

Environmental Assessment Report

Summary Initial Environmental Examination (West Bengal)
Project Number: 37066
May 2008

India: Rural Roads Sector II Investment Program (Project 3)

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

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RURAL ROADS SECTOR II INVESTMENT PROGRAMME

WEST BENGAL, INDIA

(ADB LOAN NO. 2248-IND)

INITIAL ENVIRONMENTAL EXAMINATION REPORT

BATCH II ROADS



MAY 2008

TECHNICAL SUPPORT CONSULTANTS

OPERATIONS RESEARCH GROUP PVT. LTD

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SECTION 1: INTRODUCTION

1.1 GENERAL BACKGROUND

The GOI is currently implementing the PMGSY Program in many states of India through the Ministry of Rural Development (MORD). NRRDA is a part of MORD. The objective of the PMGSY is to provide all-weather road connectivity to all rural habitations with a population of more than 1000 by 2004 and habitations with more than 500 populations by 2007. 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 Project –II (RRSP II) to support the national rural roads program known as *Pradhan Mantri Gram Sadak Yojna* (PMGSY) in Assam, West Bengal and Orissa states. The ADB's loan assistance will be implemented in four batches. First batch consisted of 3,000 km rural roads (about 1000 km in each state) and was prepared under ADB's Technical Assistance. The construction work of first batch is nearing complete and for the second batch state Governments are in the process of award of contract.

The Detailed Project Reports (DPRs) for second batch, which cover 109 roads for total 908.91 have been prepared by the state Government. The second 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 second 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 roads of the second batch was prepared by the DPR's consultant and was reviewed by the PIC.

This IEE report covers: (i) the summary of all 109 environmental checklist of the roads covered by the second batch, and (ii) additional information from verification of the environmental checklist. The report has been prepared by M/s Operations Research Group (P) Ltd., The Technical Support Consultants (TSC) appointed by National Rural Road Development Agency (NRRDA) as the Executing Agency of the Rural Road Projects.

1.2 PROJECT IDENTIFICATION AND LOCATION

The West Bengal has selected about 908.091 km of rural roads to be taken up under the second batch of ADB loan assistance under RRSP II in West Bengal. The 908.091 km of roads comprises 109 different stretches spread over in 19 districts of the State. Within each district, the roads are further scattered in

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

several blocks and sub divisions. The minimum and maximum length of the roads ranges between 1.9 and 20.84 km respectively. The list of 908.091 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 10-12 m right of way (ROW), which includes side slopes for embankment, side drains on either side of the alignment.

The construction proposals are confined to the existing alignment of the unpaved tracks. Majority of these are foot/pathways 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

Based on the environmental checklist of each road, TSC carried out random checking in the field for 148 km from different stretches / locations in all district covered by the second batch in June - September, 2007.

1.4.3 Secondary Data Collection

Upon the completion of field appraisal, 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.

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 some of the selected stretches of the rural road construction proposals. 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 second batch (Batch II) of 908.091 km of rural roads in West Bengal and is based on the environmental checklists prepared for the sub projects by the PIUs. The IEE has been carried out in accordance with the Bank's Environmental Assessment Guidelines, 2005.

ACKNOWLEDGEMENT

The TSC consultants gratefully acknowledge the support received from Shri T K Majumdar, Joint Secretary, Government of West Bengal, Mr. Gour Chattopadhyaya, Advisor, WBSRDA, Mr. D. Chakraborty, Executive Engineer, WBSRDA and Mrs. S. Chanda, Asst. Engineer for their cooperation. The TSC consultant also acknowledge the support of Mr. Hideaki Iwasaki, ADB Mission-Team Leader and Ms Dewi N Uttami, Senior Environment Specialist, South Asia region for their constant guidance, encouragement and critical examination of the environmental issues and guidance in preparing this report.

The assistance received from the PIUs of the WBSRDA during site visits and other governmental agencies during the data collection and useful interaction is also gratefully acknowledged.

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 by year 2007. 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 WBN 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 Second 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 ADSB'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 LOCATION AND SELECTION CRITERIA OF ROADS FOR IEE

The second batch of **908.091 km** of rural roads is spread over **19** districts. The district wise distribution of the 908.091 km roads is given in **Table 2.1**.

Table 2.1: District wise Distribution of Rural Roads under Batch II

Sr. No.	Name of the District	No. of Packages	No. of Roads	Length (km)	Length in km	
					Minimum	Maximum
1	North 24 Parganas	6	6	66.937	4.440	18.750
2	South 24 Parganas	2	2	25.635	11.450	14.180
3	Bankura	9	9	90.227	2.685	17.483
4	Birbhum	5	5	52.772	8.404	13.198
5	Burdwan	3	3	29.550	5.800	16.600
6	Coochbehar	8	11	45.333	2.100	7.500
7	Darjeeling	4	4	38.35	3.500	12.800
8	Hooghly	7	7	66.180	5.440	17.920
9	Howrah	3	3	21.250	3.500	12.000
10	Jalpaiguri	6	6	66.653	6.391	15.988
11	Malda	4	4	38.350	7.700	13.000
12	Murshidabad	6	6	61.778	7.800	14.364
13	Nadia	2	2	32.271	11.430	20.841
14	Uttar Dinajpur	5	5	35.069	5.565	8.020
15	Purulia	5	5	51.950	5.250	15.950
16	Siliguri MP	3	3	10.030	2.415	4.165
17	Dakshin Dinajpur	14	14	53.690	2.100	5.590
18	Purba Medinipur	6	6	44.115	5.080	11.791
19	Pashim Medinipur	8	8	77.951	4.000	13.655
Total/ Overall		106	109	908.091	2.10	20.841

The list of sample roads visited is given in **Table 2.2**.

Based on the environmental criteria, the selection of the districts (project districts) representing entire state were first made and further selection of individual roads within a district were made through consultations with the PIU of WBSRDA at district level. The list of the sample roads of 148.85 km at 15 different stretches / locations, which broadly represent the batch – II road of 908 km and 106 packages, is given in **Table 2.2**. The list of 908.091 km roads is given in **Appendix 1**. The environmental criteria for selection of project districts leading to selection of 148.85 km sample rural roads for IEE within these districts are given in **Table 2.3**. The environmental (landuse features) of the state, which formed a basis for selection of districts is given in **Figure 2.1**. 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: List of Selected Roads for Initial Environmental Examination in West Bengal

District	Block	Road Name (code)	Package	Length of Road (km)
Nadia	Haringhata	Chandirampur to Sukundipur	WB14 ADB08	20.84
Malda	English Bazar	Mominpara to Jote Prithi	WB11 ADB08	8.50
Uttar Dinazpur	Raiganj	MDR connection to Barabar	WB15 ADB02	5.92

District	Block	Road Name (code)	Package	Length of Road (km)
Cooch behar	Sitalkuchi	Khutamara Bridge to Godakuta Jambari at Sitalkuchi PS	WB06 ADB07	4.5
Jalpaiguri	Dhupguri	Uttar Gosair Hat to Paschim Salbari	WB10 ADB11	15.9
Birbhum	Santhia	Sangra to Rongaipur	WB04 ADB08	13.198
Hooghly	Goghat – I	Bali to Nakunda	WB08 ADB07	7.37
South 24 Pargana	Baruipur	Moutala to Uttarbhag via Joytala	WB02 ADB07	14.18
North 24 Pargana	Baduria	Chandipur G.P to Adharmanik Barujeykata	WB01 ADB11	7.92
Murshidabad	Sagardighi	Balia to Amritpur	WB 13 ADB07	7.80
Burdwan	Jamalpur	Karalaghat to Krishnarampur	WB05 ADB09	5.8
Bankura	Patrasayar	Dhagoria to Uttarpataashpur	WB03 ADB05	3.9
Purulia	Barabazar	Hullung Kadampur to Bodoldih Road	WB16 ADB05	15.95
Paschim Medinipur	Kespur	Sakhisole to Anandapur	WB20 ADB17	12.0
Purba Medinipur	Mahisadal	Mahisadal Raj College to Kanchanpur Jalpai	WB19 ADB11	5.08
		15 Roads	15 Packages	148.858

Table 2.3 Environmental Criteria for Selection of District and Sample Rural Roads - West Bengal

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

2.5 SIZE OR MAGNITUDE OF OPERATION

The construction cost of rural roads under the second annual batch of **908 km** is broadly estimated at Indian Rupees **3492.7 million (Package wise in Appendix 1)**.

2.6 SCHEDULE FOR IMPLEMENTATION

The 908 km rural road construction works are scheduled to commence from May 2008 and expected to be complete by end of 2008.

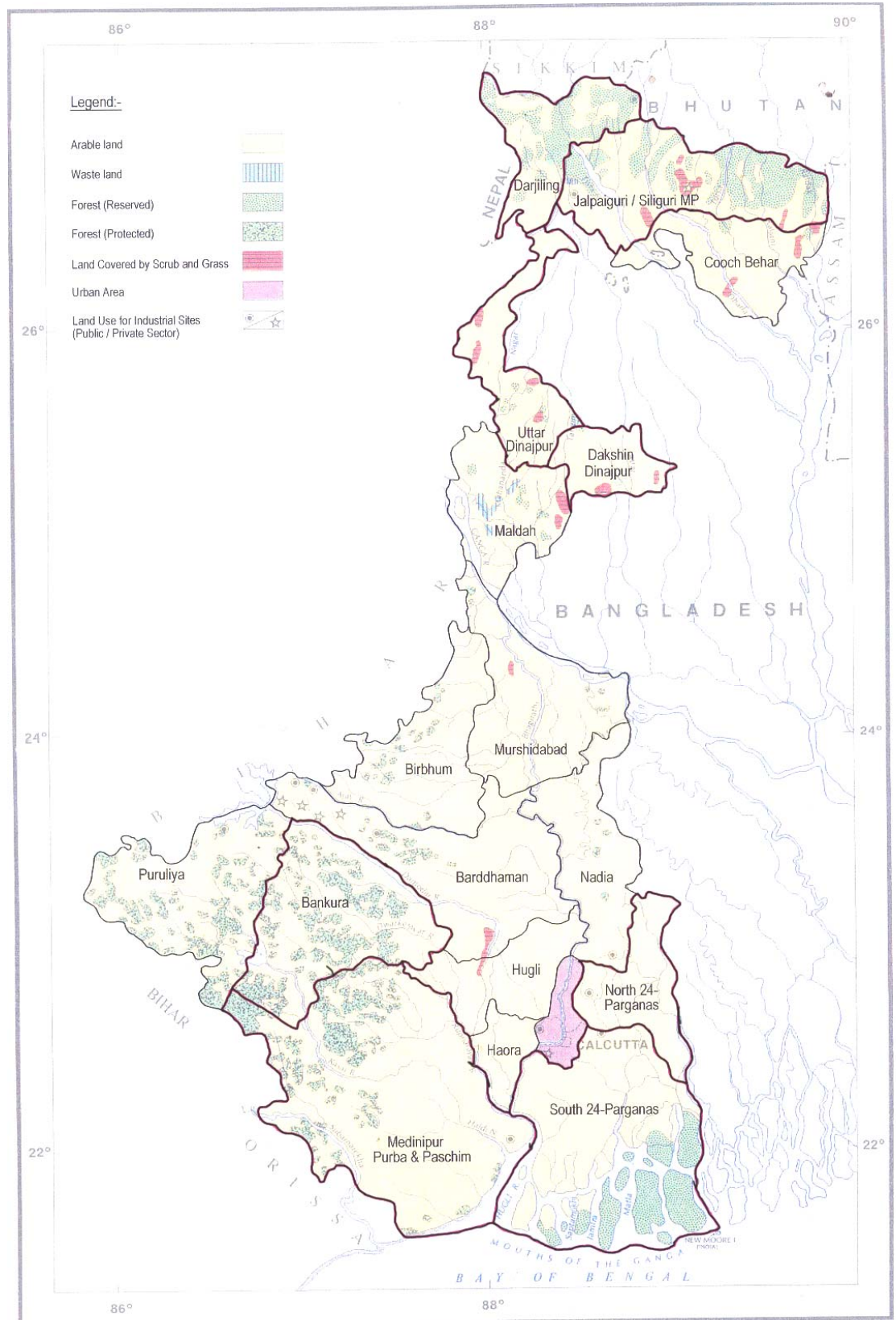


Fig No. - 2.1 Environmental Features of Project Districts - West Bengal

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 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 2.2** 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 rural habitations to be covered under PMGSY are connected to the nearest paved road network through unpaved tracks. Generally, these are the traditional village pathways that have transformed into the present tracks or unpaved roads through minor construction work undertaken over the decades under various programs by the local bodies and State Governments. The tracks are not all weather roads have corrugations at several stretches but vehicular traffic like farm tractors, light commercial vehicles still do ply on these tracks in dry seasons.

