

Environmental Assessment Report

Initial Environmental Examination (Orissa)
Project Number: 37066
October 2007

India: Rural Roads Sector II Investment Program (Project 2)

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

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

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APPENDICES

Appendix I	List of 1000.78km of Rural Roads under Second Annual Batch of ADB Loan Assistance - Assam
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ABBREVIATIONS

ADB	Asian Development Bank
OSRDA	Orissa State Rural Development Agency
BIS	Bureau of Indian Standards
CGN	Chief General Manager
CGWB	Central Ground Water Board
CO	Carbon Monoxide
COI	Corridor of Impact
ECoP	Environmental Code of Practices
EIA	Environmental Impact Assessment
EMAP	Environmental Mitigation Action Plan
EO	Environmental Officer
FEO	Field Environmental Officer
FGD	Focus Group Discussion
GOI	Government of India
GSB	Granular Sub Base
HA	Hectare
HC	Hydro Carbon
IA	Implementation Agency
IEE	Initial Environmental Examination
IRC	Indian Road Congress
LPG	Liquefied Petroleum Gas
MORD	Ministry of Rural Development
MORTH	Ministry of Road Transport and Highways
NAAQS	National Ambient Air Quality Standards
NGO	Non Governmental Organisation
NOx	Nitrogen Oxide
NRRDA	National Rural Roads Development Authority
PIC	Project Implementation Consultant
PIU	Project Implementation Unit
PMC	Project Management Consultant
PMGSY	Pradhan Mantri Gram Sadak Yojna
POL	Petroleum, Oil and Lubricants
PPTA	Project Preparation Technical Assistance
ROW	Right of Way
RPM	Respirable Particulate Matter
RRSP II	Rural Roads Sector Project II
SBD	Standard Bidding Documents
SO ₂	Sulphur di-Oxide
SPM	Suspended Particulate Matter
TA	Technical Assistance
US	United States
WBM	Water Bound Macadam

SECTION-1

1.0 INTRODUCTION

1.1 General

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 annual batches. First annual 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 annual batch is nearing complete and for the second annual batch state Governments are in the process of award of contract. The Detailed Project Reports (DPRs) for second annual batch have been prepared by the state Government. These DPRs do not have coverage of environmental assessment. The environmental assessment has to be taken up as per policy requirements of ADB. The project as per classification of ADB has been categorised as 'Category B' project and therefore requires an Initial Environmental Examination (IEE). The present volume of the report covers IEE report for about 1198.385 km road length in the State of Orissa in the second annual batch. 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) under the ADB loan assistance.

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 Orissa State Rural Road Agency (OSRRA) is the implementation agency of PMGSY program in Orissa.

1.2 Project Identification and Location

The OSRRA has selected about 1198 km of rural roads to be taken up under the second annual batch of ADB loan assistance under RRSP II in Orissa. The 1198.385 km of roads comprises 291 different stretches spread over in 14 districts of the State. Within each district, the roads are further scattered in several blocks and sub divisions. The minimum and maximum length of the roads ranges between 0.50 and 21.5 km respectively. The list of 1198.385 km roads is given in **Appendix 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 10-12m right of way (ROW), which includes side slopes for embankment, side drains on either side of the alignment.

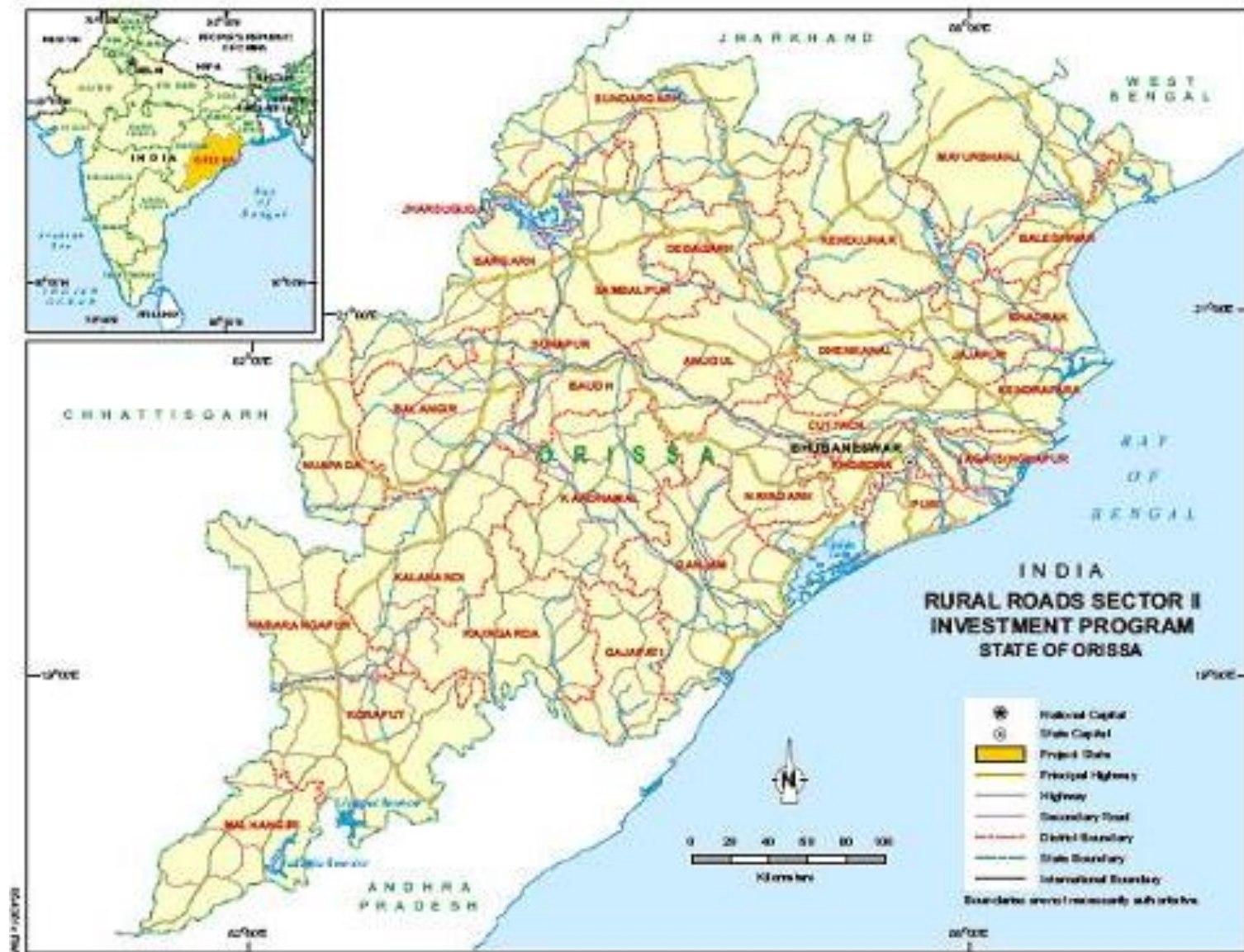


Fig No. – 1.1 District Map of Orissa

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.

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

The TSC has been appointed to assist the IAs in environmental and social safe guard during the project implementation. The TSC has prepared Initial Environmental Examination Report. For this the consultants visited project roads and OSRDA during May - August, 2007.

For Initial Environmental Examination (IEE), sample rural roads in districts from different stretches / locations were selected, which broadly represent the second batch of 1198 km spread across the 14 districts.

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 government 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 annual batch (Batch II) of 1198 km of rural roads in Orissa and is based on the review of the sample ECOP/environmental check lists prepared for the sub projects by the PIUs. The IEE has been carried out in accordance with the Bank's Environmental Assessment Guidelines, 2005.

1.6 Acknowledgement

The TSC consultants gratefully acknowledge the support received from Sri Jagannath Patel, Engineer-in-Chief, Sri M R Kar (SE), State Quality Coordinator and Sri G.K.Prasad (EE), OSRDA 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 OSRRA during site visits and other governmental agencies during the data collection and useful interactions is also gratefully acknowledged.

SECTION- 2

2.0 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 Rural Road Development Program under the PMGSY is categorised as 'B' in accordance with 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 1198 km of rural roads is spread over 14 districts. The district wise distribution of the 1198 km roads is given in **Table 2.1**.

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

S. No.	Name of the District	No. of Packages	No. of Roads	Length (km)	Length in km	
					Minimum	Maximum
1	Angul	17	28	128.97	1.12	11.36
2	Bargarh	21	46	154.96	0.5	11.8
3	Bolangir	10	31	97.74	0.6	7.0
4	Dhenkanal	12	33	103.96	0.73	7.91
5	Jharsuguda	2	7	20.7	1.41	5.41
6	Kalahandi	26	43	174.21	1.0	11.8
7	Koraput	13	23	134.43	0.5	21.5

S. No.	Name of the District	No. of Packages	No. of Roads	Length (km)	Length in km	
					Minimum	Maximum
8	Malkangiri	5	7	31.3	1.5	8.8
9	Nowrangpur	7	14	80.85	0.675	17.8
10	Nuapada	7	16	72.24	0.7	16.5
11	Rayagada	9	9	62.4	2.2	13.38
12	Sonepur	7	20	55.305	1.05	6.7
13	Sundargarh	6	12	41.92	0.96	7.15
14	Sambalpur	5	10	39.09	1.0	9.51
	Total	145	299	1198.335	0.5	21.5

The list of sample roads visited is given in **Table 2.2**. The list of 1198 km roads is given in **Appendix I**.

Table 2.2 : List of Selected Roads for Initial Environmental Examination in Orissa

S. No.	District	Package No.	From	To	Length (km)
1	Angul	OR-01-ADB-14	Thakurgarh	Tapdole	17.55
2	Angul	OR-01-ADB-09-II	Antulia	Tapdhol	2.25
3	Bargarh	OR-03-ADB-18	Kuchipali	Sidhira	3.90
4	Bargarh	OR-03-ADB-14-II	NH6	Arjunda	2.3
5	Bargarh	OR-03-ADB-14-II	Arjunda Road	Arjunda	1.34
6	Balangir	OR-05-ADB-10	SH 42	Sindurbahal	6.0
7	Bolangir	OR-05-ADB-14-II	MDR 40	Phapsi	2.5
8	Bolangir	OR-05-ADB-14-II	Gandapatrapali	Dharabgarh	4.4
9	Dhenkanal	OR-09-ADB-25	Amna	Ambatota Sahi	2.01
10	Dhenkanal	OR-09-ADB-25-II	T-7 Khaliberana chhak	Nuagaon	6.05
11	Jharsuguda	OR-14-ADB-04	NH 200	Parmanpur	3.10
12	Jharsuguda	OR-14-ADB-04-II	R.D. Road	Kuleimura	1.9
13	Kalahandi	OR-15-ADB-30	Khairmal	Naikanguma	7.1
14	Kalahandi	OR-15-ADB-30-II	RD Road	Bhainripali	2.4
15	Koraput	OR-19-ADB-08	PWD Rd.	Dumripadar	7.78
16	Koraput	OR-19-ADB-08-II	P.W.D. Road	Aripuraghati	1.2
17	Nawarangpur	OR-22-ADB-09	SH 39	Chhataguda	1.30
18	Nuapada	OR-24-ADB-09-II	NH 217	Salebhata	2.4
19	Nuapada	OR-24-ADB-11	Nagalbod	Akhadabhata	11.7
20	Rayagada	OR-27-ADB-05-II	PWD Road	Dasmantpur	6.3
21	Rayagada	OR-27-ADB-13	Polama	Paikapada	6.0
22	Sambalpur	OR-28-ADB-11	Tihadipali	Monapali	9.51
23	Sambalpur	OR-28-ADB-11-II	Dhudipali	Ladampali	2.03
24	Sonepur	OR-29-ADB-08	MDR 39	Langalkata	1.15
25	Sonepur	OR-29-ADB-08/ II	MDR-39	Lingmarini	6.7
26	Sundargarh	OR-30-ADB-06	Lephripada	Kulabira	5.0
27	Sundargarh	OR-30-ADB-06/II	PWD	Kadamal	3.6
28	Malkangiri	OR-20-ADB-06	PWD road	Salimarkonda	6.25
29	Malkangiri	OR-20-ADB-06/ II	PWD Road to	MV 72	1.75
Total					135.47

2.5 Size or Magnitude of Operation

The construction cost of rural roads under the second annual batch of 1198 km is broadly estimated at Indian Rupees 3536.278 million.

