement, 2003 and environmental assessment needs to be prepared for each road. Based on the environmental conditions of the project areas and the nature of project activities, the third batch project has been categorised as 'Category B' project, The Initial Environmental Examination (IEE) for each road was prepared by using the environmental checklist as per agreed EARF, this environmental checklist is served as the IEE. The Environmental checklist for each road of the third batch was prepared by PIC.

This summary IEE report covers: (i) the summary of all 126 environmental checklists of the roads covered by the Batch III and (ii) additional information from verification of the environmental checklist and (iii) secondary information of baseline scenario of the different districts of West Bengal.

1.2 PROJECT IDENTIFICATION AND LOCATION

Government of West Bengal have selected 696.124 km of rural roads within the 1st phase of third batch of ADB loan assistance under RRSIIP in West Bengal. The third batch consists of 696.124 km road length comprises 126 different stretches spread over in 19 districts of the State. Within each district, the roads are further scattered in several blocks and sub divisions. The minimum and maximum length of the roads ranges between 1 and 21 km. The list of 696.124 km roads is given in **Annexure 1** and the location map of the districts is given in **Figure 1.1**.

1.3 RURAL ROAD CONSTRUCTION PROPOSALS

The proposal for rural road construction works typically considers a 12-15 m right of way (ROW) which includes side slopes for embankment, side drains wherever

¹ The Environmental Assessment Review Frame work was prepared and agreed during the preparation of the MFF under loan MFF 001-IND Rural Road Sector II Investment Program, approved 2005.

required on either side of the alignment and the proposed ROW is even less than 10 m in some stretches of habitation area and in areas having tree plantation.

The construction proposals are confined to the existing alignment of the unpaved tracks. Majority of these are footpathways traditionally used by the villagers and transformed into the present form of unpaved tracks/roads through minor construction works taken up by the communities, local bodies and State Government over the decades.



Figure 1.1: District Map of West Bengal

1.4 INITIAL ENVIRONMENTAL EXAMINATION

1.4.1 Corridor of Impact and Study Area

Based on the proposed cross-section, 15m (7.5m on each side of the existing alignment) has been considered as the direct area of influence or the corridor of impact (COI) for IEE. In addition, a 10 km wide corridor (5 km on each side) of the

proposed alignment has been considered for assessment of the baseline environmental conditions of the region as a whole.

1.4.2 Field Visits

PIC carried out a thorough checking in the field for 696.124 km (126 roads) from different stretches / locations in all district covered by the third batch from April, 08 – February, 09 in this report and rest of the Batch III roads will be checked as and when the roads will be finalized.

Based on the environmental checklist of each road, TSC carried out random checking in the field for 44 km road from different stretches / locations in 8 districts (10% of the total road in sampled district) covered by the third batch during December to February, 2008-09. The IEE report is based on analysis of checklists of all roads as prepared by PIC followed by sample check of the subprojects..

Since it is decided certainly by the Govt. of India that phase 1 of Batch III considered separately for placement of 3rd PFR the field visit has been stopped and it will be commenced again within a month for the rest of the roads (including new roads under Batch III) for batch III.

1.4.3 Secondary Data Collection

Upon the completion of field visit and survey, secondary environmental data pertaining to the significant environmental issues were collected from various governments and non-governmental / research institutions for assessment of the baseline environment of the project locations / region as a whole.

The objective of secondary data collection is to gather information on the regional aspects of the basic elements of environment like geology & landuse, hydrology, meteorology, air quality, water quality, Noise, soil, ecology etc.

1.4.4 Primary Data Collection

The primary data generation was limited to the ecological investigation of typical sensitive areas among the selected rural road construction proposals. Similarly, a rapid tree enumeration survey was also carried out in all the rural roads. The details of the investigations are included under the **section 3.0 – Description of Environment**.

1.5 PURPOSE OF THE REPORT

This report summarises the Initial Environmental Examination (IEE) of the third batch (Batch III) of 696.124 km of rural roads in West Bengal and is based on the environmental checklists prepared for the sub projects by the PIUs/ PIC and followed by field checking of TSC. The IEE has been carried out in accordance with the ADB Environmental Assessment Guidelines.

SECTION 2: DESCRIPTION OF PROJECT

2.1 TYPE OF PROJECT

The PMGSY program has mandate to provide all-weather roads to all the rural habitations within the country. The PMGSY guidelines have the following priorities for establishing the rural connectivity.

- Unconnected habitations with population of 1000 or more
- Unconnected habitations with population of 500 to 999 or in population located in designated hilly or desert areas or with predominantly scheduled caste or scheduled tribe population, greater than 250.
- Population of 1000 or more presently connected by all-weather gravel roads.
- Population that satisfy the criteria described in category two above presently connected by all weather roads.
- Population of 1000 or more presently connected by all weather paved or WBM roads requiring rehabilitation.
- Population that satisfy the criteria described in category two above presently connected by all weather paved or WBM requiring rehabilitation

2.2 CATEGORY OF PROJECT

The Third Batch of West Bengal Rural Road that funded by the Rural Road Development Program under the PMGSY is categorised as 'B' in accordance with the ADB's Environmental Policy 2003 as translated into the ADB's Environmental Assessment Guidelines, 2003 and Initial Environmental Examination (IEE) are to be carried out for projects under the Category B. The Category B projects are judged to have some adverse environmental impacts but of lesser degree and / or significance than Category A projects, which require detailed EIA studies.

2.3 NEED FOR PROJECT

The rural road connectivity is seen as a catalyst for rural sector development by promoting access to health, education facilities and as an avenue to increased economic opportunities, leading to increased agricultural income and productive employment opportunities. The rural road development project is expected to play a dominant role in development of rural sector and ensuring sustainable poverty reduction program.

2.4 ROADS FOR IEE

The 696.126 km of rural roads of the third batch is spread over 19 districts. The district wise detailed distribution of the 696.126 km roads is given in **Appendix 1** and district wise summarised in **Table 2.1**.

Table 2.1: Summarised District wise Distribution of Rural Roads under Batch III

Sr. No.	Name of the District	No. of Roads	Length (km)	Length in km	
				Minimum	Maximum
1	North 24 Parganas	8	37.461	2.030	7.200
2	South 24 Parganas	2	26.580	12.450	14.130
3	Bankura	5	27.610	1.010	10.940
4	Birbhum	6	51.560	5.000	13.500
5	Burdwan	5	33.270	4.150	9.080
6	Coochbehar	34	116.350	1.140	11.410
7	Darjeeling	5	21.315	3.600	5.610

Sr. No.	Name of the District	No. of Roads	Length (km)	Length in km	
				Minimum	Maximum
8	Hooghly	8	28.640	1.320	6.200
9	Howrah	-	-	-	-
10	Jalpaiguri	6	37.945	3.815	10.280
11	Malda	11	34.340	0.810	6.040
12	Murshidabad	4	40.920	5.140	17.950
13	Nadia	2	27.560	12.150	15.410
14	Uttar Dinajpur	6	26.470	1.900	7.550
15	Purulia	2	21.650	7.850	13.800
16	Siliguri MP	4	10.860	1.075	4.830
17	Dakshin Dinajpur	6	21.250	2.100	7.030
18	Purba Medinipur	-	-	-	-
19	Pashim Medinipur	12	132.345	3.650	20.240
Total/ Overall		126	696.126		

The environmental criteria for all the districts leading to all the rural roads for IEE are given in **Table 2.2**. The detail description of the environmental (landuse) features of these districts and state as a whole are given in **Section 3.0 Description of Environment**.

Table 2.2: Environmental Criteria for IEE Batch III rural roads in West Bengal

S. No.	Name of the District	Environmental Criteria
1	North 24-Parganas	Alluvial Plain
2	South 24-Parganas	Delta & Estuarine Environment
3	Howrah	Alluvial Plain
4	Nadia	Flood prone area
5	Hooghly	Alluvial Plain
6	D. Dinajpur	Alluvial Plain
7	Bankura	Forest areas, dry area
8	Malda	Flood prone area
9	Murshidabad	Gangetic plane, erosion prone area
10	Purba Medinipur	Alluvial Plain
11	Paschim Medimpur	Coastal areas, forest area
12	Jalpaiguri	Sub Himalayan region / Hilly areas
13	Uttar Dinajpur	Alluvial Plain
14	Burdwan	Alluvial plane
15	Birbhum	Forest area, undulated zone
16	Purulia	Dry area, hilly, undulated area
17	Coochbehar	Undulated alluvial plane
18	Darjeeling	Himalayan region / Hilly areas
19	Siliguri (Darjeeling)	Sub Himalayan region

The list of selected road consider for batch III (1st phase) sample field visit by TSC are given in **Table 2.3**. The roads cover east, west, north, south and central part of West Bengal.

Table 2.3: List of Selected Roads for sample check up for IEE

Date of visit	District	Package No	Block	Road Name		Road Length (km)
				From	To	
23.12.09	West Medinipur	(T06)	Pingla	Harkandi	Sangar	5.674

Date of visit	District	Package No	Block	Road Name		Road Length (km)
				From	To	
24.12.09	East Medinipur	(L 029)	Egra-I	Tetulumuri	Sunia	4.903
26.12.09	Burdwan	WB05 ADB12 (L 028)	Mongalkote	Simulia	Krishnabati	4.257
28.08.08/ 29.12.09	North 24 Parganas	WB01 ADB18 (L026)	Deganga	Bhasila FP School (Chandpur Paschim)	Kalijuga	6.886
30.12.09	South 24 Parganas	(T04)	Canning-I	Malipara	Dakshin Kalikatala	4.338
11.02.09	Nadia	WB14 ADB10 (T 01)	Ranaghat - I	Badkulla Pucca Road	Radhakantapur via Chandaha, Badkulla, Magurkhali, Baspur	12.150
12.02.09	South Dinajpur	WB18 ADB24 (L 075)	Tapan	Daudpur	Antashimul Road	2.881
13.02.09	Maldah	WB11 ADB13 (L032)	Chanchal - II	Gourchand	Chandipur II Road	3.058

2.5 SIZE OR MAGNITUDE OF OPERATION

The construction cost of rural roads of 696.126 km under the third batch is broadly estimated at Indian Rupees 3035 million (including maintenance cost). Package wise cost is given in **Appendix 1**.

2.6 SCHEDULE FOR IMPLEMENTATION

The 696.126 km rural road construction works are scheduled to commence from April, 2009.

2.7 DESCRIPTION OF PROJECT

2.7.1 Rural Road Construction Proposals

The rural road construction work will provide 7.5 m roadway width with 3.75 m carriageway in plain terrain. The proposal considers a 3.75 m cement concrete pavement with lined storm water drains for stretches passing through waterlogged/water overtopping/ flood prone areas. The proposal also considers a 3.75 m bituminous pavement with lined storm water drains for stretches passing through the habitations. The pavement design considers a base layer of variable thickness as per the design with granular sub base, 150 mm thick water bound macadam (WBM grade I & II) and finally topped with 20 mm thick bituminous pavement. Adequate cross drainage structures like pipe or slab culverts/bridge structures are considered for drainage channels across the roads. The construction will be in accordance with Indian Roads Congress (IRC) road manual. **Figure 2.1** is showing typical cross section of the rural roads.

The rural road construction works will be in conformance with the Rural Roads Manual and / or Technical Specifications (IRC: SP20: 2002) for Rural Roads published by the Indian Road Congress (IRC) on behalf of Ministry of Rural Development, Government of India.

2.7.2 Present Condition

At present the Batch III roads are mainly “Through roads” and “Link roads”. Through routes are the ones which collect traffic from several link roads or a long chain of habitations and lead it to a market centre or a higher category road, i.e. the District Roads or the State or National Highways. Link Routes are the roads connecting a single habitation or a group of habitations to Through Roads or District Roads leading to Market Centres. Link Routes generally have dead ends terminating on habitations, while “Through Routes” arise from the confluence of two or more “Link Routes” and emerge on to a major road or to a Market Centre.

The project roads mainly pass through plain or undulating or rocky or riverine terrain with agricultural area or tea garden or forest area or any other special type garden (Bet, Bamboo, Sugarcane, Mango, Litchi etc.). The project roads have several cross drainage structure, electric post and telephone post along the existing alignment. There are some Shops, Temple, Mosque, Primary or Secondary Schools, Anga Nari Siksha Kendra, Offices beside the roads alignment, but will not be affected for the widening of roads.

The present environmental condition of the roads from the environmental impact checklist is summarized in **Table 2.4** and summary of field observation shown in **Table 2.5**.

Table 2.4: Summary of Environmental Condition of Batch III Roads

Environmental impact checklist points	Status as reported in the Checklists
A. Climate Conditions	
Temperature (°C)	
High	Maximum 44°C
Low	Minimum 10°C
Humidity (%)	
High	Maximum 95%
Low	Minimum 50%
Rainfall (mm/year)	1100 mm to 3200mm
Rainy Season (---month to ---month)	June to September
B. Locations of the Road	
Coastal area	None of the roads are in coastal belt
Mangrove (<i>along roadside</i>)	None of roadside having mangroves
Hilly/Mountainous area	Darjeeling, Siliguri MP, Jalpaiguri and Purulia districts have partial or more hilly roads.
Forest area	Siliguri, Jalpaiguri, Bankura, Purulia and Paschim Medinipur districts have social forests or unclassified forest within 500m from the project road.
Lake/Swamp	One Lake at Purulia district is located beside the project road.
Inhabited area	North and South 24 pgs, Hooghly, Malda, Jalpaiguri, Coochbehar, Bankura, Burdwan, Murshidabad, Purulia, Paschim Medinipur, Uttar Dinajpur, Dakshin Dinajpur, Siliguri MP roads having inhabited area
Agricultural land	North and South 24 pgs, Hooghly, Malda, Jalpaiguri, Coochbehar, Bankura, Burdwan, Murshidabad, Purulia, West Medinipur, Uttar Dinajpur, Dakshin Dinajpur, Siliguri MP roads having side by agriculture land area
Barren land	Paschim Medinipur, Siliguri MP, Purulia, Bankura and Jalpaiguri roads having side by barren land.
Flat area	North and South 24 pgs, Hooghly, Malda, Jalpaiguri, Coochbehar, Bankura, Burdwan,

Environmental impact checklist points	Status as reported in the Checklists
	Murshidabad, Paschim Medinipur, Uttar Dinajpur, Dakshin Dinajpur roads having side by flat area.
C. Description of the Road Environment	
Is the area along the project road prone to landslide problems?	None of the roads have landslide problems
Is the area along the project road prone to flooding problems?	Coochbehar and Jalpaiguri having flooding problem due to close proximity of rivers. Roads in Hooghly, Jalpaiguri, Murshidabad, Cooch Behar, South 24 Parganas having water topping problem due to low embankment height of the existing road during peak monsoon.
Along the road and within 500 m of the road shoulder, is there any area with natural habitat?	None of the roads have Natural habitats along or within 500m from the project road. One road each in Jalpaiguri and Purulia districts are located 500m away from the forest area where occasional wild elephant appear.
Along the road and within 500 m of the road shoulder, is there any species of flora and fauna that is classified as endangered species?	None of the roads have any species of flora and fauna that is classified as endangered species.
Along the road and within 500 m of the road shoulder, is there any faunal breeding ground?	None of the roads have any faunal breeding ground.
Along the road and within 500 m of the road shoulder, is there any bird migration area?	None of the roads have any bird migration area.
D. Impacts and Proposed Mitigation Measures	
Encroachment on historical/cultural areas?	None of the roads have encroachment of historical areas. 4 roads in Paschim Medinipur, 1 road in Dakshin Dinajpur, 2 roads in Bankura, 5 roads in Coochbehar, 4 roads in Burdwan, 1 road in Purulia and 1 road in South 24 Parganas are passing near the cultural (religious) areas which have encroachment to some extent.
Disfiguration by road embankments, cuts, landscape by road embankments, cuts, fills, and quarries?	None of the roads have disfiguration by road embankments, cuts, landscape by road embankments, cuts, fills, and quarries.
Encroachment on precious ecology (e.g. sensitive or protected areas)?	None of the roads have encroachment on precious ecology
Water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	There are several roads in Dakshin Dinajpur, Paschim Medinipur, Jalpaiguri, Maldah, Bankura, Coochbehar, North 24 Parganas, Burdwan, Siliguri MP and South 24 Parganas having waterways cross by the road (mitigation measures are proposed).
Deterioration of surface water due to sanitary wastes from worker-based camps and chemicals used in construction?	None (mitigation measures are proposed)
Inconvenient environmental condition due to poor sanitation and solid waste disposal in construction camps and work sites?	None (mitigation measures are proposed)
Inconvenient environmental condition due possible transmission of communicable diseases from workers to local populations?	None (mitigation measures are proposed)
Deterioration of surface water quality due to silt runoff?	None (mitigation measures are proposed)
Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	None (mitigation measures are proposed)

Environmental impact checklist points	Status as reported in the Checklists
Noise and vibration due to blasting and other civil works?	None (mitigation measures are proposed)
Inconvenience due to land slide or erosion?	None
Dislocation or involuntary resettlement of people?	None
Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	None
Creation of temporary breeding habitats for mosquito vectors of disease?	None (mitigation measures are proposed)
Accident risks associated with increased vehicular traffic leading to loss of life?	Yes (mitigation measures are proposed)
Inconvenience due to transportation of construction materials?	None (mitigation measures are proposed)
E. Public Consultation	
Consultation with local community was conducted before finalizing the alignment?	Yes (for each road)
Any suggestion received in finalizing the alignment?	Yes for all districts
If suggestions received, do they get incorporated into design?	Yes for all district roads
F. Permit/Clearance Required Prior to Commencing Civil Work	
SPCB–Non objection Certificate	None
Forest Department	None
MOEF	None
For water extraction	None
For Quarry	Having Licensed quarries
For Disposing Spoil Materials	None
Others(Describe in the remarks column)	SPCB-No Objection Certificate required for vehicles deployed for the construction work.

Table 2.5: Salient Environmental Features: Batch III Roads

District	Block	Package No.	Road Name	Salient Environmental Features
North 24 Paraganas	Bongaon	WB01 ADB14	Chaitapara to Ballavpur	<ul style="list-style-type: none"> Banana orchard One Temple
	Bongaon	WB01 ADB15	Rasulpur to Raghunathpur	<ul style="list-style-type: none"> Banana orchard 2 Temples
	Bongaon	WB01 ADB16	Near Nahata Bazar to Mamudpur	<ul style="list-style-type: none"> 3 Temples, 2 Graveyards
	Bongaon	WB01 ADB17	Chalki More to Polta	<ul style="list-style-type: none"> Banana orchard River Ichhamati in close proximity 2 Temples, 1 Mosque
	Deganga	WB01 ADB18	Bhasila FP School (Chandpur Paschim) to Kalijuga	<ul style="list-style-type: none"> Mango and Banana orchard Fishery pond Occasional water topping 2 Mosques, 3 Graveyards Tree felling
	Deganga	WB01 ADB19	Nasimpur to Sirajpur	<ul style="list-style-type: none"> Banana orchard 1 Canal 2 Mosques, 1 Graveyard

District	Block	Package No.	Road Name	Salient Environmental Features
South 24 Pgs	Baruipur	WB02 ADB09	Auliapur (Arapanch) to Uttarbhag	<ul style="list-style-type: none"> Guava and Karamcha plantation 1 Canal 2 Temples Tree felling
Bankura	Khatra	WB03 ADB13	T02 to Dhanara	<ul style="list-style-type: none"> 1 Canal 1 Temple
	Khatra	WB03 ADB14	T04 to Dumuria	<ul style="list-style-type: none"> 3 Temples
	Khatra	WB03 ADB15	T03 to Tiring	<ul style="list-style-type: none"> Unclassified forest 2 Canals
	Khatra	WB03 ADB16	Bahadurpur to Jamada	<ul style="list-style-type: none"> 2 Canals
	Indpur	WB03 ADB17	T05 to Belut	<ul style="list-style-type: none"> 1 Canal Tree felling 3 Temples
Burdwan	Ausgram - I	WB05 ADB11	Shibda More to Noda	<ul style="list-style-type: none"> 3 Canals 1 Mosque, 2 Temples
	Mongalkote	WB05 ADB12	Simulia to Krishnabati	<ul style="list-style-type: none"> 2 Temples, 2 Mosques, 1 Idga
	Mongalkote	WB05 ADB13	Bonkapasi to Gopalpur	<ul style="list-style-type: none"> River Brahamani in close proximity 4 Temples Tree felling 2 Canals
	Ausgram - II	WB05 ADB14	Jinjira to Shri Chandrapur	<ul style="list-style-type: none"> A small river 2 Canals Tree felling 3 Temples
	Memari - II	WB05 ADB15	Gargeswar to Paikara (From Gantia More to Mushagoria)	<ul style="list-style-type: none"> 5 Temples, 1 Mosque, 1 Graveyard Tree felling
Coochbehar	Tufanganj - II	WB06 ADB15	Langal Gram Pucca Road to Balbhoot Pucca Road (via Begakhata East & West)	<ul style="list-style-type: none"> No important features Bet jungle
	Coochbehar - I	WB06 ADB16	Boxirhat to Towards Saheberhat via Battala (Tetultala)	<ul style="list-style-type: none"> 2 Temples
	Coochbehar - I	WB06 ADB17	Bogura Para Tephathi to Towards Katmari Hat (Titiar Chhara Chandamari)	<ul style="list-style-type: none"> Large water body (jhil) River Saltia 2 Temples, 1 Burning ghat
	Coochbehar - I	WB06 ADB18	Charakbari Primary School to Mashanpath (Charak Bari)	<ul style="list-style-type: none"> Swamp Bet jungle Tree felling 7 Temples, 1 Graveyard
	Coochbehar - I	WB06 ADB19	3 No. Bridge to Towards SSB Camp (Natuar Par)	<ul style="list-style-type: none"> 1 Canal 1 Temple
	Mathabhanga - I	WB06 ADB20	Nenda Wooden Bridge to Sardarer Tari	<ul style="list-style-type: none"> Large waterbody Watertopping 1 Mosque

District	Block	Package No.	Road Name	Salient Environmental Features
	Coochbehar - I	WB06 ADB21	Sutkabari Bazar to Khagerhat	<ul style="list-style-type: none"> Banana orchard Occasionally flood prone River Mara Torsha 1 Mosque
	Coochbehar - I	WB06 ADB22	Chilkirhat to Towards Saheberhat (Holdir Tari)	<ul style="list-style-type: none"> River 1 Mazar
	Coochbehar - I	WB06 ADB23	Moniganger Hat to Barobari Domukha (Uttar Chhoto Atharo Kotha)	<ul style="list-style-type: none"> Bet jungle Jute field River Mora Torsha 2 Canals 1 Mosque, 3 Temples
	Coochbehar - I	WB06 ADB24	Chilkirhat to Kater Hat via Sannyasir Ghat and Deurhat	<ul style="list-style-type: none"> 1 Canal Teagarden 3 Temples
	Coochbehar - I	WB06 ADB25	Basabari to Chowpathi Nouerkura	<ul style="list-style-type: none"> No important features
	Coochbehar - I	WB06 ADB26	Pakuratala to Panishala High School	<ul style="list-style-type: none"> 5 Temples
	Coochbehar - I	WB06 ADB27	NH 31 (near Kathaltala) to East Falimari Primary School	<ul style="list-style-type: none"> 13 Temples
	Coochbehar - I	WB06 ADB28	Chilkirhat Chandamari Road to Modakpara	<ul style="list-style-type: none"> 3 Temples
	Haldibari	WB06 ADB29	Jakir Hoshin House to Dewanganj PWD	<ul style="list-style-type: none"> 2 Temples, 1 Monk
	Haldibari	WB06 ADB30	Sarika (Kakaria Para) to Bhojali Para More	<ul style="list-style-type: none"> 1 Temple, 1 Graveyard
	Haldibari	WB06 ADB31	Balur Tari to Sen Para	<ul style="list-style-type: none"> 3 Temples
	Haldibari	WB06 ADB32	Kashiabari Petrol Pump Barer Danga	<ul style="list-style-type: none"> 2 Temples
	Mathabhanga - I	WB06 ADB33	Bhaberhat to Khursamari	<ul style="list-style-type: none"> 5 Temples
	Mathabhanga - I	WB06 ADB34	Bhanga More to Gadaler Kuthi	<ul style="list-style-type: none"> River Suranga 1 Temple
	Mathabhanga - I	WB06 ADB35	Baro Gopalpur to Keshar Hat	<ul style="list-style-type: none"> Tree felling 3 Temples
	Mekhliganj	WB06 ADB36	Jamaldah PWD Road near Sutunga Bridge to Patchhara More	<ul style="list-style-type: none"> River Sutunga 9 Temples
	Mathabhanga - II	WB06 ADB37	T05/ T02 to Dwarlaxmipur	<ul style="list-style-type: none"> 2 Temples
	Mathabhanga - II	WB06 ADB38	SH 12A (Near Nishiganj) to Chhat Sitkibari	<ul style="list-style-type: none"> Banana Orchard 16 Temples
	Mathabhanga - II	WB06 ADB39	Ghoksa Danga to Souder Bash	<ul style="list-style-type: none"> 1 Temple
	Mathabhanga - II	WB06 ADB40	T05/ T02 to Fulbari	<ul style="list-style-type: none"> 2 Temples
	Mekhliganj	WB06 ADB41	Dhapra PWD Road to Sitai Bridge	<ul style="list-style-type: none"> 1 Canal 5 Temples
	Tufanganj - II	WB06 ADB45	Langal Gram Road at Chandir Pat to Mansai Ward No. 2	<ul style="list-style-type: none"> No important features

District	Block	Package No.	Road Name	Salient Environmental Features
Hooghly	Arambagh & Khanakul- I	WB06 ADB12	Gourhati market to Radhaballavpur via Gouran, Helan	<ul style="list-style-type: none"> 1 Canal 1 Mosque
	Khanakul-II	WB06 ADB13	Seepara to Janapara	<ul style="list-style-type: none"> 1 Canal Tree felling
	Khanakul-II	WB06 ADB14	Rajhati Dhanga Ajgubitala to Daulatchak Bajpai	<ul style="list-style-type: none"> 1 Canal Tree felling
	Khanakul- I	WB06 ADB15	Krishnanagar to Radhunathpur Dispensary Centre	<ul style="list-style-type: none"> River Dwarakeswar in close proximity 1 Canal Tree felling Birth place of Raja Rammohan Roy
Jalpaiguri	Alipurduar - II	WB10 ADB15	NH 31C at Mahakal Choupathi to T 07 at Gadadhar Bridge	<ul style="list-style-type: none"> River Gadadhar in close to road Water topping
	Matiali	WB10 ADB17	T 03 at Purba Batabari to T 06 at Murti Village Joyantee Village	<ul style="list-style-type: none"> Murti Beat office 500 m away River Murti along the road Water topping
	Maynaguri	WB10 ADB18	T 09 at Tekatuli to Paja Ddiner Bari at Sussthir Hat	<ul style="list-style-type: none"> Tea garden River Seuli along the road Tree felling 1 Mazar, 2 Temples
	Alipurduar - I	WB10 ADB19	T-08 at Kalabari to Adhikaripara	<ul style="list-style-type: none"> Jaldapara forest 2 km away Tree felling Jute, Bettlenut plantation Nepathi jhora
	Dhupguri	WB10 ADB20	T-11 at Tatpara TG to Guru Line at Debpara TG	<ul style="list-style-type: none"> Tea plantation Unclassified forest 1 km away 1 Canal Tree felling
	Mal	WB10 ADB21	T-02 at Chowrangee & L036 at Premganj to Maua Mari & Taltala	<ul style="list-style-type: none"> River Mara Teesta along the road
Malda	Chanchal - II	WB11 ADB12	Kashimpur to Bijali	<ul style="list-style-type: none"> Nachnia Nala
	Chanchal - II	WB11 ADB13	Gourhand to Chandipur-II	<ul style="list-style-type: none"> 2 Temples, 2 Mosques
	Chanchal - II	WB11 ADB14	Malahar to Belungoon	<ul style="list-style-type: none"> No specific features
	Chanchal - II	WB11 ADB15	Gourshand to Meghdumra	<ul style="list-style-type: none"> 2 Temples
Murshidabad	Beldanga - I	WB13 ADB13	Mahespur to Jalalpur Ferry Ghat	<ul style="list-style-type: none"> 1 canal Occasional water topping
	Bhagowangola - I	WB13 ADB14	Connection with SH 11 to Dostina	<ul style="list-style-type: none"> Mango orchard
Darjeeling	Karandighi	WB15 ADB11	Naudubi to Mahato Bhatia Para	<ul style="list-style-type: none"> 6 Mosques

District	Block	Package No.	Road Name	Salient Environmental Features
	Karandighi	WB15 ADB12	MDR Connection to Adibasipara	<ul style="list-style-type: none"> • Tree felling
	Karandighi	WB15 ADB13	NH 34 Connection to Sahapur	<ul style="list-style-type: none"> • 4 Temples, 2 Mosques, 1 graveyard • 1 Canal
	Karandighi	WB15 ADB14	Bhangipara to Kamartore	<ul style="list-style-type: none"> • 6 Temples, 2 Mosques • Tree felling
	Karandighi	WB15 ADB15	NH 34 Connection to Laipara	<ul style="list-style-type: none"> • River Denga beside the road • Banana orchard
	Karandighi	WB15 ADB16	Connection of MDR to School Para	<ul style="list-style-type: none"> • 1 Temple, 1 Mosque
Purulia	Arsha	WB16 ADB09	Ghatbera More to Bamni with a link to Sitarampur Road	<ul style="list-style-type: none"> • Unclassified forest • Hilly terrain • Tree felling • 5 Temples
	Raghnathpur - II	WB16 ADB10	Kulisara to Rangamati G.P Office Road	<ul style="list-style-type: none"> • Lake • Canal
Siliguri MP	Phansidewa	WB17 ADB06	Chathat to Murikhawa	<ul style="list-style-type: none"> • Tea garden, Pineapple firm • Canal • 1 Mosque
	Phansidewa	WB17 ADB07	Hansqua More to Gangarampur TE under Hetmuri Singhijora	<ul style="list-style-type: none"> • Tea garden
	Kharibari	WB17 ADB08	Kharibari PWD Road to Goursingh	<ul style="list-style-type: none"> • River Mechi runs along the road
	Matigara	WB17 ADB08	Patharghata Road Rajpouri	<ul style="list-style-type: none"> • Tea garden • Canal • 1 Temple
Dakshin Dinajpur	Balurghat	WB18 ADB20	Sewai to Baniakuri	<ul style="list-style-type: none"> • No specific features
	Gangarampur	WB18 ADB21	Jhanjhar to Mahendri	<ul style="list-style-type: none"> • Canal • 2 Graveyards
	Kushmondi	WB18 ADB22	Chandipur to Purbabasail	<ul style="list-style-type: none"> • 3 Temples
	Tapan	WB18 ADB23	Atila More to Atila	<ul style="list-style-type: none"> • No specific features
	Tapan	WB18 ADB24	Daudpur to Antashimul	<ul style="list-style-type: none"> • 1 Temple
	Tapan	WB18 ADB25	Salas to Jaminipara	<ul style="list-style-type: none"> • 2 Temples, 1 Graveyard • Canal
Paschim Medinipur	Kharagpur - II	WB20 ADB20	Sanjual to Paniseuli (T-04)	<ul style="list-style-type: none"> • Tree felling • 1 Canal
	Garbeta - II	WB20 ADB21	Khapribhanga to Agurbandh (T-02)	<ul style="list-style-type: none"> • 4 Temples • 4 Canals

District	Block	Package No.	Road Name	Salient Environmental Features
	Garbeta - II	WB20 ADB22	Manikdipa to Jirapara	<ul style="list-style-type: none"> Unclassified forest 1 Canal Tree felling 3 Temples
	Garbeta - III	WB20 ADB23	Tatarbati to Guiyadaha Hospital (T04)	<ul style="list-style-type: none"> Unclassified shal forest Tree felling 1 Temple (Raskundu Basantraj) 3 Canals
	Sankrail	WB20 ADB24	Baburbani to Naihati	<ul style="list-style-type: none"> Tree felling 4 Temples 2 Canals Sugarcane cultivation
	Sankrail	WB20 ADB25	Bakra to Khayrapoti	<ul style="list-style-type: none"> Unclassified forest 2 Temples 3 Canals
	Sabang	WB20 ADB26	Chandkuri to Malpara	<ul style="list-style-type: none"> No important features
	Sabang	WB20 ADB27	Basantapur to Khorai	<ul style="list-style-type: none"> Tree felling 3 Canals Jute plantation
	Keshiary	WB20 ADB28	Hatigeria to Uriabara	<ul style="list-style-type: none"> Unclassified forest area located nearby 1 Canal
	Pingla	WB20 ADB29	Harkandi to Sangar	<ul style="list-style-type: none"> Tree felling 3 Temples, 2 Mosques, 1 Graveyard 2 Canals
	Keshpur	WB20 ADB30	Biswanathpur to Kharika (Part II)	<ul style="list-style-type: none"> 4 Temples 2 Canals River Parang
	Garbeta - I	WB20 ADB31	Chakparbati to Moyrakati (T-01)	<ul style="list-style-type: none"> Shal plantation 4 Temples, 1 Mosque 2 Canals

2.7.3 Available Right of Way (ROW)

The existing width of tracks generally varies between 3-12 m in stretches passing through agricultural lands or habitations and 8-15m in stretches through the open lands / agricultural fields. As per the information available with WBSRDA, in most of the roads the required ROW of 10-12m is available even in stretches passing through the agricultural lands. The ROW has been encroached and put to agricultural use by the adjacent landowners in almost all the road construction proposals.