The present environmental condition of the sample roads from the environmental impact checklist prepared by PIUs is summarized in **Table-2.4** and summary of field observation shown in **Table 2.5**

Table 2.4: Summary of Environmental Condition of Sample Roads

Environmental impact checklist points	Status as reported in the Checklists
A. Climate Conditions	
Temperature (°C)	
High	Maximum 45°C
Low	Minimum 9°C
Humidity (%)	
High	Maximum 92%
Low	Minimum 25%
Rainfall (mm/year)	1000 mm to 2400 mm
Rainy Season (---month to ---month)	June to October
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, Jalpaiguri districts have partial or more hilly roads
Forest area	One road at Pashim Medinipur district passes through forest area

Environmental impact checklist points	Status as reported in the Checklists
Lake/Swamp	None of the roads having Lake/Swamp
Inhabited area	North and South 24 pgs, Hooghly, Malda, Nadia, Jalpaiguri, Coochbehar, Bankura, Burdwan, Murshidabad roads having inhabited area
Agricultural land	Burdwan, North and South 24-pgs, Purulia, Coochbehar, Birbhum, Nadia, Coochbehar roads having side by agriculture land area
Barren land	Purulia, Bankurara, Pashim Medinipur roads having side by barren land
Flat area	Burdwan, North and south 24 – paganas, Jalpaiguri, Coochbehar, Birbhum 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?	Malda, Nadia, Birbhum, North 24- parganas roads are prone to flooding problems
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.
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 on historical/cultural areas.
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?	None (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)
Noise and vibration due to blasting and other civil works?	None (mitigation measures are proposed)

Environmental impact checklist points	Status as reported in the Checklists
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?	None (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)	None

Table 2.5: Salient Environmental Features: Batch II Road

District	Block	Road Name	Package (Road length in km)	Salient Environmental features
Nadia	Haringhata	Chandirampur to Sukundipur	WB14 ADB08 (20.84)	<ul style="list-style-type: none"> Continuous water body like <i>bill</i> located at 16.2 km chainage to 17.15 km chainage and also at 18.45 km chainage Drainage provision should be considered near habitation Few tree felling necessary- villagers agreed voluntarily
Malda	English Bazar	Mominpara to Jote Prithi	WB11 ADB08 (8.50)	<ul style="list-style-type: none"> Flood prone area Road passes through canal side Mango orchard, bamboo bush to be cut down – villagers agreed Borrow pit available
Uttar Dinazpur	Raiganj	MDR connection to Barabar	WB15 ADB02 (5.92)	<ul style="list-style-type: none"> Few tree felling necessary- villagers agreed voluntarily CD structure required as per field condition Borrow area available Few ponds located along the present alignment- protection work

District	Block	Road Name	Package (Road length in km)	Salient Environmental features
				necessary
Cooch behar	Sitalkuchi	Khutamara Bridge to Godakuta Jambari at Sitalkuchi PS	WB06 ADB07 (4.5)	<ul style="list-style-type: none"> Few tree felling necessary- villagers agreed voluntarily Vast agricultural land (use for cultivation of Jute, Tobacco) located on both side of the road
Jalpaiguri	Dhupguri	Uttar Gosair Hat to Paschim Salbari	WB10 ADB11 (15.89)	<ul style="list-style-type: none"> Few tree felling necessary- villagers agreed voluntarily Protection work including embankment stabilization necessary
Birbhum	Santhia	Sangra Rongaiapur to	WB04 ADB08 (13.20)	<ul style="list-style-type: none"> Few tree felling necessary- villagers agreed voluntarily Protection work- drum sheet wall necessary near pond Vast agricultural land (produce vegetable, Paddy) located on both side of the road Borrow area available during non-agricultural period (Nov-Dec)
Hooghly	Goghat – I	Bali to Nakunda	WB08 ADB07 (7.37)	<ul style="list-style-type: none"> Highly flood prone area Vast agricultural land (produce Pumpkin, Potato, Paddy) located on both side of the road Constrain in availability of borrow area due to continuous agricultural production
South Pargana 24	Baruipur	Moutala to Uttarbhag via Joytala	WB02 ADB07 (14.19)	<ul style="list-style-type: none"> With anticipation of start of work villagers already cut trees Borrow area available Water pipeline and utility shifting will be required Seed already procured from forest department for post project plantation Camp site available Labour force available at site Drainage provision and protection work as per DPR
North Pargana 24	Baduria	Chandipur G.P to Adharmanik Barujeykata	WB01 ADB11 (7.92)	<ul style="list-style-type: none"> For side protection U.C ballaha is considered With anticipation of start of work villagers already cut trees Few big natural trees exist Some places borrow area available
Murshidabad	Sagardighi	Balia to Amritpur	WB 13 ADB07 (7.8)	<ul style="list-style-type: none"> Bhagirathi river very near to road alignment For protection work UC ballaha

District	Block	Road Name	Package (Road length in km)	Salient Environmental features
				<ul style="list-style-type: none"> considered instead of stone pitching – stability of the protection work should be consider • Drainage provision as per DPR • Few road side trees to be felled
Burdwan	Jamalpur	Karalaghat to Krishnarampur	WB05 ADB09 (5.8)	<ul style="list-style-type: none"> • River Damodar within 25m of the road alignment • Few road side trees and bamboo <i>jhar</i> felling will be required - villagers agreed voluntarily • Borrow area not available • Drainage considered as per DPR
Bankura	Patrasayar	Dhagoria to Uttarpatashpur	WB03 ADB05 (3.9)	<ul style="list-style-type: none"> • Number of road side trees and bamboo <i>jhar</i> • Few tree felling necessary- villagers agreed voluntarily • Open area, agricultural land exist along road • Borrow area available – villagers agreed to provide borrow soil • Pond very close to road- protection work considered • Drain already exist at residential area
Purulia	Barabazar	Hullung Kadampur to Bodoldih Road	WB16 ADB05 (15.95)	<ul style="list-style-type: none"> • Existence of natural drain along the road • Trees are present – felling of trees unavoidable • Village residence close to the road • Agricultural land exist • Protective work consider
Paschim (West) Medinipur	Kespur	Sakhisole to Anandapur	WB20 ADB17 (12.0)	<ul style="list-style-type: none"> • Forest land located 2.5 km stretch of the road • Alignment available no impact on forest trees • Meeting has been done with forest department • Few road side tree felling unavoidable • Guard wall consider in DPR • Borrow area available along the road
Purba (East) Medinipur	Mahisadal	Mahisadal Raj College to Kanchanpur Jalpai	WB19 ADB11 (5.08)	<ul style="list-style-type: none"> • At one side of road irrigation canal exist • Number of trees located along the proposed road – tree felling will be required • Road embankment is high • High level difference between NH-41 intersections with existing road, maximum earth work will be required. Moreover safety at the National Highway intersection is questionable

2.7.3 Available Right of Way (ROW)

The existing width of tracks generally varies between 3-8m in stretches passing through agricultural lands or habitations and 8-10m 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 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 a cement concrete pavement is considered in all such cases.

2.7.4 Alignment and profile

The construction works are to be confined to the existing alignment of the unpaved tracks. 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.

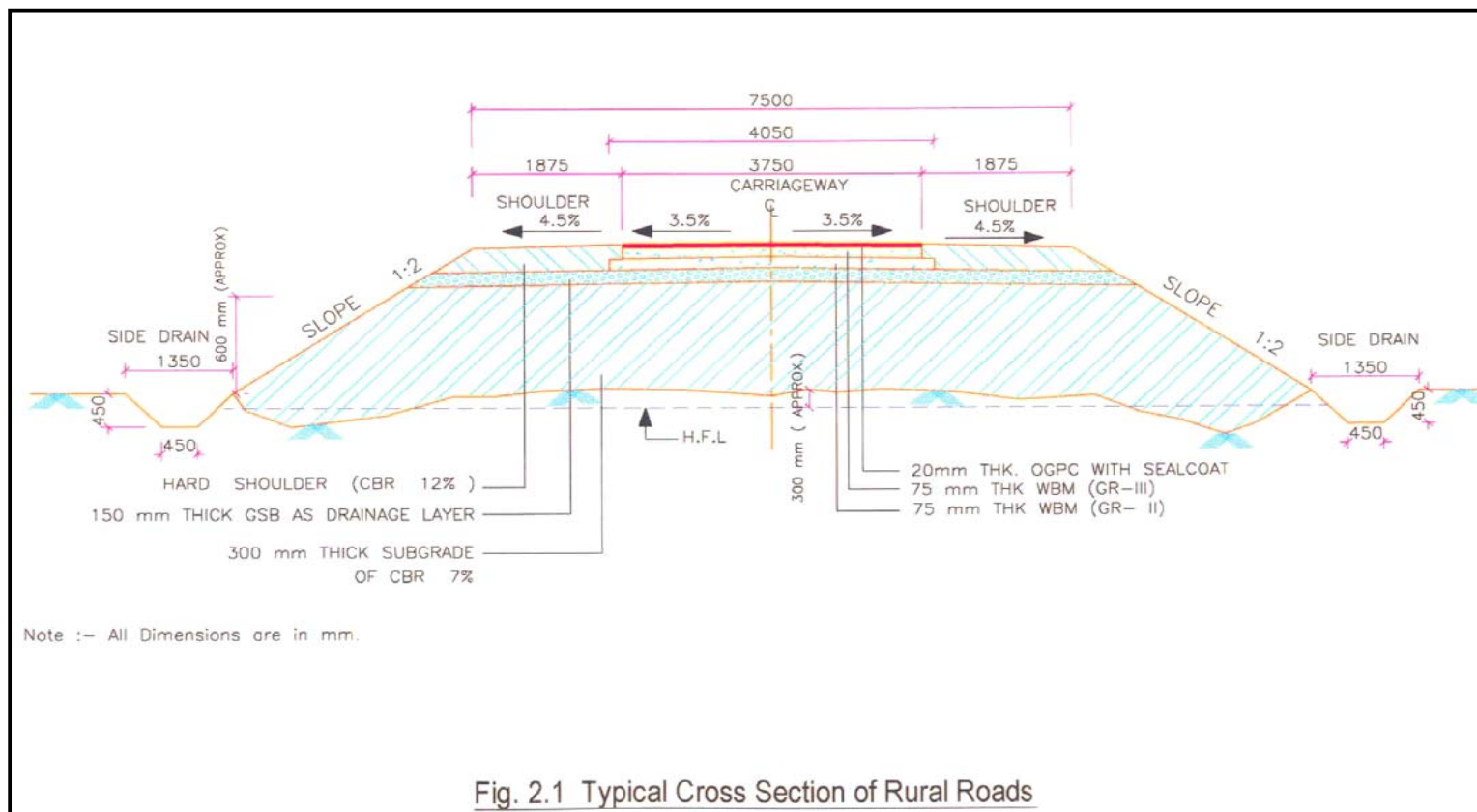


Fig. 2.2 Typical Cross Section of Rural Roads

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 148 km sample roads are given in this section.

3.2 PHYSICAL RESOURCES

3.2.1 Geology

The West Bengal state is covered by alluvial and deltaic deposits 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. 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

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

S. No.	Formation Type	Age Group	Lithology
1	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 intrusives (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

¹ Defined under 1.4 of Section 1.0

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.