2.6 Schedule for Implementation

The 1198 km rural road construction works are scheduled to commence from December 2005 and expected to be complete by end 2007.

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 2.1** is showing typical cross section of the rural roads.

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

2.7.2 Present Condition

At present the 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 works 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-2.3**;

Table-2.3: Summary Environmental Condition on sample Roads

Environmental impact checklist points	Status as reported in the Checklists
A. Climate Conditions	
Temperature (°C)	
High	Maximum 47°C
Low	Minimum 7°C
Humidity (%)	
High	Maximum 92%
Low	Minimum 15%
Rainfall (mm/year)	1020 mm to 2146.8 mm
Rainy Season (---month to ---month)	June to October

Environmental impact checklist points	Status as reported in the Checklists
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	Jharsuguda, Rayagada, Sablepur, Koraput & Malkangiri districts have partial or more hilly roads
Forest area	No road passes through forest area
Lake/Swamp	None of the roads having Lake/Swamp
Inhabited area	Denkanal, Jharsuguda, Sonapur, Nuapada, Rayagada, Sambalpur, Angul, Koraput & Malkangiri roads having inhabited area
Agricultural land	Bargarh, Denkanal, Sonapur, Bolangir, Kalahandi, Nuapada, Rayagada, Sambalpur, Koraput & Malkangiri roads having side by agriculture land area
Barren land	Denkanal, Jharsuguda, Sonapur, Bolangir, Kalahandi, Nuapada, Rayagada & Sambalpur roads having side by barren land
Flat area	Bargarh, Denkanal, Jharsuguda, Sonapur, Sundergarh, Bolangir, Kalahandi, Nuapada, Rayagada & Angul 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?	Bargarh, Sonapur & Bolangir 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)

Environmental impact checklist points	Status as reported in the Checklists
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 to 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)
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 district roads except Jharsuguda, Nawarangpur & Sambalpur districts
If suggestions received, do they get incorporated into design?	Yes for all district roads except Jharsuguda, Kalahandi, Nawarangpur, Sambalpur, Koraput & Malkangiri districts
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

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 OSRDA, 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.

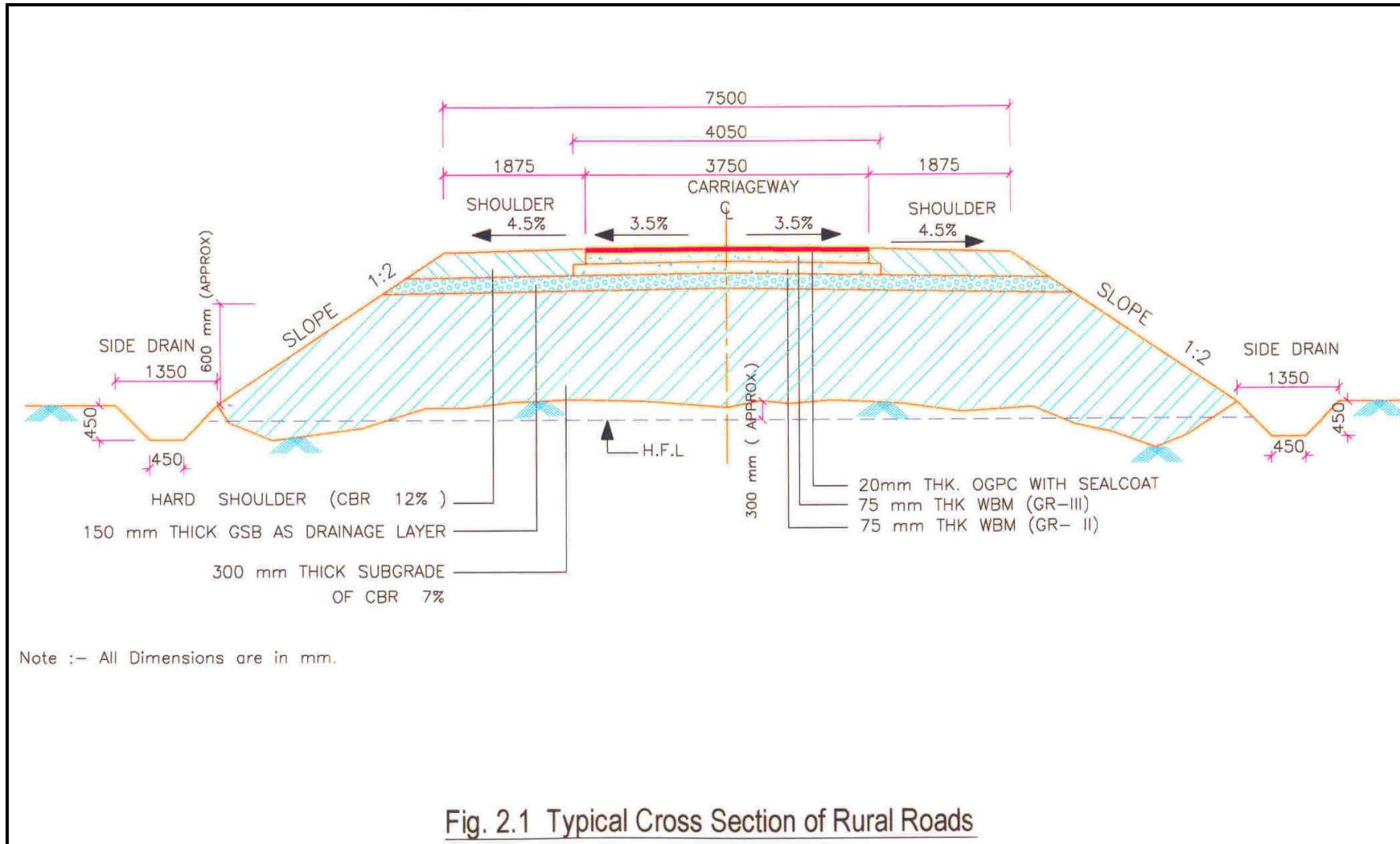


Fig. 2.1 Typical Cross Section of Rural Roads

SECTION-3

3.0 DESCRIPTION OF ENVIRONMENT

3.1 General

The baseline environment of the study area along with environmental profile within the corridor of impact (COI) of the project roads are given in this section.

The State of Orissa is divided into the following broad regions for assessment of the baseline environment profile of the project districts as a whole and along the Corridor of Impact (COI) of the 135.47km sample roads.

- Upland Districts with Mixed landuse in Northern and Western Part of State
- Uplands Districts with Mixed landuse in Southern and Central Part of State

3.2 Physical Resources

3.2.1 Topography

Orissa is located between the parallels of 17.49'N and 22.34'N latitudes and meridians of 81.27'E and 87.29'E longitudes. It is bounded by the Bay of Bengal on the east; Madhya Pradesh on the west and Andhra Pradesh on the south. It has a coast line of about 450 kms. It extends over an area of 155,707 square kms. According to the 1991 census, it has a total population of 31,512,070 (3.73 percent of the total population of India) out of which about 16,237,000 are male and 15,275,070 are female. This region is the combination of several deltas of varied sizes and shapes formed by the major rivers of Orissa, such as the Subarnarekha, the Budhabalanga, the Baitarani, the Brahmani, the Mahanadi, and the Rushikulya. Therefore, the coastal plain of Orissa is called the "Hexadeltaic region" or the "Gift of Six Rivers". It stretches along the coast of the Bay of Bengal having the maximum width in the Middle Coastal Plain (the Mahanadi Delta), narrow in the Northern Coastal Plain (Balasore Plain) and narrowest in the Southern Coastal Plain (Ganjam Plain). The North Coastal Plain comprises the deltas of the Subarnarekha and the Budhabalanga rivers and bears evidences of marine transgressions. The Middle Coastal Plain comprises the compound deltas of the Baitarani, Brahmani and Mahanadi rivers and bears evidences of past 'back bays' and present lakes. The South Coastal Plain comprises the lacustrine Plain of Chilika Lake and the smaller delta of the Rushikulya River. The plateaus are mostly eroded plateaus forming the western slopes of the Eastern Ghats with elevation varying from 305-610 metres. There are two broad plateaus in Orissa : (i) the Panposh - Keonjhar -Pallahara plateau comprises the Upper Baitarani catchment basin, and (ii) the Nabrangpur - Jeypore plateau comprises the Sabari basin.

3.2.2 Geology

The state of Orissa is on the eastern coast of India extending from 17 49 'N to 22 34'N Latitude and from 81 27'E to 87 29'E longitude. Geographically, Orissa can be divided into four parts - the Coastal Plains, Central Tract, Northern Plateau and the Eastern ghats. The coastal plain stretches along the eastern margin of the state from the Subarnarekha in the North to the Rusikulya in the South. It comprises of Balasore, Cuttack, Puri and Ganjam districts.. The central tract comprises of the mountainous region covering around 3/4th area of the State-stretching from North to South. The Northern plateau is an extension of the Chhotangapur plateau covering the districts of Mayurbhanj, Keonjhar, Sambalpur and Eastern Sundargarh. The Eastern ghats covers the South Western portion of the state

forming an undulating plateau through Ganjam and Koraput district in the South and parts of Kalahandi and Phulbani in South West. The central and southern coastal districts of the state are largely covered with Igneous Sedimentary and Metamorphic rocks. The Igneous rocks comprise Granite, Grano-Diorite Pegmatite type. The sedimentary rocks are largely alluvium in nature. The metamorphic rocks comprise khondalite, Charcoknites and unclassified Crystallines. The Eastern and western districts are largely covered with mixed formations comprising Alluvium, Laterite, Granite, Grano-Diorite Pegmatite, Gneisses, Khondalite, Charcoknites and unclassified Crystallines.

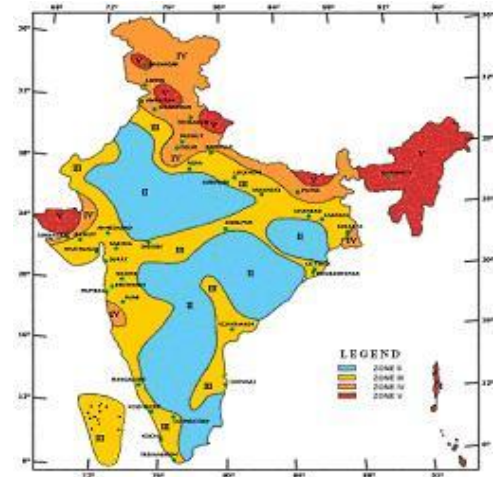
The Rocks and Mineral map of the project districts is given in **Figure 3.1**

3.2.3 Earthquake Zone / Sensitivity

The Bureau of Indian Standards has categorised the entire India into 5 seismic zones depending upon the degree of proneness to earthquakes. The Zone I signify lesser degree while Zone V is of highest order. The northern and southern most parts of Orissa are classified as Zone I and remaining parts of the state are classified under Zone II & Zone III.