The private landowners along the proposed right of way (ROW) are voluntarily parting the encroached land and in some cases parted even their own private land without any compensation, anticipating the developmental benefits from the road

construction works. In case of construction works through the intermediate rural settlements / habitations the carriageway width is restricted to 3.75 m and sometimes a cement concrete pavement is considered in such cases.

The ROW requirement in built up area may be squeezed to 6m along with the drain and for these stretches, a provision of service lane before and after the stretch in both direction has been proposed.

2.7.4 Alignment and profile

The existing road is generally earthen track with some stretches of moorum in poor condition. Thus the project road is a new connectivity road. The existing Right of Way (ROW) is varying from 3.0 m to 5.0 m.

The construction works are to be confined to the existing alignment. The existing horizontal and vertical alignment / profile will be generally maintained except for minor smoothing or corrections to sustain consistent design speed without causing any land acquisition requirements and thereby the possible social and/or environmental concerns.

2.7.5 Traffic

The present traffic data on each of these rural roads typically vary between 8-12 vehicles per day on most of the rural stretches. The traffic largely comprises motor cycles/two wheelers, tractors, light commercial vehicles, animal drawn carts and bicycles.

2.7.6 Economic Assessment

The economic analysis carried out under the project has indicated that the rural road construction works will act as a catalyst for the rural economic growth and poverty alleviation of the community in the region.

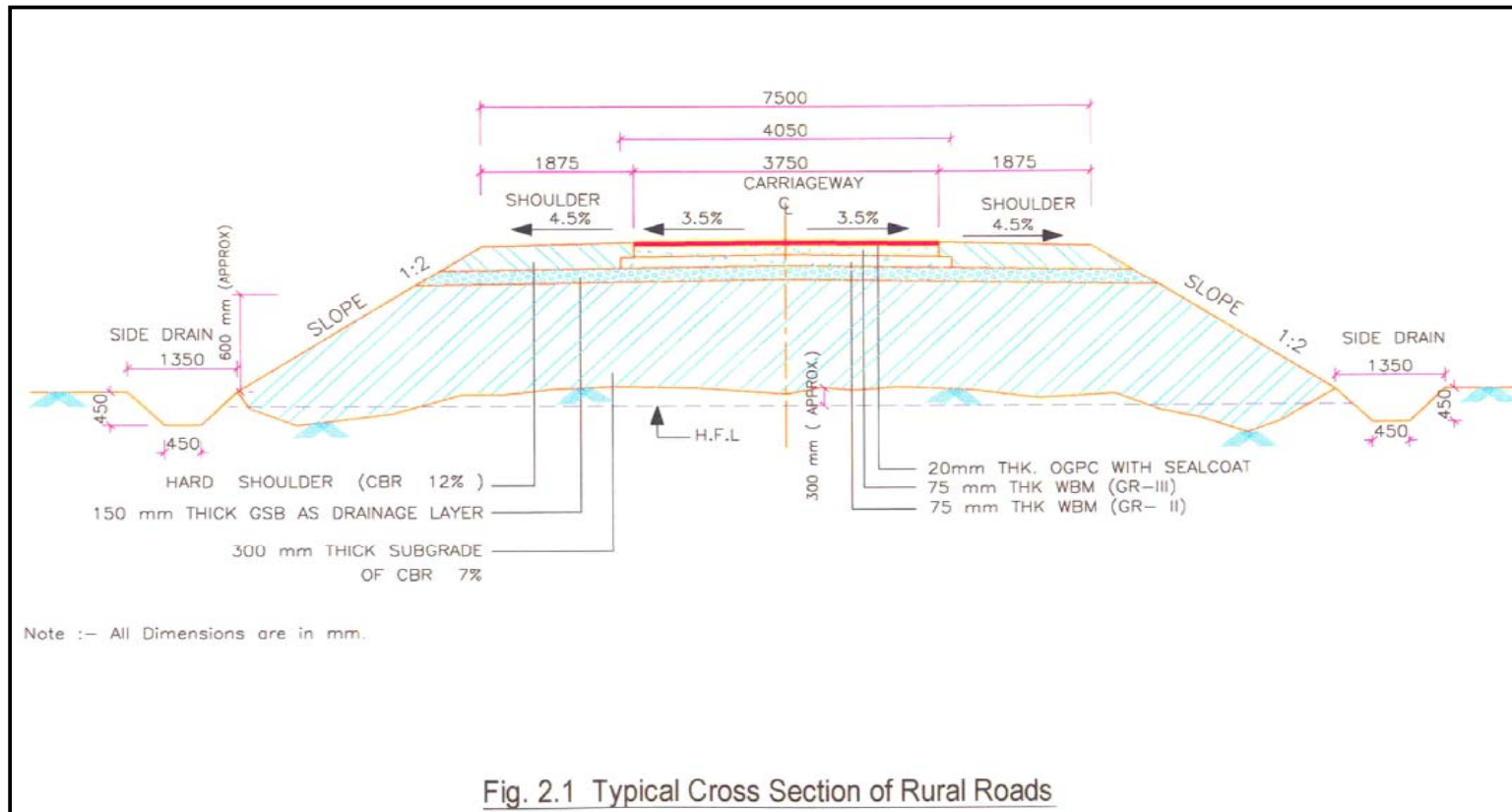


Fig. 2.1 Typical Cross Section of Rural Roads

SECTION 3: DESCRIPTION OF ENVIRONMENT

3.1 GENERAL

The baseline environment of the study area¹ along with environmental profile within the corridor of impact (COI) of the 696.126 km length covering 126 roads are given in this section.

3.2 PHYSICAL RESOURCES

3.2.1 Geology

The State of West Bengal covers an area of 87,616 sq.km. and is bounded approximately by 21°10'N and 27°38'N latitudes and 85°50'E and 89°50'E longitudes. The State is mainly covered by alluvial and deltaic of Sub-Recent and Recent time in more than 80% of the geographical area and remaining part is covered with a wide variety of hard rocks. Out of this total area, 73,858 sq.km. is occupied by the unconsolidated sedimentary deposits of the Quaternary period. The rest of the area is covered by hard rocks ranging in age from the Precambrian to the Tertiary periods, which are decidedly older than the sedimentary formations. The entire state is divided into the following three distinct physiographic units,

- Extra Peninsular region of the Northern part
- Peninsular mass of the South-western part
- Alluvial and deltaic plains of South and Eastern part

In Darjeeling and Jalpaiguri Districts, Pre-Cambrian is represented by the Darjeeling Gneiss, Lingtse Gneiss and Daling group of rocks. Apart from the Precambrian formations, there exist some sedimentary rocks of the Gondwana period and also of Siwalik formations of the late Tertiary period.

The Darjeeling Gneiss is, in general, a migmatitic-banded gneiss containing enclaves of high grade schist represented by garnet staurolite-kyanite-mica schist, calc-silicate rocks, amphibole and graphite schist. The schist erodes easily.

Lingtse Gneiss occurs as linear, medium to coarse-grained, foliated biotite gneiss, emplaced within the Daling Group of rocks. It occupies mostly the snow clad mountain peaks of the Singalila Range which runs southwards from the Kanchanjungha Peak right up to the north-western border of Darjeeling District with Nepal in the West and Sikkim in the east.

The Gondwana rocks occur in Jalpaiguri and Darjeeling districts of the south of the Darjeeling Himalayas. Lithologically the Gondwana rocks consist of pebble/boulder beds, quartzite, sandstone, slates, carbonaceous slates and coal seams.

A belt of alluvial detritus of Tertiary age occurs in the *Terai* region of the northern part of Jalpaiguri, Coochbehar and Darjeeling districts. This area consists of alluvium terrain underlain by lithified soft Quaternary Formation comprising sand, silt and clay with fine texture. Flood plain deposits are noticed in and around the meander belt of different rivers.

The terrain of Maldah, Uttar Dinajpur, Dakshin Dinajpur, Nadia and Murshidabad have been formed by the river borne deposits underlain by lithified soft Quaternary Formation comprising sand, silt and clay. No hard rock formation is expected in and around the project site. The Barind area falls in the central part of North Bengal and covers an area of about 7680 sq km. Barind area is subdivided into two broad units i) Barind clay and sand formation ii) Rohonpur silty clay. Presently Barind Formation has evolved away and the dissected surface has been filled up with the recent

¹ Defined under 1.4 of Section 1.0

sediments. In the Barind, middle and lower members are overlain by Holocene deposits but the Holocene infilling was not so high and that's why, the Barind tract apparently is seen to be elevated compared to the surrounding flood plain. This apparent elevation of the flat surface of the Barind is an erosional feature and does not indicate a tectonic event.

The Pre-Cambrian in the Peninsular West Bengal is mostly exposed in Puruliya district and also along the western margins of Bankura and Birbhum districts. There are also extensive exposures of Gondwana rock formations in the districts of Bardhaman, Puruliya, Bankura and Birbhum.

The Gondwana rocks show extensive development in the Bardhaman district and extend into adjoining parts of Bankura and Puruliya districts and also occur as small basins in Birbhum district. The Gondwanas rest unconformably over the Precambrians. Subsequently the rocks have suffered a series of block faulting. The coalfield has a faulted contact with the Precambrians. A boulder bed, at the base of the sequence is considered to be of glacial origin. A thick series of shale and sandstones with inter-calatines of a number of coal seams overlie the boulder bed. Coal seams are mainly confined to Barakar and Raniganj formations. The Gondwana rocks are intruded by dykes and sills of dolomite, mica-peridotite and amprotite.

Medinipur, Howrah and Hooghly districts are a part of the Bengal basin located close to the main sea (Bay Of Bengal). The area forms a part of the lower Gangetic delta plain underlain by Recent to Tertiary sediments. The top most sediments, belonging to recent alluvium consisting of clay, kankar and at some places laterite gravel. Again clay, silt, sand and gravel constitute the major sub-surface geology of the area. In this region, alluvial sediments occur in rhythmic pattern represented by alternate layers of sand, silt and clay. Sand beds are grayish, micaceous, fine to coarse grained, which is very important from the point of ground water storage. Fairly persistent clayey layers separate these sand beds generally. In deeper level (>290m) the unconsolidated sediments are generally argillaceous and do not hold much scope for ground water development.

North 24 Parganas and South 24 Parganas districts are underlain by Quaternary sediments consisting of clay, silt and various grades of sand gravel and pebble. No hard rock geological formation is found here. Lithological log indicates the presence of a clay bed at the top of the geological succession with thickness varying from 10-40 m. Alternate clay and sand bed exists further in the downward direction. A group of granular aquifer is found between 250-650 m below ground level. These layers are being tapped as groundwater sources. The unconsolidated alluvial sediments of Quaternary age have overlain the older deposits of Tertiary age as noticed in this pile of alluvium. The top most sediment, belonging to Recent alluvium which contains mostly of clay.

The lithology of the project districts and state as whole is given in **Table 3.1**.

Table 3.1 Lithology of Project District / West Bengal State

Sl. No.	Formation Type	Age Group	Lithology
I	Semi Consolidated / Unconsolidated Formations	Quaternary Upper Tertiary	Recent Alluvium, Clay, Silt, Sand, Gravel, Pebble, Calcareous Concretion etc
			Older Alluvium and Laterites, Silt, Sand, Ferruginous Concretions, Lithomargic Clay, Gravels, Pebbles, Cobbles etc.
		Tertiary Mesozoic Upper Paleozoic	Siltstone, Claystone, Grit, Sandstone, Shale, Conglomerate, Limestone, including intrusive

2	Consolidated Formations, Sedimentaries Meta-Sedimentaries Effusives Basal Crystallines	Mesozoic Paleozoic	Basalt with intertrappean clay
		Tertiary Pre-Cambrian	Sandstone, Dolomite, Limestone
		Pre-Cambrian	Slate, Quartzite, Phyllite, Schist, Gneiss, Marble
		Achaean	Gneissic complex and associated intrusive (Post - Achaean)

Owing to the alluvial and deltaic plains there are no significant stone bearing areas in many of the districts / parts of state. The stone bearing areas are located in the Birbhum district. The potential stone bearing areas in these districts are Pachami, Rampurhat, Nalhati and Pakur among others. The West Bengal Mineral Development Corporation, a Government of West Bengal undertaking has quarry operations in Pachami of Birbhum district. Some of these stone bearing areas could serve as potential sources of the aggregates for sub-base and base courses, bituminous courses and concrete works for rural road construction works.

The geological map of the project districts and state as a whole is given in **Figure 3.1**.

3.2.2 Earthquake Zone / Sensitivity

The Bureau of Indian Standards² has categorized the entire India into zones depending upon the degree of proneness to earthquakes. The Zone I signify lesser degree while Zone V signifies highest order. The northern and southern most parts of West Bengal are classified as Zone IV and rest part of the state is classified as Zone III. The classification of earthquake zones of the project districts/ state is shown in **Figure 3.1A** and given in **Table 3.2**.

Table 3.2 Earthquake Zones of Project District / West Bengal State

Sr. No.	Name of the District	Earthquake Zone
1	Bardhaman	III
2	Howrah	III
3	North 24-Parganas	III
4	South 24-Parganas	III & IV
5	Hooghly	III
6	Coochbehar	IV
7	D. Dinajpur	IV
8	DGHC	IV
9	Nadia	III
10	Murshidabad	III
11	Purba Medinipur	III
12	Siliguri MP	IV
13	Paschim Medinipur	III
14	Purulia	III
15	Bankura	III
16	Jalpaiguri	IV
17	Birbhum	III
18	Uttar Dinajpur	IV
19	Malda	IV

² Bureau of Indian Standards (BIS), a Government of India body has prepared the seismic zoning map for the entire India and established criteria for earth quake resistant design of structures. Zone I indicate the lesser proneness of the region to earthquakes and Zone V indicates higher degree of proneness of earthquakes.

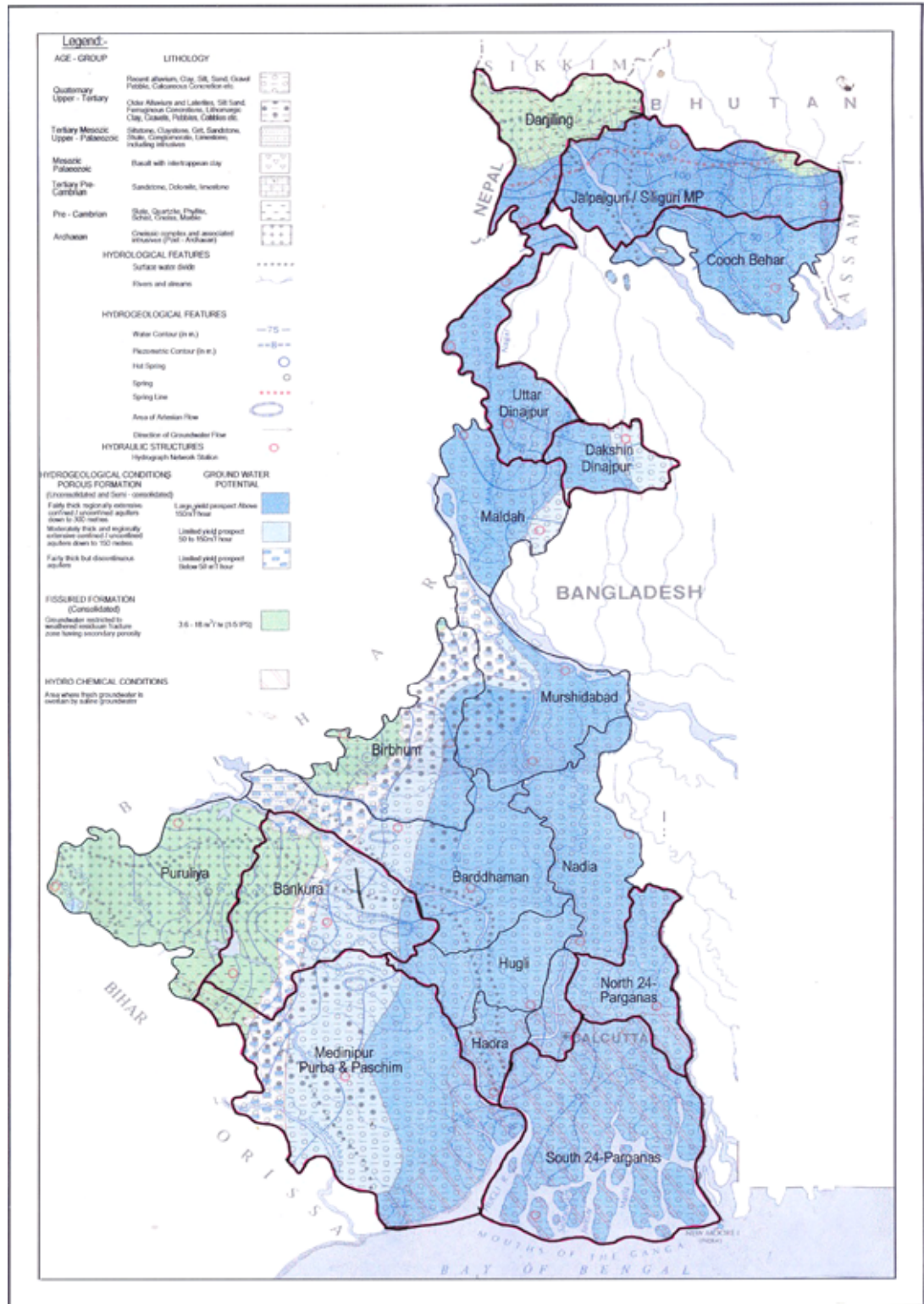


Fig No. - 3.1 Geology & Hydrogeology Map of Project Districts - West Bengal

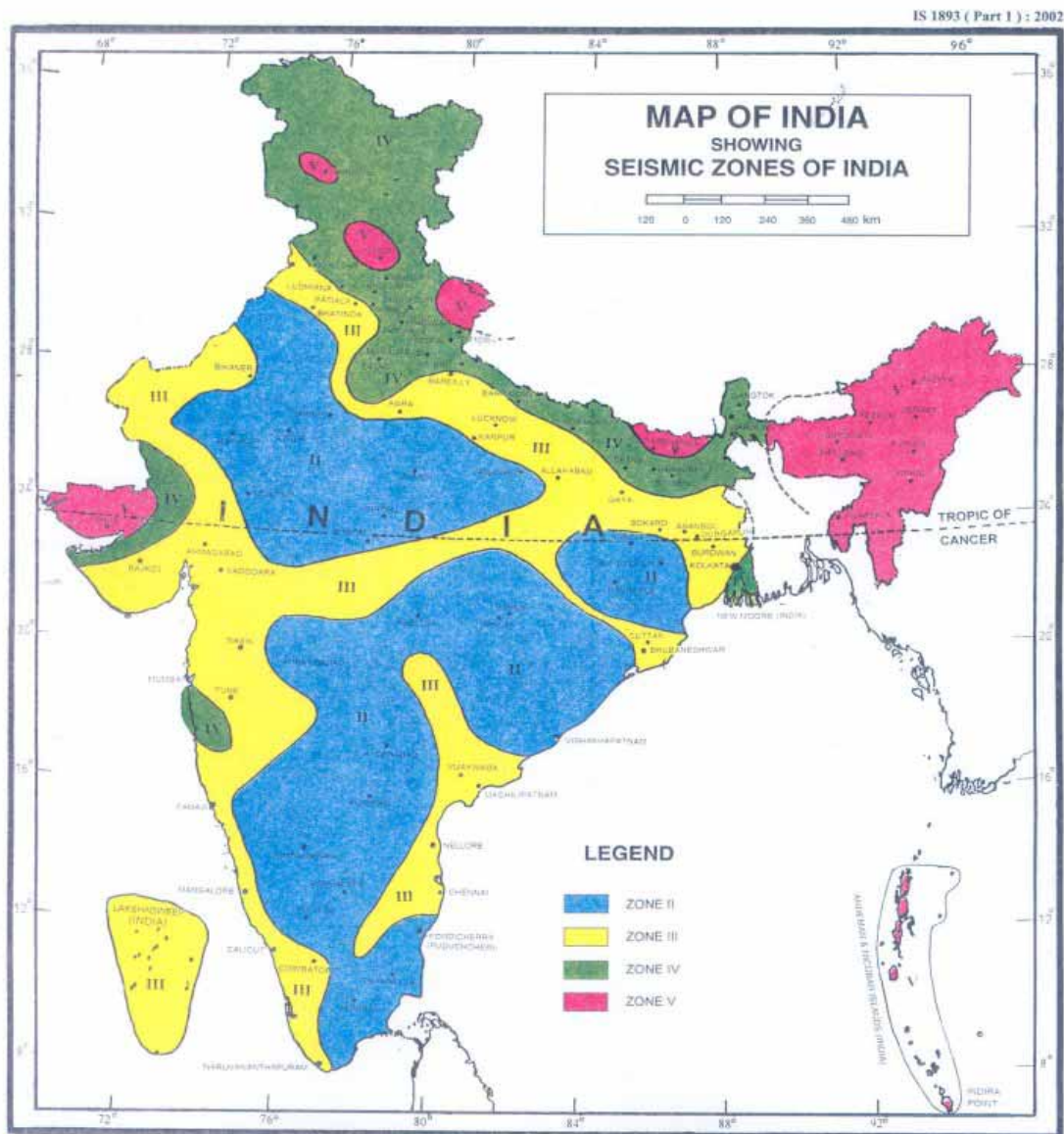


Fig 3.1 A: Classification of Earthquake Zones of India

3.2.3 Geo-hydrology

Based on the geological and geomorphologic set up, the entire state can be divided into two broad hydro geological units namely fissured formations and porous formations. The fissured formations occur in major parts of Darjeeling region, western parts of Bardhaman, Bankura, Birbhum, East Medinipur, West Medinipur and Purulia districts. The porous formations almost cover the rest two third area of state.

The ground water within the fissured formations occurs in the upper weathered mantle (5-10m) and at deeper levels (60-100m depth) in the fractures. The occurrence and ground water movement in porous formations is controlled by primary porosities of the sediments. The ground water in these formations occurs

both under water table and in confined condition. In the coastal tract of East Medinipur, South 24 Parganas and some pockets of Howrah district, the fresh water aquifers occurs within a depth of 120m to 300m sandwiched between saline aquifers.

The hydro geological conditions in both porous and fissured formations spread across project districts / state are given in **Table 3.3**.

Table 3.3 Hydro geological Conditions of Project District / West Bengal State

S. No	Formations Type	Hydro geological Conditions	Groundwater Potential
1	Porous Formations (Unconsolidated/ Semi Consolidated)	Fairly thick regionally extensive confined/ / unconfined aquifers down to 300 meters.	Large yield prospect above 150 cum/ hour
		Moderately thick and regionally extensive confined / unconfined aquifers down to 150 meters	Moderate yield prospect 50 to 150 cum/ hour
		Fairly thick but discontinuous aquifers	Limited yield prospect below 50 cum / hour
2	Fissured Formation (Consolidated)	Groundwater restricted to weathered residuum fracture zone having secondary porosity	3.6 - 18 cum/hour (1 - 5 lps)

In the coastal tract of East Medinipur, S 24- Parganas, southern part of N 24- Parganas, Bidhannagar and some parts of Howrah lying in the active delta of the Ganga --- the Bhagirathi river system ground water occurs under a characteristic hydrochemical situation in which fresh water group of aquifers occurs within span of 120-300m sandwiched between saline to brackish aquifers. Yield of the tube well varies from 100-150m³/hr. Some of the hot springs (35-41^oC) from deep seated fractured zones of older rocks occurs around Bakreswar in Birbhum district.

The sand zones occurring within the depth range of 127 to 290 m bgl are more pronounced and attain fairly good thickness (often 25 or more) and laterally extensive as well. These grayish micaceous sand beds which are fine to coarse grained in texture are very important from the point of ground water storage. The sand beds are separated generally by fairly persistent clayey layers. Below the depth of 290 m, the unconsolidated sediments are generally argillaceous and do not hold much scope for ground water development.

The ground water development in West Bengal is generally occurring through shallow tube wells (yield up to 30 cum per hour), medium tube wells (yield up to 100 cum per hour) and deep heavy tube wells (yield up to 200 cum per hour). The entire region has a very good potential for ground water development with estimated present ground water utilization at less than 50% of the available resources. Therefore the entire project region falls under the white³ category as per Central Ground Water Board (CGWB) guidelines.

The hydrogeology of the project districts/state showing ground water table contour, direction of flow and the ground water potential are also given in **Figure 3.1**.

³ Central Ground Water Board (CGWB), a body of the Government of India regularly reviews and assess the ground water potential of the various regions and recommends the level of ground water development. The categories for ground water development are White Category indicating present utilisation of ground water at less than 50% and ample scope for ground water development; Grey Category indicate present utilisation of ground water between 50-70% with scope for ground water development; Dark Category indicate present utilisation of ground water at more than 70% with limited to very limited scope for further development.

3.2.4 Physiography and Relief

The West Bengal state can be divided into four distinct physiographic divisions as here under;

- Hilly and Tarai Districts like Darjeeling, Jalpaiguri, Coochbehar and Uttar Dinajpur in Himalayan region
- Central part of the state like Maldah, Dakshin Dinajpur, Nadia, Murshidabad are mainly being alluvial plains.
- Districts like Purulia, Western part of Bardhaman, West Medinipur, Bankura and Northern part of Birbhum districts forming a fringe of western plateau.
- Lower Gangetic plain of South 24 Parganas, North 24 Parganas, Howrah, Hooghly and East Medinipur districts forming the part of deltaic zone

In the elevation of the project districts in Southern part of West Bengal (deltaic region) ranges from 0 meters to 450 meters above the mean sea level in the alluvial plains of central and northern parts of the state. The elevation of Coochbehar, Jalpaiguri and Darjeeling districts in the Himalayan and sub-Himalayan region rise abruptly from less than 100m to 3500m above mean sea level. The western parts of the state, particularly districts like Purulia, western parts of Bardhaman, West Medinipur districts forming a part of the western plateau have a quite number of hills, some of which are fairly high and exhibit undulating topography.

Detail of physiographic characteristics in four distinct regions is elaborated in **Table 3.4**.

Table 3.4: Physiographic Characteristics of different districts

Districts	Physiographic Characteristics
Darjeeling, Jalpaiguri, Coochbehar and Uttar Dinajpur	Upper portion of the region is hilly terrain, Himalayan and sub Himalayan and rises abruptly from less than 100 m to 3500 m above msl. The lower part of this region is generally flat with gentle ups and down locally. The area is sloping towards south.
Maldah, Dakshin Dinajpur, Nadia, Murshidabad	The physiography of the region is that of a typical alluvial plain with gentle ups and downs. The terrain is essentially composed of soft rocks and river-borne sediments deposited under fluvial environment. The area is sloping towards the south with undulating area on the north east. The river Mahananda divides the Maldah district into two parts. The river Ganga flows along the south-western boundary of the Malda district.
Burdwan, Bankura, Birbhum, Purulia and West Medinipur	This region with its varied tectonic elements and riverine features, is a transitional zone between the Jharkhand plateau which constitutes a portion of peninsular shield in the west and Ganga-Brahamaputra alluvial plain in the north and east. In general the Jharkhand plateau consists of the meta-sedimentary rocks of precambrian age, Gondwana sedimentary rocks, Rajmahal basalts and upper tertiary sediments. Laterite has developed on these older rocks as well as on early Quaternary sediments. Towards south, the alluvial plain merges with Damodar-Kasain-Subarnarekha deltaic plains. The western half of the district resembles a promontory jutting out from the hill ranges of Chotonagpur plateau and consists of barren, rocky and rolling country with a laterite soil rising into rocky hillocks, the highest being 227 m. These diversify the otherwise monotonous landscape and lend a special charm to the skyline around Asansol subdivision. In Purulia district due to undulated topography nearly 50% of the rainfall flows away as runoff. The district is covered by mostly

Districts	Physiographic Characteristics
	residual soil formed by weathering of bed rocks.
South 24 Parganas, North 24 Parganas, Howrah, Hooghly, East Medinipur and Sundarban	<p>The physiography of the region is that of a typical alluvial plain with gentle ups and downs. The terrain is essentially composed of soft river borne sediments deposited under fluvial environment. The general slope is from north west to south east. As the area is situated very near to the out fall, the dominant slope of the land is towards south with average elevation varying from 3.5 m to 2.5 m above MSL.</p> <p>The region is criss-crossed by a network of small streams and rivulets with out falls either at river Hooghly or Haldi. Since these rivers are connected to the sea, the channels suffer daily fluctuations in water level due to tidal influence. Hence, estuarine conditions prevail here with problems of salinity and coastal hazards especially along the banks and river fronts.</p>

The Physiography and landforms of the project districts/ state is shown in **Figure 3.2**.