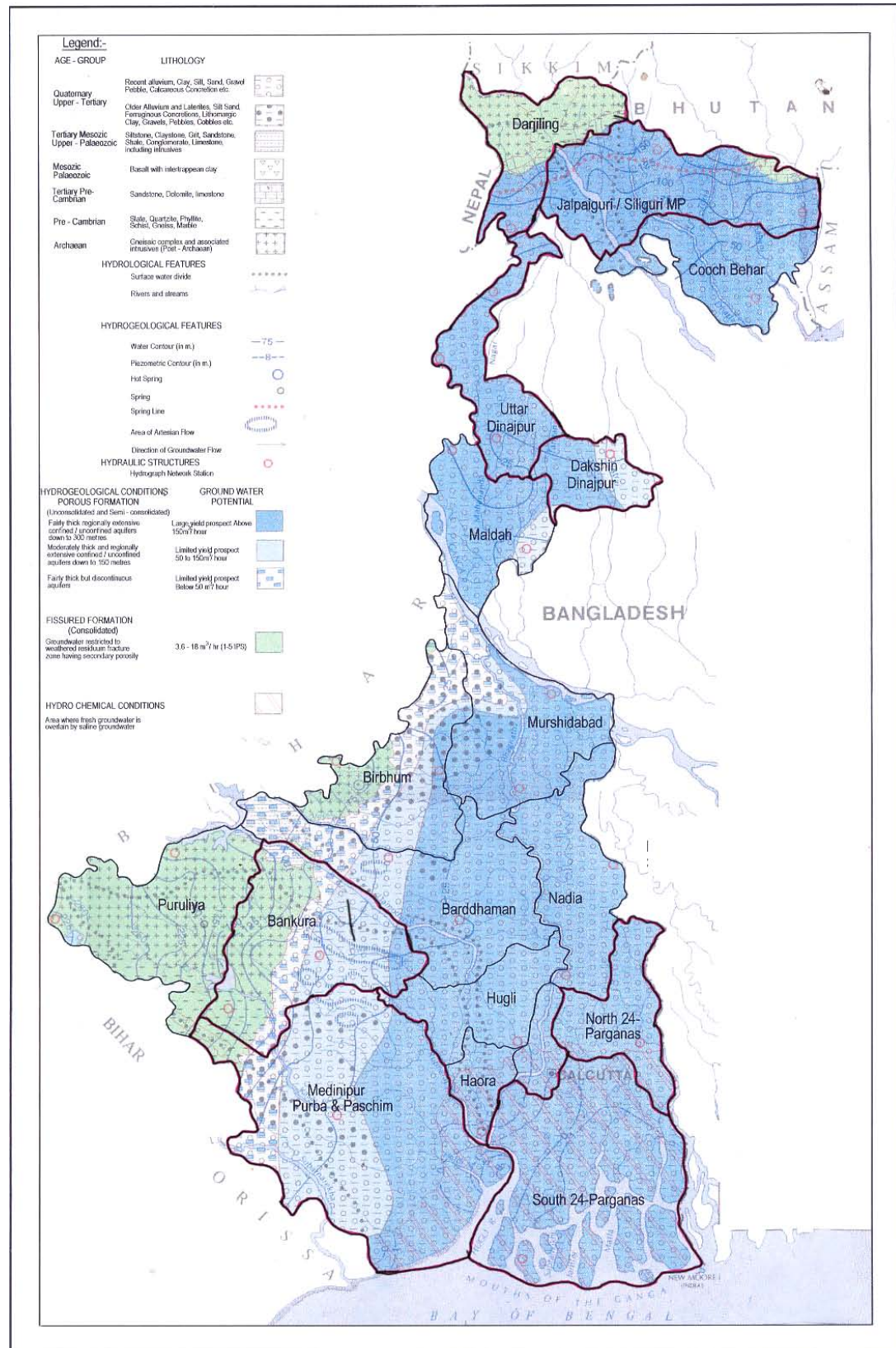


Fig No. - 3.1 Geology & Hydrogeology Map of Project Districts - West Bengal

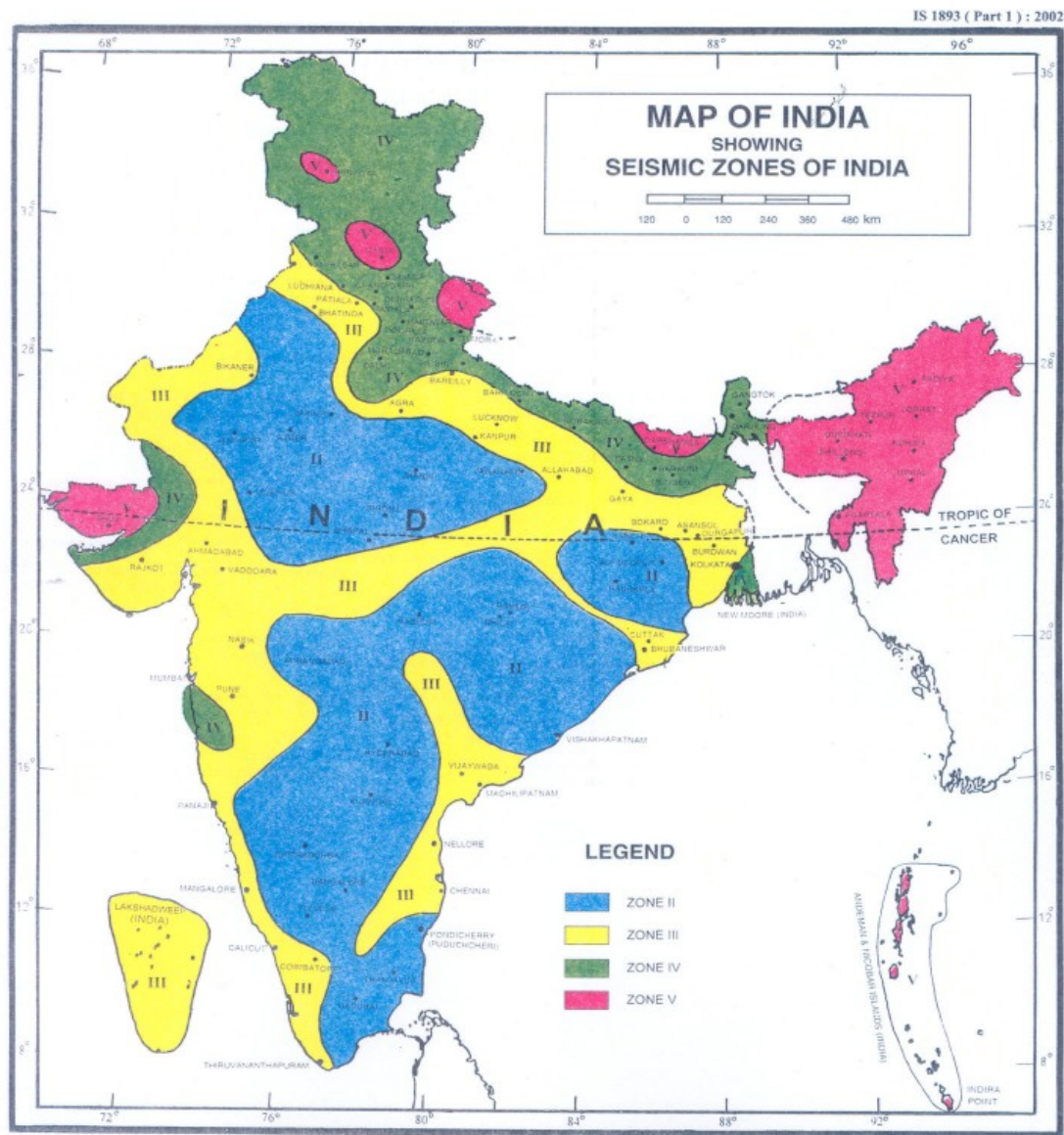


Figure 3.1 A: Classification of Earthquake Zones of India

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, 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 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 confirmed/ / unconfirmed 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)

The ground water development in the region is generally occurring through shallow tube wells (yield up to 30 cu. m per hour), medium tube wells (yield up to 100 cu.m per hour) and deep heavy tube wells (yield up to 200 cu. m 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 is given in **Figure 3.1**.

3.2.4 Physiography and Relief

The West Bengal state can be divided into four distinct physiographic divisions as hereunder

- Hilly Districts like Darjeeling, Jalpaiguri and Coochbehar in Himalayan region
- Districts like Purulia, and western parts of the districts like Bardhaman. Medinipur, Birbhum and Northern part of Birbhum districts forming a fringe of western plateau
- Sunderbans area of South 24 Parganas and a small part of North 24 Parganas forming a part of deltaic zone
- Remaining part of the state in central and eastern part of the state mainly

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.

being alluvial plains.

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, and western parts of Bardhaman, 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.

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

3.2.5 Drainage

The West Bengal has three major river basins namely Ganga, Brahmaputra and Subarnarekha and 80% of the state is within Ganga basin, 13% of area within Brahmaputra basin and less than 5% within Subarnarekha basin.

The Darjeeling, Coochbehar districts in the northern most part of the state is with in Brahmaputra basin. The Medinipur district in south- western part of the state is within Subarnarekha and rest of 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**.