3.2.4 Climate:

The climate of the state is generally tropical in nature. The state has several weather observatories located all across the state. The compiled weather data from these observatories for the project districts are given hereunder.



Earth Quake Zones of India

Temperature: The mean minimum and mean maximum annual temperature across the state covering the Northern, Eastern, Western and Southern districts is 13.5°C and 37°C respectively. In certain parts of the state, occasionally the mean maximum temperature can rise up to 47°C.

Relative Humidity: Normally, May to October months are humid and January to April are dry. The relative humidity is normally more in coastal districts as compared to the upland districts. The relative humidity in project districts range between 15 to 92%.

Wind: The predominant wind direction in the state is South during both morning (24% of time) and evening hours (26% of time). The calm period prevail for 50% of time during morning hours and 61% of time in the evening hours. The mean wind speed ranges between 2.6 km/ h to 4.9 km/h. Generally, April to June is windy as compared to other months. The region has clear visibility even more than 20km for over 250 days in a year. The cyclonic storms over the Bay of Bengal particularly in the south and western parts of the state cause widespread cyclonic weather, which in turn lowers the temperature and cause high relative humidity and sultry weather conditions.

Rainfall: The rainfall in the project districts range between 1020 mm to 2146.8 mm, out of which more than 80% is received between June to September.

The Climate map of the project districts is given in **Figure 3.2**.

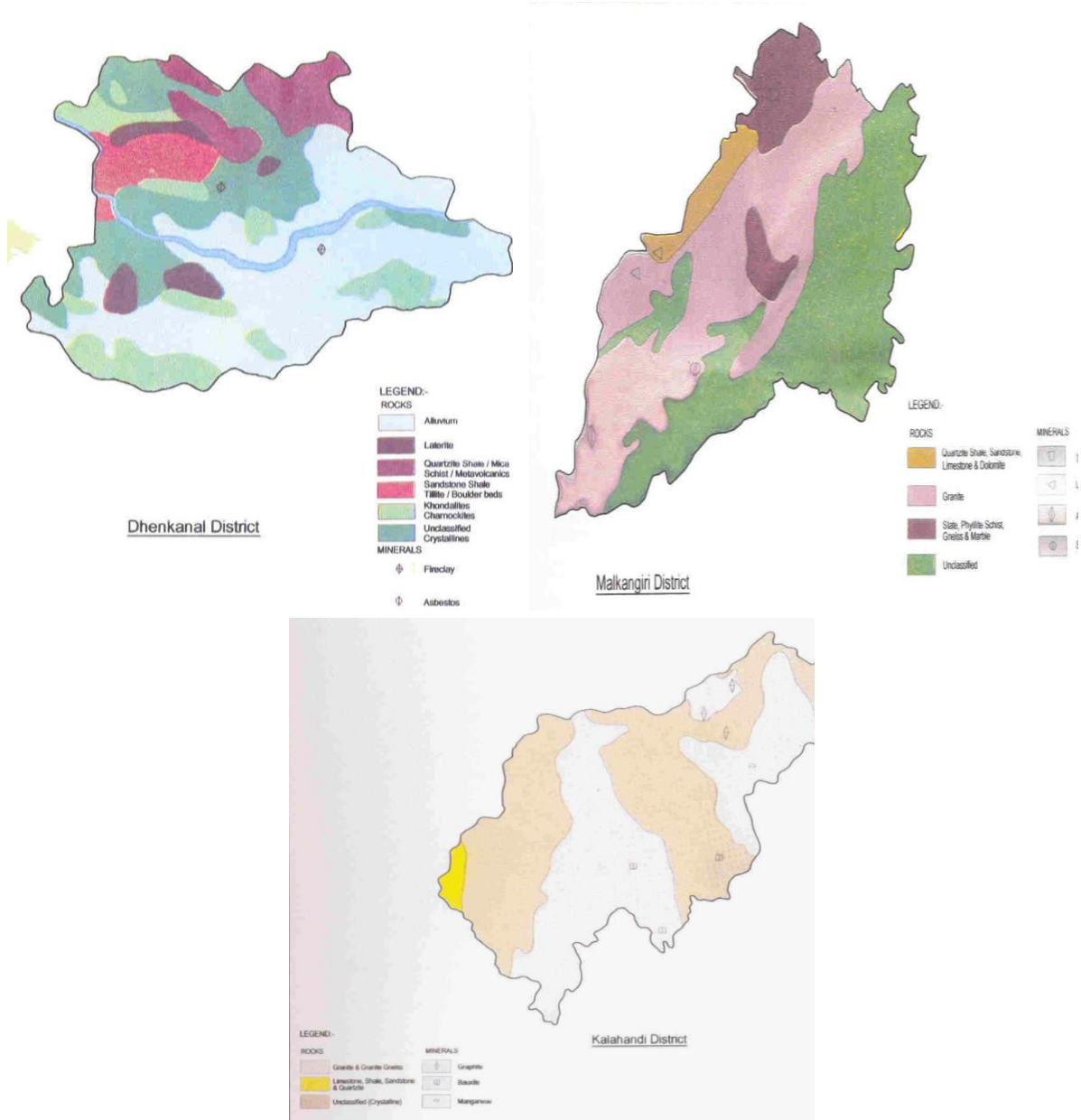


Figure No.- 3.1 Rocks and Minerals of Project Districts

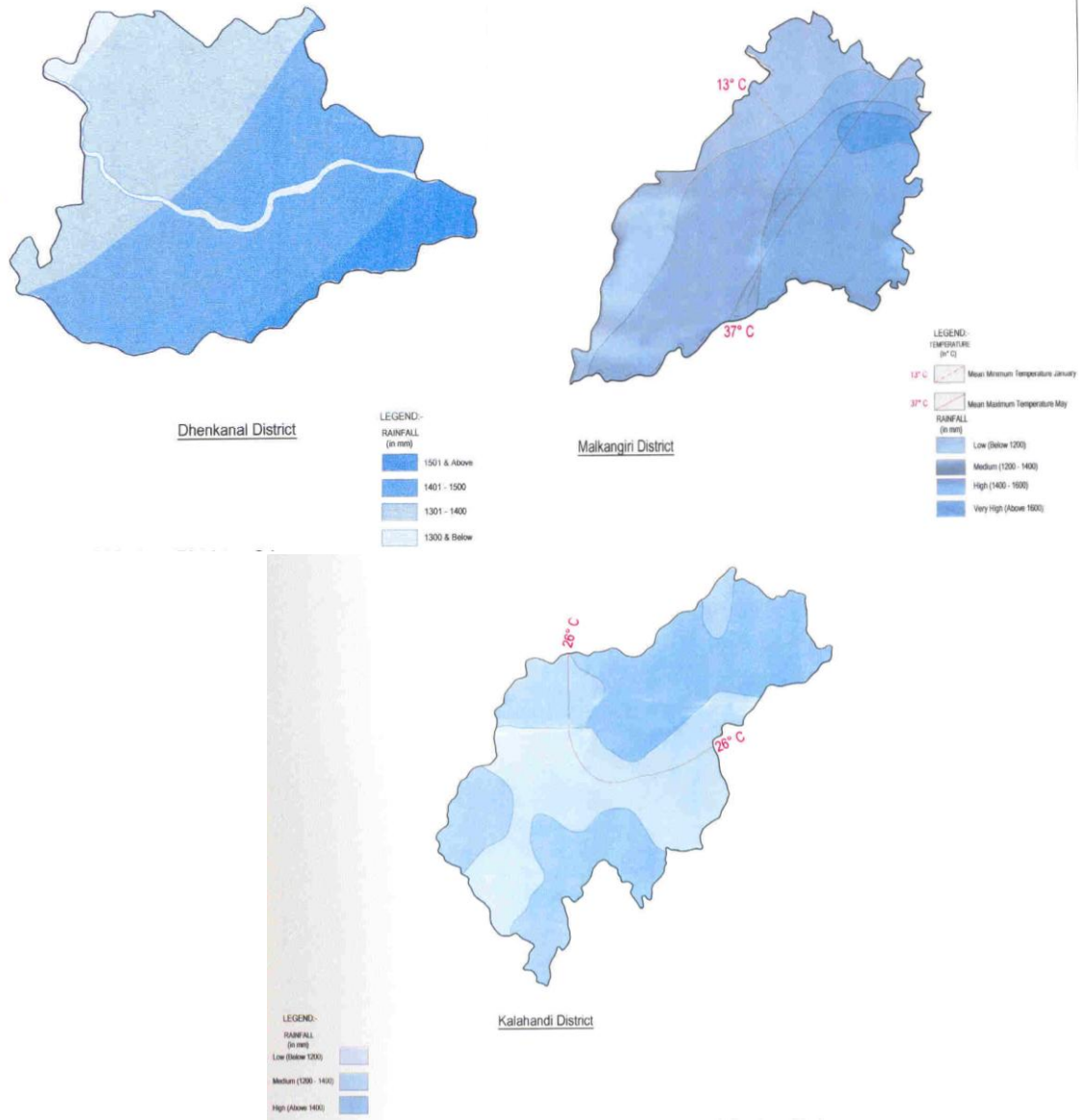


Figure No.- 3.2 Climate map of the project districts

3.2.5 Surface Water:

Orissa has three major river basins, namely Mahanadi, Brahmani and Subarnarekha basins. Among these, Mahanadi is the largest, followed by Brahmani and Subarnarekha basins. The Northern parts of the state is drained by Subarnarekha river, the central part (partly) of the state is drained by Brahmani whereas the Mahanadi River drains central (largely) and Southern parts of the State.

3.2.6 Ground Water:

The groundwater potential in the project districts vary from than 1 litre/sec to 40 litre/sec. the hydro-geological formations in the coastal districts range between porous confined aquifers having primary intra-granular porosity (with yields up to 40 litre/sec). to upland regions with generally limited ground water potential having less intra-granular porosity and fractures (with yield less than 1 litre/sec) the occurrence of ground water table range from 1m above mean sea level to 500 m above mean sea level across the state.

The hydrogeology of the project districts showing the ground water potential, water table contour is given in **Figure 3.3**

3.2.7 Soils:

The major soil types within the project districts can be classified into five groups namely inceptisols, ultisols, entisols, aridisols and alfisols, these soil types can be further classified into brown, red, yellow and lateritic soils. The entisols is subclassified into younger alluvial, and laterite soils. The aridisols is sub-classified into saline and saline alkali soils. The alfisols is sub-classified into deltaic alluvial soils, older alluvial soils, red gravel soils, red sandy soils, red sandy soils, red loamy and mixed red black soils.

The soil types of the project districts is given in **Figure 3.4**

3.2.8 Surface Water Quality

The rural road construction proposals normally cross small drainage channels (Mostly agricultural field 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. Therefore, surface water quality is expected to remain as such.