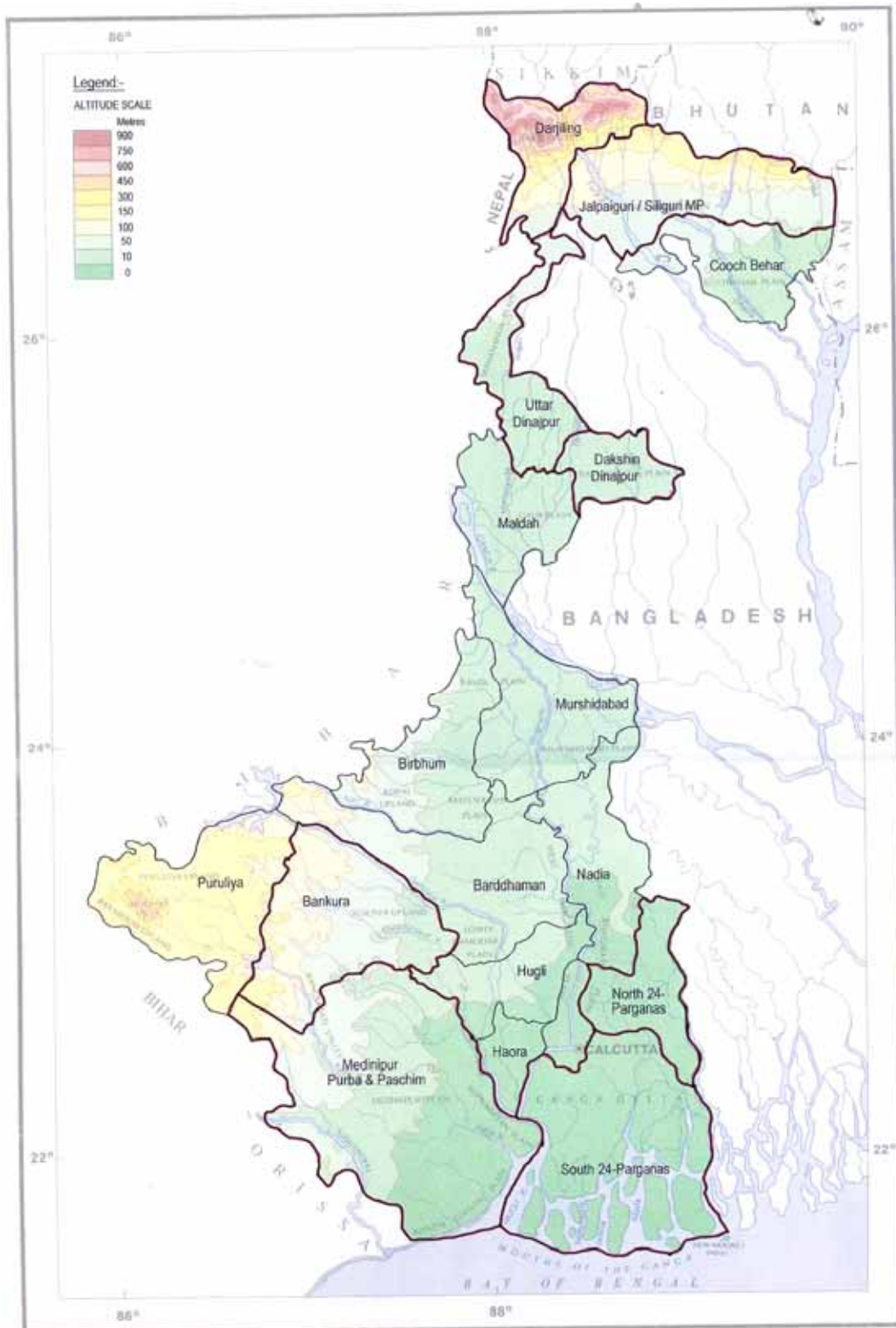


Fig No. - 3.2 Physiography & Landforms Map of Project Districts - West Bengal

3.2.5 Drainage

West Bengal is a land of rivers. Some of these are tributaries and others are distributaries. The State has three major river basins namely Ganga, Brahmaputra

and Subarnarekha and 80% of the state is within Ganga basin, 15% of area within Brahmaputra basin and less than 5% within Subarnarekha basin.

Darjeeling, Jalpaiguri and Coochbehar districts in the northern most part of the state is within Brahmaputra basin. Purulia and Medinipur districts in south- western part of the state are within Subarnarekha and the entire state is within Ganga basin. The Ganga River system with its tributaries and sub tributaries meanders severely due to which many abandoned channels, oxbow lakes and swamps have formed in the flood plain and/or deltaic plain. In addition, the project region has numerous low-lying areas, which gets flooded during/ after the monsoon and remain water logged due to the natural inherent inadequate drainage outlets for the receding floodwaters.

The Drainage map of the project districts/ state is shown in **Figure 3.3**.

It may be noticed that the Ganges drainage system covers most part of West Bengal. In the north eastern part of West Bengal, some rivers are not parts of the Ganges basin. These join the Brahmaputra drainage system. The Subarnarekha drainage basin has the smallest catchment area within West Bengal.

- The Brahmaputra Drainage System

The major rivers, like Sankosh, Raidak, Torsa and Jaldhaka, act as tributaries to the Teesta river. These originate in the Himalayan mountain zone. For a variable distance from their points of origin, especially within the mountain and the piedmont fans, all the streams are swift flowing. However, after reaching the riverine plains, these cause considerable flooding. The channels of these rivers within the piedmont fans and diluvial plains contain boulders of many sizes. These are exploited for construction purposes. Unregulated excavation of boulders from the river bed often causes stream bank erosion and consequent channel widening and shoal formation. The shoals get covered by grasses to invite animal husbandry. At subsequent periods, trees invade the shoals. This invites deforestation as action preceding farming. For all these reasons, the Brahmaputra drainage system remains unstable.

- The Ganges Drainage Basin

The features of the Ganges drainage basin are indeed complex. It drains some 46% of surface water of the State. Amongst the left bank tributaries, the Mahananda is the most important stream. It originates from the southern flank of the Himalayan mountain zone.

Down stream of Farakka, the Ganges-Padma river has thrown several left bank distributaries. Amongst these, the Bhagirathi is the major one. Many of these distributaries join each other in the eastern part of South Bengal. In the extreme south, the rivers are tidal in character. These are now filling up the depressions in the transition zone between riverine and tidal delta. Due to low gradient, stagnation of water is a frequent problem in the monsoon months.

From the Deccan shield zone many rivers flow into the Ganges basin. These are all tributaries to the Bhagirathi. Amongst these, the Damodar is the major one. All these rivers are flood prone, although many reservoirs have been constructed on several of these streams. Many depressions widen their water spread areas in those months. Amongst all these rivers, the Damodar in its lower course has not yet attained any stable channel.

- The Subarnarekha Drainage Basin

It originates in the Deccan shield, but flows directly into the sea. Within west Bengal, its catchment area is the smallest accounting for only 2.74% of the total surface runoff of the State. The Dolong river is its only major tributary within West Bengal. The Subarnarekha is experiencing lateral shift towards south-west. It is also a flood prone river. The flood water passes from the left bank through the southern part of

Medinipur District.

The catchment area of major drainage basins of West Bengal is given in **Table 3.5**.

Table 3.5: Catchment area of major Drainage Basins of West Bengal

Basin	Rivers	Area(sq. km)	Location by districts
Ganges		74,720 (Total)	Darjeeling, Jalpaiguri, Coochbehar, Dinajpur, Malda, Murshidabad, Birbhum, Nadia, Bardhaman, Hooghly, Howrah, Purulia, Medinipur & 24-Parganas
	Mahananda & Atrai	11,100	Darjeeling, Jalpaiguri, Coochbehar, Dinajpur & Malda
	Bagmari & Pagla	1,250	Murshidabad & Birbhum
	Jalangi	5,640	Murshidabad & Nadia
	Mayurakshi & Babla	5,470	Birbhum, Murshidabad & Bardhaman
	Ajoy	2,490	Birbhum, Murshidabad & Bardhaman
	Damodar	5,250	Puruliya, Bardhaman, Hooghly & Howrah
	Khari & Ghia	5,400	Bardhaman & Hooghly
	Rupnaraian	10,930	Puruliya, Bankura, Medinipur & Howrah
	Haldi	8,920	Medinipur
	Rasulpur	2,620	Medinipur
	Tidal Rivers	15,650	Medinipur & 24-Parganas
Brahmaputra		10,670 (Total)	Jalpaiguri & Coochbehar
	Raidak II & Sankosh	440	Jalpaiguri & Coochbehar
	Raidak I & Torsa	3,340	Jalpaiguri & Coochbehar
	Jaldhaka	3,730	Darjeeling, Jalpaiguri & Coochbehar
	Teesta	3,160	Darjeeling, Jalpaiguri & Coochbehar
Subarnarekha		3,170 (Total)	Purulia & Medinipur
	Subarnarekha & Dolong	3,170	Purulia & Medinipur

The following **Table 3.6** represents the district wise and road wise important rivers/channels that criss-cross the project roads.

Table 3.6: Important rivers /channels located near Batch III project roads

District	Road Name	Road Code	Rivers and Channels located around the Batch III Roads
Siliguri (Darjeeling)	Kharibari PWD Road to Goursing	L045	A small river, Mechi runs approx. 150 m away from the road.
Jalpaiguri	T03 Purba Batabari to T06 Murti Village, Joyantee Village	T07	Close proximity of river Murti
	NH 31C at Mahakal Choupathi to T 07 at Gadadhar Bridge	T10	Close proximity of river Gadadhar
	T 08 at Kalabari to Adikaripara	L025	Canal named Nepathi Jhora runs app. 130 m along the project road

District	Road Name	Road Code	Rivers and Channels located around the Batch III Roads
	TO9 at Tekatuli to Paja Ddiner Bari at Susthir Hat	L029	River Seuli runs along the road
	T02 at Chowrangee to Mauamari & Premganj to Taltala	L036 & L037	Mora Teesta runs along the road
Coochbehar	Chilkirhat towards Saheberhat	L045	Road ends at Jhaljhali river
	Bogurapara Tephathi to Katmari Hat	L060	River Saltia runs along the road
	Monigangerhat to Barobari Domukha	L072	River Mara Torsha cross the road and then runs 800m along the road
	Sutkabari Bazar to Khagerhat	L077	Area is occasionally flood prone due to presence of river Mara Torsha
	Bhanga More to Gadaler kuthi road	L028	Suranga River cross the road
	Jamaldah PWD road near Sutanga bridge to Patchhara More road	L026	Sutanga river cross the road
Uttar Dinajpur	NH 34 Connection to Laipara	L033	River Denga runs beside the road
Malda	Kashimpur to Bijali Road	L028	Nachnia Nala cross the road
Burdwan	Bonkapashi to Gopalpur	L051	River Brahamani runs along the project road
	Jinjira to Shri Chandrapur Road	T08	A small river cross the road and then runs along the road
Hooghly	Krishnanagar tto Radhunathpur Dispensary Centre	L041	River Dwarekeswar runs along the road
North 24 Pgs	Chalki More to Polta Road	L073	River Ichhamati runs close proximity to the road
Paschim Medinipur	Biswanathpur to Kharika	T06	River Parang runs beside the road

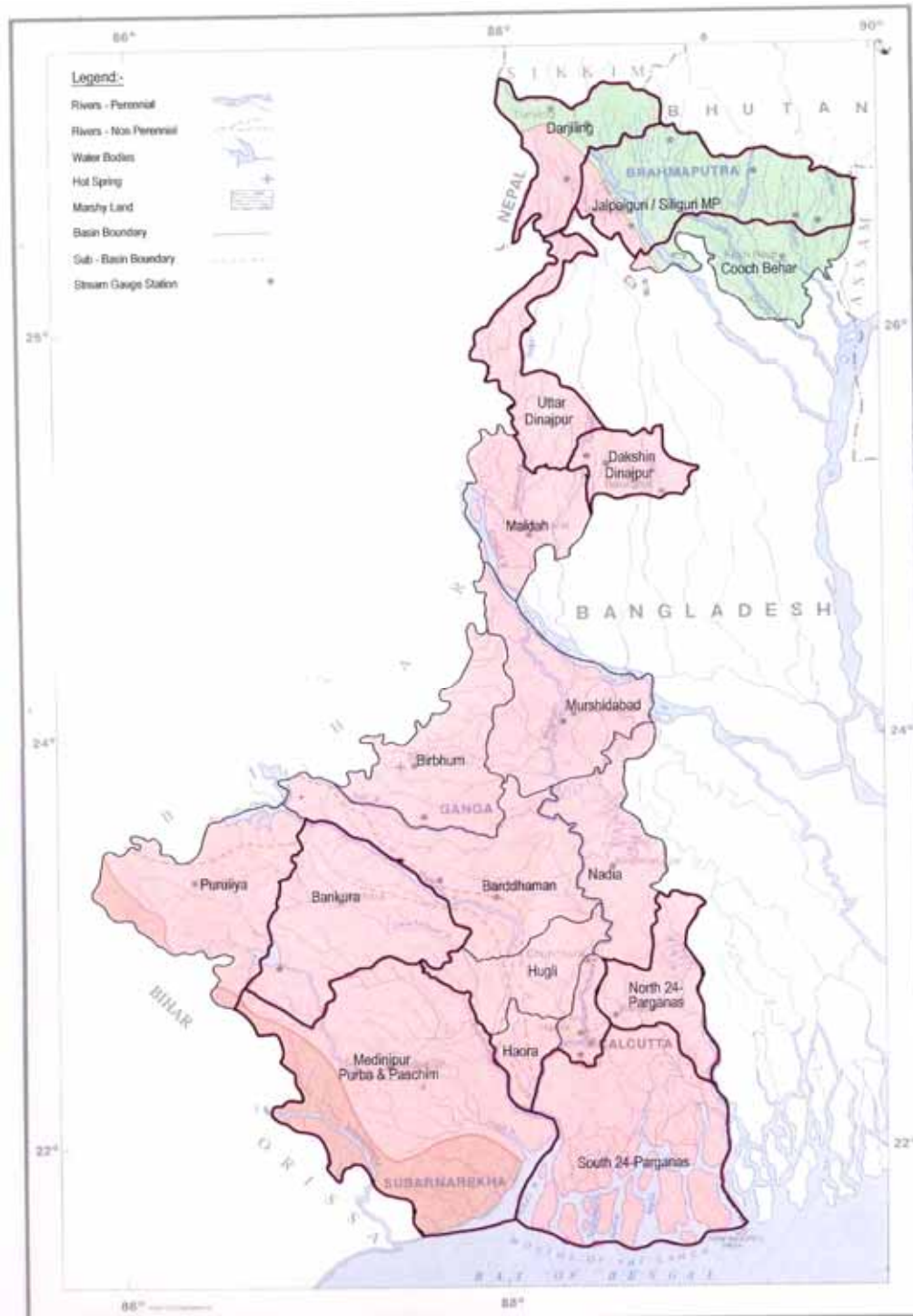


Fig No. - 3.3 Drainage Map of Project Districts - West Bengal

3.2.6 Climate

The climate of the state, except the Himalayan and sub-Himalayan region in the northern part of the state has a tropical climate. The tropic of cancer passes through the middle of Nadia and Bardhaman districts and northern parts of Bankura and Purulia districts. Although the area lying south of tropic of cancer is in the equatorial zone, Himalayan region in the North and Bay of Bengal in the south and extensive

network of rivers, canals, and tanks have not allowed extreme climatic conditions to prevail in the state. The state has 13 weather observatories located all across the state.

The compiled weather data from these observatories are given hereunder.

Temperature: The minimum annual temperature in the northern districts (Himalayan foot hill region) varies from freezing point to 17°C and over 18°C in other parts of the state. The annual mean maximum temperature ranges from 28°C in the Himalayan region to 33°C in the plains. In certain parts of the state, occasionally the mean maximum temperature can rise up to 43°C. The district wise maximum and minimum temperature in the year 2006 is presented in **Table 3.7**.

Table 3.7: District Wise Maximum and Minimum Temperature (Year: 2006)

Month	Darjeeling		Jalpaiguri		Coochbehar		U.Dinajpur		D.Dinajpur		Malda	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	9	1	28	9	28	9	26	10	26	11	27	5
February	19	3	30	12	30	12	33	11	31	16	37	13
March	23	4	35	15	35	14	35	23	34	24	39	18
April	24	5	37	17	36	17	37	23	34	24	41	18
May	21	8	37	20	37	20	37	25	37	26	39	21
June	22	11	36	23	35	22	NA	26	NA	27	39	23
July	22	13	36	23	36	24	39	25	37	25	37	26
August	25	13	37	23	38	24	36	24	36	25	37	25
September	21	9	36	21	35	23	NA	NA	34	NA	35	24
October	21	9	35	17	34	17	NA	NA	NA	NA	35	18
November	22	0	33	13	31	13	31	18	28	20	32	14
December	16	2	29	11	28	10	23	16	23	17	29	12
For the year	25	0	37	9	38	9	39	10	37	11	41	5

NA-Not available

Month	Murshidabad		Nadia		Birbhum		Burdwan		Bankura	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	28	8	31	8	30	7	30	9	29	8
February	37	15	38	15	37	13	38	14	39	14
March	38	16	40	15	40	15	38	16	43	17
April	38	21	38	15	40	18	38	21	42	21
May	40	21	39	22	39	21	38	22	40	22
June	39	22	37	23	39	23	38	21	39	23
July	36	23	34	25	35	24	35	24	36	24
August	35	24	36	24	35	23	35	24	36	25
September	36	24	35	24	35	24	34	23	36	24
October	36	21	35	20	35	19	34	20	35	20
November	31	14	32	12	32	12	33	14	33	14
December	28	13	28	11	29	10	30	11	32	11
For the year	40	8	40	8	40	7	38	9	43	8

Month	E. Medinipur		W. Medinipur		Hooghly		Howrah		N 24 pgs		S 24 Pgs	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
January	30	12	33	10	28	8	28	10	27	12	38	14

Month	E. Medinipur		W. Medinipur		Hooghly		Howrah		N 24 pgs		S 24 Pgs	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
February	32	NA	38	13	37	13	33	14	33	18	39	17
March	38	21	38	18	40	16	34	18	34	22	37	21
April	41	24	39	22	37	19	35	21	36	26	39	21
May	42	25	38	22	37	23	36	22	36	26	37	23
June	42	23	38	24	35	23	37	22	35	27	35	25
July	35	25	35	25	34	24	33	25	33	27	35	25
August	35	25	37	25	34	23	35	23	32	27	35	24
September	37	24	33	24	33	24	33	24	33	26	36	21
October	36	20	34	21	32	20	32	22	33	24	32	15
November	34	16	32	15	29	14	32	15	30	20	32	12
December	32	12	30	12	27	10	26	12	28	14	39	9
For the year	42	12	39	10	40	8	37	10	36	12	39	9

NA: Not Available

Rainfall: The state receives an annual average rainfall of 1750mm, out of which 1250mm is received between the month of June and September. On the basis of rainfall, the state can be classified into two zones namely the Himalayan and sub-Himalayan regions and the Gangetic plains (Ganga basin). The Himalayan and sub-Himalayan zones comprise Darjeeling, Jalpaiguri, Coochbehar and Northern part of Dinajpur districts, which receive rainfall ranging between 2000-4000mm. The rest of the state in the plains receives varied rainfall and can be sub-classified into three sectors; Sector I comprising Bankura, Birbhum, Bardhaman districts with annual rainfall ranging between 1140 and 1700mm. Sector II comprising Nadia, Hooghly, Western part of Dinajpur, Medinipur, North 24 Parganas with annual rainfall ranging between 1400 and 1650 mm. The sector III comprising eastern parts of Dinajpur, South 24 Parganas and Medinipur districts with annual rainfall ranging between 1650 and 1900mm. Monthly variation in Rainfall is presented in **Table 3.8**.

Table 3.8: District Wise Monthly Rainfall in West Bengal (Ten years' average 1996-2005)

District	January (mm)	February (mm)	March (mm)	April (mm)	May (mm)	June (mm)
Burdwan	18.3	21.2	37.9	64.0	114.3	223.9
Birbhum	12.6	18.4	31.4	56.5	104.2	238.8
Bankura	17.2	22.1	30.9	48.7	94.0	237.5
Midnapore(East) Midnapore(west)	15.3	46.0	47.9	52.9	109.6	256.3
Howrah	16.0	12.0	44.3	58.6	105.5	219.2
Hooghly	16.3	14.7	49.1	54.4	104.4	215.9
North 24-parganas and South 24-parganas	12.1	11.9	46.6	50.9	118.3	254.7
Nadia	15.9	23.1	37.4	50.1	126.1	232.7
Murshidabad	9.3	16.2	26.1	51.2	127.3	211.2
Uttar Dinajpur Dakshin Dinajpur	9.2	11.7	13.0	75.6	168.9	292.2
Malda	7.9	14.7	25.3	56.1	117.7	261.6
Jalpaiguri	12.6	11.3	58.8	163.4	326.4	655.2
Darjeeling	17.5	16.1	36.3	111.2	256.5	264.2
Cooch Behar	9.3	8.4	48.7	159.3	297.2	628.5
Purulia	15.5	21.6	26.2	23.0	81.9	262.7

District	July (mm)	August (mm)	September (mm)	October (mm)	November (mm)	December (mm)	Annual Rainfall
Burdwan	283.2	261.7	263.5	132.2	15.0	4.8	1440
Birbhum	318.1	296.9	309.8	151.8	11.5	3.5	1553.5
Bankura	278.0	263.7	205.7	127.6	9.3	6.4	1341.1
Midnapore (East) Midnapore (west)	277.0	307.1	282.2	211.8	22.2	5.9	1634.2
Howrah	NA	301.9	231.5	170.5	24.9	4.0	1188.4
Hooghly	260.7	244.4	231.4	141.6	19.0	2.8	1354.7
North 24-parganas South 24-parganas	326.4	319.5	261.8	215.9	34.0	4.8	1656.9
Nadia	272.1	225.0	262.5	170.3	16.4	4.0	1435.6
Murshidabad	303.1	256.4	285.7	163.6	6.4	2.7	1459.2
Uttar Dinajpur Dakshin Dinajpur	447.5	348.7	377.2	184.7	4.75	5.6	1939.05
Malda	365.9	309.2	331.8	195.3	3.1	4.3	1692.9
Jalpaiguri	NA	625.5	439.7	221.1	18.1	7.6	2239.7
Darjeeling	865.8	647.8	368.3	146.3	9.7	10.0	2749.7
Cooch Behar	784.2	493.0	410.2	207.2	3.8	7.0	3056.8
Purulia	282.9	282.6	205.9	115.2	8.1	6.6	1332.2

NA: Not Available

Relative Humidity: Normally, May to October months are humid and January to April are dry. The relative humidity (expressed in percentage) is more in northern and southern part of State as compared to western and eastern parts of the state. The maximum relative humidity ranges from 75 to 95% in morning hours and 50 to 65% in the evening hours.

Table 3.9: Relative Humidity by Station and Month in West Bengal (mean reading at 08.30 hours)-2005

Station	January	February	March	April	May	June
	In %	In %	In %	In %	In %	In %
Hill Station						
Kalimpong	90	82	76	82	86	89
Darjeeling	94	95	92	84	93	96
Sub Himalayan West Bengal						
Jalpaiguri	88	81	74	75	75	84
Cooch Behar	87	78	73	73	78	85
Uttar Dinajpur	69	79	NA	NA	85	80
Malda	83	71	71	71	74	76
Gangetic west Bengal						
Kolkata	84	75	79	76	75	78
Nadia	87	84	85	84	85	84
Murshidabad	84	74	71	75	81	83
Burdwan	82	71	75	74	75	78
Birbhum	85	69	69	67	69	74
Bankura	88	77	72	71	73	74
Midnapore	77	64	71	70	76	74
Purulia	NA	NA	NA	NA	NA	NA

NA: Not Available

Station	July	August	September	October	November	December
	In %	In %	In %	In %	In %	In %
Hill Station						
Kalimpong	91	96	85	76	75	NA
Darjeeling	97	98	89	94	84	89
Sub Himalayan West Bengal						
Jalpaiguri	87	90	81	83	79	79
Cooch Behar	87	90	84	79	74	70

Station	July	August	September	October	November	December
	In %	In %	In %	In %	In %	In %
Uttar Dinajpur	83	83	NA	NA	85	85
Malda	86	85	80	85	90	74
Gangetic west Bengal						
Kolkata	86	86	84	87	78	73
Nadia	88	86	83	85	75	79
Murshidabad	90	89	88	91	83	77
Burdwan	88	85	85	88	72	73
Birbhum	88	85	84	88	77	78
Bankura	89	87	87	90	85	85
Midnapore	87	85	87	86	71	70
Purulia	NA	NA	NA	NA	NA	NA

NA: Not Available

Wind: The predominant wind direction in the state is Southerly during both morning (22% of time), and evening hours (24% of time). The calm period prevails for 5.1% of time during morning hours and 61% of time in the evening hours. The mean wind speed ranges between 2.6 km/h and 9 km/h. Generally April to June is windy as compared to other months. The region has clear visibility even more than 20 km for over 250 days in a year. The occurrence of thunders in the state range between 18 and 58 days with Maldah region experiencing most of them. The cyclonic storms over the Bay of Bengal particularly in the south and south western parts of the state cause widespread dark rain bearing clouds, which in turn lowers the temperature and cause high relative humidity and sultry weather conditions.

The climate of project districts / state is depicted in **Figure 3.4**

3.2.7 Flood Affected and Drought Prone areas

The West Bengal has both chronically draught prone and flood affected areas within the state. The chronically drought prone areas are Purulia, part of Bankura and Medinipur districts. Chronically flood affected areas are parts of Medinipur, Howrah, Hooghly, Bardhaman, Murshidabad districts and a few patches in the northern districts of Jalpaiguri and Coochbehar . **Table 3.10** listed the flood prone zone of the Batch III roads.

Table 3.10 Flood prone zone of Batch III roads

District	Road Name	Road Code	Flood prone due to rivaers/ canals/ channels
Jalpaiguri	T03 Purba Batabari to T06 Murti Village, Joyantee Village	T07	Area is occasionally flood prone due to close proximity of river Murti
	NH 31C at Mahakal Choupathi to T 07 at Gadadhar Bridge	T10	Area is occasionally flood prone due to close proximity of river Gadadhar
Cooch Behar	Sutkabari Bazar to Khagerhat	L077	Area is occasionally flood prone due to river Mara Torsha
	Nenda Wooden Bridge to Sarderer Tari	L065	Water topping occurs in few areas due to low embankment
Murshidabad	Maheshpur to Jalapur Ferry Ghat	T06	The area is flood prone
North 24 Parganas	Bhasila FP School (Chandpur Paschim) to Kalijuga	L026	Occasional water topping due to low embankment height

Consultations with the Irrigation and Waterways Directorate, Government of West Bengal reveals that about 40% areas of the state are considered to be flood prone.

The chronically flood affected and drought prone areas within the state are shown in **Figure 3.4**.

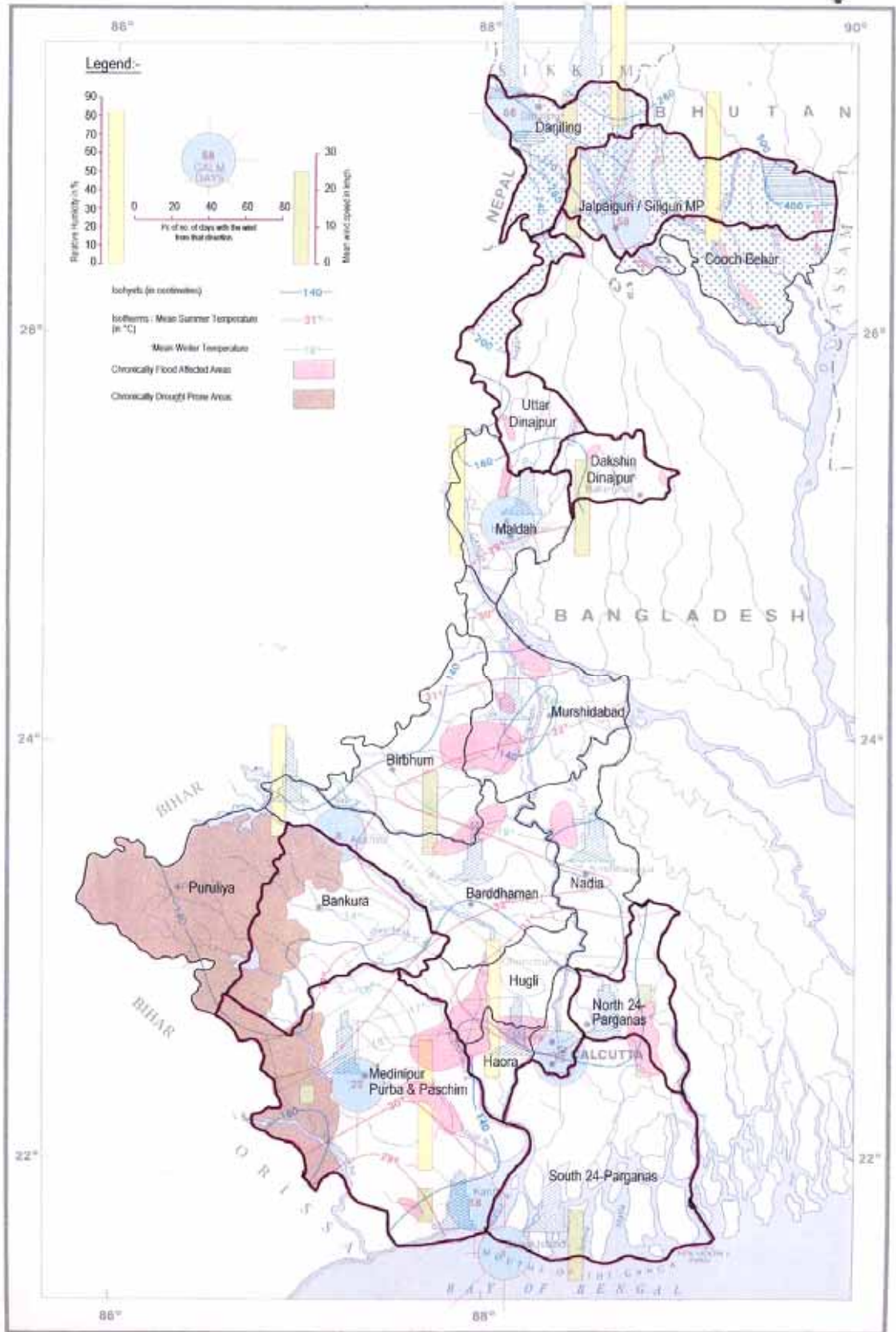


Fig No. - 3.4 Climate Map of Project Districts - West Bengal

3.2.8 Soils

The major soil types within West Bengal can be classified into five groups namely ultisols, entisols, aridisols, mollisols and alfisols. These soil types can be further classified into several sub groups. The ultisols is sub-classified into brown, red, yellow and laterite soils. The entisols is sub-classified into younger alluvial, coastal alluvial and bhabar soils. The aridisols is sub-classified into saline and saline alkali soils. The mollisols is sub-classified into Tarai soils and mountain meadow soils. The alfisols is sub-classified into deltaic alluvial soils, older alluvial soils, red gravel soils, red sandy soils, and red loamy and mixed red black soils.

The brown soils of sub-mountain region occur in Darjeeling and Jalpaiguri districts. Red acidic lateritic soils are dominantly present in western parts of state comprising Purulia, Bankura, Birbhum and parts of Medinipur and Bardhaman districts. The deltaic and saline soils are present in South 24 Parganas and Medinipur districts. The alluvial soils, the most dominant soil types occur, eastern and northern parts of the state covering districts like Dinajpur, Murshidabad, North 24 Parganas, Bardhaman, Bankura, Birbhum, Howrah and Medinipur districts.

The total state of West Bengal can be classified in six regions on the basis of soil characteristics. The classifications are

The warm humid agro-ecological sub region

The warm to hot humid agro-ecological sub-region

The hot humid agro-ecological sub-region

The hot moist sub-humid agro-ecological sub region

The moist sub-humid agro-ecological sub-region

The hot dry sub-humid agro-ecological sub-region

The **warm humid agro-ecological sub region** covers the mountainous region of Darjeeling District. Soils of this sub-region are heterogeneous in nature. The soils developed on steep hill slopes are shallow, excessively drained with severe erosion hazard potential. The soils of the foothill slopes and valleys are moderately deep, well drained, loamy in texture with moderate erosion hazards. Soil acidity, high runoff rate and limiting soil depth (on steep hill slopes) are the most important problems of this region.