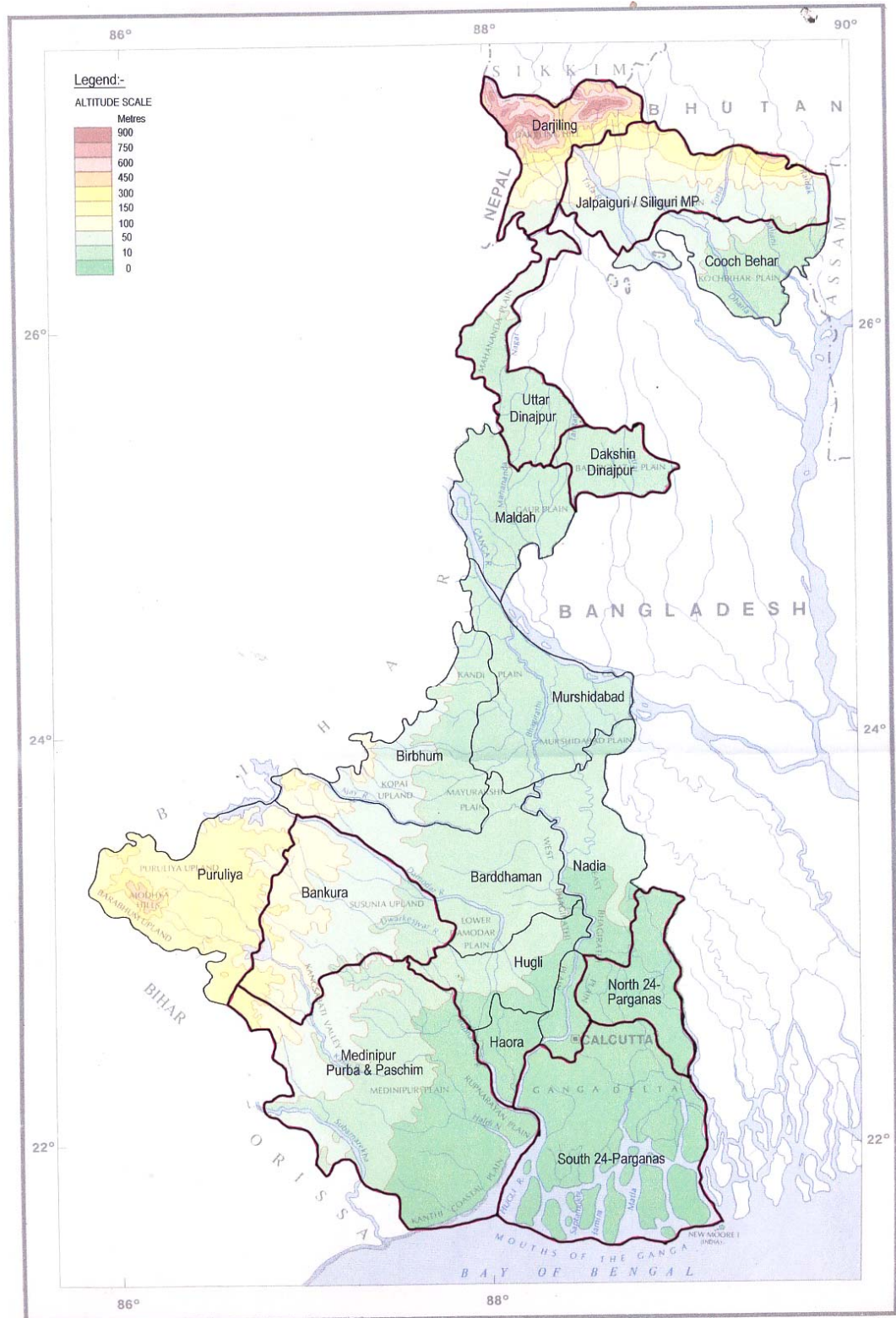


Fig No. - 3.2 Physiography & Landforms Map of Project Districts - West Bengal

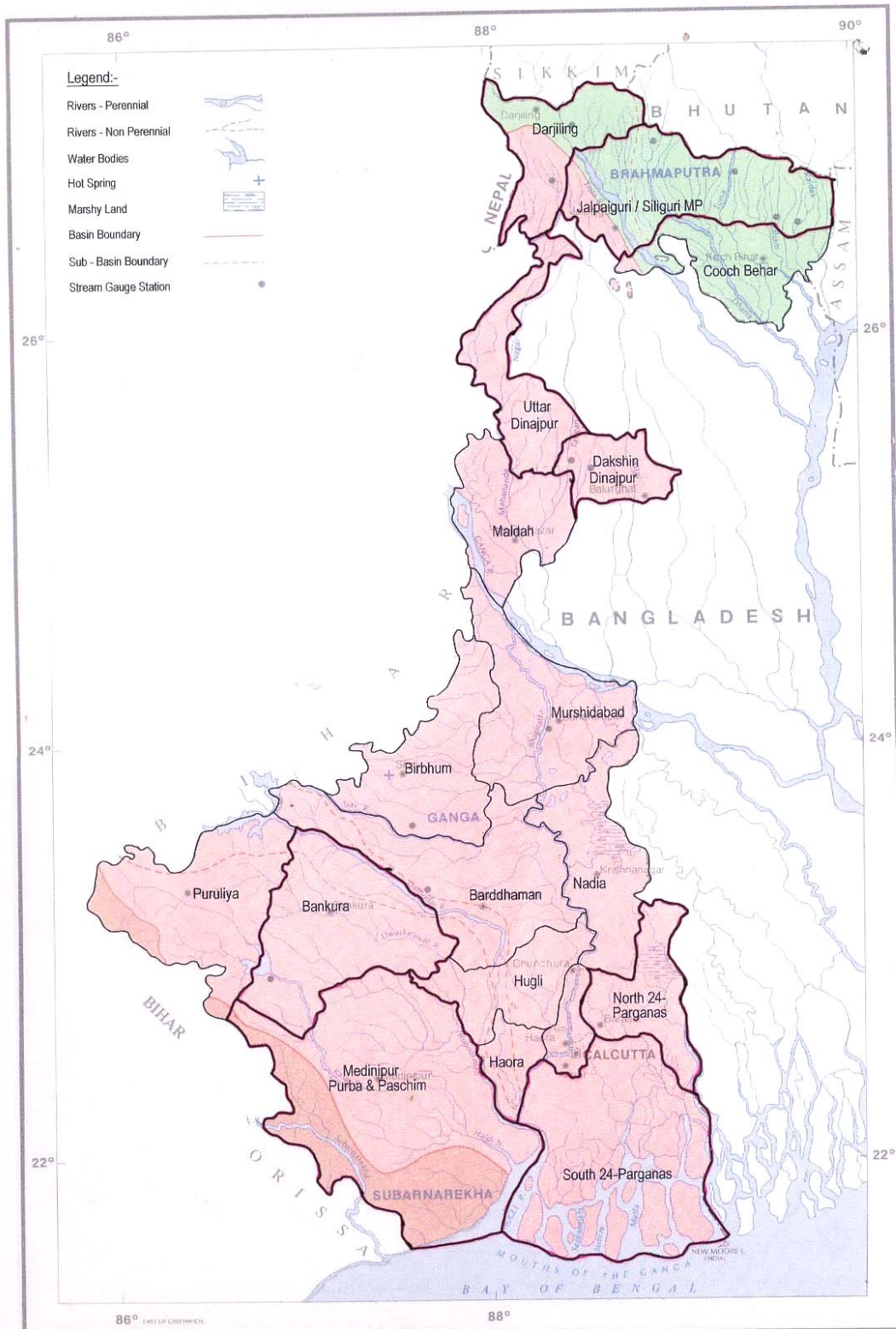


Fig No. - 3.3 Drainage Map of Project Districts - West Bengal

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.

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 85% in morning hours and 50 to 65% in the evening hours.

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 range between 2.6 km/h and 4–9 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 Malda 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.

Rainfall: The state receives an annual average rainfall of 1750mm, out of which 1250mm is received between the months 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, with some minor pockets receiving rainfall even up to 6000mm. 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.

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 drought 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

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

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

3.2.8 Soils

The major soil types within the 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, 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, Haora and Medinipur districts.

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

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 3.4** for entire state and **Table 3.5** as district wise.

Table 3.4 Land Use Categorization of West Bengal (State as a whole)

Sr. No.	Land 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 3.5: 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 sown area
Burdwan	698762	198909	16931	22266	5717	454939
Birbhum	451118	96738	5334	15853	13234	319959
Bankura	687998	149716	15530	148930	38239	335583
Purba Medinipur	396594	93434	4270	899	3935	294056
Paschim Medinipur	928581	159255	26256	171935	19415	551720
Howrah	138676	49897	2856	-	4271	81652
Hooghly	312224	88468	3584	530	825	218817
24- pgs (N)	386524	120336	4317	-	1334	260537
24- pgs (S)	948706	135792	4147	426507	11893	370367
Nadia	390655	85709	6490	1216	5245	291995
Murshidabad	532499	127267	2389	771	703	401369
Uttar Dinajpur	312466	33290	4115	580	4250	270231
Dakshin Dinajpur	221909	29570	794	932	2665	187948
Malda	370862	86718	3467	1679	57461	221537
Jalpaiguri	622700	85722	6958	179000	14333	336637
Darjeeling	326469	37716	7548	124575	13857	141773
Coochbehar	331565	67288	9915	4256	3167	246939
Purulia	625646	107453	15800	75048	118702	308643
Total West Bengal*	8682954	1753328	140701	1174977	319246	5294702

* 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: District statistics handbook 2005-2006, Govt. of West Bengal)