3.2.9 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 significant 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 parameters 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 beyond the limits of the NAAQS as prescribed in

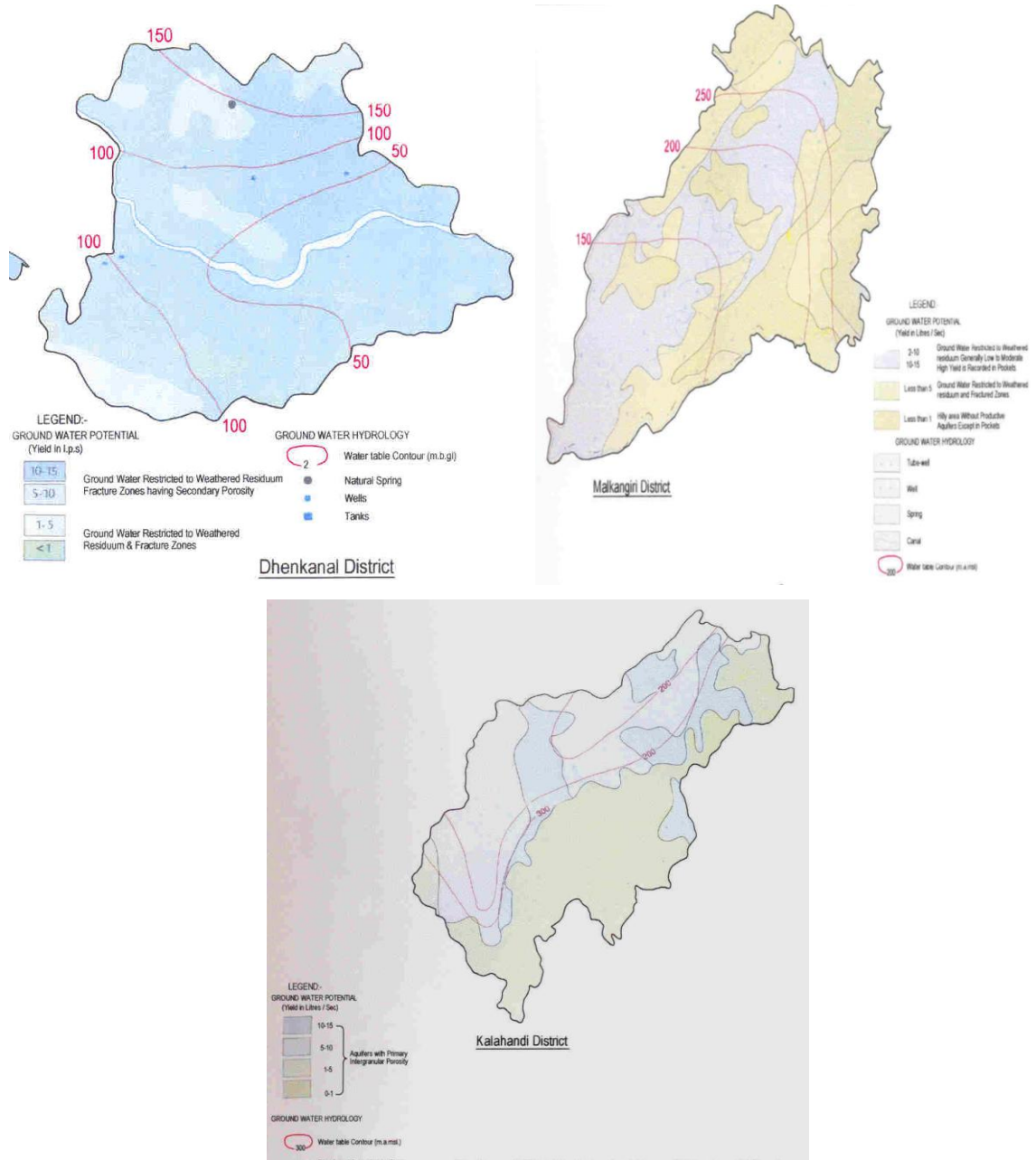


Figure No.- 3.3 Hydrological map of the project districts

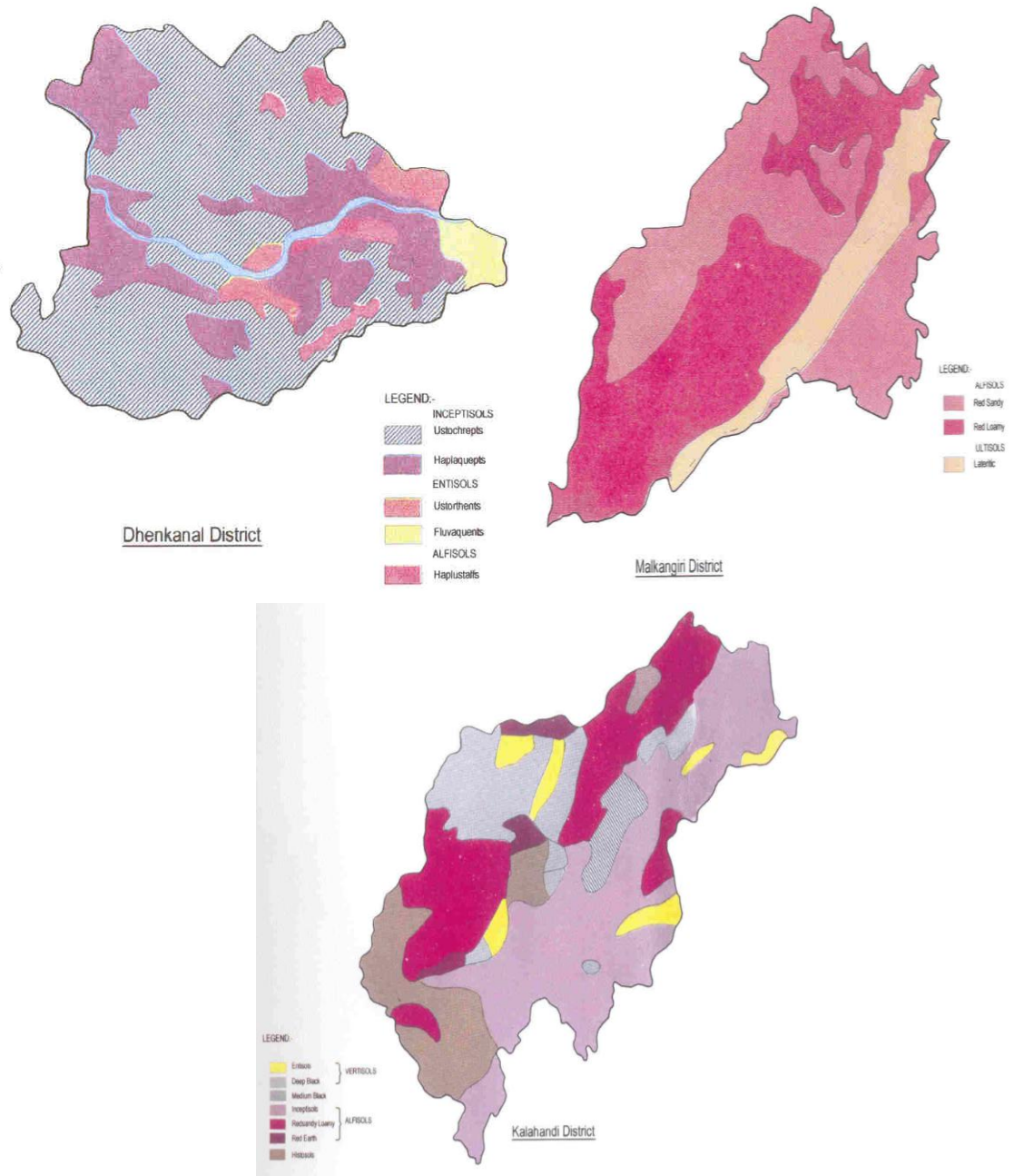


Figure No.- 3.4 Soil map of the project districts

Environmental Protection Act, 1986, which is an umbrella act for the protection of environment in the country published by Ministry of Environment and Forest (MOEF).

3.2.10 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.

3.2.11 Drought & Cyclone:

Orissa has both chronically draught prone and cyclone affected areas within the state. Some of the chronically drought prone areas are Kalahandi, Bolangir and Koraput districts.

3.2.12 Land Use:

The land use pattern within the project districts can be broadly classified into arable irrigated, arable un-irrigated, forest areas, waste land/scrub, and rural / urban settlements areas. The land use pattern of project districts is shown in **Figure 3.5**.

3.3 Ecological Resources:

3.3.1 Terrestrial flora:

Plants/animals and environment are inter related to each other. With the change in environmental conditions, the vegetation cover as well as animals reflect several changes in its structure, density and composition.

During the field investigations, the most dominant terrestrial flora within the project districts was recorded. The prevailing vegetation cover over the area is mainly of tropical dry deciduous forest [5B/C-1/C] as per the Champion and Seth (1968) "Classification of forest type of India". 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 may 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 3.1**