The **warm to hot humid agro-ecological sub-region** comprising of foothills of Bhutan Himalayas constitutes the northern fringe of Jalpaiguri district with Tarai soils. The soils are partly developed and are mainly formed of young alluvium on alluvial fans of the foothills. These are shallow to moderately deep and at places deep with medium to fine texture. Mostly tea and horticultural plantation are supported by these soils. Severe flood hazards coupled with abrupt break in gradient and severe runoff poses serious water management problems.

The **hot humid agro-ecological sub-region** comprising of the level Teesta Plain (Duars) below the Bhutan Himalayas, covers the districts of Cooch Bihar, Jalpaiguri (southern part) and northern parts of West Dinajpur. The soils of this region have developed from the alluvium deposited by the rivers Teesta, Mahananda and Jaldhaka. These are moderately deep coarse to fine loamy in texture. At places these soils are moderately well drained but mostly they are imperfectly and/or poorly drained. The area is intensively cultivated for rice and jute. The major problems are water logging, severe flood hazards etc.

The **hot moist sub-humid agro-ecological sub region** comprises of the Ganga Plain (an eastward continuation of Indo Gangetic Plain covering the districts of Maldah, West Dinajpur (southern part), Murshidabad, Nadia, Howrah, Hugli, 24

Parganas (Northern Part), Bardhaman (eastern part), Birbhum, Bankura and Medinipur (eastern part). The soils have been formed from the alluvium deposited by Ganga and its tributaries and sub tributaries viz. Ajoy, Damodar, Kansabati, Bhagirathi, Haldi, Rupnarayan etc. These soils are greatly variable in their morphological, physical and chemical properties depending upon the geomorphic situations, moisture regime and degree of profile development. The soils are intensively cultivated for rice, wheat, potato and oilseed crops. Frequent inundation of low lying areas result in stagnation of water for certain times of the year. Besides flood hazards also affect the normal dry land crop yields. The soils of this sub-region have high nutrient content and mineral resource with a high potential for a large variety of agricultural and horticultural crops.

The ***moist sub-humid agro-ecological sub-region*** encompasses the coastal parts of the districts of 24 Parganas comprising mostly Sundarban areas of south 24 Parganas and coastal Medinipur. The alluvium deposited by Matla, Haldi, Rupnarayan rivers have gradually developed into deep, fine loamy to fine textured soils, by and large salt impregnated due to tidal flow of sea water through creeks and sub-tributaries. These soils are imperfectly to poorly drained with moderate to very high salinity hazards. The soils remain wet and saline for considerable period of the year and are suitable particularly for salt resistant crops.

The ***hot dry sub-humid agro-ecological sub-region*** comprising the outlines of Chotonagpur Plateau includes the district of Puruliya and western parts of Bardhaman, Bankura, Birbhum and Medinipur. The soils have developed on parent materials of sedentary nature. They vary from shallow to deep reddish to yellowish red, loamy to clayey and are imperfectly to well drained. Relatively less aggregated red and laterite soils are prone to frequent development of surface encrustation. Poor capacity for retention of rainwater leads to severe runoff and soil loss. Soil infertility and limiting soil depth also pose problems.

The soil types of the project districts / state are given in **Figure 3.5**.

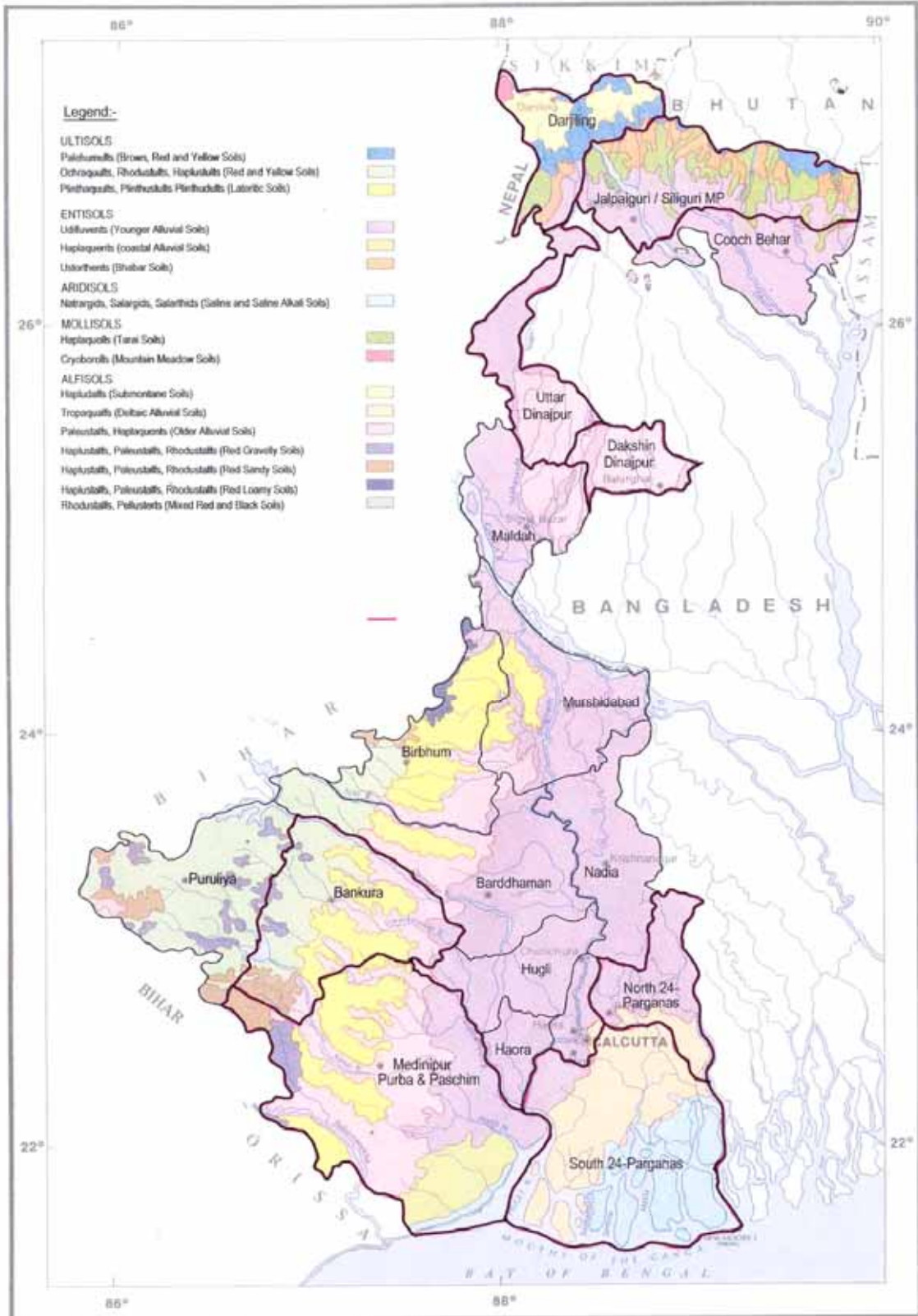


Fig No. - 3.5 Soils Map of Project Districts - West Bengal

3.2.9 Land Use

The distribution of land utilisation within the entire state broadly comprises types like uncultivable land, forestland, land available for cultivation, wasteland, urban area and land under industrial use. The entire geographical area of the state has been divided into these categories and the land use classification is given in **Table 3.11** for entire state and **Table 3.12** as district wise.

Table 3.11: Land Use Categorization of West Bengal (State as a whole)

Sr. No.	Lard Use Category	2004-2005		2005 -2006	
		Area in thousand hectares	Percentages	Area in thousand hectares	Percentages
1	Net area sown	5375	61.9	5295	61.0
2	Current fallows	314	3.6	319	3.7
3	Forests	1175	13.5	1175	13.5
4	Area not available for cultivation	1699	18.8	1753	20.2
5	Other uncultivated land excluding current fallows	124	1.4	141	1.6
	Total	8687	100.0	8683	100.0

Source: District Statistics Handbook, 2005-2006, Govt. of West Bengal

Table 3.12: Land Use Categorization of West Bengal (District wise) (all values in hectare)

District	Area according to village papers	Area not available for cultivation	Other uncultivated land excluding current fallows	Area under forest	Current fallows	Net area sown
Burdwan	698762	196747	0.79	22266	7.70	457.80
Birbhum	451118	92153	0.38	15853	13.65	320.61
Bankura	687995	148040	4.05	148930	42.68	338.18
Purba Medinipur	396594	92289	1.66	899	2.10	297.50
Paschim Medinipur	928581	162491	4.03	171935	21.84	552.12
Howrah	138676	47067	0.19	-	4.59	84.90
Hooghly	312224	85259	0.61	530	1.08	219.73
24 pgs (N)	386524	114469	-	-	1.78	265.51
24 pgs (S)	953368	129759	0.01	426300	15.28	378.26
Nadia	390656	80595	0.05	1216	4.29	299.94
Murshidabad	532499	122651	1.86	771	0.92	404.57
Uttar Dinajpur	312466	32177	0.11	580	6.48	269.60
Dakshin Dinajpur	221907	28391	0.20	932	3.18	188.58
Malda	370862	83580	-	1679	54.60	227.60
Jalpaiguri	622700	80659	2.58	179000	18.39	340.00
Darjeeling	325469	35430	2.65	124576	13.99	143.86
Coochbehar	331566	62326	1.54	4256	2.20	254.16
Purulia	625483	105910	5.04	75048	99.25	331.79
Total West Bengal*	8687450	1699993	25.75	1174771	314.00	5374.71

* Excluding Kolkata Metropolitan District,

** Area under non-agricultural uses, barren, unculturable land,

*** Area under permanent pastures & other grazing lands, land under misc. trees groves not indicated in net area sown, culturable waste lands, fallow lands and other than current fallows.

(Source: Statistical Abstract, 2006)

The land use pattern of project districts / state is shown in **Figure 3.6**.

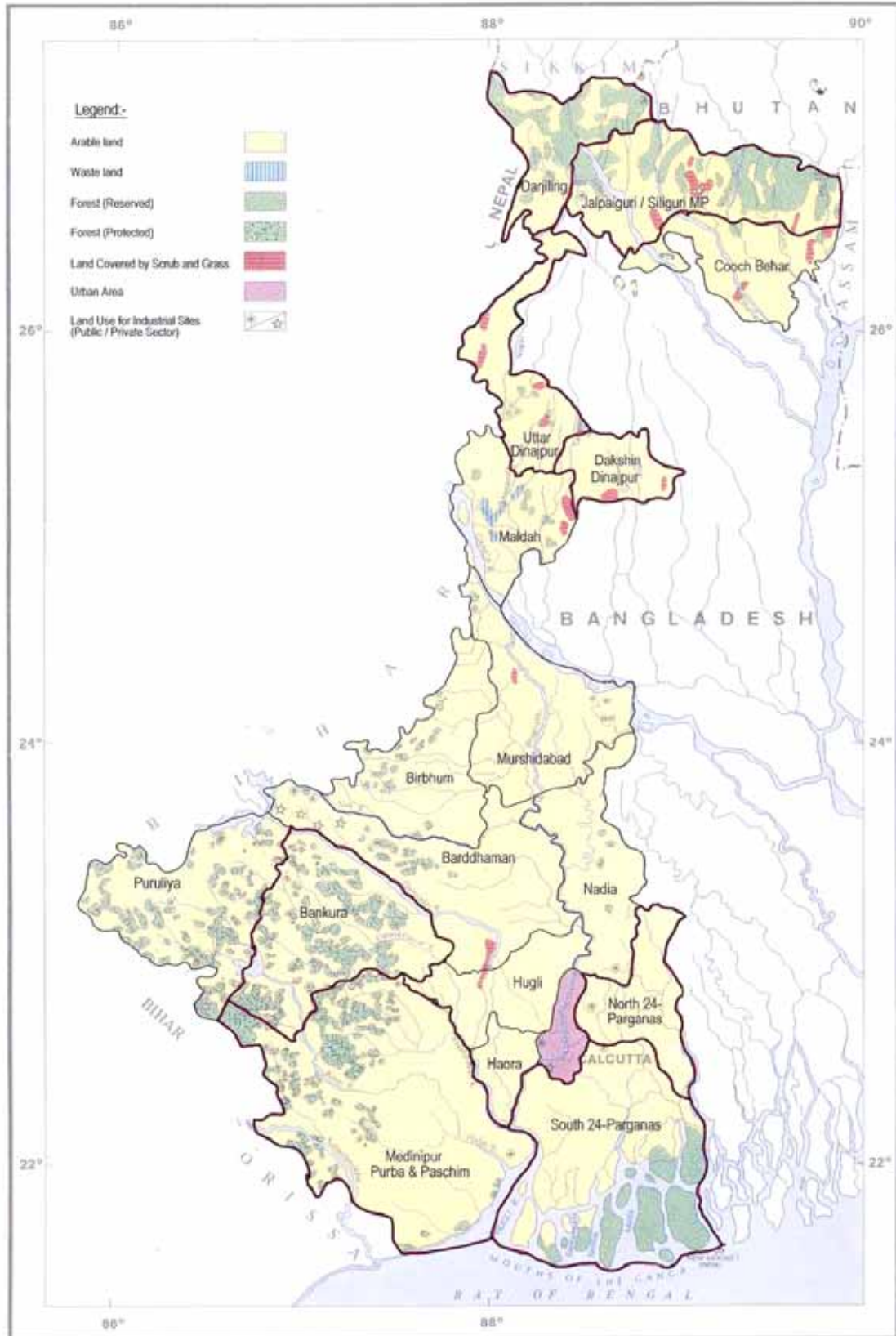


Fig No. - 3.6 Landuse Map of Project Districts - West Bengal

3.2.10 Ambient Air Quality

At present the sources of air pollution are the vehicle plying on the existing rural roads, small scale industries and domestic fuel burning. In some places road side small factory and brick field are also the sources of air pollution. It is expected that, during construction period, the air quality may be deteriorated due to increase in pollutant in the ambient air.

Air Quality Monitoring

To establish the baseline air quality scenario secondary ambient air quality results of earlier studies at 28 locations in different districts of west Bengal is being considered.

Ambient air quality monitoring results are presented for the parameters, Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur dioxide (SO₂) and Oxides of Nitrogen, as per the guidelines IS:5182 and the result is presented in **Table 3.13**.

Table 3.13: Locations and Results of Ambient Air Quality Monitoring stations

Sl. No.	Station Code	Location	Category of Area	SPM	RPM	SO ₂	NO _x
				Mean (µg/m ³)	Mean (µg/m ³)	Mean (µg/m ³)	Mean (µg/m ³)
1.	AQ-1	Shivmandir, Siliguri	Residential cum commercial	193	95	2.68	18.95
2.	AQ-2	Fulbari, Siliguri	Residential cum commercial	193	75	3.22	18.83
3.	AQ-3	Assam More, Siliguri	Commercial	190	87	3.06	18.36
4.	AQ-4	Mainaguri (Indira More), Jalpaiguri	Residential cum commercial	193	89	3.18	18.28
5.	AQ-5	Dhupguri, Jalpaiguri	Residential cum commercial	198	91	3.12	18.75
6.	AQ-6	Near New Salbari, Jalpaiguri	Commercial	104	47	3.46	19.04
7.	AQ-7	Near Jaichandpur, Jalpaiguri	Residential cum commercial	103	46	2.98	17.78
8.	AQ-8	Gabgachi, Bidhannagar, Maldah	Commercial	193	83	5.97	35.54
9.	AQ-9	Narayanpur, Maldah	Industrial	191	79	6.35	35.75
10.	AQ-10	Gazole, Maldah	Residential cum commercial	188	78	6.34	32.04
11.	AQ-11	Itahar, Uttar 12.Dinajpur	Residential cum commercial	161	68	6.00	33.53
12.	AQ-12	Laohati, South 24 Parganas	Commercial cum residential	156	63	5.66	22.05
13.	AQ-13	Nabasan, south 24 Parganas	Residential	141	54	4.69	22.01
14.	AQ-14	Sundia Bazar, South 24 Parganas	Commercial	147	59	4.80	20.79
15.	AQ-15	Suryapur, South 24 Parganas	Residential	144	57	4.92	20.70
16.	AQ-16	Gabberia Nandan Complex, Howrah	Residential	146	59	6.4	25.2

Sl. No.	Station Code	Location	Category of Area	SPM	RPM	SO ₂	NO _x
				Mean (µg/m ³)	Mean (µg/m ³)	Mean (µg/m ³)	Mean (µg/m ³)
17	AQ-17	Nimbalia, Howrah	Mixed area	138	56	4.2	23.5
18	AQ-18	Munsirhat, Howrah	Commercial	138	59	6.7	22.7
19	AQ-19	Maju Bazar, South 24 Parganas	Residential	140	57	6.2	21.7
20	AQ-20	Kukrahati, South 24 Parganas	Residential	171	84	9.99	24.26
21	AQ-21	Baneswar chack South 24 Parganas	Residential	160	80	10.29	23.89
22	AQ-22	Kasipur, South 24 Parganas	Residential	162	76	9.92	26.79
23	AQ-23	Raynagar, South 24 Parganas	Residential	160	76	9.61	24.53
24	AQ-24	Parbatpur, South 24 Parganas	Residential	164	74	10.66	23.73
25	AQ-25	Dolanghata, South 24 Parganas	Residential	163	73	9.66	24.86
26	AQ-26	Ramchandrapur, South 24 Parganas	Residential	161	71	10.08	25.88
27	AQ-27	Monoharpur, South 24 Parganas	Residential	165	76	10.04	24.13
28	AQ-28	Boria/Lalhati, South 24 Parganas	Residential	163	71	9.85	24.03

It reveals from the ambient air quality results that the SPM and RPM levels varies between 103 to 198 µg/m³ and 46 to 95 µg/m³ respectively, well within the National Ambient Air Quality Standards (ref: **Table 3.14**) with respect to rural and residential areas. Gaseous pollutants like SO₂ and NO_x varies between 2.68 to 10.66 µg/m³ and 17.78 to 35.75µg/m³, respectively and also well within the National Ambient Air Quality Standards (ref: **Table 3.14**) with respect to rural and residential areas. It is noted that all monitoring stations are located in the typical rural or semi-rural areas, for which the overall ambient air quality is good.

Table 3.14: National Ambient Air Quality Standards
[as per Environment (Protection) Rules, 1986]

Pollutant	Time Weighted Average	Concentration (µg/m ³) in Ambient Air		
		Industrial Area	Residential, Rural and Other Areas	Sensitive Area
Sulphur Dioxide (SO ₂)	Annual*	80	60	15
	24 Hours**	120	80	30
Oxides of Nitrogen (as NO ₂)	Annual*	80	60	15
	24 Hours**	120	80	30
Suspended Particulate Matter (SPM)	Annual*	360	140	70
	24 Hours**	500	200	100
Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual*	120	60	50
	24 Hours**	150	100	75
Lead (Pb)	Annual*	1.00	0.75	0.50
	24 Hours**	1.50	1.00	0.75

Pollutant	Time Weighted Average	Concentration ($\mu\text{g}/\text{m}^3$) in Ambient Air		
		Industrial Area	Residential, Rural and Other Areas	Sensitive Area
Ammonia	Annual* 24 Hours**	100 400	100 400	100 400
Carbon Monoxide (CO) in mg/m^3	8 Hours** 1 Hour	5000 10000	2000 4000	1000 2000

- * Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval.
- ** 24-hourly/8-hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

3.2.11 Water Quality

As mentioned under section 3.2.5, West Bengal State has three major river basins, namely Ganga, Brahmaputra and Subarnarekha. Among these, Ganga is the largest and covers almost 80% of the state, whereas the Brahmaputra basin covers about 15% of the area and Subarnarekha basin covers about 5% of the geographical area of the State.

The rural road construction proposals are normally cross small drainage channels, which eventually join the major channels/rivulets. All of these channels generally remain dry for most part of the year and drain the storm water for few weeks only during or after the monsoon.

Several hand operated tube wells are seen alongside of the existing tracks in many of the proposed road construction proposals. These tube wells appear to be serving as the main source of drinking water for rural communities in the region.

In order to assess the water quality of the study area, secondary information/data from the earlier studies have been used. The above-mentioned river basins are important in the local context and, therefore, their water quality needs to be analysed to assess the impact, if any, of the project. Ground water has also been found as an important source for catering the local needs of water consumption for various purposes mainly domestic in the villages. Keeping in view the importance of ground water to the local population, its quality has to be assessed at some selected locations.

For generating data on surface water quality as well as ground water quality parameters and drawing up the baseline scenario of the study corridor, 22 nos. surface water and 18 nos. ground water quality monitoring results (designated as SW-1 to SW-18 and GW-1 to GW-22) are collected from earlier studies in different parts of West Bengal.

(a) Quality of Ground Water

The physico-chemical characteristics of the ground water are presented in **Table 3.15**.

Table 3.15: Locations and Results of Water Quality Monitoring

Station Location / Station code	Parameters						
	pH	Total Alkalinity (as CaCO_3) [mg/l]	Total Hardness (as CaCO_3) [mg/l]	Total Dissolved Solids [mg/l]	Chloride (as Cl) [mg/l]	Iron (as Fe) [mg/l]	Total Coliform [MPN/100 ml]
Bhutkhat, Jalpaiguri GW1	6.61	118.1	141.4	234	23.8	5.62	<1.1
Fatapukur Saradamani Vidyalaya, Jalpaiguri GW 2	6.74	42.5	40.4	98	7.1	3.07	<1.1
Assam More, Jalpaiguri GW 3	6.51	99.2	136.4	308	52.4	0.63	<1.1
Bhutnir Ghat Girls High	7.39	276	250.9	378	6.9	1.64	<1.1

Station Location / Station code	Parameters						
	pH	Total Alkalinity (as CaCO ₃) [mg/l]	Total Hardness (as CaCO ₃) [mg/l]	Total Dissolved Solids [mg/l]	Chloride (as Cl) [mg/l]	Iron (as Fe) [mg/l]	Total Coliform [MPN/100 ml]
School, Jalpaiguri GW 4							
Jalalpur, Kaliyachak, Maldah GW 5	7.05	436.6	415.8	624	46.2	0.71	5.1
Adina, Old Maldah GW 6	7.06	314.2	324.7	476	28.8	0.80	<1.1
Gajol, Maldah GW 7	7.10	248.9	225.7	504	10.5	<0.1	<1.1
Itahar Raiganj, Maldah GW 8	6.57	97.9	83.2	417	22.7	0.57	<1.1
Padmapukur, Sonarpur, South 24 Parganas GW 9	7.31	347.1	298.7	512	70.7	0.89	Absent
Rajpur, Sonarpur, South 24 Parganas GW 10	7.14	329.3	381.1	562	103.7	0.25	Absent
Raypur, South 24 Parganas GW 11	7.51	252	254.8	564	146.9	0.18	<1.1
Uttarbag, Canning I South 24 Parganas GW 12	7.45	315	323.4	682	255.8	0.13	<1.1
Sirakol, South 24 Parganas GW 13	7.28	486	490.0	1072	416.9	0.19	<1.1
Gabberia Hospital, Howrah GW 14	7.21	326.4	235.2	474	93.1	0.37	<1.1
Muashirhat Bazar, Howrah GW 15	7.21	384.0	58.8	412	48.8	0.37	<1.1
Khadar Ghat, Howrah GW 16	7.29	547.2	176.4	448	53.2	0.25	<1.1
Sultanpur Primary School Diamond Harbour South 24 Parganas GW 17	7.47	290	207.9	512	265.2	0.18	<1.1
Maya Road, Diamond Harbour South 24 Parganas GW 18	7.70	290	168.3	512	159.1	0.11	<1.1

It is revealed from the **Table 3.15** that pH varies between 6.51 and 7.70; TDS ranges between 98 and 1072 mg/l and most of the ground water has no coliform content. Few ground water samples contain coliform, may be due to contamination from unhygienic waste water at tubewell site.

(b) Quality of Surface Water

Surface water quality results are taken up from the secondary sources of earlier studies in West Bengal. The physico chemical characteristics of pond and river water are presented in **Table 3.16**

Table 3.16: Locations and Results of Water Quality Monitoring

Station Location / Station code	Parameters						
	pH	Total Alkalinity (as CaCO ₃) [mg/l]	Total Hardness (as CaCO ₃) [mg/l]	Total Dissolved Solids [mg/l]	Chloride (as Cl) [mg/l]	Iron (as Fe) [mg/l]	Total Coliform [MPN/100 ml]
Karatowa River, Jalpaiguri, SW1	6.64	45.5	35.4	88	14.3	3.21	2.2 x 10 ³
Fatapukur, Pond water Jalpaiguri, SW2	6.52	23.6	30.3	54	9.5	0.12	1.7 x 10 ³
Teesta River, Jalpaiguri, SW3	7.51	47.3	60.6	108	9.5	0.08	1.1 x 10 ³
Jaldakha River, Jalpaiguri, SW4	7.84	33.1	40.4	96	9.5	0.32	9.0 x 10 ³
Near Old Salbari, Darjeeling, SW5	6.09	10	11.8	38	4.9	0.75	1.1 x 10 ³

Station Location / Station code	Parameters						
	pH	Total Alkalinity (as CaCO ₃) [mg/l]	Total Hardness (as CaCO ₃) [mg/l]	Total Dissolved Solids [mg/l]	Chloride (as Cl) [mg/l]	Iron (as Fe) [mg/l]	Total Coliform [MPN/100 ml]
Saitandighi, Pond water, Maldah, SW7	7.66	155.0	14	316	39.2	0.72	2.2 x 10 ³
Mahananda River, Maldah, SW8	7.48	130.6	8.7	216	12.2	0.49	1.4 x 10 ³
Itahar, Pond water, Itahar, Uttar Dinajpur, SW9	7.49	212.2	64	354	31.4	0.34	3.5 x 10 ³
Padmapukur, Pond water, Sonarpur, South 24 Parganas, SW10	7.28	142.4	164.8	434	127.3	1.01	1.1 x 10 ³
Rajpur Club, Pond water, South 24 Parganas, SW11	7.47	89.0	103.0	212	47.1	1.08	1.4 x 10 ³
Metiagacha, Pond water, South 24 Parganas, SW12	7.18	306	343.0	628	217.9	0.38	3.5 x 10 ³
Kashinathpur, Pond water, South 24 Parganas, SW13	7.23	378	352.8	784	270.1	0.90	9.0 x 10 ³
Rajapur Canal, Howrah, SW16	7.90	124.8	137.2	202	22.2	0.11	900
Muashirhat, Pond water, Howrah, SW17	8.03	220.8	127.4	486	181.8	0.35	2200
Dakshin Ram Chandrapur Canal, Howrah, SW18	7.27	144.0	176.4	372	102.0	0.44	3500
Near Fishery Jetty Nala, Diamond Harbour, south 24 parganas, SW21	7.80	144	150.5	330	30.9	4.49	9.0 x 10 ⁴
Ramchandrapur, Pond water, Diamond Harbour, South 24 Parganas, SW 22	7.50	116	142.6	356	150.4	4.38	9.0 x 10 ⁴

Water Quality Criteria as per Central Pollution Control Board are given below.

Sr.No.	Parameters	Class A	Class B	Class C
1	pH	6.5 or more	6.5 to 8.5	6.0 to 9.0
2	Dissolved oxygen, mg/l	6 or more	5 or more	4 or more
3	Biochemical oxygen Demand, mg/l	2 or less	3 or less	3 or less
4	Coliform organisms, MPN / 100ml	50 or less	500 or less	5000 or less

Class A: Drinking water source without conventional treatment but after disinfection.

Class B: Outdoor bathing (Organized).

Class C: Drinking water source after conventional treatment and disinfection.

It reveals from the surface water quality results that pH varies between 6.09 and 8.03; TDS ranges from 38-784 mg/l, total hardness varies between 8.7 and 352.8 mg/l and iron ranges from 0.08-4.49 mg/l. Surface water may be used for domestic purposes after necessary treatment and disinfection.

3.2.12 Ambient Noise Quality

Similar to the database on air quality, the Central Pollution Control Board and State Pollution Control Board maintain a database on the ambient noise levels for major cities/urban centres and some selected industrial areas. No secondary data is available for the project districts particularly representing the rural areas. Along the proposed road construction proposals, neither there is significant industrial activity nor significant vehicular traffic contributing to ambient noise levels. The occasional vehicular movement on the unpaved roads contributes to increased noise levels over short duration limited to daytime. The existing roads do not appear to have vehicular traffic in the night time. Therefore the ambient noise levels are expected to be within the National Ambient Noise Standards (Table 3.18).

The project alignment passes mainly through rural areas. Outdoor noise sources are mainly from crowds, machineries used in agricultural field, pumps, two wheeler, three wheeler, motor vehicles plying on the existing road. To assess baseline noise level, earlier monitoring data at 24 locations are presented in **Table 3.17**, which covers all the landuse areas.

Table 3.17: Locations and Results of Ambient Noise Level Monitoring

Sl. No.	Station Code	Location	Category of Area	Day time	Night time
				[dB (A)] L eq	[dB (A)] L eq
1	NL-1	Fulbari, Darjeeling	Residential cum commercial	64.68	66.53
2	NL-2	Near New Shalbari, Jalpaiguri	Residential	60.96	50.98
3	NL-3	Near Jaichandpur	Commercial	61.12	47.46
4	NL-4	Sujapur, Maldah	Commercial & Residential	55.8	64.2
5	NL-5	Narayanpur, Maldah	Industrial	71.3	77.8
6	NL-6	Itahar Hospital More, Uttar Dinajpur	Silence	53.0	60.8
7	NL-7	Near Narendrapur Ramkrishna Mission main gate, Sonarpur, South 24 Parganas	Mixed Area	70.9	71.7
8	NL-8	Near Jama Masjid, Sonarpur, South 24 Parganas	Mixed Area	69.1	67.9
9	NL-9	Near Laohati Market, South 24 Parganas	Commercial	58.5	50.3
10	NL-10	Near SH-3 at Suryapur, South 24 Parganas	Residential	57.5	54.3
11	NL-11	Near Sirakol Tematha More, South 24 Parganas	Mixed (Residential and Commercial)	60.2	53.6
12	NL-12	Dockyard, East Medinipur	Industrial Area	62.1	56.2
13	NL-13	Chiranjibpur, East Medinipur	Residential Area	55.8	50.0
14	NL-14	Township Hospital, East Medinipur	Silence Zone	47.7	38.4
15	NL-15	Munshirhat Chandni More, Howrah	Commercial Area	58.3	49.5
16	NL-16	Khadarghat, Howrah	Residential Area	51.9	48.6
17	NL-17	Fatik Gachhi More, Howrah	Residential Area	57.2	52.7
18	NL-18	Gabberia More, Howrah	Residential Area	59.3	52.2
19	NL-19	Dakshin Ramchandrapur, Howrah	Residential Area	52.1	45.4
20	NL-20	Near Old Kella (Picnic Spot) South 24 Pgs	Residential Area	56.2	52.5
21	NL-21	Near Sultanpur Fishery Jetty (Near Main Gate) South 24 Pgs	Commercial Area	62.5	60.3
22	NL-22	Infront of New Bhabani Ice Factory, South 24 Pgs	Commercial Area	62.3	59.3
23	NL-23	Behind Durga Hotel, South 24 Pgs	Commercial Area	57.4	55.3
24	NL-24	Diamond Harbour High School (Near Main Gate), South 24 Pgs	Mixed (Residential and Commercial)	57.3	54.8

Table 3.18: Noise Quality Standards

(As per Noise Pollution Regulation & Control Rules, 2000)

Area Code	Category of Area	Limits in dB(A) L_{eq}	
		Day Time	Night Time
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Note : i) Day time is from 6.00 am to 10.00 pm

ii) Night time is from 10.00 pm to 6.00 am

It reveals from the Ambient Noise monitoring result that during day time ambient noise varies between 47.7 to 71.3dB(A) and nighttime noise level varies between 38.4 to 77.8dB(A). In most of the cases ambient noise levels during night time exceeds the National Noise Quality Standards with respect to residential areas and silence zone.