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

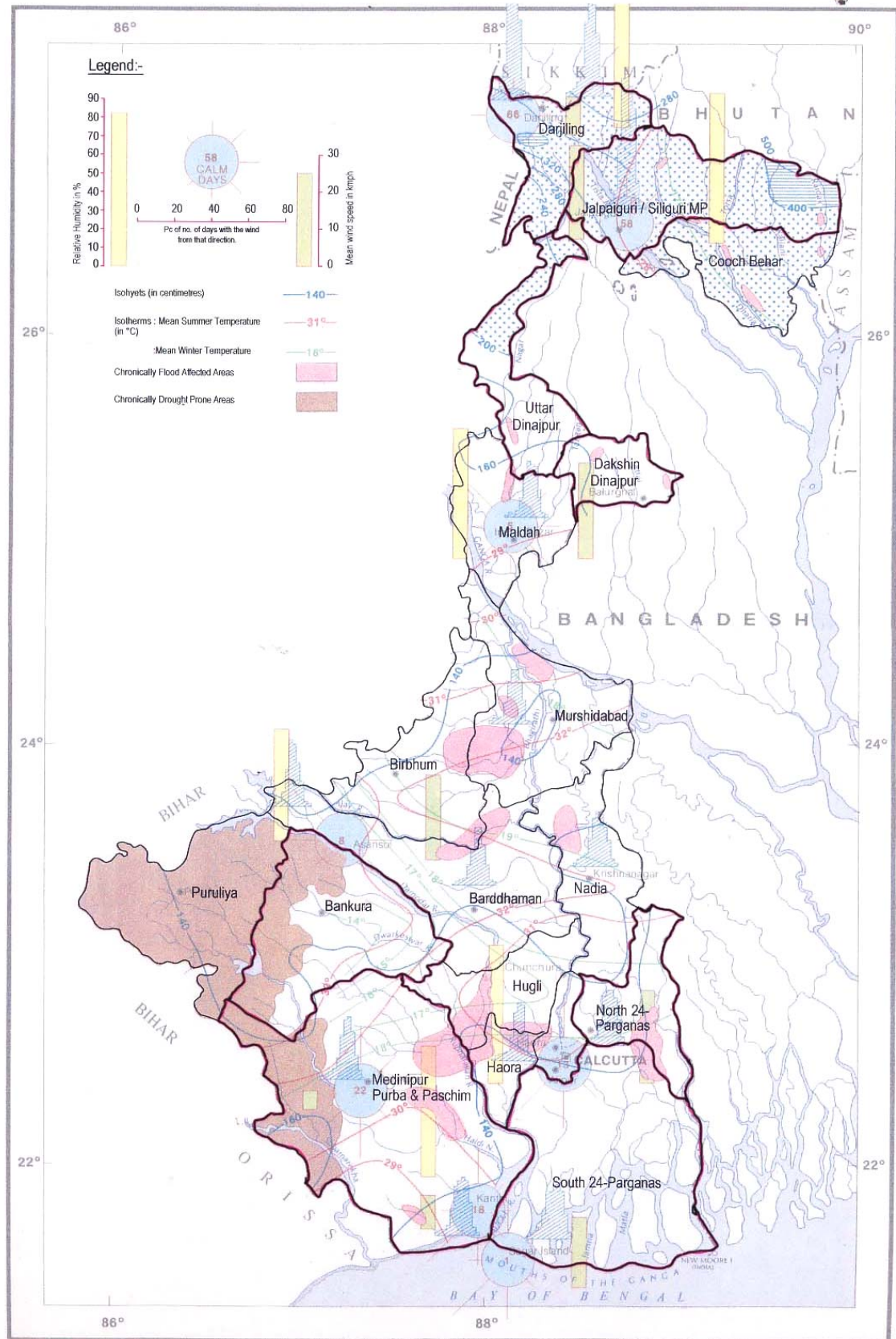


Fig No. - 3.4 Climate Map of Project Districts - West Bengal

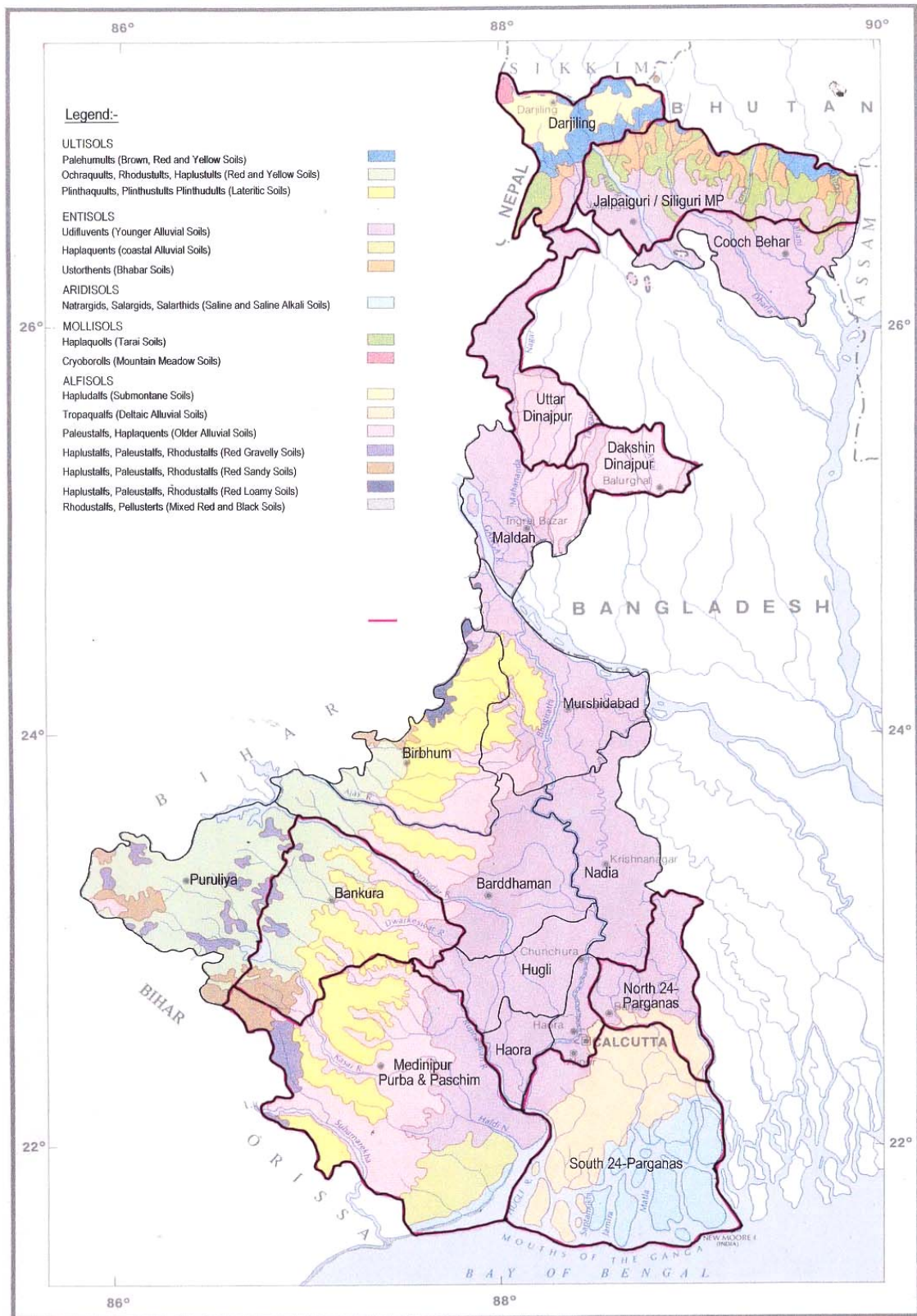


Fig No. - 3.5 Soils Map of Project Districts - West Bengal

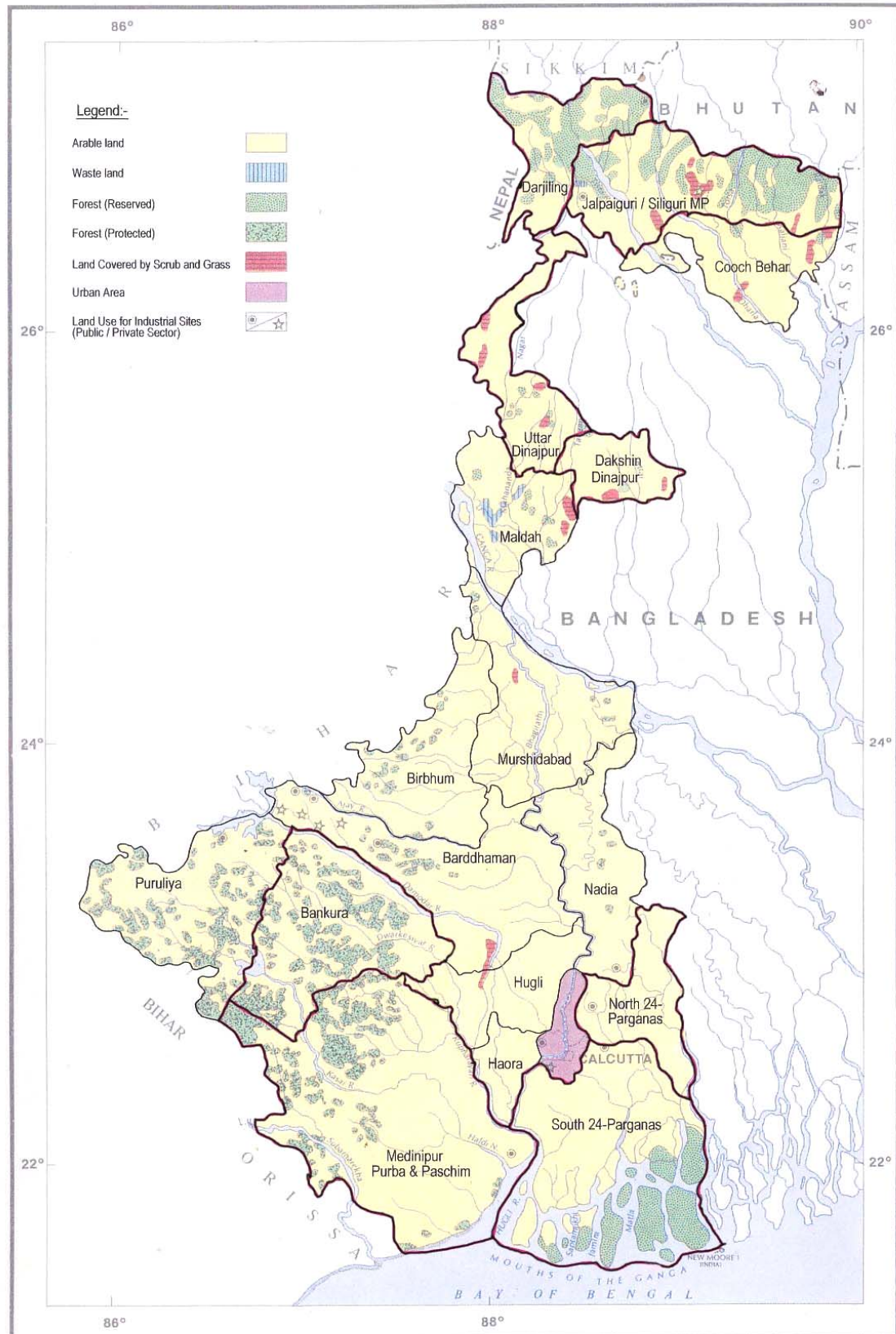


Fig No. - 3.6 Landuse Map of Project Districts - West Bengal

3.2.10 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 Subanarekha 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.

3.2.11 Ambient Air Quality

The Central Pollution Control Board and State Pollution Control Board maintain database on the ambient air quality of the state. However, such database is limited to 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 any industrial activity nor significant vehicular traffic contributing to air pollution. Therefore the ambient air quality is expected to be within the National Ambient Air Quality Standards (NAAQS) for all parameters⁴ excepting the dust or particulate matter. The occasional vehicular movement on unpaved roads lead to formation of dust clouds over short periods. The airborne dust increases the concentration of both the Suspended Particulate Matter (SPM) and Respirable Particulate Matter (RPM< 10 micron) beyond the limits of the NAAQS.

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.

⁴ Parameters like Oxides of Sulphur, Oxides of Nitrogen, Carbon Monoxide, Hydrocarbons, Benzene

3.3 ECOLOGICAL RESOURCES

3.3.1 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/ patches⁵ 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; agricultural wastes. The 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 water-logged areas of the project districts/ state are presented in **Figure 3.4**.

The Institute of Wetland Management and Ecological Design⁶, Government of West Bengal has prepared an inventory of wetlands in West Bengal. The distribution of wetlands in the selected districts of West Bengal (having maximum of them) is presented in **Table 3.6**.

Table 3.6 Distribution of Wetlands in Project Region

Sr. No.	Nature of Wetlands			Districts Covering Project Corridor				
			Classes of Wetlands	24-Parganas	Nadia	Murshidabad	Malda	Dakshin Dinajpur
1	INLAND	NATURAL	Ponds/Lakes	30	58	18	22	37
2			Cut off Meanders/ Ox-bow Lakes	144	227	248	190	129
3			Waterlogged/ Seasonal	232	64	191	235	69
4			Marsh/Swamp	23	49	27	20	153
5		MAN MADE	Reservoirs	-	-	2	4	-
6			Tanks	100	43	86	90	103
7			Waterlogged	-	1	7	1	2
8			Ash pond	-	-	8	-	-
Total				589	442	587	562	493

Source: Institute of Wetland Management and Ecological Design

⁵ These low-lying areas with marshy conditions are locally termed as 'beels'

⁶ 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.

The most dominant flora and fauna of the wetland presented in **Table 3.7**.

Table 3.7 Most Dominant Flora and Fauna of Wetland/ pond		
Flora		Fauna
(A) Free Floating	(D) Rooted Floating	Avian Fauna
<i>Eichornia crassipes</i>	<i>Hydrorhiza aristata</i>	Common Sandpiper
<i>Lemna perpusilla</i>	<i>Limnophila heterophylla</i>	Common Teal
<i>Azolla pinnata</i>	<i>Marsilea minuta</i>	Cotton Teal
<i>Pistia stratiotes</i>	(E) Marginal amphibious	Large Egret
<i>Wolffia arrhiza</i>	<i>Alternanthera philaxeroides</i>	Lesser Whistling Teal
(B) Suspended	<i>Jussiaea repens</i>	Little Cormorant
<i>Ceratophyllum demersum</i>	<i>Eliptia alba</i>	Openbilled Stork
<i>Utricularia species</i>	<i>Lipomoea aquatica</i>	Painted Snipe
(C) Anchored (Submerged)	<i>Ludwigia adscendens</i>	Pintail
<i>Hydrilla verticillata</i>	<i>Phragmites karka</i>	Paleas Tailed Jacana
<i>Alisma plantago</i>	<i>Typha angustata</i>	Purple Moorhen
<i>Sagittaria capensis</i>	<i>Commelina species</i>	Spat Bill Duck
<i>Myriophyllum tuberosum</i>	<i>Colocasia esculenta</i>	Tufted Duck
<i>Vallisneria spiralis</i>	<i>Polygonum plebeium</i>	White Breasted Water Hen
<i>Potamogeton species</i>	<i>P. hydropiper</i>	White Eyed Pheasant
<i>Hydrophila spinosa</i>	<i>Rumex dentatus</i>	
<i>Najas species</i>		
<i>Ottelia alata</i>		

Source: Field investigations during IEE

3.3.2 Terrestrial Flora

During the field investigations, the most dominant terrestrial flora within the project districts were 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 sample road projects are presented in **Table 3.8**.

Table 3.8: 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>Albizia lebbek</i>	Timber	36	<i>Melia azadirach</i>	Timber
8	<i>Alstonia scholaris</i>	Medicine	37	<i>Mimusops chengi</i>	-
9	<i>Anthocephalus chinensis</i>	Ornamental & Timber	38	<i>Myrtagyna perviflora</i>	Timber
10	<i>Azadirachta indica</i>	Timber & Medicine	39	<i>Odina woder</i>	Saponin
11	<i>Artocarpus</i>	Fruit & Timber	40	<i>Oroxylum indicum</i>	Medicine

Sr. No.	Botanical Name	Use/yield	Sr. No.	Botanical Name	Use/yield
	<i>integrifolia</i>				
12	<i>Bauhinia variegata</i>	Ornamental	41	<i>Peltophorum 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>Phoenixsylvestris</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
20	<i>Dalbergia sissoo</i>	Timber & Medicine	49	<i>Sweitenia macrophyi1a</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 strieta</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 in 5 rural road construction proposals. Although, none of these stretches pass through any forest land/area but still has trees, which might require felling during clearing up operations and construction of rural roads. The tree enumeration survey⁷ indicates that the selected 4 rural road construction proposals (within the ROW) have trees ranging between 30-40 trees per km. The actual number of trees which require felling can only be determined after marking of the improved alignment on ground.

The clearance of the vegetation and felling of trees for the road construction is an environmental concern. 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.

3.3.3 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 3.9 below lists the different species of fauna present in the region. All of these are widely distributed and common for rural areas

⁷ Tree enumeration survey identified and enumerated (species and girth wise greater than 30cm trees located within the ROW)

Table 3.9: 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>
	Bufallow	<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 ornate</i>
	Pythan	<i>Pythan moluris</i>
	Common Krait	<i>Bungarus caeruleas</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 maculatus</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 punctatus</i>
	Puthi	<i>Puntius Sp.</i>
	Bhangar	<i>Liza tade</i>
	Sole	<i>Chana striatus</i>
	Koi	<i>Anabas tesludineus</i>
Birds	Cattle 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>

Type of Fauna	Name	Scientific Name
	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>Linus excubitor</i>
	Black headed Oriole	<i>Oriolus Xanthormus</i>
	Black Drongo	<i>Dicrurus adisimiles</i>
	Racked Tailed Drongo	<i>Dicrurus remifer</i>
	Common Myna	<i>Acridotheres tristis</i>
	House Crow	<i>Corvus splendens</i>
	Red vented Bulbul	<i>Pycnonotus cafer</i>
	Shyama	<i>Copsychus malabaricus</i>
	Grey Tit	<i>Parus major</i>
	White Wagtail	<i>Motacilla alba</i>
	Purple Sunbird	<i>Nectarinia asitica</i>
	House Sparrow	<i>Passer domesticus</i>
	Tree Sparrow	<i>Passer montanus</i>
	Spotted Munia	<i>Lonchura punctulata</i>
	Large Whistling teal	<i>Dendro cygna javanica</i>
	Open billed Stork	<i>Anastomus oscitans</i>
	Pariah Kite	<i>Milvus miguans govinda</i>
	Pintail Snipe	<i>Capela stenura</i>

Fish, reptiles, birds and mammals mainly represent the fauna. They are highly tolerant to all types of disturbances arising from anthropogenic activities.