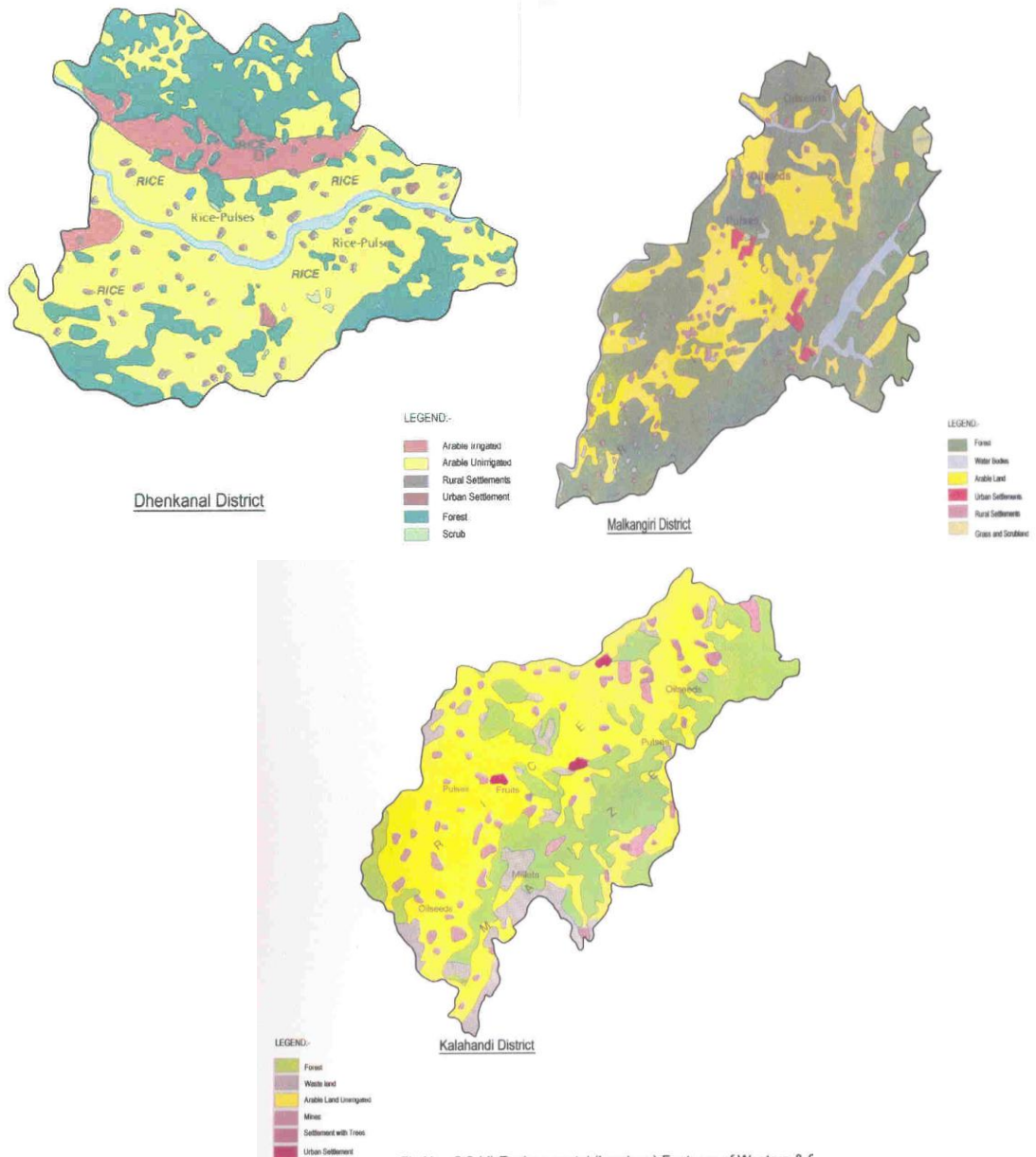


Figure No.- 3.5 Land Use map of the project districts

Table 3.1 List of Common Trees of Project Districts

S. No.	Botanical Name	S. No.	Botanical Name	S. No.	Botanical Name
1	Acacia Catechu	9	Anthocephalus	17	Casuarina equisetifolia
2	Acacia nilotica	10	Azadirachta indica	18	Ceiba pentandra
3	Acacia auriculiformis	11	Artocarpus integrifolia	19	Cordia myxa
4	Adina cardifolia	12	Bauhinia variegata	20	Dalbergia sissoo
5	Aegl mermelos	13	Bombax cieba	21	Delonix regia
6	Alangium Salvifolium	14	Boswellia serratta	22	Dipterocarpus
7	Albizialebbek	15	Cassia fistula	23	Diospyros malaberica
8	Alstonia sholaris	16	Cassia seamea	24	Ervthrina strieta
25	Eucalyptus globossus	37	Mumusops chemgi	49	Sweitenia macrophylla
26	Ficus benghalensis	38	Mytragyna perviflora	50	Syzygium cumini
27	Ficus glomerata	39	Odina wodier	51	Tectona grandis
28	Ficus infectoria	40	Oroxylum indicum	52	Terminalia arjuna
29	Ficus religiosa	41	Peltophorum pterocarpum	53	Terminalia catappa
30	Gliricidia sepium	42	Pithecolobium dulee	54	Tamarindus indica
31	Gmelina arborea	43	Phoenixsilyestris	55	Thespesia populnea
32	Guazoma tomentosa	44	Pongamia pinnata	56	Toona ciliata
33	Lagerstroemia speciosa	45	Polyalthia longifolia	57	Trema orientalis
34	Leucaena leucocephala	46	Samanea saman	58	Trewia nudiflora
35	Mangifera indica	47	Stereulia foetida		
36	Melia azaderach	48	Sweitenia macrophylla		

Although, none of the road stretches passes 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 survey indicates that the selected rural road construction proposals (within the ROW) have trees ranging between 5 -10 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 value but provide a serene landscape and the trees serve as a nesting place for tree dwelling avian fauna as well as provide clean atmosphere..

3.3.2 Terrestrial/Avian fauna:

The general faunal study was carried out for the core zone and buffer zone separately as given below; the species observed in buffer zone are migratory, common ones are given in **Table – 3.2.**

Table 3.2: List of common fauna of Project Districts

S. No.	Zoological Name	S. No.	Zoological Name	S. No.	Zoological Name
1	Bufo sp	14	Rattus rattus	27	Copsychus sp.
2	Rana tigrina	15	Corves splendens	28	Coracius bengalensis
3	Calotes versicolor	16	Passer domesticus	29	Ceryle sp.
4	Hemidactylus sp.	17	Ploceus philippinus	30	Vespa orientalis
5	Naja naja	18	Psittacula krameri	31	Agrian sp.
6	Vipera sp	19	Pavo cristatus	32	Apis indica
7	Fumambulus pennanti	20	Columba livia	33	Musca domestica
8	Felis sp.	21	Egretta sp.	34	Periplanata sp.
9	Cuon sp	22	Pycnonotus sp.	35	Lasioderma sp.
10	Bos sp.	23	Acridotheres tristis	36	Pachlomerus sp.
11	Bubalis babalis	24	Eudynamys scolopacea	37	Schistocera sp.
12	Eqqus sp.	25	Apus affinis	38	Camponotus sp.
13	Herpestes sp.	26	Ardeola grayii	39	Gryllus sp.

Amphibians: Among amphibians toad (*Bufo sp.*) and frog (*Rana tigrina*) are reported.

Reptiles: Among reptiles Indian garden lizards (*Calotes versicolor*), house lizards (*Hemidactylus sp.*) are generally reported while cobra (*Naja naja*) and viper (*Vipera sp.*) are rarely reported.

Mammals: Among mammals Indian palm squirrel (*Fumambulus pennanti*), cat, dog (*Cuon sp.*), cow, Buffalo, rat (*Rattus rattus*) etc. are reported.

Aves: Among aves common birds like crow (*Corves splendens*), sparrow (*Passer domesticus*), parrot (*Psittacula krameri*), baya (*Ploceus philippinus*), peafowl (*Pavo cristatus*), pigeon (*Columba livia*), *Egretta sp.* etc. are reported.

Arthropods: Among arthropods common insects viz Butterflies, Dragonflies, Wasps; Grasshopper, Cockroach, House fly, Beetles, Mosquitoes etc are reported.

3.3.3 Forests:

The prevailing vegetation cover over the area is mainly of tropical dry deciduous forest [5B/C-1/C] as per the Champion and Seth (1968) "Classification of forest type of India".

The forest map of orissa indicates that central districts like Angul, Denkanal are having dense forest areas while south and western parts have a mix of dense and open forest areas.



3.3.4 Wildlife:

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.

3.3.5 Rare or endangered species:

Endangered and threatened animals of India have been listed in the Schedule I and Schedule II of the Wildlife (Protection) Act, 1972 (amended in 2001). The details of these species present in the study area are given below:

No threatened, rare, endangered or endemic species were observed during the survey in core zone. In buffer zone following species were rarely reported.

Schedule I: None of the species were recorded from Schedule I.

Schedule II:

- Birds: Peafowl- *Pavo cristatus*
- Reptiles: Indian cobra- *Naja naja*

3.3.6 Fisheries:

None of the sample project roads area is having any fish culture ponds. However, in remaining roads of second annual batch small fisheries ponds of natural/manmade may appear. No encroachment shall be allowed in such cases.

3.3.7 Aquatic Biology:

No wetland or big water bodies are existing in and around the selected project roads area. Therefore construction works are not envisaged to affect aquatic biology of the area. Certain small ponds may be in remaining roads of second annual batch impact corridors, which has to be protected from runoff of the construction work and shall not be disturbed.

3.4 Human and Economic Development:

3.4.1 Population and Community;

Orissa has a population of 32 million. About 87% of the population lives in the villages and one third of the rural population does not own any land other than homesteads. 25% of Orissa's Population is Tribal. The southern and the south western districts of Koraput, Malkangiri, Rayagada, Nawarangpur and Kalahandi show a higher percentage ST population compared to the other western and central project districts.

3.4.2 Industries:

Although Angul, Koraput and Rayagada have major industrial areas, none of them fall within the core or the buffer zone of the proposed road corridors. In general, mineral mining is common in hilly areas of Koraput, Rayagada and Kalahandi while coal mining is the major mining activities of Dhenkanal and Jharsuguda districts. Sundargarh is known for the iron ore mining areas and rourkela steel plant. None of these mining areas fall within the core or the buffer zone of the proposed road corridors.

3.4.3 Flood Control facilities:

Orissa is generally prone to various disasters like flood, cyclone, drought and fire. The last super cyclone in 1999 is an unforgettable event in the history of Orissa so also the High Flood in 2001 and the drought in 2002. Bargarh, Sonapur and Bolangir roads are prone to flood during monsoon season. Various organizations working in Orissa in the field of disaster management as given below might be consulted for any further precaution in construction work apart from proper drainage provisions.

- Orissa State Disaster Mitigation Authority
- National Informatics Centre
- UNDP

3.4.4 Agriculture:

The majority of the population in project districts is dependent on forest and subsistence agriculture. Podu cultivation (slash and burn) is practiced extensively by the tribals in the "dongar" (Upland). In the high hill slopes pulses, millets, mandya (ragi) and oilseeds like niger and mustard are grown. In the "Bilo" (low land) paddy is cultivated. Horticulture is also practiced particularly among the tribals. Vegetables are also cultivated crops being sweet potato, beans, chilly and yam. The agriculture is rain-fed. The agricultural implements used are deshi wooden plough, wooden plod-breaker (coporpotta) and phouda sickle and hand axe etc.

3.4.5 Archeological/Historical monuments:

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

3.4.6 Temples/Shrines/Idols/Statues:

The corridor of impact (COI) or the direct influence area of the 135.47km road (sample) construction proposals have no shrines, idols, tombs and roadside small temples which might be impacted or require relocation due to the construction works.

SECTION- 4

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 INTRODUCTION

This Section identifies and assesses the probable impacts on different environmental parameters due to planning, construction and the operation of the proposed development of rural roads. After studying the existing baseline environmental scenario, initial field visits/surveys, reviewing the process and related statutory norms, the major impacts can be identified and assessed during the design, construction and the operation phases. Potential positive impacts or improvements are also reviewed.

Road construction related impacts occur at three stages of the project:

- i) Planning and Design
- ii) Construction
- iii) Operation

Planning and Design covers the construction details, materials of construction etc. that ultimately decides the impact during later phases. Most of the impacts are during construction and operation phase. While some of the construction phase impacts are temporary, some are permanent. The permanent impacts would be positive in nature such as increase in business & employment opportunities, reduction in accidents, and comfort in journey. Though project road are only small rural roads not a national highway thus negative impact such as risk of HIV/AIDs and human trafficking will be negligible, however these negative impacts would be during construction phase only.

Other important criterion for identification of impact is the identification of the Corridor of Impact. For present IEE study, a Corridor of Impact (Col) of 15 m width of road alignment has been considered.

Environmental parameters are broadly classified into three groups.

- i) Physical Environment
- ii) Biological Environment
- iii) Human Environment

Physical environment includes water resources, water quality, air quality, noise and land environment, Biological environment includes, flora, fauna and plantations.

Human environment includes the social environment rehabilitation, employment, agriculture, housing, culture, etc. Social impacts such as Poverty impacts, involuntary resettlement, HIV/ AIDs, trafficking of women and Children have also been covered in detail in the Social Impact Assessment Report.

4.1.1 Approach to Mitigation Measures

The Environmental Management Plan (EMP) is the key to ensure that the environmental quality of the zone under impact does not deteriorate beyond the expected level due to the project. As discussed in the previous chapters, the road design, construction and operation activities can have various levels of environmental impacts. The Environmental Management Plan (EMP) covers all aspects of the design, construction and operation phases related to environment. The Environmental Management Plan (EMP) needs to be implemented right from the inception and should continue throughout. The EMP can be

divided into three phases - (a) Design phase (b) Construction phase and (c) Operational phase.

4.2 IMPACT AND MITIGATION DURING DESIGN STAGE

4.2.1 Impacts

The major impact associated with Design or Pre-construction phase deals with loss of land, properties and livelihood due to acquisition of properties. The design of alignment also decides the acquiring or impacting water bodies, forest, cultural sites etc. In the design phase these issues along with environmental and social studies, are integrated to minimise the impact in the project no land acquisition and property acquisition is planned. Besides the impact on environment and social factors, there should also be consideration for legal issues so that the project can be operated with ease.

4.2.2 Mitigation Measures

In case of present rural, the major issue at design stage has been the land availability on the existing can't tracks. While finalizing alignments and deciding on corridor of impact, these data will be considered and design has tried to minimize the impact on environment.