3.3 ECOLOGICAL RESOURCES

3.3.1 Terrestrial Flora

During the field investigations, the most dominant terrestrial flora within the project districts was recorded. The dominant flora comprised generally the trees planted along side of the rural road proposals, particularly the stretches along agricultural lands. Many of these are planted by the adjacent landowners and often perceived, as a fence to their respective lands. Some of these trees will be required to be felled during the clearing up operations for road construction. The common trees observed alongside of the road projects are presented in **Table 3.19**.

Table 3.19: List of Common Trees of Project Region/West Bengal

Sr. No.	Botanical Name	Use/yield	Sr. No.	Botanical Name	Use/yield
1	<i>Acacia catechu</i>	Timber & Tanin	30	<i>Ghricidia sepium</i>	Ornamental
2	<i>Acacia nilotica</i>	Medicine	31	<i>Gmelina arborea</i>	Timber
3	<i>Acacia auriculiformis</i>	Timber & Saponin	32	<i>Guazoma tomentosa</i>	Fruit
4	<i>Adina cardifolia</i>	Timber	33	<i>Lagerstroemia speciosa</i>	Ornamental
5	<i>Aeci mermelos</i>	Fruit & Medicine	34	<i>Leucaena leucocephala</i>	Fodder
6	<i>Alangium salvifolium</i>	-	35	<i>Mangifera indica</i>	Fruit & Timber
7	<i>Albizialebbek</i>	Timber	36	<i>Melia azaderach</i>	Timber
8	<i>Alsrtonia scholans</i>	Medicine	37	<i>Mumusops chengi</i>	-
9	<i>Anthocephalus chinensi</i>	Ornamental & Timber	38	<i>Mytragyna perviflora</i>	Timber
10	<i>Azadirachta indica</i>	Timber & Medicine	39	<i>Odina wodier</i>	Saponin
11	<i>Artocarpus integrifolia</i>	Fruit & Timber	40	<i>Oroxvlum indicum</i>	Medicine
12	<i>Bauhinia variegata</i>	Ornamental	41	<i>Peltphorum pterocarpu</i>	Ornamental
13	<i>Bombax cieba</i>	Ornamental & Fibre	42	<i>Pithecolobium dulee</i>	Timber & Fruit
14	<i>Boswellia serratta</i>	Timber	43	<i>Phoenixslyyestris</i>	Fruit
15	<i>Cassia fistula</i>	Medicine	44	<i>Pongamia pinnata</i>	Timber & Medicine
16	<i>Cassia seamea</i>	Ornamental	45	<i>Polvalthia longifolia</i>	Timber
17	<i>Casuarina equisetifolia</i>	Ornamental	46	<i>Samanea saman</i>	Timber & Ornamental
18	<i>Ceiba pentandra</i>	Ornamental	47	<i>Stereulia foetida</i>	Fruit & Timber
19	<i>Cordia mvxa</i>	-	48	<i>Sweitenia mahagoni</i>	Timber

Sr. No.	Botanical Name	Use/yield	Sr. No.	Botanical Name	Use/yield
20	<i>Dalbergia sissoo</i>	Timber & Medicine	49	<i>Sweitenia macrophylla</i>	Timber & Medicine
21	<i>Delonix regia</i>	Ornamental	50	<i>Syzygium cumini</i>	Fruit & Timber
22	<i>Dipterocarpus tarbinat</i>	Medicine & Timber	51	<i>Tectona grandis</i>	Timber
23	<i>Dyospyros malaberica</i>	Fruit	52	<i>Terminalia ariuna</i>	Timber & Medicine
24	<i>Erythrina striata</i>	Ornamental	53	<i>Terminalia catappa</i>	Fruit
25	<i>Eucalyptus globossus</i>	Timber & Medicine	54	<i>Tamarindus indica</i>	Fruit
26	<i>Ficus benghalensis</i>	-	55	<i>Thespesia populnea</i>	Timber & Ornamental
27	<i>Ficus glomerata</i>	-	56	<i>Toona ciliata</i>	Timber
28	<i>Ficus infectoria</i>	-	57	<i>Trema Orientalis</i>	-
29	<i>Ficus religiosa</i>	-	58	<i>Trewia nudiflora</i>	Timber

As a case study, tree enumeration within the required ROW of 12m was undertaken for all rural roads under construction proposals. In most of the cases forest area are located outside the road corridor. Only in some cases tree felling will be required for construction of the road. The actual number of trees which will require cutting can only be determined after marking of the proposed alignment on ground. **Table 3.20** listed the forest area around the project road and the approximate number of tree felling for the Batch III roads.

Table 3.20: List of Forest Area and Number of Trees felling in Batch III roads

District	Road Name	Road Code	Tree Felling	Forest
Siliguri (Darjeeling)	Kharibari PWD Road to Gourising	L045	Some Tree felling	
Jalpaiguri	T03 Purba Batabari to T06 Murti Village, Joyantee Village	T07		Murti Beat Office of Gorumara forest is located 500m away from the project road
	T 08 at Kalabari to Adikaripara	L025	More than 100 tree felling	Jaldapara Forest is situated 2 km away from Pradhan Para
	TO9 at Tekatuli to Paja Ddiner Bari at Susthir Hat	L029	Some Tree felling	
	T-11 at Tatpara TG to Guru Line at Debpara TG	L043	30 no. of tree felling	Unclassified forest area is located 1 km away
Coochbehar	Charakbari Primary School to Mashanpath (Charak Bari)	L047	Some tree felling	
	Baro Gopalpur to Keshar Hat	L056	Some tree felling	
Uttar Dinajpur	Bhangipara to Kamrtore Road	L065	12 no. of tree felling	
	MDDR Connecton to Adibashipara	L024	10 no. of tree felling	
Bankura	T03 to Tiring	L024	No tree felling	Unclassified forest area exist
	T05 to Belut	T06	30 no. of tree felling	
Purulia	Ghatbera More to Bamni with a link to Sitarampur Road	T 07	Some Tree felling	Forest exists within the hilly areas (Ch 5+000 to Ch 10+500).

District	Road Name	Road Code	Tree Felling	Forest
Burdwan	Gargeswar to Paikara	T04	30 no. of tree felling	
	Jinjira to Shri Chandrapur Road	T08	20 no. of tree felling	
South 24 Pgs	Auliapur (Arapanch) to Uttarbhag	T05	80 no. of tree felling	
Hooghly	Krishnanagar tto Radhunathpur Dispensary Centre	L041	20 no. of tree felling	
	Rajhati Dhanga Ajgubitala to Daulatchak Bajpai	L031	30 no. of tree felling	
	Seepara to Janapara	L028	15 no. of tree felling	
Paschim Medinipur	Chakparbati to Moyrakati	T12		Social forestry (Shal Plantation)
	Manikdipa to Jirapara	T14	Some tree felling	Unclassified forest area exists along some portion of the road
	Tatarbati to Guiyadaha Hospital	T03	80 no. of tree felling	Unclassified Shal forest exists along some portion of the road.
	Hatigeria to Uriabara	T02	No tree felling	The initial 3 km stretch of project road passes near the forest area
	Sanjual to Paniseuli	T09	More than 100 no. of tree felling	
	Harkandi to Sangar	T06	Some tree felling	
	Basantapur to Khorai	L053	Some tree felling	
	Bakra to Khayrapati	T03		Unclassified forest exists all along the project road.
	Baburbani to Naihati	T05	Some tree felling	

Since no reserved/ protected forest exist within the road corridor no permission will be required from forest department for felling up the trees. Although most of the trees within the ROW do not have ecological and/or significant economic values but provide a serene landscape to the road users. The trees serve as a nesting place for tree dwelling avian fauna.

3.3.2 Aquatic Flora and Fauna

The West Bengal has three major river basins, namely Ganga, Brahmaputra and Subarnarekha and Ganga is the largest and spread over 80% of the area. The Ganga River system with its tributaries and sub tributaries meanders severely due to which many abandoned channels, oxbow lakes and swamps have formed in the flood plain and / or deltaic plain. In addition, the region has numerous low-lying areas, which gets flooded during / after the monsoon and remain water logged due to the natural inherent inadequate drainage outlets for the receding floodwaters.

The high ground water table further contributes to water logging and therefore these low-lying areas have developed into marshy lands/ patches⁴ over the years. Such perennially water logged lands with marshy conditions can be seen at several parts of the state and many of them are infested with the water hyacinths due to discharge of nitrogenous wastes from near by human settlements and agricultural wastes. The

⁴ These low-lying areas with marshy conditions are locally termed as 'beels'

surrounding high lands (either natural or artificially created) in and around these low lying areas are extensively used for agriculture. The stagnated waters in the low lying areas are used for irrigating the highlands through mechanical water lifting devices. The marshy lands so formed in the topographically low lands are termed as 'beels', many of which have transformed into seasonal wetlands over the years.

The Institute of Wetland Management and Ecological Design⁵, Government of West Bengal has prepared an inventory of wetlands in West Bengal. The most dominant flora and fauna of the wetland presented in **Table 3.21**.

Table 3.21 Most Dominant Flora and Fauna of Wetland/ pond

Flora		Fauna
(A) Free Floating	(D) Rooted Floating	Avian Fauna
Eichomia crassipes	Hygorrhiza aristata	Common Sandpiper
Lerma perpusilla	Limnophila heterophylla	Common Teal
Azolla pinnata	Marsilea minuta	Cotton Teal
Pistia stratiotes	(E) Marginal amphibious	Large Egret
Wolffia arrhiza	Alternanthera philaxeroides	Lesser Whistling Teal
(B) Suspended	Jussiaea repens	Little Cormorant
Ceratophyllum demersum	Elipta alba	Openbilled Stork
Utricularia species	Lepidochloa aquatica	Painted Snipe
(C) Anchored (Submerged)	Ludwigia adscendens	Pintail
Hydrilla verticillata	Phragmites karka	Pheasant Tailed Jacana
Alisma plantago	Typha angustata	Purple Moorhen
Sagittaria arifolia	Commelina species	Spat Bill Duck
Myriophyllum tuberosum	Colocasia esculenta	Tufted Duck
Vallisneria spiralis	Polygonum plebeum	White Breasted Water Hen
Potamogeton species	P. hydrophilum	White Eyed Pheasant
Hydrophilum spinosa	Rumex dentatus	
Najas species		
Ottelia alata		

Source: Field investigations during IEE

3.3.3 Fauna

The occurrence of wild life species and or threatened or endangered species has not been reported within the Corridor of Impact of any of the road construction proposals under the IEE studies.

Table 3.22 below lists the different species of fauna present in the region. All of these are widely distributed and common for rural areas

Table 3.22: Check List of Fauna in and around the present road corridor

Type of Fauna	Name	Scientific Name
Domestic animal	Pig	<i>Sus cristatus</i>
	Dog	<i>Canis familiaris</i>
	Cow	<i>Bos indicus</i>
	Buffallow	<i>Bubalus indicus</i>
	Cat	<i>Felis domesticus</i>
	Goat	<i>Capra hircus</i>
Reptiles (Snake)	Rat Snake	<i>Ptyas mucasus</i>
	Indian spectacled Cobra	<i>Naja naja naja</i>
	Indian monocled Cobra	<i>Naja naja kouthia</i>
	Common sand boa	<i>Eryx johnii</i>
	Flying snake	<i>Chrysapelea ornata</i>
	Pythan	<i>Pythan moluris</i>

⁵ The Institute of Wetland Management and Ecological Design was set up by the Government of West Bengal in 1986 primarily to identify the fragile ecosystems, formulation of wetland conservation policies and strategies for the state of West Bengal.

Type of Fauna	Name	Scientific Name
	Common Krait	<i>Bungarus caeruleus</i>
	Banded Krait	<i>Bungarus fasciatus</i>
	King Cobra	<i>Ophiophagus hannah</i>
Reptiles (Lizard)	Common monitor lizard	<i>Calotes versicolor</i>
	Common house gecko	<i>Hemidactylus gleadowii maculates</i>
	Barred monitor	<i>Varanus flavescens</i>
	Snake lizard	<i>Acanthodactylus cantoris</i>
Reptiles (Amphibia)	Frog	<i>Bufo melanostictus</i>
	Frog	<i>Rana taipehensis</i>
	Skipper Frog	<i>Rana cynophylctis</i>
	Frog	<i>Euphlyctis cyanophictys</i>
	Frog	<i>Chirixalus vittatus</i>
	Toad	<i>Bufo stomaticus</i>
	Frog	<i>Uperodon globulosum</i>
	Frog	<i>Hoplobatrachus crassus</i>
	Frog	<i>Rana livida</i>
Reptiles (Rodents)	Common house rat	<i>Rattus rattus</i>
	Indian field mouse	<i>Mus booduga</i>
	Indian bush rat	<i>Golunda ellioti</i>
	House mouse	<i>Mus museulus</i>
Fishes	Rahu	<i>Labeo rohita</i>
	Katla	<i>Catla catla</i>
	Mirgala	<i>Cirrhinus mirgala</i>
	Magur	<i>Clarius batrachus</i>
	Chingri	<i>Macrobrachium rosenbeigie</i>
	Lata	<i>Channa punetatus</i>
	Puthi	<i>Puntius Sp.</i>
	Bhangar	<i>Liza tade</i>
	Sole	<i>Chana striatus</i>
	Koi	<i>Anabas tesludineus</i>
Birds	Catle Egret	<i>Bubucas ibis</i>
	Large Egret	<i>Ardea alba</i>
	Little Egret	<i>Egretta intermedia</i>
	Little Bittern	<i>Ixobrychus minutus</i>
	Chesnut Bittern	<i>Ixobrychus cinamomeus</i>
	Little Cormorant	<i>Phalacrocorax niger</i>
	Bittern	<i>Botaunus stellaris</i>
	Adjutant Stork	<i>Leptoptilos dubins</i>
	Brahminy Kite	<i>Halistur indus</i>
	Indian long billed Vulture	<i>Gyps indicus</i>
	Common Sandpiper	<i>Tringa hupalencos</i>
	Spotted Dove	<i>Streptopelia chinensis</i>
	Rose ringed Parakeet	<i>Prittacula krameri</i>
	Indian plaintive Cuckoo	<i>Cacomantis passerinus</i>
	Spotted Owlet	<i>Athena brama</i>
	Brown fish Owl	<i>Bubo Zeylonesis</i>
	Common Kingfisher	<i>Alcedo atthis</i>
	White breasted Kingfisher	<i>Halcyon smymensis</i>
	Green Bee- eater	<i>Merops orientalis</i>
	Indian Roller	<i>Caracias benghalensis</i>
	Hoopoe	<i>Upupa epops</i>
	Lesser Golden Backed Wood-Pecker	<i>Dinopium benghalense</i>
	Stripe breasted Wood-Pecker	<i>Picoides atratus</i>
	Copper smith Barbet	<i>Megalaima haemacephala</i>
	Large green Barbet	<i>Megalaima zeylanica</i>
	Blue throated Barbet	<i>Megalaima asiatica</i>
	Grey Shrike	<i>Linius excubitor</i>
	Black headed Oriole	<i>Oriolus Xanthormus</i>

SECTION 4: POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 GENERAL

The environmental impacts due to construction of rural roads particularly along existing alignment induce relatively less adverse impacts as compared to construction along new alignments. The impacts due to construction of rural roads can be largely mitigated through engineering designs, good construction practices accompanied by appropriate environmental mitigation measures or Environmental Code of Practices.

The screening of potential impacts due to the rural road construction works in West Bengal along with the appropriate mitigation measures (wherever applicable) are summarized under the following different stages.

- Environmental Problems due to Project Location
- Environmental Problems Related to Design
- Environmental Problems Associated with Construction Stage
- Environmental Problems Resulting in Project Operations
- Potential Environmental Enhancement Measures
- Additional Considerations

The environmental impacts on the rural road have been taken into consideration for 696.124 km at this stage out of 1000 km of total Batch III rural roads.

4.2 ENVIRONMENTAL PROBLEMS DUE TO PROJECT (ROAD) LOCATION

4.2.1 National Parks/Wild Life Sanctuaries

Potential Impacts: Out of the 696.124 km of Batch III rural road construction works in 126 different stretches/ locations, none are passing through the National Parks/wild life sanctuaries.

The current environmental regulations of the Ministry of Environment & Forests, Government of India does not permit development activity within the National Parks/Wild Life sanctuaries that are not in consonance of section 29 of Wild Life Act 1972.

Mitigation: As none of the construction proposals are through the National parks/sanctuaries, no environmental/ecological threat to any National Park/ Wildlife sanctuaries are perceived due to the location of any of the 696.124 km of Batch III roads. Further Batch III roads that pass through sanctuaries, national parks or roads that will affect the movement or life of endangered species will be excluded and not considered under the ADB loan assistance program.

4.2.2 Archaeological/ Heritage Monuments

Potential Impacts & Mitigation: Although, West Bengal is known to have several archaeological and historical/ protected heritage monuments spread all over the state, none of them are situated in the immediate vicinity of the rural roads of 696.124 km. Therefore no environmental impacts are envisaged on the archaeological/heritage monuments due to the location of road construction proposals. In case, archaeological/ heritage monuments are situated in the immediate vicinity of the rural roads of 696.124 km in the third batch, the Department of Archaeology, Government of West Bengal will be consulted for seeking the

required regulatory clearances including any preventive measures that may be required for protection of the monuments during construction phase.

4.2.3 Natural Habitat/Nature reserves

Potential Impacts: None of the 126 stretches of rural roads are in the immediate vicinity of (500 m away) of natural habitat/ nature reserves notified by the Government of India. Patches of social forestry/ unclassified forest area are observed in few rural roads which are not reserved or protected by the Government of India. Therefore no environmental/ecological threat to any Natural Habitat/Nature reserves is perceived due to the location of road construction proposals.

Mitigation: As none of the proposals is either passing through or within 500 m on each side from the Batch III rural roads of 696.124 km of Natural habitat/nature reserves notified by Government of India. Therefore, no ecological threat to any Natural habitats/ nature reserves is perceived due to the location of any of the 126 roads of 696.124km. Further, the remaining 303.876 km of roads in the third batch that will be taken up under the same batch that pass through natural habitat/ nature reserves or roads that will affect the movement or life of endangered species will be excluded and not considered under the ADB loan assistance program.

4.2.4 Reserve Forests/ Protected Forest and/or Unclassified Forest Areas/ Lands

Potential Impacts: Out of the 696.124 km of Batch III roads in 126 stretches, there are some roads in different districts which are passing through the Unclassified Forest Areas or in close proximity of some forest areas. The lists of roads under this category are given under **Chapter 3 Table 3.20**.

Mitigation: All the roads in different districts it is noted that ROW for the proposed road is clear, no impact on forest flora. Other than that no proposals are through the Reserve Forests/ Protected Forest and no environmental; ecological threat to any forest areas are foreseen due to the location of any of the 126 roads. If any road passes through reserve forest/ protected forest necessary permissions will be obtained from the Department of Forests, Govt. of West Bengal and Ministry of Environment and Forests, Government of India.

The road construction works through forest land and causing diversion of forestland to non-forestry activities comes under the purview of Forest Conservation Act 1980 of Government of India. Under this act, diversion of forestland for non-forestry activities will require prior mandatory clearances from the Ministry of Environment & Forests, Government of India. The WBSRDA (project implementation agency) will seek the required forest clearances in the prescribed format from Department of Forests, Government of West Bengal and Ministry of Environment & Forests, Government of India.

As per the current regulations, diversion of forest land for non-forestry activities will be considered based on several factors like legal status of forest, extent of the land to be diverted, ecological sensitivity, whether the forest land forms a part of National Park or Wild life Sanctuary among others. The clearance will be given depending upon the merit of case with a stipulation that the concerned project implementation authorities will be required to compensate for afforestation of any other degraded forest in the region twice to the extent of forestland to be diverted for non-forestry purposes. The Department of Forests, of State Government will identify suitable degraded forest in the same region or elsewhere and take up the compensatory afforestation, which shall be funded by the Project Implementation Agency.

4.3 ENVIRONMENTAL PROBLEMS DUE TO PROJECT (ROAD) DESIGN

4.3.1 Embankment construction

Potential Impacts & Mitigation: Generally road construction proposals follow the existing alignment of the unpaved roads with minor smoothing of horizontal and vertical alignment/profiles.

Assessment of the present road conditions and the construction proposals indicates that no major embankment construction will be required in any of the Batch III roads construction works. The proposals are also consciously confined to the existing alignment with minor corrections for vertical/horizontal profile in order to minimize environmental and social Impacts. Therefore no major Impacts are foreseen due to the road construction proposals.

4.3.2 Soil erosion

Potential Impacts:

The soil in most of the study area is alluvial-clayey loam. Erosion will be exacerbated if the vegetation is removed from the sides since roots are known to hold soil together. This will however be for the duration until the compensatory afforestation and roadside turfing have matured. In stretches where raised carriageway has been planned, slope protection measures are required.

To prevent the eroded material from entering the watercourse, silt fencing and/or sand bags can be provided at the end of ditches or cascade arrangements can be provided at the end of ditches as they enter the watercourse. While the former requires frequent cleaning to prevent built-up, the voids in the cascade will be filled up by eroded material and eventually vegetation will be established there.

No soil erosion is envisaged when the road is in operation as all the slopes and embankments of the project road shall be stabilised through sound engineering techniques and checks will be made that the works have been carried out to the required standard.

Soil erosion results in the loss of soil cover, slope stability and addition of sediment loading to drainage channels. The problem of soil erosion is likely to be more pronounced during the construction stage along bridge-end fills, over steep banks and embankment slopes.

Mitigation Measures

The slope of the road embankment has been fixed at 1:2, which is stable and reduces the possibilities of slope failures. This protection will mainly be provided at approaches of major and minor bridges. The slope protection will be done in accordance with recommended practice. IRC: 56-1974. All the culverts to be constructed as cross drainage structures, the slopes will be protected by turfing with grasses and shrubs.

To check the slope stabilisation of the borrow pits adjacent to the embankment, the depth of the pit will be so regulated that the bottom edge of pit shall not intersect the imaginary line of slope 1:4 drawn from the top edge of the nearest embankment. To avoid embankment slippage and erosion, borrow pits shall not be dug continuously.

4.3.3 Clearing of vegetation

Potential Impacts & Mitigation: The vegetative cover/trees within the right of way will be impacted due to clearing operations of the right of way for road construction works. Trees have to be felled in many rural roads on either side of the tracks. Most of the trees within the right of way do not have any significant ecological and/or

commercial value but appear to have planted by the adjacent landowners and often perceived as boundary to their private lands.

The clearing of trees within the ROW will have a visible impact on the road users and also temporarily upon the tree dwelling fauna. The clearing operations of the right of way will not have any impact on wild life species, threatened or endangered species as these are not known to occur along the ROW. The lists of roads under this category are given under **Chapter 3 Table 3.20**.

Mitigation: The impacts due to tree clearing operations of the right of way can be retrieved by re-plantation of the corridor. As per the regulations of the State Forest Department, prior approvals are to be sought for tree felling. The approvals for tree felling particularly for road construction works are generally issued by the Department of Forests with a stipulation that at least three new saplings are to be planted for every tree felled and maintained for three years. The cost of plantation of the corridor including maintenance up to 3 years will be borne by Gram Panchyat from the fund of NREGA scheme. The selection of species will be finalized in consultation with the Department of Forests, Government of West Bengal.

The Impacts due to tree felling within the right of way is applicable to Batch III roads which are under tree felling roads.

4.3.4 Cross Drainage

Potential Impacts: Some of the Batch III roads are across or along the small streams of rivers/ natural canals. The lists of such roads are incorporated under **Chapter 3 Table 3.6**.

Mitigation: The project preparation of the road proposals has considered cross drainage structures like hume pipe, RCC or slab culverts and minor bridges in some cases at all such locations to ease the storm discharge during or after the monsoon.

4.3.5 Roadside Sanitation

Potential Impacts: The local bodies and the State Governments have constructed tube wells along the existing roads particularly near habitations to meet the water supply needs of community. These have been provided with a platform around the tube well, which connects to nearest pit through a lined open drain. The drains appear to be of standard type design and often do not connect up to the nearest pits as per specific site requirements or the pits are often seen to be overflowing without proper drainage leading to improper and unsatisfactory sanitary conditions in and around the tube wells.

Mitigation: Provision of adequate sanitary arrangements with lined drains connecting up to the nearest natural drain or the roadside drains constructed, as a part of road construction proposal will improve the sanitary conditions around the tube wells. A cost provision for such arrangement has been made under Environmental Management Action Plan.

4.3.6 Road cutting for Conveyance of Irrigation Pipes

Potential Impacts: Along many stretches of the road construction proposals, agricultural landowners across the existing roads appear to share the water for irrigation purposes. The tube well water from one side of the road is taken to other side through pipes beneath the road by making a temporary incision at the road surface. This appears to be a very common 'practice particularly in South and North 24 Parganas district. Even instances of digging up bitumen-paved roads could be seen at: several places for taking the pipes across the road. Such practice will damage the newly improved road if not addressed during the project preparation of construction works.

Mitigation: The practice of digging the roads for taking the pipes across the road can be prevented by laying 150mm diameter cement concrete pipes at regular intervals to serve as ducts, particularly along stretches having agricultural land on one or either side. This will provide an option to take the irrigation water pipes can be taken across the road through these ducts without road cutting and prevent unwarranted digging of roads. In addition, the village community leaders are to be encouraged to form a watchdog committee to safeguard against un-warranted digging of roads for laying pipes or for any other reasons, unless it is utmost essential.

4.4 ENVIRONMENTAL PROBLEMS ASSOCIATED WITH PROJECT (ROAD) CONSTRUCTION

4.4.1 Geology / Stone Quarries

Potential Impacts: The quantity of stone aggregates for road construction works conforming to specifications are to be sourced from either the existing or the new quarry sites and hauled to work sites through existing roads. Otherwise it can have substantial environmental impacts on soil, water and natural environment. The impacts range from erosion and siltation to air quality and noise impacts during their use, as well as permanent visual and aesthetic intrusion if rehabilitation is neglected.

Impact Mitigation: Quarry operations in the region/ state are regulated by the state department and require license and compliance of the state environmental regulations. Nonetheless, implementation of the following measures will limit or mitigate the impacts:

- Aggregates are to be sourced only from the approved/licensed quarry sites, complying the local/ state environmental and other applicable regulations
- At times the contractors may set up their own quarries and/ or aggregate crushing units in nearby areas to the construction sites. Any such practice shall have a consent or No Objection Certificate from the State Pollution Control Board
- Occupational safety procedures/practices for the work force should be in place at all quarries as per local regulations
- Quarry and crushing units should have adequate dust suppression measures like water sprinklers in work areas and along approach roads to quarry sites. All the work personnel likely to be exposed heavy dust levels shall be provided with dust masks
- The quarries shall have valid environmental compliance certificates obtained from the State Pollution Control Board from time to time
- Water tankers with suitable sprinkling system are to be deployed along the haulage roads. Water shall be sprinkled regularly to suppress the airborne dust due to the dumper/truck movement. The required frequency is to be determined as per site conditions.
- Trucks/ dumpers deployed for the material transportation are to be spillage proof. In any case, all haul roads are to be inspected at least once daily to clear accidental spillage, if any;
- Material stacking sites are to be access controlled for unauthorised entry of people, grazing cattle and stray animals;

4.4.2 Hydro-geology/Ground Water

Potential Impacts: The construction water requirement of the road construction works is likely to be met through ground water. Therefore, the potential impacts, if any will be from the use of ground water for the meeting the water requirements of

construction works, sprinkling of water for dust suppression, stabilisation of embankments/ shoulders, watering of roadside re-plantations, water for the work force camps, and alike.

An assessment of the construction water demand and the available/ recommended ground water yield/potential of the project region indicate that use of ground water for rural road construction works will not have any significant impacts on the geo-hydrological resources of the region. If surface water is available around the project road, it may be suitable for the use of construction work, except the use of ground water for domestic purposes in the construction camp.

Impact Mitigation: Although, the impacts may not be significant due to use of ground water for rural road construction works, following preventive measures are suggested

- The contractor should identify the potential water sources for construction and make arrangements with local communities and Gram Panchayat if sharing water resources is needed
- Ensure prior approvals are obtained from State Ground Water Authorities, for the construction of new tube/bore wells wherever required
- If the water is sourced from existing agricultural tube wells, the contractor must perform a yield test on such wells and the source are to be used under approval of WBSRDA. In addition the owner of tube well is to be clearly informed of the implications of water withdrawal in excess quantities than usual and a written consent is to be obtained
- The contractor must be encouraged to source water from more than one agricultural tube well and such tube wells shall be at least 300m away from each other
- Extreme precaution is to be exercised while finalising the locations of new tube/bore wells (wherever applicable); the wells shall be away (at least 300m) from the existing tube wells particularly those which are meeting the daily needs of communities
- Under no circumstances the contractor is to be allowed to source water from tube wells, which are being used by the community for their daily needs
- The wells constructed for the works are to be left in good working condition for the use of the local community (wherever applicable)

4.4.3 Soil/ Borrow Areas

Potential Impacts: The road construction works will require significant quantities of good quality earth for embankment construction and other components of the road construction as per the engineering design. This facility can have substantial environmental impacts on soil, water and natural environment. The impacts range from erosion and siltation to air quality and noise impacts during their use, as well as permanent visual and aesthetic intrusion if rehabilitation is neglected.

The project preparation of rural roads has identified all such potential areas for borrowing including assessing the suitability of the material. In certain situations, contractors also negotiate with the local villagers to lease or outright purchase of agricultural lands for mining the earth. Borrowed earth is to be transported to construction sites through existing roads. Borrowing and hauling operations are to be regulated to contain impacts.

Impact Mitigation: Impacts due to borrowing earth can be significantly mitigated by the following measures:

- The contractor should identify borrow area location in accordance with the Recommended Practice for Borrow pits for Road Embankments Constructed by Manual Operation (IRC:10-1961) and arrange for borrowing the area with land owners or Gram Panchayat
- Detailed investigations are to be carried out by the contractor to identify the borrow options/areas. The borrow areas are to be approved by the respective PIUs not only for the material quality but also for its location
- The borrow area should not be located in irrigated agricultural land, grazing land, protected areas, wetlands or area supporting rare flora/ fauna and not within of settlements and in ecologically stable areas
- The contractor must be discouraged to use the agricultural land (either through lease or purchase) for borrowing the earth, until no feasible alternative options are available
- Within the identified borrow areas, the topsoil (upto 15-20cm) must be preserved and used for re-vegetation of borrowed areas. The actual extent of borrow area/zones to be excavated are to be demarcated with signboards and the operational areas are to be access controlled
- Borrowing areas are to be provided with gentle side slopes revegetated (to contain erosion and connected to nearest drainage channel to avoid the formation of cess-pools during / after rainy seasons)
- As per the current regulations, use of fly ash is mandatory for all construction works within a radius of 100 km from any thermal power plant. Therefore, fly ash will be used in all road construction works, which are within the 100 km from thermal power stations. A list of thermal power stations within West Bengal is given in **Table 4.1**. The Rural Road manual specifies design and construction procedures for construction of fly ash embankments
- All machinery and vehicles deployed in borrowing operations is to conform to the vehicle emission and noise regulations of the State Pollution Control Board
- Operations are to be limited to day hours only. Provisions of protective gears like earplugs are to be made available to the work force exposed to noise levels beyond the threshold limits. Rotation of personnel may be exercised as an alternative option. All operation areas are to be water sprinkled to contain dust levels to the National Ambient Air Quality Standards

Table 4.1: Location of Thermal Power Plants and Other Captive Power Plants Producing Fly Ash in West Bengal

State	Thermal Power Plants
West Bengal	Bakreshwar(WBPDCL)
	Bandel (WBPDCL)
	Budge Budge (CESC)
	Durgapur (DPL)
	Durgapur (DVC)
	Farakka (NTPC)
	Kolaghat (WBPDCL)
	Mejia (DVC)
	Mulajore (CESC)
	New Cossipore (CESC)
	Santaldih (WBPDCL)
	Sagardighi (WBPDCL)

	Southern generation station (CESC)
	Titagarh (CESC)
	Durgapur Steel Plant, Dist. Durgapur (ECL)
	Disergarh ECL CPS, Disergarh
	Chinakuri CPS (ECL), Chinakuri
	Seepore CPS, Seepore (ECL)

WBPDCL: West Bengal Power Development Corporation Limited, Govt of West Bengal, CESC: Calcutta Electric Supply Corporation, ECL: Eastern Coalfield Ltd., NTPC: National Thermal Power Corporation, DVC: Damodar Valley Corporation

4.4.4 Land Use

Potential Impacts: The road construction works will require clearing of right of way (ROW) i.e 5 to 6 m on either side from the centerline of the present alignment. The land use pattern along the existing tracks is generally agriculture lands interspersed with rural habitations.