3.4 QUALITY OF LIFE VALUES

3.4.1 Archaeological/ Historical Monuments

Although, West Bengal is known to have several archaeological and historical/protected monuments spread all over the state, none of them are situated within 5 km on each side from the sample rural roads of the 148 km road construction proposals.

3.4.2 Temples / Shrines / Idols

The corridor of impact (COI) or the direct influence area of the 148 km road construction proposals have no shrines, idols, tombs, and roadside small temples which might be impacted or require relocation due to the construction works.

3.4.3 Roadside Sanitation

The local bodies and the State Governments have constructed tube wells along side of the existing unpaved roads/ tracks, particularly near habitations to meet the water supply needs of community. These have been provided with a platform around the tube well, which connect 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. Out of the estimated 35 tube wells along the 148 km tracks, unsatisfactory sanitary conditions can be seen in at least 15 or more.

This situation prevails not only near tube wells along the proposed road construction proposals but also in many other tube wells along side of other roads in the region. At times, the over flowing pits or clogged drains near the tube wells pose a threat to road condition and damage the bituminous surface along with base and sub base layers of the road. Several such instances of damaged pavement due to improper sanitary condition of the nearby tube wells have been seen along the roads in the project region.

3.4.4 Road Cutting Along Rural Road Proposals

During the field investigations, it has been observed that along many stretches of the road construction proposals agricultural landowners across the tracks appear to share the water for irrigation purposes. The tube well water from one side of the track is taken to other side through pipes beneath the track by making a temporary incision at the road/track surface. This appears to be a very common practice particularly in some parts of S and N 24 Parganas, Malda, Nadia and instances of even digging up bitumen paved roads is seen at several places for taking the pipes across the road.

This practice of the local people requires to be addressed during the project preparation of construction works so that the incisions on the newly constructed roads could be prevented and prolong the life of the new road construction works.

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

4.2 ENVIRONMENTAL PROBLEMS DUE TO PROJECT (ROAD) LOCATION

4.2.1 National Parks/Wild Life Sanctuaries

Potential Impacts: Out of the 148 km of sample rural road construction works in 15 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 148 km sample roads. Further, the subsequent batches 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 within 5 km on each side from the sample rural roads of 148 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 within 5 km on each side from the sample rural roads of 148 km of the remaining 860 km of roads in the second batch and roads that will be taken up under the subsequent batches, 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 15 stretches of sample rural roads are within 5 km on each side from the sample rural roads of 148 km of natural habitat/ nature reserves notified 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 5 km on each side from the sample rural roads of 148 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 148 km sample roads. Further, the remaining 760 km of roads in the second batch and roads that will be taken up under the subsequent batches 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 148 km of sample rural roads in 15 stretches, only one road at West Medinipur district is passing through the Unclassified Forest Areas.

Mitigation: In case of road of West Medinipur district it is noted that ROW for the proposed road is clear no impact on forest flora and that issues are jointly verified by Forest Department and PIU. Other than that no proposals are through the Reserve Forests/ Protected Forest and; or Unclassified Forest Areas/Lands, no environmental; ecological threat to any forest areas are foreseen due to the location of any of the 148 km sample roads. Further, In case of the remaining 760 km of roads of second batch and roads that will be taken up under the subsequent batches, if the roads pass through reserve Forests/ protected forest

and/or unclassified forest areas/lands, 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 (embankment height greater than 12m) will be required in any of the sample rural roads construction works. The proposals are also consciously confined to the existing alignment with minor corrections for vertical/horizontal profile In order to minimise 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 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. For treatment of embankment slopes for erosion control, 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/trees¹ within the right of way will be impacted due to clearing operations of the right of way for road construction works. Almost all the 148 Km sample roads 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 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

¹ The list of trees recorded within the corridor is presented under Section 3.3.2 - Flora

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.

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 re-plantation of the corridor including maintenance up to 3 years will be borne by Gram Panchayat from their annual action plan budget. 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 both the 148 Km sample roads and all the subsequent batches including the balance 760 km of the second batch.

4.3.4 Cross Drainage

Potential Impacts: None of the rural road construction proposals (148 km, 15 different stretches/locations) are across any major rivulets/ drainage channels within their respective river basins. However, road proposals cross several small drainage channels, which are non-perennial and drain the storm water for few weeks only during or after the monsoon. In one case at Purulia natural drainage system is exist along the road alignment.

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.

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/potential² 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.

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

- 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

¹. _____

² The ground water potential of the project region as recommended by the Central Ground Water Board is described under Section 3.2.3- Geo hydrology

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.

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:

- 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 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. One sample road at Murshidabad located near Sagardghi Thermal Power plant where fly ash will be used (also mentioned in DPR) for construction of road embankment. 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

S. No.	State	Thermal Power Plants
1	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)
		Sagardghi (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 148 km of roads will change the present land use in about 17.8 ha³ of land from the present agriculture to road construction. It is important to note that this 17.8 ha of land is scattered over 15 stretches / locations over a length of 148 km. 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: Out of the 148 km of sample rural roads in 15 stretches, only 2.5 km of one road at West Medinipur district is passing through the unclassified Forest Areas/Lands and social forestry 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 148 km sample roads. Further, in case of the remaining 760 km of roads that will be taken up under the subsequent batches, if the roads pass through reserve Forests/ Protected forest and/ or unclassified forest areas/lands, necessary permissions will be obtained from the Department of Forests, Government of West Bengal and Ministry of Environment and Forests, Government of India.

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³ The estimate considers that out of the required 12m ROW, on an average 1.5m wide of agricultural land on each side of alignment will be required in 40% length of sample roads i.e. 148 Km. The rest of the right of way is assumed to have habitations, where the fences are to be shifted backwards

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 forest land for these 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 mentioned in the previous sub section. The loss of agricultural land although is 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.

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.

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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 POL⁴ storage areas, work force camps and all other 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 within 5 km on each side from the sample rural roads of 148 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 in to 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 / trees⁵ 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

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⁴ POL: Petroleum, Oil and Lubricants

⁵ The list of trees recorded within the corridor is presented under Section 3.3.2 - Flora

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 as provided in Table 3.9 under section 3.0.

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 a month;
- 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 con tractor / PIU⁶ as per the site conditions
- Construction or work force camps are to be provided with fuel⁷ 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
- All operational areas under the rural road construction works are to be regularly monitored at least bi-monthly for air quality parameters; SPM, RPM, SO₂, NO_x, HC, CO. This will enable identification of the operations/areas of concern for air pollution mitigation, if any.
- Operational areas include work sites, haulage roads, hot mix plants,

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⁶ PIU- Project Implementation Unit see section 6.0 for Institutional Requirements for Implementation of EMAP

⁷ Liquefied Petroleum Gas (LPG) will be a preferred fuel

quarries, 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 109 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 confirm 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 hear plugs. 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 sample rural roads of 148 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 within 5 km on each side from the sample rural roads of 148 km of the remaining 760 km of roads in the second batch and roads that will be taken up under the subsequent batches, 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 148 km sample roads does not have any major shrines/temples within the right of way and requiring relocation due to road construction. In case, major shrines/temples are situated within the right of way and requiring relocation in any of the remaining 760 km of roads in the second batch and roads that will be taken up under the subsequent batches, 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. Some secondary pollutants like ozone, Peroxyacetyl nitrate (PAN) etc. are formed depending upon meteorological factors, topography, 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. The present air quality is below permissible limit of CPCB.

Mitigation Measures

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

4.6 POTENTIAL ENVIRONMENTAL ENHANCEMENT MEASURES

4.6.1 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.

4.6.2 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 children⁸ who are exposed to increased dust and other emissions due to poor condition of the present unpaved tracks.

4.6.3 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.

4.6.4 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.

4.7 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 second batch, there is a need to revise the EMP to effectively implement 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 second batch. The applying of the revised EMP (**Appendix ...**) will be processed and it is expected to be used in the next batches.

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⁸ Women spend significant time along roadside either doing various domestic chores or collecting water. Children are seen playmg along road side or collecting water along with the elders

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 second batch of 908 km 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, on environmental technical matter NRRDA has appointed Technical Support Consultants (TSC). The technical support consultant has environmental expert in their team. The environmental expert of TSC will periodically review the EMAP compliances at site. The project Implementation Consultant (PIC) appointed by the PIU will continue to supervise the Construction Supervision Consultant in addressing environmental matter of the Project. The PIC has employed one Environmental Officer (EO) in their team. The contractor shall implement the EMAP through its own FEO (Field Environmental Officer).

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 EO, if found warranting may also conduct field tests, independent of the contractor to determine the effectiveness of EMAP under approval of PIC/PIU.

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.

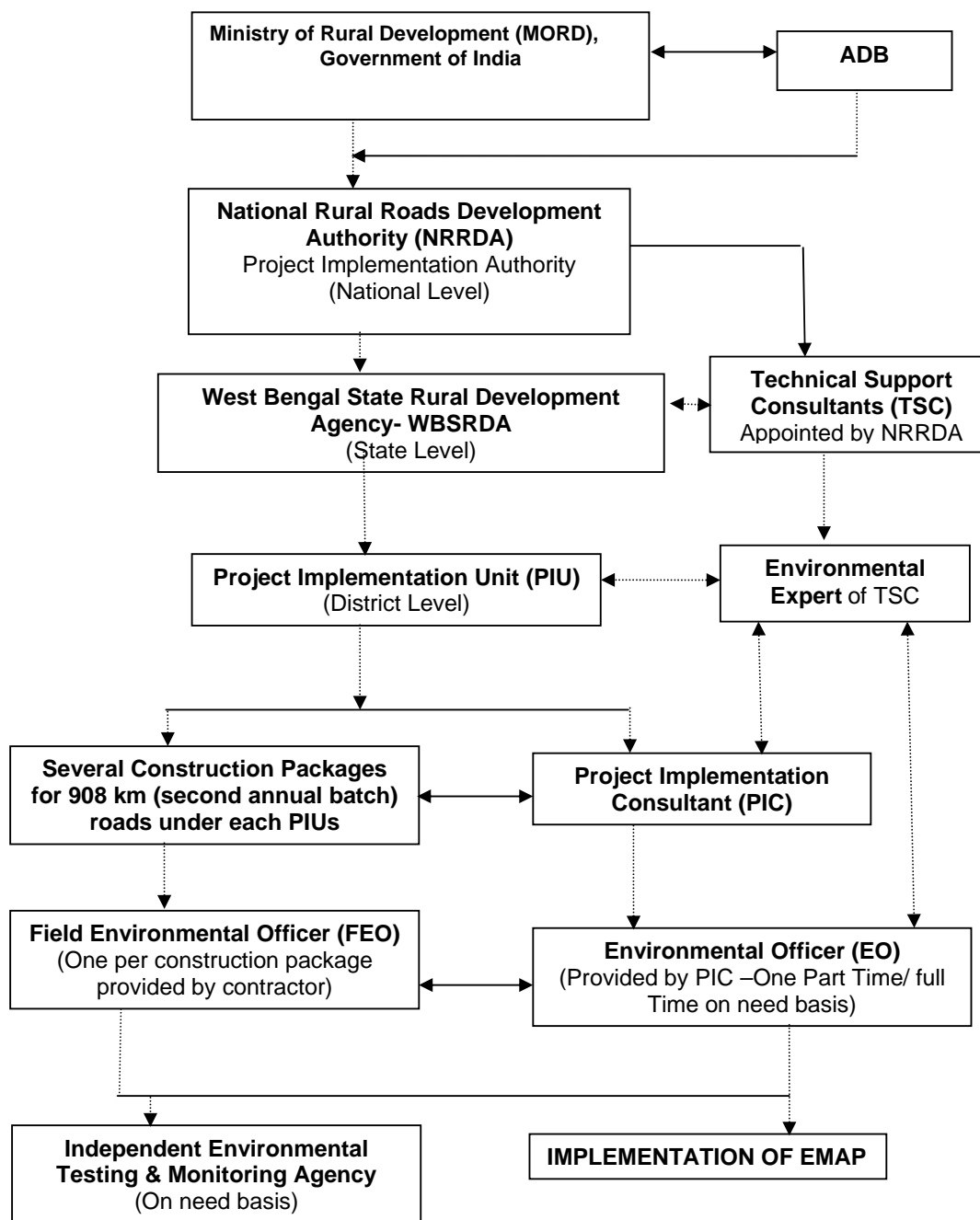


Figure 5.1: Institutional Requirements for Implementation of EMAP

SECTION 6: PUBLIC CONSULTATIONS AND INFORMATION DISCLOSURES

6.1 INTRODUCTION

The rural project comprising of **908 km** 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
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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/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 State Pollution Control Board.