Table 4.1: Design Phase Mitigation Measures – General

Impacts	Mitigation Measures
Land Acquisition	Alignment design avoids land acquisition
Removal of Trees	Alignment design to reduce the number and compensatory plantation.
Impact on public utilities e.g. community wells etc.	Alignment design to consider. In case of removal alternate arrangement to be done before.
Borrow pits	Locations to be selected considering minimum loss of productive land and redevelopment
Environmental Specifications for Contractors	Environmental qualifications specification shall be included in pre-qualification packages for the contractors

These mitigation measures have been considered during finalising the road design. The widening is being carried out in available RoW and is concentric in nature in most portion of each rural road. This will save trees and utilities.

Table 4.2 shows some special mitigation measures adopted in project design to avoid damage to public properties and livelihood.

Table 4.2: Mitigation Measures in Project Road Design

Impacts	Mitigation Measures
Removal of Trees	Compensatory plantation of triple the number of trees to be cut will be carried out.
Impact on public utilities e.g. community wells etc.	In case of removal alternate arrangement will be done before. Social Impact Assessment will consider these issues.
Borrow Pits and queries	These have been identified and the required measures will be carried out.

No acquisition of land has been planned for the project route.

4.3 PRE CONSTRUCTION & CONSTRUCTION STAGES

4.3.1 Impacts

As discussed in Section -3 ambient air quality is anticipated to be within the ambient air quality standards at rural roads. However, air quality is one of the most important parameters to be impacted during construction phase.

Impacts on air quality during construction are due to generation of dust due to earth moving activities on roadside, generation of dust due to excavation and handling of construction materials and vehicle movements. Emission of gaseous pollutants like sulphur dioxide, nitrogen oxides, hydrocarbon, particulates, carbon monoxide etc. from heavy vehicles are also important sources.

Gaseous emission from Asphalt mixing plant is another important source of pollution. The larger sized plant can have serious impact. Dust is produced due to handling of aggregates. Smoke and soot, consisting carcinogenic materials are generated due to partial combustion of mixtures. Heating of bitumen also releases toxic gases.

However, the mitigation measures and special attention at the sensitive spots can reduce the impact substantially. Observing environmental regulations regarding use of vehicles, crusher plants and asphalt mixing plants will also mitigate the air pollution within acceptable limits. Impact on air quality during construction phase is temporary and site specific. Thus it is difficult to quantify on an objective level. Overall, impact will not be significant if proper mitigation measures are implemented.

4.3.2 Mitigation Measures

The proposed rural road construction will reduce dust generation due to vehicle movement as paved surface will be created.

The asphalt plants, crushers and the batching plants will be sited at least 1.5 km away in the downwind direction from the nearest human settlement.

Authorised quarries shall only be used and therefore emissions from the crusher and vibrating screen at the stone quarries shall not exceed the emission standards set by Central Pollution Control Board.

All precautions to reduce the level of dust emissions from the hot mix plants, crushers and batching plants and other transportation of materials will be taken up in line with SPCBs and MoEF requirements. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce spills on haul roads. Water will be sprayed on earthworks, temporary haulages and detour roads on a regular basis. During and after compaction of the sub-grade, water will be sprayed at regular intervals to prevent dust generation. The hot mix plant will be fitted with dust extraction units.

To ensure the control of exhaust gas emissions from the various construction activities, the contractor shall take up the following mitigation measures:

- An adequate cyclone/scrubber to control emissions from the stack of hot mix plants will need to be provided in the event of the emissions exceeding the SPCB norms.
- The contractor shall obtain a No Objection Certificate (NOC) from SPCBs prior to the location and operation of plant to ensure the efficacy of the mitigation measures. All vehicles, equipment and machinery used for construction will be

regularly maintained and monitored to ensure that the pollution emission levels conform to the SPCB, CPCB and MoEF norms.

- A vehicle maintenance schedule prepared by the contractor and approved by the Engineer shall be adhered to. Contractor will take necessary consent from state pollution control board for location of hot mix plants.

4.4 IMPACTS DURING OPERATION STAGE

4.4.1 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 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.

4.4.2 Mitigation Measures

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

4.5 WATER RESOURCES

4.5.1 Impacts and Mitigation Measures during Pre-Construction Stage

a) Impacts

To facilitate the cross-drainage at the drains and streams, various cross drainage (CD) structures are proposed, including improvements in the existing structures. The road side ponds and other water bodies have not been noticed. There are road side ditches. The water table along the road is 3 - 5 m below ground. Due to the high water table along the corridor, wells and tube wells are mostly the sources of potable and irrigation water. The typical impacts on water resources during the construction of a road are summarised in **Table - 4.3**.

Table –4.3: Impacts on Water Resources Due To Construction Activities

Impacts Due To Construction	Indicators
Alteration of drainage, run off, flooding	No. of cross drainage channels
Depletion of Ground Water recharge	Area rendered impervious
Use of Water Supply for Construction	Quantum of water used

Impacts Due To Construction	Indicators
Contamination from fuel and lubricants	Nature and quantum of contaminants
Contamination from improper sanitation and Waste Disposal in Construction Camps	Area of camp / disposal site and proximity to water bodies / channels

4.5.2 Alteration of Drainage

Impacts of road construction in the proposed project will be due to construction of cross drainage structures at Nallas, etc. Alteration of drainage can lead to soil erosion of adjacent areas. However, as mostly CD works are done in summer when the water levels are low, the impacts due to alteration of drainage can be minimised effectively by planning construction only in the dry season. In the CD works mostly culverts are to be constructed therefore no major impacts on drainage are anticipated.

b) Mitigation Measures

No drainage modification of surface flow of rivers is envisaged and no mitigation is required.

4.6 IMPACTS AND MITIGATION MEASURES DURING OPERATION STAGE

a) Impacts

One of the potential impacts of road construction is the increased surface run off. The construction of road in the project area will increase surface runoff due to paved impervious surface of main carriageway.

Impacts due to surface runoff include increased soil erosion and local flooding or water logging. However, the rural roads have been designed with side drains to take care of runoff, therefore, this runoff shall be drained to the nearest cross drainage structure. The engineering design includes design of cross drainage structures, which shall take care of the extra flow.

b) Mitigation Measures

To maintain an efficient storm water flow, the roadside ditches will be cleaned regularly at least once every year prior to the monsoons. The waste collected will be disposed off at locations identified during construction phase.

4.7 INCREASED SEDIMENT AND DEGRADATION OF WATER QUALITY

4.7.1 Impacts and Mitigation Measures during Pre-construction and Construction Stage

a) Impacts

The degradation of water quality can occur during construction stage from increased sediment load into watercourses near the construction site. This may be aggravated by removal of trees and consequent increase in soil erosion. As soil in the study area is alluvial-clayey loam type with a low silt composition, the impacts due to the increased sediment load will be insignificant.

Degradation of water quality is possible due to accidental discharges into watercourses from drainage of workers' camps and from spillage in vehicle parking and/or fuel and lubricant storage areas.

b) Mitigation Measures

Design Stage

To ensure efficient cross-drainage and to prevent water logging along the sides, adequately sized and adequate numbers of cross-drainage structures have been provided. Along the settlements, as part of the engineering design, provision has been made for drainage along the sides of main carriageway.

Construction Stage

The contractor will remove obstructions that may cause any temporary flooding of local drainage channels during construction. No spoil or construction material will be stored outside the RoW or at places obstructing the natural drainage system.

All necessary precautions such as proper drainage and height of road will be maintained to construct temporary or permanent devices to prevent inundation. Temporary drains for collection and disposal of runoff into natural drainage system will be constructed. The contractor will take all the necessary measures such as proper drainage to prevent temporary or permanent flooding of the work site or any adjacent area.

4.7.2 Flood Hazard

The extent of impact due to the streams/local rivers may damage the pavement and washing away of road sections of levels of carriageway is not kept above HFL. Further such eventuality will not occur as design takes care of this aspect by providing carriageway level 1metre above HFL. Further adequately sized drain on either side of rural roads portions will be part of good engineering practice. Adequate numbers culverts have been planned to avoid flooding of road surface. It is expected that overall the rural roads will not be subjected to flooding.

4.8 CUMULATIVE IMPACTS- NATURAL AND BIO-PHYSICAL ENVIRONMENT

4.8.1 Impacts on Air Quality

a) Pre Construction and Construction Stage

The area will be impacted to some extent by air pollution during construction stage only. Construction stage impacts will be of short term and may have adverse impacts on the construction workers as well as on the settlements adjacent to the alignment, especially those in the downwind direction. During pre-construction stage impacts will be due to establishment of construction camp, site clearance and due to construction vehicle movements. It is anticipated that these impacts will be limited within 500m on either side of project road and 500m radius around construction camp. It is anticipated that these impacts will be limited within 1.0 km radius around construction camp.

b) During Operation Stage

During operation stage impact on air quality will be due to increased number of vehicles and vehicular pollution. But air quality impacts are not expected to be significant as vehicular movement is not much.

4.8.2 Mitigation Measures

b) During Construction

To mitigate air quality impacts during construction, there will be regular water spray at construction site. All vehicles and machinery will be maintained. There will be regular environmental monitoring and remedial actions will be taken in the event of AAQ violation. At locations of air sensitive receptors the construction activities will be closely monitored by the supervision consultant.

b) During Operation

During operation regular monitoring is planned. The compensatory plantation will alleviate the impacts to a great extent.

4.9 LAND/PHYSIOGRAPHY

The impact of road construction on physiography is a function of the terrain of the area. It is most drastically altered where hilly terrain or where extensive cut-and-fill operations are involved. In present case project road is already existing and is being widened therefore no change in physiography is expected after project implementation.

4.10 SEISMICITY

Orissa does not have a history of seismic disaster. No blasting is envisaged at the construction site. Therefore there will be no significant impacts in ground vibration due to construction.

4.11 LOSS OF PRODUCTIVE SOIL

4.11.1 Impacts and Mitigation during Pre-Construction Stage

a) Impacts

Loss of productive soil, albeit during the construction stage only, is envisaged at locations of workers camps, stockyards, storage, godowns etc. (for the duration of construction) if these are located on fertile areas. The EMP can ensure that no productive areas are used for these purposes and avoid adverse impact. In any case, though it would be a direct impact, it would be reversible as the soil can be stockpile and replace after the construction is complete and the worker camps etc are closed.

b) Mitigation Measures

In the selection of borrow areas for the project, productive agricultural areas have been avoided for borrowing of materials. The workers camps, stockyard, storage and godowns will not be established at agricultural land. In case productive areas are taken for borrow areas, stock yards, storage or workers' camp, the post construction rehabilitation will be ensured.

4.11.2 Impacts and Mitigation during Construction Stage

a) Impacts

Soils both within and outside the RoW may be negatively impacted due to the proposed project. The loss of productive topsoil due to road construction is a direct adverse long-term impact. The project road alignment in most of its part will utilise land available in existing RoW hence will not involve loss of much productive soil. In addition to this there will be temporary impact on productive soil at diversions and labour camp due to leasing of land for construction period. The top soil from productive areas will be either utilised in side slopes/shoulder dressing or will be stored outside and will be spread back during rehabilitation.

b) Mitigation Measures

Given the practical experienced there may be temporary requirement of productively agriculture areas for construction camps, all areas of cutting, borrow areas and etc. in productive lands and all areas to be permanently covered, the top soil will be stripped to a specified depth of 150 mm and stored in stockpiles of height not exceeding 2m. Stockpiles would be covered with tarpaulin to prevent runoff and leaching of nutrients. The stockpiling will be done in slopes of 2:1, to reduce surface runoff and enhance percolation through the mass of stored soil. Since topsoil will be in substantial quantities it is suggested that it will be stored in stockpiles at each km within the RoW.