The cleaning of the ROW could have following impacts

- Diversion of land under agricultural use
- Diversion of forestland (in specific cases)
- Loss of tree cover along the existing ROW

Diversion of land under agricultural use: The clearing operations of the ROW will lead to permanent change in land use in some stretches of the road construction particularly along agricultural lands. The clearing operations for construction of 696.124 km of roads will change the present land use from agricultural area. The impact arising out of this change in land use is very negligible as compared to the benefits that can accrue from the road construction to the rural economy, benefits to the community in terms of easy and faster accessibility to better education, health facilities and poverty alleviation among others.

Generally private landowners along the proposed ROW are voluntarily parting their land and in many cases vacate the encroached government land along ROW without any demand for compensation anticipating the social benefits due to the road construction. The WBSRDA currently implementing PMGSY works apparently have not faced any social resentment in this regard. In some cases, the assistance of District administration and community leaders have been sought and the matters have been sorted out without any legal channel or compensation. The issues arising out of this is separately addressed in the Social Impact Analysis under Social Assessment Report.

Diversion of Forest Land: As none of the proposals in the sample rural roads are passing through the Reserve Forests/ Protected Forest, no environmental / ecological threats to any forest areas are foreseen due to the construction of 696.124 km Batch III roads. Further, in case of the remaining 303.876 km of roads that will be taken up under the subsequent batches, if the roads pass through Reserve Forests/ Protected forest, necessary permissions will be obtained from the Department of Forests, Government of West Bengal and Ministry of Environment and Forests, Government of India.

The road construction works through forest land causing diversion of forestland to non-forestry activities comes under the purview of Forest Conservation Act 1980 of Government of India. Under this act, diversion of forestland for non-forestry activities will require prior mandatory clearances from the Ministry of Environment & Forests, Government of India. The project implementation agencies (WBSRDA) will have to seek the required forest clearances in the prescribed format from the Ministry of Environment & Forests, Government of India.

The agreed EARF has stated clearly that prior to commencing a civil works, the Implementing Agency, WBSRDA, has to obtain all the clearance related to environment. In this context, the forest clearance has to be obtained prior of commencing the civil works for these particular road stretch.

As per the current regulations, diversion of forest land for non forestry activities will be considered based on several factors like legal status of forest, extent of the land to be diverted, ecological sensitivity, whether the forest land forms a part of National Park or Wild life Sanctuary among others. Based on the current regulation, the proposed diversion of the forestland for this rural road under the second batch should not be a problem for obtaining forest clearance, because those forest land affected has no ecological sensitive. However, it will require to be compensated either by afforestation or reforestation of any other degraded forest in the region. The compensation based on the current regulation will be twice to the extent of forestland to be diverted for non-forestry purposes. The Department of Forests, State Government will identify suitable degraded forest in the same region or elsewhere and take up the afforestation or reforestation, funded by the Project Implementation Agency (WBSRDA).

Impact Mitigation: The impacts due to diversion of forest land/loss of tree cover can be retrieved through measures like compensatory afforestation of degraded forest in the same region and re-plantation of the ROW as already mentioned in the previous sub section. The loss of agricultural land although minimal is irretrievable.

Other than this, establishment of camp sites for the work force, work sites, construction of road diversions during works also will lead to change in land use temporarily and limited to the construction stage and in the construction area. Adopting measures to restore site to its previous state will be required right after completion of construction.

- Whether the road passes through forest areas, efforts have to be made to minimize encroachment into forest areas and cutting trees by limiting widening only on the roadside, and consult with local forest officers prior to removing any ground cover including trees
- Limit removal of ground cover, trees or shrubs only to the area needed for permanent works
- Allow no chemical substances to be used for land clearing

4.4.5 Drainage

Potential Impacts: As mentioned in the previous sections, the project preparation has considered cross drainage structures (pipe / RCC or slab culverts and minor bridges in some cases) and therefore the road construction works will not alter and rather improve the existing drainage system of the region.

Impact Mitigation: The cross drainage structures are scheduled for construction during dry season to avoid impacts on watercourses. Further the drainage channels on both upstream and down stream across the road works are to be cleaned for at least 50m on both upstream and downstream and restored to its previous state after completion of construction works.

4.4.6 Water Quality

Potential Impacts: Discharge of effluents from construction sites, liquid and solid waste discharges from POL¹ storage areas, work force camps and all other

¹ POL: Petroleum, Oil and Lubricants

operational areas may impact the water quality of the drainage channels if disposed off directly. As there are no perennial surface water bodies/drainage channels near the immediate vicinity on each side from the Batch III rural roads of 696.124 km of the road construction work, no such impacts are foreseen.

Impact Mitigation: Scheduling the construction works to non-monsoon months can prevent the impacts on water quality due to the discharge of effluents from construction and related sites. Disposal of solid and liquid waste disposal into dry channel beds is also to be strictly prohibited at any stage of the road construction.

The work force camps shall be provided with adequate septic tank and soak away pits so that the discharges from these areas do not impact the near by drainage channels. Similarly the discharge of liquid and solid waste from POL storage areas into the drainage channels is to be prohibited.

As the rural roads are not subjected to vehicular traffic carrying hazardous chemicals, the impacts on water courses/quality due to hazardous spills from accidents from vehicles carrying hydrocarbons, chemicals, acids and similar other substances are not foreseen. The impacts arising from wayside amenities are not foreseen as the rural road construction works does not have any provision for such facilities.

4.4.7 Terrestrial Flora & Fauna

Potential Impacts: The impacts on flora due to road construction can be categorised into the following two types

- Clearing of vegetation cover within the right of way
- Loss of forest land/cover due to diversion of forest land to road construction works

Clearing of vegetation: The vegetative cover / trees within the right of way will be impacted due to clearing operations of the right of way for road construction works. Almost all road construction proposals have trees on either side of the tracks. Most of the trees within the right of way do not have any significant ecological and/or commercial value but appear to have been planted by the adjacent landowners and often perceived as boundary to their private lands.

The clearing of trees within the ROW will have a visible impact on the road users and also temporarily upon the tree dwelling fauna. The clearing operations of the right of way will not have any impact on wild life species, threatened or endangered species as these are not known to occur along the ROW.

Impact Mitigation: The impacts due to tree clearing operations of the right of way can be retrieved by re-plantation of the corridor. As per the regulations of the State Forest Department, prior approvals are to be sought for tree felling. The approvals for tree felling particularly for road construction works are generally issued with a stipulation that at least three new saplings are to be planted for every tree felled and maintained for three years. The cost of re-plantation of the corridor including maintenance up to 3 years is to be borne by the project Implementation authorities/ Panchayat department under annual action plan budget. The selection of species will be finalised in consultation with the Department of Forests, Government of West Bengal and generally should represent the common trees of the project region.

4.4.8 Loss of Forest land/ Cover

Potential Impacts: The loss of forestland/ cover due to road construction works have been discussed under the previous subsection 4.4.4.

Impact Mitigation: The loss of forest cover and the tree cover within the ROW due to road construction works can be retrieved through compensatory afforestation as

per the stipulations of Government of India and Department of Forests, Government of West Bengal.

4.4.9 Aquatic Flora & Fauna

Potential Impacts: As mentioned under section 4.4.3, the road construction will also involve construction of drainage structures, which can be scheduled for dry season. Therefore the construction works will not induce any impacts on the aquatic flora & fauna in the region.

Impact Mitigation: No mitigation measures are required except for cleaning of the channel beds up to 50m on both upstream and down stream sides and restoration to its previous state after completion of construction works.

4.4.10 Air quality

Potential Impacts: During the road construction works, dust and emissions from the construction equipment, hot mix plants and other vehicles deployed various construction activities are the major sources of air pollution. During the operation stage, vehicular emission is a major contributor to the air pollution both in urban and rural environment. The vehicular emissions are determined by several factors like fuel composition, level of engine maintenance, vehicle age, speed and congestion, traffic and road condition. Human health, terrestrial flora and faunal health are the most immediate receptors of the vehicular emissions.

As the rural roads are not subjected to significant vehicular traffic, the emissions will not be a major contributor to the air pollution. Instead the road construction will have beneficial impact on the air quality along the roads as compared to present situation. The construction works after completion: will ensure relatively a dust free environment during or after vehicle passage, reduced vehicular emissions due to more uniform speed and less frequent acceleration/ deceleration of vehicles which otherwise contribute to increased fuel consumption and therefore increased pollution as compared to the present situation. The most notable beneficiaries will be women and children who are exposed to increased dust and other emissions due to poor condition of the present unpaved tracks.

Impact Mitigation: Air quality impacts during the construction stage are transitory in nature and can be largely mitigated by the measures described below

- All construction equipment and machinery deployed shall not be older than 3 years and regularly maintained
- Vehicles/equipments are to be regularly subjected for emission tests and have valid 'Pollution Under Control' certificates. Re-validation of certificates will be done once in 6 months
- All vehicles deployed for material haulage are to be spillage proof Water tankers with suitable sprinkling system are to be deployed along the haulage roads and in the work sites to suppress airborne dusts from truck/ dumper movements particularly on unpaved roads. Actual frequency may be determined by the contractor / PIU² as per the site conditions
- Construction or work force camps are to be provided with fuel³ so that dependence on firewood is totally avoided; the use of LPG shall be mandatory in work force camps of road construction works passing through forest lands
- Operational areas include work sites, haulage roads, hot mix plants, quarries,

² PIU- Project Implementation Unit see section 6.0 for Institutional Requirements for Implementation of EMAP

³ Liquefied Petroleum Gas (LPG) will be a preferred fuel

borrow sites and spoil disposal sites.

- All hot mix plants under the road construction works are to be located at least 500m away from the human settlements and preferably on the leeward side

The operation stage air quality Impacts, which mainly relates to the fuel composition, emission norms for vehicles among others are generally beyond the purview of the road construction authorities.

4.4.11 Noise

Potential Impacts: Both the construction and operation of roads induce noise impacts. There will be no blasting involved in all activities to improve these 126 rural roads. The noise Impacts during the construction stage can be largely controlled, operation stage Impacts are generally beyond the purview of the road construction authorities. The major factors contributing to noise levels during the road operation stage are vehicular (engine) noise, driving behaviour, pavement condition and road geometry, most dominant of these being vehicular noise.

Noise induced by the construction activities is generally intermittent and depends on the type of specific operation, location, function, and equipment usage cycles and attenuates quickly with distance.

Impact Mitigation: Impacts of noise during the construction activities can be largely controlled by the following measures

- All equipment/ vehicles deployed for the construction activities shall conform to stipulated noise emission criteria by the Central Pollution Board; not older than 3 years and regularly maintained
- Work force likely to be exposed to noise levels beyond the threshold limits is to be provided with protective gears like earplugs. Rotation of personnel every four hours should be considered as a supplement measure
- Limiting the operations to daytime only particularly near the human settlement areas

The noise impacts after the completion of the road construction works is not likely to be significant. Due to the construction works, settlements along the roads are likely to be exposed to relatively lower vehicular noise as compared to the present situation due to the improved pavement conditions and smoother movement of traffic.

4.4.12 Vibration

Potential Impacts: Vibrations induced by heavy traffic can impact on the roadside buildings particularly old or ancient structures. As the rural roads are neither subjected to any significant vehicular traffic nor any ancient archeologically important structures have been recorded along any of the road construction proposals, no impacts due to vibration are envisaged. Therefore no specific measures for mitigating vibration are required.

4.4.13 Construction Debris

Potential Impacts: The rural road construction works are not expected to generate construction debris, which require safe handling prior to disposal. Hence no specific mitigation measures are required or suggested.

4.4.14 Archaeological/ Historical Monuments

Potential Impacts & Mitigation: Although, West Bengal is known to have several archaeological and historical/protected heritage monuments spread all over the state, none of such protected/heritage monuments are situated within 5 km on each side

from the rural roads of 696.124 km. Therefore no environmental impacts are envisaged on the Archaeological/Heritage Monuments due to the location of road construction works. In case, archaeological/heritage monuments are situated in the vicinity of the project road on each side from the rural roads of 696.124 km and the remaining 303.876 km of roads in the third batch that will be taken up, the Department of Archaeology, Government of West Bengal will be consulted for seeking the required regulatory clearances including any preventive measures that are required for protection of the monuments during construction works.

4.4.15 Road Side Shrines/Temples

Potential Impacts & Mitigation: The 696.124 km Batch III sample roads have small shrines/temples within the right of way and requiring relocation due to road construction or shoulder portion near the temples will be reduced. In case, major shrines/temples are situated within the right of way and requiring relocation in any of the remaining 303.876 km of roads in the third batch, the local community leaders of the respective rural habitations and the district administration are to be consulted for obtaining their consent for relocation and or protection works that may required for the purpose.

4.4.16 Road Side Sanitation

Potential Impacts: The local bodies and the State Governments have constructed tube wells along the tracks particularly near habitations to meet the water supply needs of community. In few cases unsatisfactory sanitary conditions has been noticed.

Under the proposed road constructions, the paved surface will extend almost up to the tube wells, in many cases posing a serious threat to the improved road due to the present improper/inadequate sanitary arrangements which can damage the bituminous surface along with base and sub base layers of the road.

Mitigation: All the tube wells along the improved roads are to be provided with adequate sanitary arrangements with lined drains connecting up to the nearest natural drain or the roadside drains constructed as a part of road construction works. A cost provision for such arrangement has been made under Environmental Management Action Plan.

4.5 ENVIRONMENTAL PROBLEMS RESULTING FROM PROJECT OPERATIONS

No major environmental problems are perceived due to the project operations except for an increased degree of threat to the safety of the pedestrians/ slow moving traffic due to the increased speed of the motorised vehicles in comparison to the present situation. On the contrary, the project operations would enhance certain environmental attributes, which are described in the following section. Some minor impacts and mitigation measures are discussed below.

Impacts

During operation phase major impact can result from vehicular pollution. These pollutants include sulphur dioxide, nitrogen oxides, particulates, lead, carbon monoxide, hydrocarbon etc. Dust is another important air pollutant that is generated due to bad maintenance of road, accumulation of wastes on roads etc. Impact during operation phase is continuous and to some extent unavoidable.

The impact on ambient air quality will be insignificant during operation because numbers of vehicles in a day are expected to be around 10-15 numbers. Due to creation of paved surface dust generation will also be minimised.

In India emission regulations are being made more stringent day by day. Already lead has been abolished from petrol in all metropolitan cities and is expected to be abolished from the entire country very soon. Indian emission standards are now following to meet Bharat II norms and if there is effective enforcement there should be reduction, in impacts as these standards take effect over time. By the time construction will be over Bharat III stage emission norms will be applicable.

Mitigation Measures

Compensatory plantation to be taken up will also screen the dust and other emissions.

4.6 SPECIFIC IMPACTS AND MITIGATION MEASURES OF THE PROJECT ROADS

The road specific impacts and mitigation measures are presented in **Table 4.2**.

Table 4.2: Road Specific Impacts and mitigation measures

District	Block	Road Name (Package No.)	Environmental Impact on important features	Mitigation Measures
North 24 Paraganas	Bongaon	Chalki More to Polta WB01 ADB17	<ul style="list-style-type: none"> River Ichhamati in close proximity 	<ul style="list-style-type: none"> River bank protection will be provided by shal bullah piling
	Deganga	Bhasila FP School (Chandpur Paschim) to Kalijuga WB01 ADB18	<ul style="list-style-type: none"> Occasional water topping Tree felling 	<ul style="list-style-type: none"> Embankment height will be raised Compensatory plantation will be done.
South 24 Paraganas	Baruipur	Auliapur (Arapanch) to Uttarbhag WB02 ADB09	<ul style="list-style-type: none"> 1 Canal 2 temples Tree felling 	<ul style="list-style-type: none"> Eucalyptus bullah piling will be given Temples will be shifted to suitable places Compensatory plantation will be done.
Bankura	Khatra	T04 to Dumuria WB03 ADB14	<ul style="list-style-type: none"> 1 temple 	<ul style="list-style-type: none"> Temple will be shifted to suitable place
	Indpur	T05 to Belut WB03 ADB17	<ul style="list-style-type: none"> Tree felling 2 temples 	<ul style="list-style-type: none"> Compensatory plantation will be done. 2 temples will be shifted
Burdwan	Ausgram - I	Shibda More to Noada WB05 ADB11	<ul style="list-style-type: none"> 1 mosque, 1 temple 	<ul style="list-style-type: none"> Shoulder will be reduced to retain the mosque and temple will be shifted
	Mongalkote	Bonkapasi to Gopalpur WB05 ADB13	<ul style="list-style-type: none"> 1 temple Tree fellig 	<ul style="list-style-type: none"> Temple will be shifted Compensatory plantation will be done.
	Ausgram - II	Jinjira to Shri Chandrapur WB05 ADB14	<ul style="list-style-type: none"> Tree felling 1 temple 	<ul style="list-style-type: none"> Shoulder will be reduced to retain the temple Compensatory plantation will be done.
	Memari - II	Gargeswar to Paikara (From Gantia More to Mushagoria) WB05 ADB15	<ul style="list-style-type: none"> 3 temples, 1 mosque, 1 graveyard Tree felling 	<ul style="list-style-type: none"> 2 temples will be shifted, shoulder will be reduced to retain 1 temple and 1 mosque. Compensatory plantation will be done.

District	Block	Road Name (Package No.)	Environmental Impact on important features	Mitigation Measures
Coochbehar	Coochbehar - I	Charakbari Primary School to Mashanpath (Charak Bari) WB06 ADB18	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Mathabhanga - I	Nenda Wooden Bridge to Sardarer Tari WB06 ADB20	<ul style="list-style-type: none"> Watertopping 	<ul style="list-style-type: none"> Embankment height will be raised
	Coochbehar - I	Sutkabari Bazar to Khagerhat WB06 ADB21	<ul style="list-style-type: none"> Occasionally flood prone due to river Mara Torsha 	<ul style="list-style-type: none"> Boulder pitching and wire crating will be done for river bank protection.
	Coochbehar - I	Chilkirhat to Kater Hat via Sannyasir Ghat and Deurhat WB06 ADB24	<ul style="list-style-type: none"> 1 temples Teagarden 	<ul style="list-style-type: none"> Temple will be shifted in a suitable place. Roadside drain will be provided for tea garden.
	Coochbehar - I	NH 31 (near Kathaltala) to East Falimari Primary School WB06 ADB27	<ul style="list-style-type: none"> 1 temple 	<ul style="list-style-type: none"> Shoulder portion will be reduced to retain the temples
	Haldibari	Jakir Hoshin House to Dewanganj PWD WB06 ADB29	<ul style="list-style-type: none"> 1 temple 	<ul style="list-style-type: none"> Temple will be shifted to suitable location.
	Mathabhanga - I	Bhaberhat to Khursamari WB06 ADB33	<ul style="list-style-type: none"> 1 temple 	<ul style="list-style-type: none"> Shoulder portion will be reduced to retain the temples
	Mathabhanga - I	Baro Gopalpur to Keshar Hat WB06 ADB35	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Mathabhanga - II	SH 12A (Near Nishiganj) to Chhat Sitkibari WB06 ADB38	<ul style="list-style-type: none"> 3 temples 	<ul style="list-style-type: none"> temples will be shifted to suitable places.
Hooghly	Khanakul-II	Seepara to Janapara WB06 ADB13	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Khanakul-II	Rajhathi Dhanga Ajgubitala to Daulatchak Bajpai WB06 ADB14	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Khanakul- I	Krishnanagar to Radhunathpur Dispensary Centre WB06 ADB15	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
Jalpaiguri	Alipurduar - II	NH 31C at Mahakal Choupathi to T 07 at Gadadhar Bridge WB10 ADB15	<ul style="list-style-type: none"> Water topping occur due to close proximity of rive Gadadhar 	<ul style="list-style-type: none"> Measures will be taken to prevent water topping
	Matiali	T 03 at Purba Batabari to T 06 at Murti Village Joyantee Village WB10 ADB17	<ul style="list-style-type: none"> Water topping occur due to close proximity of rive Murti 	<ul style="list-style-type: none"> Measures will be taken to prevent water topping
	Maynaguri	T 09 at Tekatuli to Paja Ddiner Bari at Sussthir Hat WB10 ADB18	<ul style="list-style-type: none"> Tea garden Tree felling 	<ul style="list-style-type: none"> Drains to be provided for tea garden Compensatory plantation will be done
	Alipurduar - I	T-08 at Kalabari to	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will

District	Block	Road Name (Package No.)	Environmental Impact on important features	Mitigation Measures
		Adhikaripara WB10 ADB19		be done.
	Dhupguri	T-11 at Tatpara TG to Guru Line at Debpara TG WB10 ADB20	<ul style="list-style-type: none"> Tea plantation Tree felling 	<ul style="list-style-type: none"> Drains to be provided for tea garden Compensatory plantation will be done.
Murshida bad	Beldanga - I	Mahespur to Jalalpur Ferry Ghat WB13 ADB13	<ul style="list-style-type: none"> Occasional water topping due to nearby canal 	<ul style="list-style-type: none"> Embankment height will be raised.
	Bhagowan gola - I	Connection with SH 11 to Dostina WB13 ADB14	<ul style="list-style-type: none"> Mango orchard 	<ul style="list-style-type: none"> Earthen side drain will bwe provided.
Uttar Dinajpur	Karandighi	MDR Connection to Adibasipara WB15 ADB12	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Karandighi	Bhangipara to Kamartore WB15 ADB14	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Karandighi	Connection of MDR to School Para WB15 ADB16	<ul style="list-style-type: none"> 1 temple 	<ul style="list-style-type: none"> Temple will be shifted to a suitable place.
Purulia	Arsha	Ghatbera More to Bamni with a link to Sitarampur Road WB16 ADB09	<ul style="list-style-type: none"> Tree felling 1 temple 	<ul style="list-style-type: none"> Compensatory plantation will be done. Temple will be shifted to a suitable palce
Siliguri MP	Phansidewa	Chathat to Murikhawa WB17 ADB06	<ul style="list-style-type: none"> Tea garden, pineapple firm 	<ul style="list-style-type: none"> Drains will be provided for tea garden.
	Phansidewa	Hansqua More to Gangarampur TE under Hetmuri Singhijora WB17 ADB07	<ul style="list-style-type: none"> Tea garden 	<ul style="list-style-type: none"> Drains will be provided for tea garden
	Matigara	Patharghata Road Rajpouri WB17 ADB08	<ul style="list-style-type: none"> Tea garden 	<ul style="list-style-type: none"> Drains will be provided for tea garden
Dakshin Dinajpur	Kushmondi	Chandipur to Purbabasail WB18 ADB22	<ul style="list-style-type: none"> 3 temples 	<ul style="list-style-type: none"> Alignment will be shifted to opposite side to retain the structures of temples
	Tapan	Salas to Jaminipara WB18 ADB25	<ul style="list-style-type: none"> 1 Canal 	<ul style="list-style-type: none"> Eucalyptus bullah and close bamboo piling will be provided near the canal
Paschim Medinipur	Kharagpur - II	Sanjual to Paniseuli (T-04) WB20 ADB20	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Garbeta - II	Manikdipa to Jirapara WB20 ADB22	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.
	Garbeta - III	Tatarbati to Guiyadaha Hospital (T04) WB20 ADB23	<ul style="list-style-type: none"> Tree felling 1 temple (Raskundu Basantraj) 	<ul style="list-style-type: none"> Compensatory plantation will be done. Alignment will be shifted to opposite side to retain the structures of temple
	Sankrail	Baburbani to Naihati WB20 ADB24	<ul style="list-style-type: none"> Tree felling 	<ul style="list-style-type: none"> Compensatory plantation will be done.

District	Block	Road Name (Package No.)	Environmental Impact on important features	Mitigation Measures
	Sankrail	Bakra to Khayrapoti WB20 ADB25	• 1 temples	• Temple will be shifted to a suitable place.
	Sabang	Basantapur to Khorai WB20 ADB27	• Tree felling	• Compensatory plantation will be done.
	Pingla	Harkandi to Sangar WB20 ADB29	• Tree felling	• Compensatory plantation will be done.
	Garbeta - I	Chakparbati to Moyrakati (T-01) WB20 ADB31	• 1 temple	• Temple will be shifted to suitable place

(Note: For other roads only general mitigation measures will be applied)

General mitigation measures will be consider for all project roads.

- Plantation all along the road
- The construction camp shall be located at a minimum 5 km from forest areas to deter trespassing of construction labour.
- No construction wastes shall be disposed to the forest land.
- Rumble strip will be provided near the sensitive and habitation area
- Caution board and road safety measures wherever applicable
- Guardwall by shal/eucalyptus bullah near the pond and water bodies
- Provision of side drain near the habitation area and orchard
- Cross drainage structure will be provided wherever applicable
- The alignment plan will consider the option to minimize excessive cuts and fills to the extent possible.
- Turfing on the road embankment slope and earthen shoulder
- Water sprinkler will be used to minimize or to prevent dust generation during cutting and filling works.
- Precautionary measures like clean up operation by bleaching, phenyl etc and periodical medical check up will be taken up.

4.7 POTENTIAL ENVIRONMENTAL ENHANCEMENT MEASURES

4.7.1 Retrieval of Green (Tree) Cover

The re-plantation of the corridor (three saplings per tree felled) including maintenance up to three years will enable to retrieve the tree cover in a better managed manner. The retrieved tree cover will enhance the environmental aesthetics and serene to the road users as compared to present situation.

4.7.2 Improvement in Air/Noise Quality

The post road construction stage will enhance the ambient air quality through reduction of the dust concentration and vehicular emissions. The paved surface will contribute to a relatively a dust free environment during or after vehicle passage due to paved roads, reduced vehicular emissions due to more uniform speed and less frequent acceleration/ deceleration of vehicles The most notable beneficiaries will be the women and children who are exposed to increased dust and other emissions due to poor condition of the present unpaved tracks.

4.7.3 Improvement of Road Side Sanitation

Provision of adequate sanitary arrangements around tube wells will improve the present unsatisfactory sanitary conditions along side of the road. The improved sanitary conditions will also prolong the life and aesthetic value of the newly improved road.

4.7.4 Socio-economic Benefits

The road construction works is expected to promote better & faster access to health, education facilities and act as a avenue to increased economic opportunities, increased agricultural income and productive employment opportunities. The economic assessment carried out by the National Rural Roads Development Authority (NRRDA) in West Bengal and several other states also has amply demonstrated both tangible and non-tangible benefits due to the connectivity of rural habitations under PMGSY.

4.8 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The generic Environmental Management Plan (EMP) as part of the ECOP used in the first batch and the potential impacts of the third batch will be implemented all the environmental measures by providing detailed actions, responsibilities and timeframes for each adverse impact anticipated. However, the generic EMP as part of the ECOP will still be used for the bidding document for civil work contract of the third batch. The EMP applicable for the batch III roads have been listed in **Appendix 2**. Specific EMP will be handed over to successful contractor before commencement of construction Activity.

SECTION 5: INSTITUTIONAL REQUIREMENTS & ENVIRONMENTAL MONITORING PLAN

5.1 GENERAL

The IEE of the rural road construction proposals has identified potential impacts and their mitigation measures. An Environmental Management Action Plan (EMAP) has been drawn up for implementing the mitigation measures. A monitoring plan for implementation of EMAP along with the required institutional framework is also given in this section.

5.2 ENVIRONMENTAL MANAGEMENT ACTION PLAN

The EMAP broadly comprises;

- Identification of the project action (s) and environmental attributes those are likely to be impacted.
- Appropriate mitigation and/or environmental enhancement measures
- Responsible agency for the implementation of the mitigation measures
- Monitoring Frequency

5.2.1 Issues / Project Actions / Environmental Attributes

The project actions, which generally induce environmental impacts are clearing operations of ROW, traffic diversions, construction of campsites, haul roads, quarry and borrowing operations, transportation of materials, construction of cross drainage structures, air & noise pollution at all operational areas from the construction equipment, plant and machinery, sanitation in workforce camps and plant sites among others.

5.2.2 Mitigation Measures

Appropriate mitigation and /or environmental enhancement measures are identified for all project actions during the construction stage, which are likely to impact the certain environmental attributes. The mitigation measures in the form of an Environmental Management Action Plan (EMAP) are given in **Appendix 2**.

5.3 RESPONSIBILITY FOR IMPLEMENTATION

The EMAP is to be appended to the Standard Bidding Documents (SBD) of all the construction packages so that it serves as a condition of contract for adopting the Environmental Code of Practices (ECOP) by the prospective contractor(s). The implementation of the EMAP and/or ECOP by the contractor (s) is to be administered by the Project Implementation Unit (PIU) of the WBSRDA through the Project Implementation Consultant (PIC).

5.4 EMAP IMPLEMENTATION MONITORING

A monitoring frequency for overseeing the implementation of the EMAP is given in **Appendix 3**.

5.5 INSTITUTIONAL REQUIREMENTS FOR IMPLEMENTATION OF EMAP

5.5.1 Institutional Requirements – Construction Stage

The third batch (part 1) of 696.124km will be packaged into several construction contract packages (district wise) by the Project Implementation Unit (PIUs) of WBSRDA. In order to support PIUs and WBSRDA, WBSRDA has appointed Project Implementation Consultants (PIC). The Project Implementation Consultant has environmental experts in their team. The environmental expert of PIC will periodically review the EMAP compliances at site. The project Implementation Consultant (PIC) appointed by the WBSRDA will continue to supervise the Construction Supervision

Consultant in addressing environmental matter of the Project. The PIC has employed Environmental Officers (EO) in their team.

The institutional requirement for the implementation of Environmental Management Action Plan (EMAP) is given in **Figure 5.1**. The roles and responsibilities for implementation of EMAP during the construction stage are described herein.

5.5.1.1 Environmental Officer: The Project Implementation Consultant (PIC) responsible to supervise the Construction Supervision Consultant in implementing EMP. The EO will be responsible to ensure adherence and implementation of EMAP at all stages of works by the contractor.