Tools for Consultation

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

(i) Formal/Informal discussion

During the transect walk, consultations were held with the panchayat officials and 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 field assistants for the purpose. The FGDs were held at all the locations of 15 sample 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, 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 during FGD are given in **Appendix 4**.

6.4. RESULT OF THE CONSULTATION

The consultation was carried out between June to November 2007. The detailed result is attached in Appendix 4. 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 second annual batch of rural road projects will not require public hearing in the light of revised EIA Notification in the year 2006.

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 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.

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

No such cases arise for shifting of idols/ shrines

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.

Impacts on Health

Separate consultation sessions were organised by social 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 6.1**.

Table 6.1: 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
Road Safety	Adequate safely signage planned all along the rural road.
Land acquisition and Mode of compensation	The proposed ROW is 12m along the rural road. Minimum land acquisition is planned for some cases of the project road.
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 at the ratio of three to four trees for each tree to be cut.
Increased pollution levels	Pollution levels are not crossing 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 6.2**.

Table 6.2: Summarisation of Issues and Findings at Various Locations

Location	Issues	Participants Comments and Suggestions	Mitigation Measures and Action Plan
North and South 24-pgs, Nadia, Hooghly, Birbhum, Bankura, Burdwan, Murshidabad, Malda, Purulia, Jalpaiguri, Coochbehar, Uttar Dinajpur	<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 	<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

Location	Issues	Participants Comments and Suggestions	Mitigation Measures and Action Plan
		<p>existing sources.</p> <ul style="list-style-type: none">• The villagers required proper traffic control at the road junctions to prevent accidents.• Villagers are sound in health	<p>existing ones.</p> <ul style="list-style-type: none">• Road alignment is planned during transect walk.• Locals will be given preference in employment during construction.

CHAPTER 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 **908 km** of rural roads, which represent the second annual batch.
- The potential impacts have been screened in accordance with the Environmental Assessment Guidelines, 2003 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 occurred 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. 40 million** has been made for implementation of EMAP for the second batch of **908 km**.
- The review on environmental compliances carried out by TSC that will be reported quarterly will also be used to monitor the effectiveness of the implementation of EMAP.

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

Table: Details of Subprojects of Batch II under ADB assisted PMGSY (2006-07)

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
1	2	3	4	5	6	7	8	9	10
North 24 Parganas	Minakha	WB 01 ADB 08	Shibpur	Sankardaha	T03	18.750	810.120	40.490	850.610
	Swarupnagar	WB 01 ADB 09	Tepul	Gajna	T011	11.390	435.340	24.150	459.490
	Hasnabad	WB 01 ADB 10	Barunhat	Mahispukur	L023	4.440	202.150	9.750	211.900
	Baduria	WB 01 ADB 11	Chandipur GP Office	Adharmanik Barujjeyakata	T010	7.920	331.220	16.690	347.910
	Bongaon	WB 01 ADB 12	Chak Chowberia More	Sehalapara	T016	9.027	359.280	19.700	378.980
	Bongaon	WB 01 ADB 13	Subharatnapur GP Office	Mathurapur	T015	15.410	664.720	33.690	698.410
		6	6 Roads			66.937	2802.830	144.47	2947.3
South 24 Parganas	Baruipur	WB 02 ADB 07	Moutala	Uttarbhag via Joytala	L034	14.185	599.33	38.221	637.551
	Pathar Pratima	WB 02 ADB 08	Uttarabad	Purnachandrapur Road	T05	11.450	536.34	35.43	571.77
		2	2 Roads			25.635	1135.67	73.65	1209.32

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
Bankura	Patrasayar	WB 03 ADB 04	Deulpara	Belut	T01	17.205	511.677	33.058	544.735
	Patrasayar	WB 03 ADB 05	Dhagoria	Uttarpatashpur	T09	3.898	119.845	8.679	128.524
	Bankura I	WB 03 ADB 06	Chelema	Shibrampur	T02	9.504	246.057	18.247	264.304
	Sonamukhi	WB 03 ADB 07	Joynagar	Bara	T01	17.221	453.950	34.148	488.098
	Raipur	WB 03 ADB 08	Dublala	Thakurbaba	T03	2.685	70.557	5.073	75.630
	Bishnupur	WB 03 ADB 09	Joyrampur	Gumut	T01	4.487	141.088	9.275	150.363
	Teldangra	WB 03 ADB 10	Mourberia	T01	L025 (Part II)	7.706	214.904	15.718	230.622
	Bishnupur	WB 03 ADB 11	Narikala	SH	T013	10.038	331.064	21.089	352.153
	Patrasayar	WB 03 ADB 12	Habibpuskarini	Chapatrasayer	T08	17.483	554.396	38.092	592.488
		9	9 Roads			90.227	2643.538	183.379	2826.917
Birbhum	Sainthia	WB 04 ADB 06	Rakhakalitala	Simulia	T07	10.541	288.358	19.861	308.219
	Nalhati I	WB 04 ADB 07	Chamtibagan	Sardah	T05	9.988	264.523	17.537	282.060
	Sainthia	WB 04 ADB 08	Sangra	Rongaipur	T010	13.198	384.283	24.730	409.013
	Suri II	WB 04 ADB 09	Adjacent Block Dubrajpur	Purandarpur	L034	8.404	206.131	16.027	222.158

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
	Nalhati II	WB 04 ADB 10	Gumanidewan Setu MSD Link	Mustafadanga	T04	10.641	257.346	19.390	276.736
		5	5 Roads			52.772	1400.641	97.545	1498.186
Burdwan	Jamalpur	WB 05 ADB 09	Karalaghat	Krishnarampur	T04	5.800	236.550	13.590	250.140
	Raina - I	WB 05 ADB 10	Bokra	Meral	L027	7.150	299.280	15.200	314.480
	Ausgram - II	WB 05 ADB 11	Ramnagar Mouldanga More	Abhirampur	T04	16.600	585.520	36.800	622.320
		3	3 Roads			29.550	1121.350	65.59	1186.94
Cooch Behar	Sital Kuchi	WB 06 ADB 07	Khutamara Bridge	Godukata Jambari at Sitalkuchi P.S.	L045	4.500	144.690	9.255	153.945
	Tufanganj I	WB 06 ADB 08	Balarampur-Dinhata Pucca Road near Tepathi	Soul Dhukri Daspara	L058	3.000	102.220	6.372	108.592
	Tufanganj I		NH-31 Maruganj	Moradanga South	L070	3.000	93.120	5.990	99.110
	Sital Kuchi	WB 06 ADB 09	Deosal Bridge	Dangapara	L025	2.100	70.480	4.434	74.914
	Sital Kuchi		Gossair Tari	Baburhat Tepathi	L059	2.593	86.180	5.575	91.755
	Cooch Behar I	WB 06 ADB 10	SH-12A	VR Modakpara at Cob.-I	L082	3.000	95.730	6.311	102.041

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
	Cooch Behar I		Nishiganj	Towards Makpala Pucca Road via Dewan Bash Rna High School	L067	5.000	162.290	10.340	172.630
	Dinhata I	WB 06 ADB 11	No.1 Gate	Debibari Ghat	L030	5.640	191.930	11.760	203.690
	Mathabhangha	WB 06 ADB 12	Sitalkuchi P.S.Border	Kedarhat via Sikarpur Nayerhat & Kalirhat	T03	7.500	252.600	15.460	268.060
	Cooch Behar I	WB 06 ADB 13	Saheberhat	Gourangabazar at Cob.I	L049	5.500	165.610	11.304	176.914
	Cooch Behar II	WB 06 ADB 14	Coochbehar-Alipurduar Road at Kholta (Bokali Math)	Dhaloguri	L024	3.500	110.770	7.052	117.822
		8	11 Roads			45.333	1475.620	93.853	1569.473
Darjeeling	Kurseong	WB 07 ADB 02	Dilaram (Mana)	Kalijhora (Latpanchar)	T01	12.800	600.890	35.480	636.370
	Darjeeling Palbazar	WB 07 ADB 03	Chungtung (Kaijalay)	Lodhoma Bazar	T08	10.500	522.240	31.690	553.930
	Darjeeling Palbazar	WB 07 ADB 04	Bijanbari Lodhoma (Thapa Gaon)	Suntalay via Noor	T013	3.500	192.090	10.330	202.420
	Kalimpong II	WB 07 ADB 05	Relli	Deorali	T05	11.550	500.390	31.460	531.850

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
		4	4 Roads			38.350	1815.610	108.96	1924.57
Hooghly	Khanakul I	WB 08 ADB 05	Balance Part Kishorpur	Ramnagar B.T.	T07	6.450	561.130	14.020	575.150
	Arambagh	WB 08 ADB 06	Charmile	Dakshin Narayanpur	T011	12.640	580.770	25.930	606.700
	Goghat I	WB 08 ADB 07	Bali	Nakunda	T04	7.370	265.951	15.410	281.361
	Goghat I	WB 08 ADB 08	Kulia	Sanbadhi	T06	10.560	504.160	21.950	526.110
	Goghat I	WB 08 ADB 09	Goghat Matel Road	Barjalkona	T08	17.920	645.300	36.910	682.210
	Goghat I	WB 08 ADB 10	Sanbabhi	Goghat Matel Road	T07	5.440	172.590	10.990	183.580
	Khanakul II	WB 08 ADB 11	Sabalsinghapur	Harischak Primary School	L024	5.800	230.250	11.730	241.980
		7	7 Roads			66.180	2960.151	136.94	3097.091
Howrah	Amta - I	WB 09 ADB 06	Balichak Patrapara	Santrapara	L056	5.750	245.280	15.450	260.730
	Udaynarayanpur	WB 09 ADB 07	Dihi Bhursut	Udaynarayanpur Block Office	T03	12.000	497.520	31.827	529.347
	Shyampur - II	WB 09 ADB 08	Radha Nagar	Belpukur	T02	3.500	150.290	9.652	159.942
		3	3 Roads			21.250	893.090	56.929	950.019

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
Jalpaiguri	Madarihat	WB 10 ADB 09	T04 at Madhya Madarihat	Paschim Madarihat Falakata Border	L023	7.440	196.750	11.150	207.900
	Maynaguri	WB 10 ADB 10	Singhimari Hospital	Ramsai Irrigation Bungalow	T08	15.988	479.450	24.290	503.740
	Dhupguri	WB 10 ADB 11	Uttar Gosairhat	Paschim Salbari	T010	15.890	453.650	24.080	477.730
	Alipurduar-ii	WB 10 ADB 12	Dakshin Panial Guri	New Alipurduar Radhamadhab Mandir	T017	6.391	180.670	10.020	190.690
	Alipurduar-i	WB 10 ADB 13	T03 at Uttar Sonarpur	T03 at Pakuritala	T04	10.188	267.080	12.620	279.700
	Alipurduar-i	WB 10 ADB 14	Pakuritala	Kalchini Border at Uttar Paitkapara	T09	10.756	282.980	16.410	299.390
		6	6 Roads			66.653	1860.580	98.57	1959.15
Malda	English bazar	WB 11 ADB 08	Mominpara	Jorprithi	T08	8.500	298.310	22.310	320.620
	Chanchal-i	WB 11 ADB 09	Kharba	Purbabhabganpur	L023	7.700	294.440	22.660	317.100
	Kaliachak-iii	WB 11 ADB 10	Satangapara	Bamuntola	L036	9.150	295.230	23.170	318.400
	Chanchal-i	WB 11 ADB 11	Jaganathpur	Sripatipur	T02	13.000	511.230	38.730	549.960
		4	4 Roads			38.350	1399.210	106.87	1506.08