The stored topsoil will be spread back to maintain the physio-chemical and biological activity of the soil. The stored topsoil will be utilised for:

- Covering all disturbed areas including for the redevelopment of borrow areas;
- Top dressing of the road embankments and fill slopes;
- Filling up of tree pits, proposed as part of compensatory afforestation; and

To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to RoW.

4.12 SOIL EROSION

4.12.1 Impacts and Mitigation Measures during Pre-Construction Stage

a) 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.

b) 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.

4.12.2 Impacts and Mitigation Measures during Construction Stage

a) Impacts

Impacts in the construction stage due to soil erosion are mainly at the construction sites of approaches of bridges and culverts and along the edges of the diversion channels.

Severe erosion of earth slopes is usually caused by a concentration of storm water flowing from the roadway section or from the area at the top of cut slopes down unprotected embankments or other slopes. Preventing concentration of water in these critical areas is essential. Rainfall on cut and fill slopes will cause erosion to varying degrees, depending on the intensity of rainfall, the type of soil, the degree of slope, the length of the exposed surface, the climatic exposure, and the effectiveness of the vegetative or other protective cover.

b) Mitigation

Channels, ditches, berms, or shoulder dikes for diverting water to satisfactory outfalls should be constructed at appropriate locations early in the construction of the project.

Benches or terraces, enclosed drainage systems, or the mulching or covering of the soil with various materials may be required to reduce slope erosion due to rainfall especially while constructing embankments.

4.13 COMPACTION OF SOIL

4.13.1 Impacts and Mitigation during Pre-Construction Stage

a) Impacts

Preconstruction Stage

Compaction of Soil will occur in the pre-construction stage (particularly during site clearance stage) due to movement of heavy machinery and vehicles. Similarly, compaction will take place during setting up of construction camps and stockyards. However, this is a short duration impact. Appropriate mitigation measures have been given in section 4.13.4.

4.13.2 Construction Stage

Compaction occurs beyond the carriageway and within the vegetated area of the RoW by the movement of vehicles and heavy machinery. Movement of vehicles during road construction is the major cause of soil compaction. This impact is direct and will be the maximum in the RoW. It is necessary to ensure that there is no adverse impact of soil compaction in areas other than the RoW, where vegetation can grow and rain infiltration will take place.

4.13.3 Operation Stage

During the operation period compaction will be restricted to the carriageway. Compaction cannot be said to be an impact of the operation stage as the pavement itself is a function of compacted base and sub base.

4.13.4 Pre-construction and Construction Stage

Vehicles and machinery will be kept within ROW to minimise the adverse impacts during pre- construction and construction. In case the machineries are needed to be placed / installed outside the RoW they shall be done on barren or unused land. At construction camp vehicles/machineries will be parked at designated location.

4.13.5 Operation Stage

During operation stage no impacts are anticipated as pavement itself is a function of completed base and sub-base.

4.14 CONTAMINATION OF SOIL

a) Impacts

4.14.1 Pre-Construction Stage

Contamination of soil in the pre-construction stage may be considered as a short-term residual negative impact. Soil contamination may take place due to solid waste contamination from the labour camp set up during pre-construction stage. This impact is significant at locations of construction camps; stockyards, hot mix plants etc. will come up in this stage.

4.14.2 Construction Stage

Contamination of soil during construction stage is primarily due to construction and allied activities. The sites where construction vehicles are parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Pollution of soil can also occur in hot-mix plants from leakage or spillage of asphalt or bitumen. Refuse and solid waste from labour camps can also contaminate the soil. Contamination of soil during construction might be a major long-term residual negative impact. Unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to water bodies in case of dumping being done near water body locations.

b) Mitigation Measures

At various construction sites, the vehicles and equipment will be maintained and refuelled in such a fashion that oil/diesel spillage does not contaminate the soil. It will be ensured

that the fuel storage and refuelling sites are kept away from drainage channels and important water bodies.

4.15 CONSUMPTION OF CONSTRUCTION MATERIAL

The construction of the rural roads envisages the use of significant quantities of the earth, stone and grit and sand along with bitumen.

The excavation of quarries and borrow pits used for obtaining rocks, soil and aggregate materials for road construction can cause direct and indirect long-term adverse impacts on the environment. Significant quantities of materials will be required from quarry and borrow areas for the project road.

The impacts of quarrying operations could be significant at various stages of road construction. Quarrying and crushing could have an impact especially on the air quality of the area especially the area downwind to the quarry. The impacts are as described below.

4.15.1 Impacts and Mitigation Measures during Pre-Construction Stage

a) Impacts

The design team has identified some of the quarries close to project road. The bulk of the materials needed for the construction of the embankments may be procured from these quarries or any other suitable quarry as desired by the TSC/PIC.

As these quarries are already in operation with the requisite environmental clearances and redevelopment plans, no major impacts, which arise in making new quarries operational, are likely.

b) Mitigation Measures

As part of the project preparation process, an evaluation of existing quarries in the project influence area has been carried out and the status in terms of the suitability of the quarry material and their adequacy for construction purposes have been assessed.

The mitigation measures for depletion of natural resources have been considered to be there as Orissa State Government Mining Department is issuing licenses of quarries considering all future planning and other development activities.

4.15.2 Impacts and Mitigation Measures during Construction Stage

a) Impacts

A major source of dust during the construction stage is from stone crushing operations from the crusher and the vibrating screen. The dust, in addition to being an eyesore, reduces visibility thereby increasing safety concerns. Dust is generated due to procurement and transport of raw materials from quarries and borrows sites to the road construction area. These impacts will persist till the activity ceases. The regions especially downwind to the quarries/borrow areas are more vulnerable to air pollution.

Though the quarry materials are to be transported over long distances to the construction sites, almost all the quarries identified have proper access roads, therefore, no major impacts during the haulage of materials is envisaged.

The impacts of crusher goes up to a distance of at least 1km and mainly results in dust generation. In addition to this there is change in physiography of the site due to storage of crushed and uncrushed material at site.

c) Mitigation Measures

If the contractors decide to use quarries not in the recommended list, they would require obtaining clearance from mines department and State Pollution Control Board. The EMPs has incorporated requirements that the contractor will have to fulfil before materials can be procured from quarries and crushers. These include verification of availability, currently valid permissions from regulators for both operations. To offset any possibility of spillage of quarry materials due to transport proper precautionary measures such as the covering of vehicles with tarpaulin shall be carried out. Further, it will be ensured that water sprinkling arrangement at crusher belt is working.

The OSRDA in association with the Orissa Pollution Control Board shall carry out the monitoring of the rehabilitation of the quarries so as to ensure that the rehabilitation plan has been carried out as laid down in the conditions of state pollution board clearance. This can be done effectively by OSRDA by empanelling quarries having environmental compliances and in future contracts conditions is put that construction material should be procured from empanelled quarries only. Further, new lease or license to quarry owner shall be given by the mining department only on satisfactory certificate from SPCB.

4.16 BORROW PITS

4.16.1 Impacts and Mitigation Measures during Pre Construction Stage

a) Impacts

Borrowing is to be carried out in accordance to the guidelines laid out in IRC-10-1961. Also, productive agricultural areas have been avoided for borrowing. However, the borrow area pits, if not treated properly after the borrowing is complete, can form stagnant pools and pose health hazards to prevent which redevelopment of borrow areas need to be worked out.

b) Mitigation Measures

No borrow area shall be opened without permission of the OSRDA. The borrowing shall not be carried out in cultivable lands.

Location of source of supply of material for embankment or sub-grade and the procedure for excavation or transport of material shall be in compliance with the environmental requirements of the MoEF, MoRTH and as specified in IRC: 10-1961.

Redevelopment of the identified borrows areas will be worked out, as part of the project will be implemented to mitigate the impacts. These redevelopments will be in the form of fresh water fish ponds, levelled agriculture fields, plantation of trees, etc.

4.16.2 Impacts and Mitigation Measures during Construction Stage

a) Impacts

Cartage of the borrow materials to the construction sites is of significance, as almost all such areas are accessible through dirt tracks only and therefore, spillage and compaction of soil along these tracks will be a significant impact.

Rehabilitation of borrows areas from which earth has been excavated, is a potential problem, which needs to be addressed. In addition to visual blight, safety issues shall also be considered.

b) Mitigation Measures

To avoid any embankment slippage's, the borrow areas will not be dug continuously. In case borrow areas other than specified is selected, the size and shape of borrows pits will be decided by the Supervision Consultant. Borrowing of earth shall be carried out at locations recommended as per IRC: 10-1961 relevant MoRTH clauses whose salient features are described below:

Non-Cultivable lands: Borrowing of earth will be carried out upto a depth of 1.0 m from the existing ground level. Borrowing of earth shall not be done continuously. Small drains shall be cut through the ridges, if necessary, to facilitate drainage. Borrow pits shall have slopes not steeper than 1 vertical to 4 horizontal.

Public or private agricultural lands: Borrowing of earth shall not be carried out on productive lands. However, in the event of borrowing from productive lands, topsoil shall be preserved in stockpiles. A 150mm layer of the top soil shall be stripped off from the area designated for borrowing and it shall be stored in stock piles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.

Borrow pits on the riverside: The borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

Use of fly ash: Fly ash will be used in all road construction works, which are within the 50km from thermal power stations. A list of thermal power stations within Orissa is given in **Table 4.4** the Rural Road manual specifies design and construction procedures for construction of fly ash embankments.

Table 4.4 Location of Thermal Power Plants and other captive Power Plants Producing Fly Ash in Orissa

S.NO.	State	Thermal Power Plants
1	Orissa	Ib Valley (OPGCL)
		Talcher Kaniha (NTPC)
		Talcher thermal (NTPC)
		Angul (NALCO)
		Damanjodi (NALCO)
		Rourkela (RSP)
		Hirakud (INDAL)
		Chaudwar (ICCL)

Precautionary measures like the covering of vehicles will be taken to avoid spillage during transport of borrow materials. To ensure that the spills likely to result from the transport of borrow and quarry materials do not impact the settlements, it will be ensured that the excavation and carrying of earth will be done during day time only. The unpaved surfaces used for the haulage of borrow materials will be maintained properly.

The contractor shall evolve site-specific redevelopment plans for each borrows area location, which shall be implemented after the approval of the Supervision Consultant.

4.17 NOISE

Road noise depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC: 104-1988).

The baseline noise levels monitored at various locations along the project road indicate baseline levels below the permissible limits of CPCB. Noise levels will increase significantly during construction phase due to movement of construction machinery and due to movement of vehicles during operation.

As per the experience of consultants the noise levels at construction camp and construction site go upto 85 dB(A). But these will be intermittent in nature and during operation of heavy machinery/DG set at site and construction camp.

4.17.1 Impacts and Mitigation during Pre-Construction Stage

a) Impacts

Noise levels during the pre construction stage are mostly expected to be indicative of prevalent baseline levels apart from localised noise levels at locations where pre construction stage activities are taking place such as establishment of workers camps, stockyards. These increased noise levels will prevail only for a short duration during the pre construction stage. Moreover, as these activities are not likely to be placed near settlement locations the increased noise impact would be negligible.

b) Mitigation Measures

The baseline monitoring indicates the noise levels below permissible limits of CPCB along the existing road. However plantations will be made as precautionary measures.