The broad duties / responsibilities of the Environmental Officer will continue to include

- Review of project design and specifications to ensure their adequacy and suitability with respect to the implementation of EMAP and or ECOP;
- Collection and dissemination of relevant environmental documents including amendments to environmental protection acts issued by the various agencies, namely, ADB, Government of India / State and local bodies;
- Interact with the counterpart of the Contractor(s), review work progress/plans and ensure implementation of the EMAP;
- Co-ordination with the NGOs, community groups and Government departments on environmental issues, provide clarifications/ and obtain clearances during project implementation if any, as required from the regulatory authorities and/or submitting periodic compliance reports as required by the State Authorities;
- Monitoring sensitive environmental attributes during construction to ensure that the suggested mitigation measures in the EMAP are implemented;
- Documentation of the environmental management/monitoring activities for the regular project implementation progress report; and
- Conducting environmental training/awareness programmes for the contractors, the project implementation personnel and the communities.

5.5.1.2 Environmental Monitoring Agency: The Contractor(s) will engage the services of an independent and qualified agency to undertake measurement of environmental quality during the construction stage. The PIU through the PIC responsible to undertake overall environmental monitoring for the Project.

5.5.2 Institutional Requirements – Operation Stage

During use of road after construction road maintenance work including safeguard requirement will be carried out/ followed by the respective contractor for five years. After that system will be continued under the supervision of PIU and PMU.

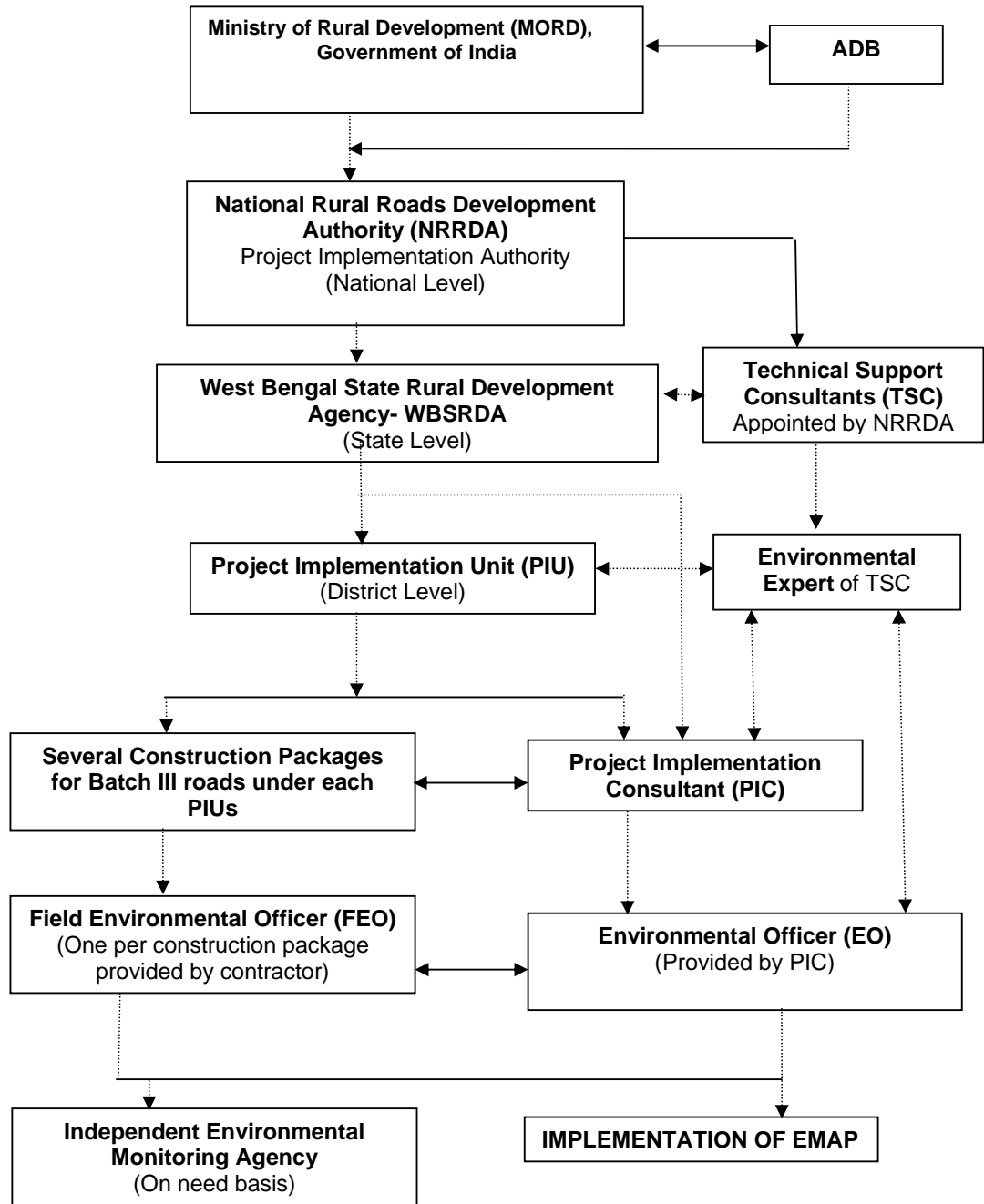


Figure 5.1: Institutional Requirements for Implementation of EMAP

SECTION 6: PUBLIC CONSULTATIONS AND INFORMATION DISCLOSURES

6.1 INTRODUCTION

This project comprising of 696.124km rural roads is likely to affect the communities residing around the corridor of impact and their activities. Moreover successful implementation of the project requires co-ordinated efforts of various stakeholders at different levels. Hence, consultation at different levels was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions were made. Public consultation was useful for gathering environmental data, understanding likely impacts and community's needs and preferences.

The various alternatives could be evolved and sustainable mitigation measures could be formulated through consultations. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance to change and enabled the participation of the local people in the decision making process. The involvement of the various stakeholders ensured that the affected population and other stakeholders are informed, consulted and are allowed to participate at various stages of project preparation.

6.2 OBJECTIVES

The main objective of the consultation process was to minimise negative impacts of the project and to maximise the benefits of the project. Other objectives of the consultation process were the following:

- To promote public awareness about the proposed project especially amongst the potentially impacted communities/individuals;
- To educate the communities/individuals close to project roads about the proposed course of action and the project alternatives;
- To solicit the views of communities/individuals residing near rural roads proposed for construction on environmental and social problems;
- To gather inputs from the affected communities/individuals in crucial decisions regarding mitigation of the identified environmental and social issues;
- To stimulate community self evaluation and analysis; and
- To ensure lessening of public resistance to change by providing them a platform in the decision making process

6.3 METHODOLOGY ADOPTED FOR PUBLIC CONSULTATIONS

6.3.1 Stages and Levels of Consultation

Public consultation was conducted both at screening stage as well as IEE stage. Consultations conducted at screening stage played an important role in scoping the level and extent of consultation to be taken in the project preparation stage.

Public consultations have been held at three levels as follows:

- **Local level** (village level, Panchayat level/Block level) villagers through which roads are passing.
- **District level** consultations involving District Magistrates, revenue department, PIU officials, local forest department; and

- **Institutional level** consultations with State Forestry Department and West Bengal State Pollution Control Board.

Tools for Consultation

Public Consultation was done using various tools including, discussion with village panchayats, panchayat samity members, government officials and other stakeholders.

(i) Formal/Informal discussion

During the transect walk, consultations were held with the officials of Panchayet and Panchayet Samity and local villagers. Also during the reconnaissance survey and site visits, discussions were carried out informally drawing people into dialogue to obtain an overview of likely impacts and concerns of the community. Consultation was held at several locations along the rural roads alignment covering areas where public activity was intense and close to proposed alignment covering owners of houses located close to rural roads.

A checklist of questions was kept ready and responses were elicited from people and guidelines were issued to environmental supervisors for the purpose. The FGDs were held at all the Batch III roads.

(ii) Institutional Level / Stake Holders Consultative Workshop

The institutional level consultations were held with representatives of institutions having stakes in implementation of the project. The institutions contacted included state forest department, West Bengal State Pollution Control Board etc.

In addition to the official listed above the officials from other departments were also contacted on several occasions. The contacted officials included Tehsildars, NGOs, industry department and respective – district magistrate Offices.

List of persons consulted district wise during FGD are given in **Appendix 4**.

6.4. RESULT OF THE CONSULTATION

The consultations were carried out between March, 2008 and February, 2009 for each of the project roads (126 nos.). In addition 9 consultations have been carried out during sample road visits to the 8 districts. The date(s) of public consultation is given hereunder.

Table 6.1: Date of public consultation- Sample Road visit

Sr. No.	District	Date(s) of consultation
1	West Medinipur	23.12.09
2	East Medinipur	24.12.09
3	Burdwan	26.12.09
4	North 24 Parganas	28.08.08/ 29.12.09
5	South 24 Parganas	30.12.09
6	Nadia	11.02.09
7	South Dinajpur	12.02.09
8	Maldah	13.02.09

The salient features of the result of consultation are described below:

6.4.1 Contents

The consultation with institutional officials focussed on the following issues.

- Project description: - Need for the construction of rural roads and benefits of the project.
- Social and environmental assessment processes *vis-à-vis*- GOI and the multilateral funding agency requirements.

- The extent / nature of negative social and environmental impact and the need for rehabilitation and resettlement in the project.
- Avoidance and mitigation aspects in the project.
- People's participation in planning, implementation and monitoring & evaluation stage.

6.4.2 Public Hearing, Schedule IV, under EIA notification of MoEF

The implementation of third batch of rural road projects will not require public hearing in the light of revised EIA Notification in the year 2006, as the roads are not under the categories of National Highways or State Highways.

6.4.3 Issues Raised and Community Perception

Some of the general issues raised during the different consultation sessions can be summed up as follows.

Water Logging and Drainage

Participants had a fear construction of rural roads with new alignment may alter natural drainage pattern in the area and may cause flooding and water logging in the agriculture fields if adequate cross drainage structures are not provided.

Loss of Livelihood and Income Restoration Options

This issue was raised by few of villagers, as loss of fertile land, pond, and business places like shops will deteriorate their income sources.

Road Safety

Safety issues were paramount in all the consultation sessions. Woman participants raised the issue of their children's safety. Old aged persons also raised the proper road safety issues.

Land Acquisition

People were not much concerned about the land requirements of the project and impact on their agriculture land. They were also of the view that community should be consulted before the road designs are finalised.

Loss of Idols/Shrines

This issue is very much important for the construction of rural roads. In consultation with the local people, most of the cases of shifting of idols/ shrines, villagers shifted the idols/shrines with the expectation of their better opportunities of education, livelihood, amenities etc.

Loss of Trees Due to Road Construction

Respondents were of the opinion that trees cutting should be avoided or else minimised. But in most of the cases the villagers already felled trees voluntarily. For trees to be cut compensatory plantation should be done. Some villagers expected additional plantation should be done. Recommended tree species for plantation were other local varieties which will be fruit bearing, medicinal value and aesthetic value.

Impacts on Health

Separate consultation sessions were organised by environmental team to identify issues pertaining to health specifically for sexually transmitted diseases (STDs). Settlements along the rural roads were reported to be getting exposed to such diseases as there are no long distance users on the project roads.

Employment during Construction

The locals demanded that locals should be given preference in employment during project implementation.

Perceptions and Expectations

Perceptions and expectations of the community recorded during the consultation sessions can be broadly listed as:

- The public and the PAPs appreciate the rural road construction.
- Community and large appreciated overall benefits to the community resulting from project development;
- Aware of the increased access, less travel time in commuting after project implementation;
- Expect better management of traffic and necessary noise barriers at educational and health facilities during construction;

Addressing of Issues

The project has tried its best to address all the issues raised during consultations under the constraints of suitability from engineering point of view. Some of the provisions made under the project to address the issues and concerns of the community are given in **Table 6.2**.

Table 6.2: Addressal of General Issues and Concerns under the Project

Issue/Concern	Addressal under the project
Water Logging and Drainage	Adequate cross drainage structures have been planned in the road design. Existing cross drainage structures have been taken into due consideration to keep the present drainage pattern. Public opinion has also been taken into consideration.
Road Safety	Adequate safely signage planned all along the rural road.
Land donation	The proposed ROW is 6-15m along the rural road. Minimum land is to be required for rural road development and villagers agreed to donate the land for road construction.
Loss of roadside idols/shrines	Idols and shrines will be relocated (if required at all) to the other nearby places with consultation and proper rituals
Loss of trees	Compensatory afforestation would be done all along the road.
Increased pollution levels	Pollution levels will be expected within the prescribed limits of CPCB and planned plantation will screen the emission.
Utilities and basic infrastructure	All the utilities, electric poles, telephone lines, wells, tube wells etc. to be impacted will be relocated under the project cost.
Employment of locals during construction	Locals will be given preference for employment during the project implementation

The issues raised and their incorporation in the design has been explained in **Tables 6.3**.

Table 6.3: Summarisation of Issues and Findings at Various Locations

Location	Issues	Participants Comments and Suggestions	Mitigation Measures and Action Plan
All the districts	<ul style="list-style-type: none"> • Peoples Perception about the Project • Air, Water Quality • Noise level • Water Source • Health and Environment • Road Alignment 	<ul style="list-style-type: none"> • The Villagers are in favour of the Project as they see a job opportunity and faster transport. • Air and Water especially drinking water qualities are not polluted. • Primary water sources are hand pump and open well and these should be relocated first if affected. • No construction activity will be taken in the night in built up area. • Affected water sources will be relocated first and then there will be dismantling of the existing sources. • The villagers required proper traffic control at the road junctions to prevent accidents. • Villagers are sound in health 	<ul style="list-style-type: none"> • Safety measures will be provided. Adequate signages will be provided. • For dust problem during construction sprinkling system will be considered • No construction activity planned during night time at habitation. • Water Resources will be relocated first before dismantling the existing ones. • Road alignment is planned during transect walk. • Locals will be given preference in employment during construction.

SECTION 7: FINDINGS, RECOMMENDATIONS AND CONCLUSION

7.1 FINDINGS AND RECOMMENDATIONS

The findings and recommendations of the IEE for the rural road construction works are summarized hereunder:

- The IEE has been carried out for **696.124 km** of rural roads, which represent the 1st part of Batch III roads out of 1000km.
- The potential impacts have been screened in accordance with the Environmental Assessment Guidelines of ADB and required adequate mitigation measures have been suggested in the form of an environmental mitigation action plan (EMAP).
- The anticipated environmental impacts will be insignificant, reversible and will mostly occur during the construction stage. The mitigation measures for minimizing these environmental impacts as stated in the EMP will be easily implemented.
- The Institutional requirements for implementation of mitigation measures has been in placed. A cost provision of around **Rs.35.9 million** has been made for implementation of EMAP for the 1st part of the third batch of 696.124 km.

7.2 CONCLUSION

Based on the IEE study and screening surveys conducted for the Project, associated potential adverse environmental impacts can be mitigated. No further Environmental Impact Assessment study will be required.

APPENDIX 1

List of ADB Batch-III Roads

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
1	North 24 Parganas	Bangaon	WB01ADB14	L-039	Chitapara to Ballavpur	2.03	99.28	6.11	105.39
2		Bangaon	WB01ADB15	L-043	Rasulpur to Raghunathpur	3.64	161.38	10.57	171.95
3		Bangaon	WB01ADB16	L-050	Nahata Bazar to Madhupur Road	2.60	123.33	7.84	131.17
4		Bangaon	WB01ADB17	L-073	Chalki More to Polta	5.03	243.57	14.95	258.52
5		Deganga	WB01ADB18	L-026	Bhaslia F.P.School (Chandpur Paschim) to Kalijuga	6.89	328.68	19.6	348.28
6		Deganga	WB01ADB19	L-041	Nasimpur to Sirajpur	5.19	229.61	14.68	244.29
7		Bangaon	WB01ADB20	L-038	Kaulupur More to Chaitapara	7.20	340.77	20.64	361.41
8		Bangaon	WB01ADB21	L-062	Nowda More to Monoharpur	4.88	291.01	14.52	305.53
						37.44	1817.63	108.91	1926.54
9	South 24 Parganas	Baruipur	WB02ADB10	T-07	Keyatala to Kbutiberia	14.13	765.47	38.27	803.74
10		Baruipur	WB02ADB9	T-05	Auliapur to Uttarbag	14.448	505.84	33.59	539.43
						28.578	1271.31	71.86	1343.17
11	Bankura	Khatra	WB03ADB13	L-062	T-02 to Dhanara	3.009	104.07	8.69	112.76
12		Khatra	WB03ADB14	L-028	T-04 to Dumuria	1.008	38.96	2.99	41.95
13		Khatra	WB03ADB15	L-024	T-03 (Part) Tiring	6.345	265.87	18.3	284.17
14		Khatra	WB03ADB16	T-05	Bahadurpur to Jamada	6.297	232.89	18.27	251.16
15		Indpur	WB03ADB17	T-06	T-05 to Belut	10.943	398.26	30.07	428.33
						27.602	1040.05	78.32	1118.37

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
16	Birbhum	Mayureswar	WB04ADB11	L-038	Amba to Atla	5.887	177.11	14.95	192.06
17		Dubrajpur	WB04ADB12	T-07	Rangana to Kultore	11.495	372.21	30.95	403.16
18		Dubrajpur	WB04ADB13	T-06	Ranjanbazar to Lokepur	7.965	291.42	21.26	312.68
19		Illambazar	WB04ADB14	L-045	Ghurisha G.P Office to Galita via Gopinathpur High School	13.5	456.95	34.89	491.84
20		Illambazar	WB04ADB15	L-029	Bonovilla Bus Stand to Sri Chandrapur Galita via Gopinathpur High School	5	183.07	13.29	196.36
21		Rampurhat-I	WB04ADB16	T05	Taljhari to Kastogora	7.7	276.07	19.62	295.69
						51.547	1756.83	134.96	1891.79
22	Burdwan	Ausgram-I	WB05ADB16	L-029	Shibda More to Noada Road	4.152	164.77	11.9	176.67
23		Mangalkote	WB05ADB12	L-028	Simulia to Krishnabati	4.258	169.18	12.4	181.58
24		Mangalkote	WB05ADB13	L-051	Bankapasi to Purba Gopalpur	7.097	345.88	20.3	366.18
25		Ausgram-II	WB05ADB14	T-08	Jinijira to Shrichandrapur	9.078	366.56	25.77	392.33
26		Memori-II	WB05ADB15	T-04	gargeswar to Paikara	8.774	352.38	24.85	377.23
						33.359	1398.77	95.22	1493.99
27	Coochbehar	Tufanganj-II	WB06ADB15	L-057	Langal gram pucca road to Balabhut pucca road	2.9	106.50	8.134	114.632
28		Coochbehar-I	WB06ADB16	L-050	Boxirhat to Sahebarhat via Battla	3.488	132.92	9.818	142.739
29		Coochbehar-I	WB06ADB17	L-060	Bogura Para Tepochi towards Katamari hat	4.916	185.75	13.8	199.55
30		Coochbehar-I	WB06ADB18	L-047	Charakbari Primary School Mashanpath	3.39	131.10	9.66	140.76

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
31		Coochbehar-I	WB06ADB19	L-046	3 no. Bridge towards SSB camp (Natuarpur) Road	3.416	117.67	9.52	127.19
32		Coochbehar-I	WB06ADB20	L-065	Nenda Wooden bridge to Sardarer Tari	4.182	166.82	11.85	178.67
33		Coochbehar-I	WB06ADB21	L-077	Sutkabari Bazar to Khagerhat	1.967	80.75	5.61	86.36
34		Coochbehar-I	WB06ADB22	L-045	Chilkirhat towards Saheberhat	2.59	96.60	7.361	103.961
35		Coochbehar-I	WB06ADB23	L-072	Maniganjerhat to Barobari Domukha	5.9	248.25	16.79	265.04
36		Coochbehar-I	WB06ADB24	L-053	Chilkirhat to Katerhat via Sannyasir ghat and Deurhat	2.522	82.59	6.78	115.34
37		Coochbehar-I	WB06ADB25	L-058	Basabari Chowpathi Nouerkura	2.483	89.06	6.67	95.73
38		Coochbehar-I	WB06ADB26	L-028	Pukurtala to Pakishala High School	3.464	111.12	8.8	119.92
39		Coochbehar-I	WB06ADB27	L-025	NH31 (Near Kathatala) to East Falimari Primary Schoo.	4.584	158.53	11.71	170.24
40		Coochbehar-I	WB06ADB28	L-054	Chikirhat Chandmari Road to Modakpara	3.336	111.01	8.64	119.65
41		Haldibari	WB06ADB29	L-031	Jakirhashin house to Dewanganj PWD Road	3.408	129.86	9.24	139.1
42		Haldibari	WB06ADB30	L-038	Sarika to Bhojalipara More	2.2888	82.24	6.14	88.38
43		Haldibari	WB06ADB31	L-022	Balurtari Sen Para Road	1.498	62.60	4.02	66.62
44		Haldibari	WB06ADB32	L-042	Kashi Bari Petrol Pump to Barer Danga	1.501	55.85	4.03	59.88
45		Mathabhanga-I	WB06ADB33	L-037	Bhaberhat to Khursamari	1.748	56.92	4.58	61.5

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
46		Mathabhanga-I	WB06ADB34	L-028	Bhanga more to Godaler Kuthi road	1.799	55.09	4.68	59.77
47		Mathabhanga-I	WB06ADB35	L-056	Baro Gopalpur to Kesharhat	2.107	72.13	5.64	77.77
48		Mekhliganj -I	WB06ADB36	L-026	Jamaldah P.W.D Roads Near Sutanga Bridge to Patchhara More	3.34	102.58	8.69	111.27
49		Mathabhanga-II	WB06ADB37	L-062	T-05/T-02 to Dwarlaxmipur	3.556	114.20	8.98	123.18
50		Mathabhanga-II	WB06ADB38	L-029	SH 12A to ChhatSitkibari	4.153	123.91	10.64	134.55
51		Mathabhanga-II	WB06ADB39	L-026	Ghoksadanga to Souder Bash	3.259	100.46	8.21	108.67
52		Mathabhanga-II	WB06ADB40	L-058	T-05/T-02 to Fulbari	2.44	76.96	6.36	83.32
53		Mekhliganj	WB06ADB41	L-047	Dhapra PWD Roads to SitaiBridge	2.422	84.83	6.51	91.34
54		Mathabhanga-II	WB06ADB42	L-041	SH 12A to kodaldhowa	6.388	194.74	16.48	211.22
55		Tufanganj-II	WB06ADB43	T09	Takoamari Atiamochor at Jalpaiguri Bordar at Bhanukumari More	11.411	368.55	27.66	396.21
56		Tufanganj-II	WB06ADB44	L-067	Tribal Road at Turkumarkuthi to Aryapara	1.136	36.79	2.81	39.6
57		Tufanganj-II	WB06ADB45	L-063	Langalgram at Chandinpat to Mansai Ward NO2	3.803	112.36	9.4	121.76
58		Tufanganj-II	WB06ADB46	L-062	Chandir tat Bazar Mansai Ward NO2	1.768	55.81	4.43	60.24
59		Haldibari	WB06ADB47	L-028	Gobardhan More to Firingidanga Anguldukha	3.909	171.24	10.51	181.75
60		Mathabhanga-I	WB06ADB48	L-024	Hazarahat Bazar to Uttar Dai Bhangi via Hazarhat-I G.P.	5.257	242.76	13.72	256.48

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
						116.3298	4118.55	307.873	4452.392
61	Darjeeling	Rangli Rangliot	WB07ADB06	L-038	Tista Valley to D.P. Site	3.915	254.06	10.68	264.74
62		Pual Bazar	WB07ADB07	L-021	Goke to Rangdu	4.104	267.66	11.94	279.6
63		Pual Bazar	WB07ADB08	L-029	Majeetar Road to Lamas via Badamtan	4.086	281.80	11.99	293.79
64		Pual Bazar	WB07ADB09	T-03	Pussimbing to TungSung TE	3.6	234.63	10.03	244.66
65		Kalimpong	WB07ADB10	L-042	Pala to Yak Primtom	5.613	348.82	15.52	364.34
						21.318	1386.97	60.16	1447.13
66	Hooghly	Khanakul-I	WB08ADB12	T-08	Radhaballavpur to Gourhati Market	6.196	334.33	17.09	351.42
67		Khanakul-II	WB08ADB13	L-028	Seepara to Janapara	1.322	70.44	3.62	74.06
68		Khanakul-II	WB08ADB14	L-31	Rajhati Dhanga Doulatchak Balpai	3.851	214.99	10.72	225.71
69		Khanakul-I	WB08ADB15	L-041	Krishnanagar to Raghunathpur Dispensary Centre	2.248	115.23	6.13	121.36
70		Khanakul-II	WB08ADB16	L-029	Hirapur to Rajhati	4.326	313.46	12.08	325.54
71		Khanakul-I	WB08ADB17	L-040	Panchui kana More to Jankari	4.19	269.22	11.68	280.9
72		Pursura	WB08ADB18	L-022	Jangalpara to Connection of S.H. to Road	2.782	176.18	7.7	183.88

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
73		Khanakul-II	WB08ADB19	L-021	Katasala Golia Football Ground to Mostafapur Primary School	3.861	268.66	10.92	279.58
						28.776	1762.51	79.94	1842.45
74	Jalpaiguri	Alipurduar-II	WB10ADB15	T-10	NH31at Mahakal Chowpathi to T-07 at Gadadhar Bridge	3.815	119.66	10.07	129.73
75		Matiali	WB10ADB17	T-07	T-03 at Purba Batabari to T-06 at Murti village	7.598	279.62	20.22	299.84
76		Maynaguri	WB10ADB18	L-029	T-09 at Tekatuli Paja Ddiner Bari at Sushthir hat	10.279	346.55	27.01	373.56
77		Alipurduar-I	WB10ADB19	L-025	T-08/T-07 at Kalabari Adhikari Adhikari Para	4.906	185.4	13.35	198.75
78		Dhupguri	WB10ADB20	L043	Tilat Talpara TG to Guruline at Debpara TG	5.536	158.92	14.35	173.27
79		Mal	WB10ADB21	L-036 & L-037	T-02 at Chowrangee to Maua Muri	5.803	202.45	15.62	218.07
						37.937	1292.6	100.62	1393.22
80	Malda	Chanchal-II	WB11ADB12	L-028	Kashimpur to Bijali	1.888	104.9	5.49	110.39
81		Chanchal-II	WB11ADB13	L-032	Gourhand to Chandipur-II	3.058	173.84	8.76	182.6
82		Chanchal-II	WB11ADB14	L-040	Malahar to Belungoon	0.814	47.48	2.34	49.82
83		Chanchal-II	WB11ADB15	L-047	Gourhand to Mehdumra	2.935	169.96	8.36	178.32
84		Harischandrapur-I	WB11ADB16	L-034	Bhaktipur to Dangi	1.82	103.5	5.32	108.82
85		Harischandrapur-I	WB11ADB17	L-038	Bhaktipur to Janamdal South	2.67	156.79	7.82	164.61
86		Harischandrapur-I	WB11ADB18	L-024	Uttar Saldah to Chayanpur	4.66	266.45	13.7	280.15

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
87		Chanchal-II	WB11ADB19	L-045	Dhusiban to Jalalpur South	6.04	333.42	17.21	350.63
88		Harischandrapur-I	WB11ADB20	L-037	Wari to Bahar	1.81	103	5.35	108.35
89		Harischandrapur-II	WB11ADB21	L-025	Mohria to Udaipur	2.97	155.91	8.69	164.6
90		Chanchal-II	WB11ADB22	L-038	Chandua to Kaliaganj	5.69	322.85	16.17	339.02
						34.355	1938.1	99.21	2037.31
91	Murshidabad	Beldanga-I	WB13ADB13	T-06	Maheshpur More to jalalpur Ferry Ghat	5.143	224.56	13.45	238.01
92		Bhagangola-I	WB13ADB14	T-05	Connection with SH-II to Dostina	9.457	368.36	24.73	393.09
93		Bharatpur-II	WB13ADB15	T08	Salar Kharer Road to Bharatpur Salar Road	8.371	10.15	22.62	32.77
94		Domkal	WB13ADB16	L-042	Jitpur More to Kashipur more	17.948	695.5	46.71	742.21
						22.971	1298.57	107.51	1406.08
95	Nadia	Ranaghat-I	WB14ADB10	T-01	Badkulla Pucca Road to Radhakantapur via Chandaha, Badkulla, Magurkhali, Baspur	12.15	483.01	32.46	515.47
96		Chapra	WB14ADB09	T-04	Amjhupi to Karsona	15.47	629.13	41.91	671.04
						27.62	1112.14	74.37	1186.51
97	Uttardinajpur	Karandighi	WB15ADB11	L-054	Naudubi to Mahata Bhatipara	1.897	94.64	5.44	100.08
98		Karandighi	WB15ADB12	L-024	MDR connection to Adibasipara	3.026	142.68	8.65	151.33
99		Karandighi	WB15ADB13	L-046	NH34 connection to Saliapur	7.553	321.91	21.37	343.28
100		Karandighi	WB15ADB14	L-065	Bhangipara to Kamatore	6.283	312	18.45	330.45

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total
101		Karandighi	WB15ADB15	L-033	NH-34 connection to Laipara Road	3.865	180.97	11.38	192.35
102		Karandighi	WB15ADB16	L-021	Connection of MDR to School	3.841	178.02	11.18	189.2
						26.465	1230.22	76.47	1306.69
103	Purulia	Arsha	WB16ADB10	T-07	Ghatbera More to Bamni with a link to Sitarampur Road	13.804	528.99	35.67	564.66
104		raghunathpur-II	WB16ADB11	T-03	NH Kulisara to Rangamati G.P. Office Road	7.845	287.06	20.14	307.2
						21.649	816.05	55.81	871.86
105	Siliguri M.P.	Phaushidewa	WB17ADB06	L-038	Chathat to Murkhawa	3.307	110.83	8.09	118.92
106		Phaushidewa	WB17ADB07	L-062	Hansqua More Gangarampur T.E. under Hetmuri Sighijora	4.826	176.89	12.9	189.79
107		Kharibari	WB17ADB08	L-045	Kharibari PWD Roads (T-07) to Goursingh &	1.646	67.96	2.75	70.71
		Matigara		& L-031	Patharghata Road (L-042) Rajpouri	1.071	40.83	4.46	45.29
						10.85	396.51	28.2	424.71
108	Dakhin Dinajpur	Balurghat	WB18ADB20	L-056	Sewai to Banjakuri	3.32	175.38	10.63	186.01
109		Gangarampur	WB18ADB21	L-081	Jhanjarar to mahendri	3.167	164.1	9.79	173.89
110		Kushmandi	WB18ADB22	L-021	Chandipur to Purbabasail	2.75	135.38	8.55	143.93
111		Tapan	WB18ADB23	L-040	Atila More to Atila	2.102	101.74	6.56	108.3
112		Tapan	WB18ADB24	L-075	Daudpur to Antasimul	2.881	146.82	9.01	155.83
113		Tapan	WB18ADB25	L-060	Salas to Jaminipara	7.028	340.7	21.14	361.84
						21.248	1064.12	65.68	1129.8
114	Paschim	Kharagpur	WB20ADB20	T-09	Sanjual to Paniseuli (T-04)	16.171	648.56	48.81	697.37