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
Murshidabad	Sagardighi	WB 13 ADB 07	Ballia	Amritpur via Tegharipara	L021	7.800	236.950	13.930	250.880
	Hariharpara	WB 13 ADB 08	Daltanpur Karkhana	Patharghata II	T01	10.914	359.180	19.130	378.310
	Hariharpara	WB 13 ADB 09	Swaruppur	Kalandanga	T06	14.364	496.970	25.250	522.220
	Jalangi	WB 13 ADB 10	Sadikhansdiar School More	Fakirabad More	T05	11.564	400.220	20.550	420.770
	Samserganj	WB 13 ADB 11	Joykrishnapur Ghosh Para	Uttar Mohammadpur via Laskarpur	T02	8.656	309.020	15.190	324.210
	Farakka	WB 13 ADB 12	Tildanga	Sikarpur	T05	8.480	311.910	16.790	328.700
		6	6 Roads			61.778	2114.250	110.84	2225.09
Nadia	Karimpur-i	WB 14 ADB 07	Funkatala	Natna (Part II)	T04	11.430	505.020	25.820	530.840
	Haringhata	WB 14 ADB 08	Chandirampur	Sukundipur	T06	20.841	772.180	41.390	813.570
		2	2 Roads			32.271	1277.200	67.21	1344.41
Uttar Dinajpur	Islampur	WB 15 ADB 06	Patagora	Gandhi Ashram	T011	5.565	222.070	10.720	232.790
	Itahar	WB 15 ADB 07	Churamon	NH 34	T07	8.020	310.000	16.201	326.201

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
	Raiganj	WB 15 ADB 08	MDR Connection	Barabar	L021	5.915	223.570	12.740	236.310
	Karandigi	WB 15 ADB 09	Tungidighi	Harbhanga	T05	7.872	281.390	14.180	295.570
	Goalpokher-II	WB 15 ADB 10	Saidpur Schoolpara	Simulia	T09	7.697	265.780	14.950	280.730
		5	5 Roads			35.069	1302.810	68.791	1371.601
Purulia	Barabazar	WB 16 ADB 05	Hullung Kadampur	Bodoldih Road	T09	15.950	455.390	44.280	499.670
	Hura	WB 16 ADB 06	Manguria Ashram	Kendbona More via Nowdih Road	T012	9.500	258.295	21.581	279.876
	Balarampur	WB 16 ADB 07	Dabha	Namasole Road	T08	15.100	403.893	34.087	437.980
	Purulia II	WB 16 ADB 08	Barasini	Kashipur Road	L024	5.250	150.723	12.185	162.908
	Kashipur	WB 16 ADB 09	Huchukpara More	Jairamdanga Road	L023	6.150	164.349	14.306	178.655
		5	5 Roads			51.950	1432.650	126.439	1559.089
Siliguri MP	Phansidewa	WB 17 ADB 03	Laxmansingh	Dandajhar Under Ghoshpukur Gram Panchayat	L057	4.165	142.650	8.290	150.940
	Matigara	WB 17 ADB 04	Baroghoria Bridge	Baroghoria Under	L057	2.415	82.180	4.680	86.860

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
				Patharghata Gram Panchayat					
	Phansidewa	WB 17 ADB 05	Mohanlaler Chhat	Pathargumia T.E. Under Ghoshpukur Gram Panchayat	T06	3.450	114.220	6.600	120.820
		3	3 Roads			10.030	339.050	19.57	358.62
Dakshin Dinajpur	Harirampur	WB 18 ADB 06	Bagbari	Mudeffar Kochpara	L031	5.500	225.960	12.970	238.930
	Gangarampur	WB 18 ADB 07	Sukdebpur	Katatair	L062	4.500	241.870	10.780	252.650
	Kumarganj	WB 18 ADB 08	Amulia	Kusumtara	L048	2.100	88.860	5.850	94.710
	Tapan	WB 18 ADB 09	Bhoirmore	Garail	L046	3.900	153.670	9.470	163.140
	Kushmondi	WB 18 ADB 10	Dikul	Bagduma	L024	5.300	214.640	12.460	227.100
	Harirampur	WB 18 ADB 11	Jodhguri	Bora	L047	3.900	152.250	9.460	161.710
	Kumarganj	WB 18 ADB 12	Dangarhat	Baraangina	L053	5.590	228.900	13.140	242.040
	balurghat	WB 18 ADB 13	Mohanpur	Paschim Kalikapur	L063	3.100	133.060	8.100	141.160
	Bansihari	WB 18 ADB 14	Dakshin Gopalpur	Deogaon	L033	2.700	115.450	6.920	122.370

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
	Gangarampur	WB 18 ADB 15	Boula	Sultanpur	L075	4.900	198.730	11.600	210.330
	Tapan	WB 18 ADB 16	Daudpur	Jaganathpur	L080	2.800	118.310	7.200	125.510
	Kushmondi	WB 18 ADB 17	Mahisbathan	Nabhor	L042	4.500	183.840	10.840	194.680
	Gangarampur	WB 18 ADB 18	Hossenpur	Kathalhat Hossenpur	L048	3.000	123.990	7.530	131.520
	Balurghat	WB 18 ADB 19	Chakram	Mazigram	L038	1.900	84.370	5.450	89.820
		14	14 Roads			53.690	2263.900	131.77	2395.67
Purba Medinipur	Egra I	WB 19 ADB 08	Egra Municipal Town More	Hasimpur (Bortona Uttar)	L033	5.431	222.080	11.010	233.090
	Patashpur-II	WB 19 ADB 09	Uttar Itaberia	Uttar Choumukh via Pratap Dighi	T01	5.958	209.110	11.800	220.910
	Egra II	WB 19 ADB 10	Madhabpur (Mallickpur)	Dakshin Choumukh	T01	9.943	365.800	15.700	381.500
	Mahishadal	WB 19 ADB 11	Mahishadal Raj College	Kanchanpur Jalpai	L033	5.080	198.940	8.440	207.380
	Egra I	WB 19 ADB 12	Kasbagola	Paniparul	T03	11.791	470.100	22.960	493.060
	Bhagwanpur II	WB 19 ADB 13	Udbadal	Uttar Khamar	T05	5.912	250.080	12.160	262.240
		6	6 Roads			44.115	1716.110	82.07	1798.18

DISTRICT	BLOCK	PACKAGE NO.	NAME OF THE ROAD		ROAD CODE	LENGTH (in Km.)	ESTIMATED COST (Rs. In Lacs)		
			FROM	TO			CONSTRUCTION	MAINTENANCE	TOTAL
Paschim Medinipur	Salboni	WB 20 ADB 12	Barokalshibhanga	Garmal	T03	8.525	313.491	18.040	331.531
	Garbeta III	WB 20 ADB 13	Birsingpur via Guidaha	Matalia (Nayabankati)	T02	11.500	514.633	29.650	544.283
	Dantan-ii	WB 20 ADB 14	Jahalda	Haripur via Amarda	T03	6.371	288.197	15.990	304.187
	Nayagram	WB 20 ADB 15	Niguri Bus Stand	Dhumsai	T03	11.750	359.126	26.840	385.966
	Nayagram	WB 20 ADB 16	Dhankamra	Atmajhia	T01	4.000	136.191	9.299	145.490
	Keshpur	WB 20 ADB 17	Sakhisole	Anandapur	T012	12.000	422.983	29.115	452.098
	Dantan-i	WB 20 ADB 18	Chaulia Level Crossing	Barangi More	T04	10.150	447.970	23.990	471.960
	Narayangarh	WB 20 ADB 19	Chaturibhara	Keshiary Block	T09	13.655	533.830	30.060	563.890
		8	8 Roads			77.951	3016.421	182.984	3199.405
GRAND TOTAL		106	109 Roads			908.091	32970.681	1956.431	34927.112

(Source: WBSRDA office, Kolkata, West Bengal)

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
Land acquisition	<ul style="list-style-type: none"> Land acquisition, 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 	All through the Rural roads excepting in stretches of habitations	Pre Construction Phase	Necessary cost provisions has been made. All other	PIC, PIU, Forest Department NGOs shifting of utilities shall be carried out by respective governmental

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>Forest Department on behalf of WBSRDA</p> <ul style="list-style-type: none"> • 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 of project. • 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, 			costs are included under project cost.	<p>bodies at cost to be reimbursed by project, implementing agency.</p> <p>Environmental officer under the PIC will coordinate and ensure implementation.</p> <p>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</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>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.</p>				<p>WBSRDA, officials of Forest Department, Contractor and local NGOs and coordinated by Environmental officer of Construction Supervision Consultant for specific package.</p>
Forest Areas (In case applicable)	<ul style="list-style-type: none"> • In case, the road construction requires diversion of 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. • 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 	All through the alignment of rural roads	Pre construction phase	Necessary cost provisions has been made	<p>Project Design 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
	<p>stipulated by Government of India/State Government.</p> <ul style="list-style-type: none"> 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 projects also contribute to increase in green cover. 				
Diversion of traffic	<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 	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

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	visible particularly at night.				
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. 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 	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
	<p>properly for the entire duration of its use.</p> <ul style="list-style-type: none"> • 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 for the duration of acquisition and land restoration. 	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
	<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 	As determined by contractor under approval of PIC / PIU	Construction Phase	Borne by Contractor	The selection of quarries and material selection will be the responsibility of contractor under

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>procedures/practices in place and regular inspection shall be carried to ensure compliance.</p> <ul style="list-style-type: none"> Large material drawls should not be a cause for neglect of safety procedures which is otherwise common. 				<p>approval of PIC /PIU/TSC</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation of mitigation actions.</p>
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. 	As determined by contractor under approval of PIC	Construction Phase	Borne by Contractor	Contractor is responsible for ensuring provision

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> 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. 	/PIU			<p>of facilities under approval by PIC / PIU</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p> <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>
Water resources & Drainage channels	<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. 	At all locations of CD structures along the rural roads	Construction Phase	To be borne by contractor	The planning, and construction / up gradation of existing/new cross drainage structures

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> • 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 with utmost caution to leave no traces. • 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. 				<p>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>
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 	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 &

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>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.</p> <ul style="list-style-type: none"> 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 manual specifies design and construction procedures for construction of fly ash embankments. 				<p>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.</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</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. 	All operational areas as determined by PIC /PIU	Construction phase	Necessary cost provisions have been	Contractor is responsible for ensuring a occupationally

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> 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 			made	<p>healthy environment for all personnel irrespective of category under approval of PIC /PIU/TSC</p> <p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation</p> <p>Environmental officer shall requisition services of private / governmental agencies for undertaking periodic environmental monitoring if necessary to ensure compliance of contractor in this</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					regard.
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 <ol style="list-style-type: none"> Minimizing area of ground clearance only to the extent required. Balancing the filling and cutting of earth to the extent possible. Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type. 	At all sections of road construction involving embankment section.	Construction phase	Forms part of project cost	<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,</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and NOT after construction has been completed.				Govt. of West Bengal in selecting endemic species, which also can serve engineering functions.
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 	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</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>stopped and instruction will be taken from archeological department.</p> <ul style="list-style-type: none"> 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 as Department of Archeology, Government of West Bengal will also be contacted in case assistance required. 				PIC will monitor and ensure appropriate implementation.
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	Contractor is responsible for ensuring a occupationally 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

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					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 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 	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

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	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.				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 / injuries due to operations. 	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 communities in and around all operational areas under approval of PIC /PIU Environmental officer and other

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					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. The areas shall be access controlled and entry shall be allowed only under authorization. 	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 irrespective of category and also

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					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 3)	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, 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		✓		

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Appendix 3)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
		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, Mosque & any other similar religious structure	Restricted movement of work force, equipment and activities. Also record 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 turfing 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 SI. 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	Ensure most activities are				

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Appendix 3)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
	beds	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			