SI No.	District	Block	Package No.	Road Code	Name of Road	Road Length (in km)	Total cost in lakh	Maintenance cost in Lakhs	Total	
115	Midnapur	Garbela-II	WB20ADB21	T-15	Khapribhanga to Agurbandh (T-02)	14.6	667.63	45.06	712.69	
116		Garbela-II	WB20ADB22	T-14	Manikdipa to Jira Para	20.243	919.11	63.03	982.14	
117		Garbela-II	WB20ADB23	T-03	Talarbati to Guiyadaha Hospital (T-04)	11.306	496.09	35.3	531.39	
118		Sankrail	WB20ADB24	T-05	Baburbari to Naihati	9.777	457.09	30.81	487.9	
119		Sankrail	WB20ADB25	T-03	bakra to Khayrapoti	10.062	415.91	30.92	446.83	
120		Sabang	WB20ADB26	T-06	Chankuri to Manpara	5.314	279.82	15.3	295.12	
121		Sabang	WB20ADB27	L-053	Basantapur to Khorai	3.651	192.27	10.35	202.62	
122		Keshiary	WB20ADB28	T-02	Hategeria to Uriabara	19.195	817.03	59.18	876.21	
123		Pingla	WB20ADB29	T-06	Harkanri to Sangar	5.674	292.88	15.61	308.49	
124		Keshpur	WB20ADB30	T-06	Biswanathpur to Kharika (Part-II)	12.101	657.08	38.02	695.1	
125		Garbeta-I	WB20ADB31	T-012	Chakparbati to Moyrakati (T-01)	3.721	242.15	10.96	253.11	
							131.815	6085.62	403.35	6488.97

APPENDIX- 2

Environmental Management Action Plan for Pre-Construction and Construction Phases

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
A. Pre-construction Phase					
Finalization of alignment	<ul style="list-style-type: none"> The right of way (ROW) to be finalized to minimize social impacts, minimum acquisition of agricultural land, forest areas, avoidance of temples, burial grounds etc to the extent possible (Ref strip plans and design report) 	All through the alignment of each rural road	Pre Construction Phase	Part of Project Cost	Project Preparation Consultant- PIC
Land acquisition	<ul style="list-style-type: none"> Land acquisition (mostly donation), compensation packages, resettlement and rehabilitation, poverty alleviation programs for affected people and all other related issues are addressed in Social Impacts and Resettlement & Rehabilitation report 	All through the alignment of each rural road	Pre Construction Phase	Land to be made available by the state Government/ WBSRDA	PIU, Govt. of West Bengal, NGOs and other agencies recommended in RAP report Environmental officer under the PIC will also coordinate and ensure implementation
Setting out and clearing ROW	<ul style="list-style-type: none"> Trees' falling within ROW and other vegetative cover are to be removed except those, clearance on both sides of proposed median edge. Compensatory plantations within proposed vegetation strip of ROW to be undertaken by Forest Department on behalf of WBSRDA Re-plantation at rate of 3 for every tree removed is to be commenced just after disturbance due to construction is stopped and NOT after completion 	All through the Rural roads excepting in stretches of habitations	Pre Construction Phase	Necessary cost provisions has been made. All other costs are included under project	PIC, PIU, Forest Department NGOs shifting of utilities shall be carried out by respective governmental bodies at cost to be reimbursed by project, implementing

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>of project.</p> <ul style="list-style-type: none"> • The species shall be endemic and very similar to the trees, which have been removed unless they are inappropriate for valid reasons. • List of species for both roadside and median and may be finalized in consultation with Forest Department, Govt. of West Bengal • Small temples, shrines particularly those which are beneath trees & often are worship places are to be transplanted to adjacent areas outside ROW in close consultation with local community leaders. If required, the Department of Archeology, Govt. of West Bengal may be consulted to transplant such structures on cost basis and such services could be utilized if found warranted. • During ROW clearing operations, any treasure trove, slabs with epigraphical evidence or edicts, sculptural or any material are found and appear to have historical importance, it should be brought to the notice of Department of Archeology, Govt. of West Bengal. • All public utilities like power transmission cables, telephone cables, water/sewerage lines, drains, tube wells etc falling within ROW to be relocated to services corridor within ROW or outside as the case may. Public utilities will be generally shifted by respective agencies like electricity board, telecom dept., public health dept. etc and all such costs are to be reimbursed from project cost. 			cost.	<p>agency. Environmental officer under the PIC will coordinate and ensure implementation. To increase survival rate of new saplings, a core Tree Management Committee is to be created to ensure complete retrieval of vegetative cover and timely replacement of perished plantations. The TMC is to be represented by project implementation Unit (PIU) of WBSRDA, officials of Forest Department, Contractor and local NGOs and coordinated by Environmental officer of PIC for specific package.</p>
Forest Areas (In case	<ul style="list-style-type: none"> • In case, the road construction requires diversion of 	All through the	Pre	Necessary	Project Design

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
applicable)	<p>forest land for non forest uses i.e. project development, The extent of forest area to be diverted and other documentation as per the guidelines is to be submitted to Forest department for seeking forest clearances and costs for afforestation is to be deposited with Forest department. The costs to cover for maintenance and upkeep to plants for at least THREE years include replanting of perished ones. This situation is not likely in second annual batch of roads.</p> <ul style="list-style-type: none"> • As a compensatory measure, plantation is to be undertaken in degraded forests to the extent of TWICE the area to be diverted as per the norms stipulated by Government of India/State Government. • The compensatory afforestation shall be undertaken by West Bengal Forest Department in accordance with the provisions of State Forest Act and the guidelines from Ministry of Environment & Forests, Government of India. • Afforestation will be carried out in degraded forests as close as to forest area, which has been diverted. The selection of species, timing and extent and implementation schedule shall be decided by Forest department. • Through this, twice the extent of forestland diverted will be compensated by afforestation. More often compensatory afforestation is carried for diversion of forest areas, which is practically have no vegetative cover and thus development 	alignment of rural roads	construction phase	cost provisions has been made	<p>Consultant/PIU / TSC, Forest Department</p> <p>Environmental Officer under the PIC Supervision Consultancy package will coordinate and ensure implementation</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
Diversion of traffic	<p>projects also contribute to increase in green cover.</p> <ul style="list-style-type: none"> • Appropriate traffic diversion schemes shall be implemented so as to avoid inconvenience due to project operations to present road users, particularly during nighttime. • Proper diversion schemes will ensure smooth traffic flow minimizes accidents, traffic snarl ups, and commotion. • The diversion signs should be bold and clearly visible particularly at night. 	All through the alignment of rural roads (in specific stretches as per progress of construction work)	Construction Phase	Borne by Contractor	Diversion schemes shall be prepared by Contractor and approved by PIC/PIU/ TSC
Construction Camp Sites	<ul style="list-style-type: none"> • The construction campsites shall be away from any local human settlements and preferably located on lands, which are not productive barren/waste lands presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. This would minimize dependence of construction personnel on outside resources, presently being used by local populace and minimize undesirable social friction thereof. • The camps shall be located at a minimum 5 km from forest land/areas to deter the construction labor in trespassing. • The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. 	As determined by contractor under approval of PIC/PIU/ TSC	Pre construction & Construction Phase	Borne by contractor	<p>All facilities are to planned and implemented by contractor under approval by PIC/PIU/ TSC</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> • The construction camps shall have health care facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The construction camps shall have health care facilities for adults, pregnant women and children. • All construction personnel shall be subjected to routine vaccinations and other preventive/healthcare measures. • The construction camps shall have in house community/common entertainment facilities. Dependence of local entertainment outlets by construction camps should be discouraged /prohibited to the extent possible. 				
Haul roads	<ul style="list-style-type: none"> • Existing tracks / roads are to be used for hauling of materials to extent possible. • The alignment of haul roads (in case of new ones transportation link shall be finalized to avoid agricultural lands to the extent possible. In unavoidable circumstances, suitable compensation may be paid to people whose land will be temporarily acquired for the duration of operations. The compensation shall cover for loss of income 	As determined by contractor under approval of PIC / PIU/ TSC	Construction Phase	Borne by Contractor	The planning, design and construction/up gradation of existing roads to be used as haulage roads are responsibilities of contractor under approval of PIC / PIU

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>for the duration of acquisition and land restoration.</p> <ul style="list-style-type: none"> • Prior to construction of roads, topsoil shall be preserved or at least shall be used for any other useful purposes like using in turfing of embankment rather than allowing its loss by construction activities. • Water tankers with suitable sprinkling system are to be deployed along haul roads. Water may be sprinkled for at least 3 times per day all along the route to suppress the airborne dust due to the vehicular movement particularly on unpaved roads. • The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation. In any case, the transportation links are to be inspected at least twice daily to clear accidental spillage, if any. • The borrow and material dumping sites must be access controlled to keep away unauthorized entry of people, grazing cattle and any other stray animals. 				<p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p> <p>Environmental officer will coordinate with the villagers to ensure that their interests are protected and no social resentment sets in.</p>
Quarries	<ul style="list-style-type: none"> • Material, particularly aggregates shall be sourced only from licensed quarries. • A list of such quarries is available from Department of mines & Geology, Govt. of West Bengal • All such quarries shall have occupational safety procedures/practices in place and regular inspection shall be carried to ensure compliance. • Large material draws should not be a cause for neglect of safety procedures which is otherwise 	As determined by contractor under approval of PIC / PIU	Construction Phase	Borne by Contractor	<p>The selection of quarries and material selection will be the responsibility of contractor under approval of PIC /PIU/TSC</p> <p>Environmental officer and other team</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	common.				members of PIC will monitor and ensure appropriate implementation of mitigation actions.
Work sites	<ul style="list-style-type: none"> • All personnel in work sites shall have protective gears like helmets, boots etc. so that injuries to personnel are minimized. • Children and pregnant women shall not be allowed to work under any circumstances. • No personnel shall be allowed to work at site for more than 10 hours per day (8 hour makes one work shift). Personnel who are likely to exposed to noise levels beyond stipulated limits shall be provided with protective gears like ear plugs etc and regularly rotated. • Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum. 	As determined by contractor under approval of PIC /PIU	Construction Phase	Borne by Contractor	<p>All facilities are to planned and implemented by contractor under approval by PIC / PIU / TSC</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation.</p>
Construction Equipment Vehicles	<ul style="list-style-type: none"> • All equipment / vehicles deployed for construction activities shall be regularly maintained and not older than 5 years. • Vehicles/equipment shall be regularly subjected for emission tests and shall have valid POLLUTION UNDER CONTROL certificates. Revalidation of certificates shall be done once in a month. • All vehicles deployed for material movement shall be spill proof to the extent possible. • In any case all material movement routes shall be inspected daily twice to clear off any accidental spills. 	As determined by contractor under approval of PIC /PIU	Construction Phase	Borne by Contractor	<p>Contractor is responsible for ensuring provision of facilities under approval by PIC / PIU</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					<p>Environmental officer will regularly interact with the local people who are likely to be affected to ensure that their interests are protected and no social resentment sets in.</p>
<p>Water resources & Drainage channels</p>	<ul style="list-style-type: none"> • The rural road construction will also require construction of several cross drainage structures, minor and major bridges to facilitate development in accordance with design requirements and standards. • Most water bodies across roads are non-perennial and drain storm water only for few weeks during monsoon season. • Impacts arising out of construction of drainage structures is not likely to impact drainage pattern since under the road design, pattern of flow and discharge capacities of all drainage structures are reviewed and designed to negate any heading up or flooding problems. • Impacts on water quality are not significant or either negligible since construction activities to be scheduled to complete during dry months of year. • Adequate precaution is to be taken to prevent oil/lubricant/hydrocarbon contamination of channel beds. Spillage if any shall be immediately cleared 	<p>At all locations of CD structures along the rural roads</p>	<p>Construction Phase</p>	<p>To be borne by contractor</p>	<p>The planning, and construction / up gradation of existing/new cross drainage structures roads are responsibilities of contractor under approval by PIC /PIU/ TSC</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>with utmost caution to leave no traces.</p> <ul style="list-style-type: none"> Channel beds are to be cleaned up (50 m u/s & 50 m d/s sides of water courses) and restored to its previous state after completion of construction but prior to onset of monsoon. 				
Borrow areas	<ul style="list-style-type: none"> Borrow areas identified / suggested during project preparation are to be investigated for presence of ecologically sensitive areas if any and cleared thereof. Within these locations, the actual extent of area/zones to be excavated areas is to be demarcated with signboards. All such operational areas are to be access controlled particularly for locals and for grazing cattle. Through this project, the borrow areas / pits may be converted into surface / ponds wherever possible, as a derivative of development. Some of the ponds could serve as source of water for agriculture, a practice prevalent in West Bengal The top soil recovered from newly acquired land areas for road construction is preserved and used for turfing of embankment(s) As per the current regulations, use of fly ash is mandatory for all construction works within a radius of 100 km from any thermal power plant. Therefore, fly ash shall be used in all road construction works, which are within the 100 km from thermal power stations. A list of thermal power stations within West Bengal is given in Table 4.1 Section 4.0 of IEE. The Rural Road 	As determined by contractor under approval of PIC / PIU	Construction Phase	To be borne by Contractor	Sourcing of borrowing materials and all related activities like planning & deployment of the most optimum, number of vehicles without disregarding the existing users in case of existing linkages and construction / upgradation of existing / new haulage roads under approval by PIC /PIU. Environmental officer and other team members of PIC will monitor and ensure appropriate implementation

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>manual specifies design and construction procedures for construction of fly ash embankments.</p>				
Air Quality	<ul style="list-style-type: none"> All operational areas under the road construction works are to be regularly monitored (atleast ONCE in a season) for air quality parameters such as SPM, RPM, SO₂, NO_x, HC, CO etc. This will ensure identification of operations/areas of concern with regard to air pollution. Operational areas include, work sites, haulage roads, hot mix plants, quarries, borrow sites, human settlement etc. mitigation measures such water sprinkling for dust suppression, permitting construction equipment/vehicles having POLLUTION UNDER CONTROL certificates will reduce work area concentration of air pollutants like RPM, SO₂, NO_x, HC, CO etc. does not exceed permissible limits and therefore does not contribute to build up of pollutants 	All operational areas as determined by PIC /PIU	Construction phase	Necessary cost provisions have been made	Contractor is responsible for ensuring a healthy environment for all personnel irrespective of category under approval of PIC /PIU/TSC Environmental officer and other team members of PIC will monitor and ensure appropriate implementation Environmental officer shall requisition services of private / governmental agencies for undertaking periodic environmental monitoring if necessary to ensure compliance of contractor in this

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
Soil erosion and conservation	<ul style="list-style-type: none"> • Along rural roads the widening activities will raise, extend and enlarge existing roadway / tracks all along the alignment therefore mitigation measures to contain erosion and drainage problems are essential along ROW • Measures to ensure embankment stabilization including selection of less erodable material, good compaction, re-vegetation, placement of gabions or any suitable measures around bridges and culverts etc. (in case required) are included in technical specification and contract documents. The engineering measures for countering soil erosion, slope protection, drainage wherever required considered for project highway and detailed project report. • Many of impacts on soil due to road construction can be significantly mitigated by some of the following measures <ul style="list-style-type: none"> a) Minimizing area of ground clearance only to the extent required. b) Balancing the filling and cutting of earth to the extent possible. c) Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type. d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and NOT after construction has been completed. 	At all sections of road construction involving embankment section.	Construction phase	Forms part of project cost	<p>regard.</p> <p>Erosion Control/embankment protection measures in accordance with the DPR and/or as governed by local site conditions shall be prepared by contractor under approval of PIC /PIU</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation.</p> <p>Environmental officer may consult with the regional forest officers of Forest Department, Govt. of West Bengal in selecting endemic species, which also can serve engineering functions.</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
Archeological monuments/ruins/religious structures/temples	<ul style="list-style-type: none"> • Strict adherence of mitigative measures such as controlled movement of men and material particularly heavy vehicles/construction equipment, avoiding/minimizing activities which produce vibrations, use of vibration dampers ;if vibrations are unavoidable, prohibiting unauthorized movement of construction personnel / labour near ruins etc. are to be enforced to prevent any direct / indirect damage to temple environs due to project development. • All construction activities of rural roads are to be carried out with utmost care. In case any slabs with epigraphical evidence or edicts, sculptural, historical remains or any other materials pertaining to archeological / historical importance, Department of Archeology, Govt. of West Bengal should be immediately informed and all activities in and around such stretches site is cleared by Department of Archeology. • Any coins, artifacts or any other chance find will be notified by the contractor. The work will be stopped and instruction will be taken from archeological department. • Number of small temples / and idols falling within ROW are to be transplanted / relocated to suitable places acceptable to local community. Interactions with local community leaders are to be initiated well in advance and necessary measures required for relocation of structures to complete satisfaction of local community. Governmental agencies such 	All through the alignment of rural road	Pre construction and construction phase	To be borne by contractor	<p>Contractor is responsible for ensuring a noise/vibration free environment especially in such stretches. Appropriate measures as stipulated in DPR and / or governed by local site conditions are to be implemented by contractor under approval of PIC / PIU</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation.</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>as Department of Archeology, Government of West Bengal will also be contacted in case assistance required.</p>				
Hot Mix Plants	<ul style="list-style-type: none"> Hot mix plants shall be at least 500 m away from any human settlements and preferably located on leeward side. Hot mix plants / sites shall be located on barren / uncultivable lands. Diversion of cultivable/agricultural lands, even preferred by local people for economic gain shall not be allowed unless otherwise warranted by specific local conditions. 	As determined by contractor under approval of PIC /PIU	Construction phase	To be borne by contractor	<p>Contractor is responsible for ensuring a healthy and hazard free environment for all personnel irrespective of category and also for communities in and around operational areas under approval of PIC /PIU. Environmental officer and other team members of PIC will monitor and ensure appropriate implementation. Environmental officer shall requisition services of private /Governmental agencies for undertaking periodic environmental monitoring if</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					necessary to ensure compliance of contractor in this regard.
Loss of Fertile soil	<ul style="list-style-type: none"> • Clearing operations within ROW and at all places of operational areas like borrow areas, work areas, labour camps, construction of new/ up gradation of existing to new haulage roads, hot mix plants, storage areas etc. shall consider preservation of fertile soil. • As a first option, topsoil should be restored to its initial place after the specific activity is completed for which the area was vacated, or for enriching some other place like embankment slopes for turfing/erosion protective measure. The topsoil can also be used for supporting re-plantation activities within ROW/median. 	All through the ROW of roads and at Borrow areas	Pre construction and construction phase	To be borne by contractor	Contractor is responsible for ensuring a proper utilization of fertile soil under approval of PIC /PIU Environmental officer shall requisition services of private / governmental agencies for undertaking periodic monitoring if necessary to ensure compliance of contractor in this regard.
Accidental risks from blasting along road way and in quarries	<ul style="list-style-type: none"> • All hazardous operations like blasting, deep excavations shall be access controlled for nearby local people/onlookers. • Adequate caution regarding blasting shall be notified for people living by if any well in advance. • The blasting operations if required shall be carried out in lean traffic hours with adequate precautionary signs for existing traffic particularly for slow moving traffic to prevent any accidents / 	All selected stretches of alignment / ROW where rocks are encountered, (anticipated rarely)	Construction phase	Forms part of project cost To be borne by contractor	Contractor is responsible for ensuring a occupationally healthy and hazard free environment for all personnel irrespective of category and also for

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	injuries due to operations.				communities in and around all operational areas under approval of PIC /PIU Environmental officer and other team members of PIU will monitor and ensure appropriate implementation
Location of campsites, storage depots	<ul style="list-style-type: none"> • The location of campsites, storage depots shall preferably on unproductive/barren lands, away from forest areas (minimum 1.5 km). • Use of agricultural/ cultivable lands shall not be allowed under any circumstances. • All fuel loading, unloading, storage areas shall be spill proof, leakage proof and carried out on paved areas. • The sites shall have suitable system to drain storm water, sanitary facilities and shall not contaminate any near by water courses / drains. • The site shall also have a system for handling any emergency situation like fire, explosion etc. 	As determined by contractor under approval of PIC /PIU	Construction Phase	To be borne by Contractor	Contractor is responsible for ensuring suggested actions under approval of PIIC/ PIU Environmental Officer and other team members of PIC will monitor and ensure appropriate implementation
Storage of hazardous materials	<ul style="list-style-type: none"> • All areas intended for storage of hazardous materials shall be quarantined and provided with adequate facilities to combat emergency situations. • The personnel in charge of such areas shall be properly trained, licensed and with sufficient experience. 	As determined by contractor under approval of PIC /PIU	Construction Phase	To be borne by Contractor	Contractor is responsible for ensuring a occupationally healthy and hazard free environment for all personnel

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> The areas shall be access controlled and entry shall be allowed only under authorization. 				irrespective of category and also for communities in and around all operational areas under approval of PIC /PIU

APPENDIX 3

Environmental Monitoring Control Matrix – Construction Phase

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Appendix 2)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
1	Setting out and clearing ROW	Archeological evidence / idols / tombs if noticed /found –inform Archeological Department	✓			
2	Relocation of Utilities	Ensure complete restoration without impacting existing users	✓			
3	Traffic Diversions & Sign Boards	Diversions to be smooth sign boards in place, clear & bold particularly in night & cause least inconvenience to road users	✓			
4	Borrow Areas	Seek prior approval from local environmental regulatory agencies and compliance at all stages of operations. After borrowing ensure re-vegetation, drainage, erosion protection as per EMAP	✓		✓	
5	Quarries	Compliance of local environmental regulations in project specific quarries and at all stages of operations		✓		
6	Haul roads	Avoid agricultural lands, finalization of compensation for land owners, regular inspection to check inconvenience to locals, spillage, dust levels /watering frequency, noise level. Restoration after ;operations with wearing course and handing over road to local community	✓			
7	Work sites	Comply with local Environmental regulations for air quality (water sprinkling), noise, occupational hazard & safety procedures at all stages work	✓			
8	Ground water level in and around construction tube wells	Bore wells shall be away form human settlements determine sustainable yield restrict withdrawal of water within yield recommended for region. Monitor depth of water below ground level in wells in and around construction tube wells before start and after completion of water withdrawal for the day		✓		
9	Construction Equipment / Vehicles	Ensure vehicles are regularly maintained have pollution under control certificates revalidated every month			✓	✓
10	Air quality at all operational areas under project	Record SPM, RPM, CO, HC, Nox, SO ₂ levels for 24 hourly in 8 hr. shifts as per methods / procedures recommended by CPCB/SPCB			✓	✓
11	Noise at all operational areas	Record noise levels at every 5 minutes for 24 hours (both day time & night time)			✓	
12	Vibration near temples,	Restricted movement of work force, equipment and activities. Also record	✓	✓		

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Appendix 2)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
	Mosque & any other similar religious structure	vibration levels during a typical working shift from a specialized agency before the start, during and after completion of operations				
13	Top soil from land clearing operations	Preserve and restore the topsoil. If can not be used for restoration, divert for other applications like re-vegetation, embankment turving and alike	As and when the situation arises			
14	Hot Mix Plants	Located at least 500 m from settlements, barren land and not agricultural lands. Monitor air quality, waste discharge and noise levels regularly as mentioned under Sl. No. 10, 11 above. Ensure all operations comply with local environmental regulations	✓	✓		
15	POL (liquid and solid waste) / Hazardous Storage Areas	POL storage areas have impervious lining, containment ditches, oil & grease traps as per EMAP. Regular inspection & maintenance. Comply all local environmental regulations	✓	✓		
16	Soil erosion and conservation	Borrow areas shall have gentle slopes connected to near by natural water bodies, re-vegetated		✓		
17	Channel / River beds	Ensure most activities are scheduled for dry months reshaping of channel bed after completion of construction		✓		
18	Archeological monuments /ruins / religious structures / temples	Archeological evidence / idols /tombs if noticed / found-inform Archeological Department. Temples within ROW are relocated in consultation with community leaders. Coordinate with Social team.	As and when the situation arises			
19	Water Supply Sanitation & Health at camp sites	Adequate water supply as per norms septic tanks and soak away pits. Kerosene and LPG supply, health care facilities vaccination for work force camps		✓		
20	Construction of Noise Barriers	Consult affected parties like hospitals, educational institutions for eliciting opinion during constructing barriers	As and when the situation arises			

APPENDIX - 4

Persons/PRI's Consulted During Field Visit

District	Name	Designation	
Paschim Medinipur	A.Basu Roy	EE/PIU	
	Tarun Chakroborty	EE/APIU	
	Kamal Saha	Sahakari Savapati, Garbeta III Panchyat Samiti	
	Lipika Banik	Member, Zilla Parisad	
	Swapan Banik	Ex-Sabhapati Zilla Parisad	
	Ramphal	Local Representative	
	Sanjoy Paul	Local Representative	
	N.S.Nigam	District Magistrate	
	D.S.Mahapatro	A.E.O. Zilla Parishad	
	Antara Bhattcharya	President Zilla Parisad	
	S.Mohapatra	Karmadkshya Purto Zilla Parisad	
	Prem Chand Naik	President/PRI	
	Gopal Chandra Mondal	Head Master/Nripendranath Institute	
	Debabbrata Mohapatra	Member/PRI	
	Balai Ghosh	Member/PRI	
	Ms.Phalguni Mal	Member/PRI	
	Sekh Ali Hussain	Secretary/Village Development Council	
	Dulal Chandra Seth	Member/Village Development Council	
	Sudhir Kumar Pramanik	Member/Village Development Council	
	Ushman Ali Khan	VAP(Vulnerable Affected Persons)	
	Sekh Kali Hussain	VAP(Vulnerable Affected Persons)	
	Purba medinipur	Asit Bhowmick	Executive Enginner, Zilla Praisad
		Janath pahari	President/PRI
Badal Jana		Dy.President/PRI	
Hemanta pati		Purta karmadhakshya	
Lakhikanta Das Mohapatra		Sri Pur Bazar Unnayan Committee	
Tapan Kumar Das		Former Member/PRI's	
Ram Chandra Achrya		Kapasiya Unnayan Committee	
Purna Chandra Das		Secretary/ Kapasiya Unnayan Committee	
Avanti Kumar Mishra		Member/Sri Pur Bazar Unnayan Committee	
Kedar Chandra		Member/Sri Pur Bazar Unnayan Committee	
Bimal Chandra Jana		Member/Kapasiya Unnayan Committee	
Ashok Kumar Das		Sri Pur Samabay Krishi Unnayan Samiti	
Naba kumar Kar		Secretary/ Sri Pur Samabay Krishi Unnayan Samiti	
Bimal Das		Member/Sri Pur Bazar Unnayan Committee	
Rabindranath maiti		Member/Sri Pur Bazar Unnayan Committee	
Tapas Kumar Pati		Member/Sri Pur Bazar Unnayan Committee	
Pushpendu Maiti		Member/Youth Club	
Burdwan	Rama Charan Choudhary	AE/ PIU/Burdwan	
	Nisit Konar	SAE/ PIU/Burdwan	
	Santanu Dutta	SAE/ PIU/Burdwan	
	Monidip Sen	AE/ PIU/Burdwan	
	Dhurba Banerjee	SAE/ PIU/Burdwan	
	Falguni Banerjee	Karmadakhwa Purta/Zilla Parisad	
	Nabakumar Ghosh	Land Manager	
	Prasantha Mondal	President/PRI	
	Pradeep Mondal	Member/PRI	
	Asraf Ali	Member/PRI	
	Gulam Mustafa	Member/PRI	
Ananya Ghosh	Member/PRI		

	Hriday Garai	Member/PRI
	Sanjay Majhi	Villager
	Sekh.Matiur	Villager
	Giyas Moulla	Villager
	Azmal Sekh	Villager
	Sekh.Hayat	Villager
	Sekh.Mustafa	Villager
	Salan Sekh	Villager
	Siddashwar Roy	Teacher
	Chandan Ghosh	Villager
	Sekh.Sabir Ali	Villager
South 24 Pargana	Pradip Halder	SAE/PIU
	Krishna Bandhyopadhya	President/PRI
	Dhurva Kumar Mondal	Member/PRI
	Ujjal Chatterjee	Member/Beneficiary Committee
	Naresh Halder	Villager
	Sandhya Mondal	Villager(Women)
	Krishna Das	Villager(Women)
	Sushil Dewan	Villager
	Banamali Sardar	Villager
	Hafiz Ali	Villager
	Shantibrata Paul	Villager
	Gadadhar panda	Teacher
	Subumal Maiti	Villager
	Asaf Ali Mallick	Villager
North 24 Pargana	Bijoy Lal Sikdar	Land manager/PIU
	Rekha Sardar	Begumpur panchyats Pradhan
	Amar mondal	Begumpur panchyats Deputy Pradhan
	Purabi Mondal	Samiti karmadksha/Barupur panchyats Samiti
	Somnath Bhattayacharya	Member
	Paresh Chandra Mondal	Sahasabadhipati/Baraupur panchyat Samiti
	Ujjal Chatterjee	Member/Beneficiary Committee
	Samsundar Chakroborty	Member
	Ajay Maiti	Member
	Sibnath Naskar	Karmadhaksha Purto
	Subhra Mondal	President
	Arati Sarkar	Pradhan Chandipur G.P
	Bipul Roy	UP Pradhan Chandipur G.P
	Sanjiv Mondal	Member Chandipur G.P
	Abdul Mazid Mondal	Member Chandipur G.P
	Jakir Hussain	Member Chandipur G.P
	Abdul Rahaman	Member/ Chadipur G.P
	Indrani Chakroborty	Member/ Chadipur G.P
	Abdul Hamid	Member/ Chadipur G.P
	Nita Biswas	Member/ Chadipur G.P
	Purnima Das	Member/ Chadipur G.P
	Gopal Ballav	Member/ Chadipur G.P
	Susanta Sarkar	Pradhan/Jashi Khati At Ghara GP
	Golam Nabi Molla	Member/Jashi Khati At Ghara GP
	Ramprasad Mondal	Member/Jashi Khati At Ghara GP
	Subrata Banerjee	Representative
	Abdul latif	Teacher
	Md.Murtuza	VAP
	Gopal Das	VAP
	Abdul Salam	AP

	Din Uddin Mondal	AP
	Md.Ali	AP
	Anima Sen	Head/SHG
	Ansal Ali	Ex-Member
	Indranil Basu	BDO/Dey Ganga Block
	Bijoy Lal Sikdar	Land manager/PIU
	Ratna Roychoudhary	Member Zilla Parisad
	Pampa Dutta	President/Panchyats Samiti
	Munawar Bibi	Member/PRI
	Sharifa Khatun	Member/PRI
Nadia	Mr.Kartik	SAE/ PIU
	Safali Biswas	President Barasat GP
	Lakshmi Rani Poddar	President Krishma G.P
	Asim Biswas	Dy.President Krishma G.P
	Shambhu Biswas	Member/Bandkulla GP
	Ananta Halder	Member/Bandkulla GP
	Rita Singh	Member/Bandkulla GP
	Pankaj Biswas	Member/Bandkulla GP
	Sailen Joaider	Member/Bandkulla GP
	Bhubwan Biswas	Member/Bandkulla GP
	Safikul Islam Biswas	Member/Bandkulla GP
Dakshin Dinajpur	Anisur Rehaman	President Tapan Panchyat Samiti
	Bimal Tarafdar	Former President Tapan Panchyat Samiti
	Nirodh Das	Pradhan
	M.C. Burman	President/Ajmadpur G.P
	Haripada Das	Former President/Ajmadpur G.P
	Sujit Kumar pattadar	Joint BDO
	S.Das	Executive Engineer/PIU/WBSRDA
	P.K.Mitra	Asst.Engineer/PIU/WBSRDA
	P.Dasgupta	Asst.Engineer/PIU/WBSRDA
	S.Das	Asst.Engineer/PIU/WBSRDA
	B.Biswas	Sub.Asst.Engineer/PIU/WBSRDA
	Sushil Barman	VAP
	Kalpana Barman	VAP
	Uma Charan Burman	VAP
	Bharti Burman	VAP
Maldah	P.K.Das	Asst.Engineer/PIU/WBSRDA
	D.Dutta	Sub.Asst.Engineer/PIU/WBSRDA
	Ganapati Soren	President/Gourhand G.P
	Ranjit Paul	Executive Assistant/Gourhand G.P
	Ram Ballav Roy	Executive Assistant/Gourhand G.P
	Sahajahan Alam	Member/Panchyat Samiti
	B.Sarkar	Member/ Panchyat Samiti