4.17.2 Impacts and Mitigation Measures during Construction Stage

a) Impacts

Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project corridor. The construction activities will include the excavation for foundations and grading of the site and the construction of structures and facilities. Crushing plants, asphalt production plants, movement of heavy vehicles, loading, transportation and unloading of construction materials produce significant noise during construction stage.

Though the noise levels presented for the various construction activities far exceed the permissible standards, it is important to note that the construction noise is generally intermittent and depends on the type of operation, location and function of the equipment. Noise shall be mitigated at source wherever possible and mitigation measures as to regulate the timings of construction. The mitigatory measures will include no construction activity at night in habitations, personal protected equipment to workers, etc.

b) Mitigation Measures

The plant and equipment used for construction will strictly conform to CPCB noise standards. Vehicles and equipment used shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. The noise level from any item of plants (measured at one metre from the edge of the equipment in free field) such as compactors, rollers, front end loaders, concrete mixers, cranes, vibrators and saws shall not exceed 75 dB (A), as specified in the Environmental Protection Rules, 1986. Noise mitigation at source will include the use of silenced and super silenced equipment, use of portable noise barriers, wherever and mitigation measures to regulate the timings of construction.

In construction sites within 250m of the nearest habitation, noisy construction work such as concrete mixing, batching will be stopped during the night time between 10:00 p.m. and 6:00 a.m. No noisy construction activities will be permitted around the silence zones, a distance of 100m from the sensitive receptors as hospitals, educational institutions etc. Portable noise barriers will be installed at such locations. To protect construction workers from severe noise impacts, noise standards of industrial enterprises will be strictly enforced, and workers shall be provided with Personal Protective Equipment (PPE) such as earplugs. The construction camp will be located at least 1.5 km downwind direction of habitation.

Monitoring shall be taken up at few locations of the alignment in addition to noise sensitive receptors where noise barriers have been provided, so as to ascertain any requirement for the provision of additional measures for the mitigation of ill effects due to increased noise resulting from the operation of the project.

4.17.3 Noise Impacts during Operation

a) Impact

The impacts due to noise during operations will be due to increased vehicular activity. This will be due to increase in vehicular flow. During operation the noise levels are not expected to go beyond CPCB limits. Since increase in vehicle numbers is not expected to be significant, therefore, expected noise levels are not likely to exceed CPCB standards.

b) Mitigation Measures during Operations Phase

During operation phase noise impacts will be mitigated to great extent through plantation.

4.18 FLORA

4.18.1 Roadside Plantations

The principal impact on flora involves the removal of trees for the creation of a clear zone within the Corridor of Impact. Reason for clearing trees is four folds:

To prevent single-vehicle collision with the roadside trees, trees very close to the road need to be cleared. Roadside trees are safety hazards, particularly those trees with strong and rigid stems. Some trees are safety hazards because they preclude clear sight distances. Some trees (such as Tamarinds indica) have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition.

All trees that are safety hazards need to be cleared. To ease construction of the embankment for the widened road formation and, to permit construction of adequate roadside drainage structure, trees located within the clear zone need to be removed. Trees need to be cleared to facilitate construction of traffic detours.

The impact on roadside trees and plantation is described in the following sections.

4.18.2 Impacts and Mitigation Measures during Pre Construction Stage

a) Impacts

The project has a significant, direct and long-term impact on Roadside trees in the Pre-construction stage. The cutting of trees shall have manifold impacts. Most visible impact is the loss of shade. Also, there is a possibility of the local people being deprived of tree products, such as wood, fruits, leaves etc. Removal of roadside trees will reduce comfort levels for slow moving traffic and pedestrians.

This negative implication needs to be taken into consideration by compensating with new plantation along the RoW of the project road.

The micro-ecosystems supported by the roadside trees are also a point of environmental concern. The removal of roadside trees will not only leads to erosion, and depletion of the ground water table, but also to the loss of the micro-ecosystems developed on the roadside. No impact is expected on forest as no acquisition of forest land is planned. The tree cutting in forest will not be done.

b) Mitigation Measures

The loss of trees is being compensated in accordance to the principles laid out in the Forest (Conservation) Act, 1980. The forest area lost due to widening will be compensated through compensatory forestation. Trees earmarked for felling will be removed only with prior approval of the District Forest Officer. The tree plantation cleared will be replaced and compensated prior to the commencement of construction. The monitoring and maintenance of plantation will be carried out by forest dept. necessary funds will be deposited by OSRDA in lieu of this assignment.

4.18.3 Impacts and Mitigation Measures during Construction Stage

a) Impacts

Accidental cutting of roadside trees may occur during the construction stage. It can also occur due to negligence from the construction crew. Therefore, it is essential that all trees that are to be felled be clearly marked. No other trees should be cut on site. Cutting of trees for fuel by workers, especially near their camps is also a concern, therefore adequate training of the workers, and availability of fuel are to be ensured by contractual obligations.

As the project road passes through protected forests, the impacts during construction could include use of forest wood for cooking of food by the construction workers. Mitigatory measures of these impacts have been given in EMP.

b) Mitigation

Apart from trees earmarked for felling, no additional tree within or outside the RoW will be carried out. No tree will be removed in the zone of construction (apart from those trees earmarked for felling) without the prior approval of the Department of Forests, through the Supervision Consultant. Construction vehicles, machinery and equipment will move or be stationed in the designated area only to prevent compaction of vegetation.

In order to minimise impacts the construction activities will be limited during daytime only. In order to discourage the use of firewood for cooking the contractor shall provide supplies of LPG/Kerosene free to the workforce at the worker camps.

4.18.4 Impacts and Mitigation Measures during Operation Stage

a) Impacts

The impacts on flora during the operation stage can occur due to accidental collision of vehicles. Though improved safety on the project road is an objective of the project, the increased speed will mean that collisions will be more damaging to the flora than before. Moreover, increased pollutant concentrations on roadsides will mean harsher conditions for the newly planted roadside trees. Improved access to reserve along the project road can also make them vulnerable to illegal logging.

b) Mitigation Measures

The tree plantation survival rate should be monitored carefully in initial three years. The minimum survival rate has been recommended as 75%. There is expected to positive impact on flora due to compensatory plantation. In order to prevent encroachment on the RoW, the plantation would be taken up in vacant spaces available. Monitoring will be taken up after each 5 years from the planting of roadside trees. It is planned to plant three trees for every tree to be cut.

4.19 FAUNA

4.19.1 Impacts and Mitigation measures During Construction

a) Impacts

There is no presence of wild life along the selected rural roads. However common domestic animals may be affected during the construction.

b) Mitigation

All construction activities will be carried out in such a fashion that damage and disruption to fauna will be minimum. The construction workers will be given instructions and trained to conserve/protect natural resources and fauna.

4.20 HUMAN USE VALUES

4.20.1 Impacts and Mitigation Measures Due to Land Acquisition

a) Impacts

There will be no land acquisition for project road widening. However, at some locations land will be taken through involuntary donations.

4.20.2 Loss of Private Properties

No loss of private properties is anticipated as road construction in habitations will be limited within available RoW.

b) Mitigation

Since no loss of private properties is anticipated therefore no mitigation measures are warranted.

4.21 CHANGES IN LAND USE

a) Impacts

Since the existing cart tracks, poorly maintained roads are to be improved/constructed change in land use is not expected.

Reduced transportation costs and availability of high-speed transportation facilities for raw materials and products will be the most important advantage of the proposed construction of rural roads.

b) Mitigation

No mitigation measures are warranted as no change in land use along proposed rural roads is anticipated.

e) Exploitation of Resource Base

i) Impacts

Development of a road in areas previously not easily accessible can work like a double-edged sword for the environmental resources in the area. While the road would unlock potential value in the area, stimulate growth and make the environment hospitable, at the same time, the rapid depletion of natural resources is also possible.

Development of such vital infrastructure will lead to over exploitation of the environmental resources (e.g. too much groundwater pumping, indiscriminate wastewater disposal, etc.). While the medium term impacts may not be large enough to be noticed, the long-term implications of such depletion are potentially disastrous.

ii) Mitigation

Proper planning and use of licensed quarries will avoid impacts on natural resource base.

4.22 SAFETY

The concern for safety stems from the proposals for faster vehicular movement along the highways. Though speedy travel is one of the objectives of the project, it also increases the intensity of loss in case of an accident. The project design takes care safety measures for road users. Safety of pedestrians as well as of the vehicles plying on the road is given highest importance and adequate measures have been incorporated in the design of the alignment.

Construction activities cause hindrance to traffic movement. Traffic management plans shall be prepared. Signboards indicating construction sites on the road and flags shall be erected. All the signboards giving caution, barricades for diverting the traffic shall be as per MoRTH specifications.

4.23 ARCHAEOLOGICAL/PROTECTED MONUMENTS AND OTHER CULTURAL PROPERTIES

There is no archaeological/ cultural property in the influence area of rural roads selected for second annual batch.

Other Cultural Properties

(a) Construction Stage

Construction Stage, which involves not only the actual road construction process, but also allied activities such as movement of road machinery, hauls vehicles etc as well. These heavy vehicles need a belt of about 2m on the roadside for movement. Also, mixing etc activities need space along the road edge. Heavy and big machinery is not expected to be used in rural road construction. The movement is expected to within the RoW. Hence no impact is envisaged.

The contractor shall keep a watch for any artefacts such as fabrics, coins, artefacts, structures, or other archaeological relics. If there are discovered, the construction works will be stopped pending directions from the Orissa State Archaeology Directorate who will be informed promptly. At these chance find locations, the contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the PIC/PIU of such discovery and carry out IA's instructions for dealing with the same, pending which all work shall be stopped 100m all directions from the discovery site.

The PIC/PIU shall seek direction from the Orissa State Archaeology Directorate before instructing the Contractor to recommence work on the site. Archaeologists will supervise the excavation to avoid any damage to the relics.

4.24 SOCIAL IMPACTS

Significant negative social impacts in project are not anticipated. The rural roads are expected to have significant positive impact which will be assessed and monitored as per the approved CPF document for the project.

4.25 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environmental Management Plan has been prepared and is intended to become a part of the contract documents so that implementation of all the environmental measures can be ensured. The implementation actions, responsibilities and timeframes have been specified for each component and adverse impact anticipated. Separate section 5: Institutional Requirements and Environmental Monitoring Plan detail out the monitoring plan.

SECTION- 5

5.0 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 mitigation 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 Mitigation 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 Mitigation Action Plan (EMAP) are given in **Table 5.1** at the end of section 5.0.

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 OSRDA through the Project Implementation Consultant (PIC).

5.4 EMAP Implementation Monitoring

A monitoring frequency for overseeing the implementation of the EMAP is given in **Table 5.2** at the end of section 5.0.

5.5 Institutional Requirements For Implementation of EMAP

5.5.1 Institutional Requirements – Construction Stage

The second annual batch of 1198 km will be packaged into several construction contract packages (district wise) by the Project Implementation Unit (PIUs) of OSRDA. In order to support PIUs and OSRDA, on 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 ENAP compliances at site. The project Implementation Consultant (PIC) will be appointed by the PIU for Supervision of Construction works. The PIC shall also provide one Environmental Officer (EO) in their team. The contractor shall implement the EMAP through its own FEO (Field Environmental Officer) in coordination with the EO provided by the PIC.

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 for Construction Supervision will provide for Environmental Officer (EO), one for each construction package. 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 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 conduct environmental field investigations under the EMAP. The agency shall be approved and certified by the state regulatory agencies. The EO will supervise the monitoring carried out by the agency.

5.5.2 Institutional Requirements – Operation Stage

No institutional requirements for the environmental management and monitoring of EMAP are required for the operation stage of the rural roads.

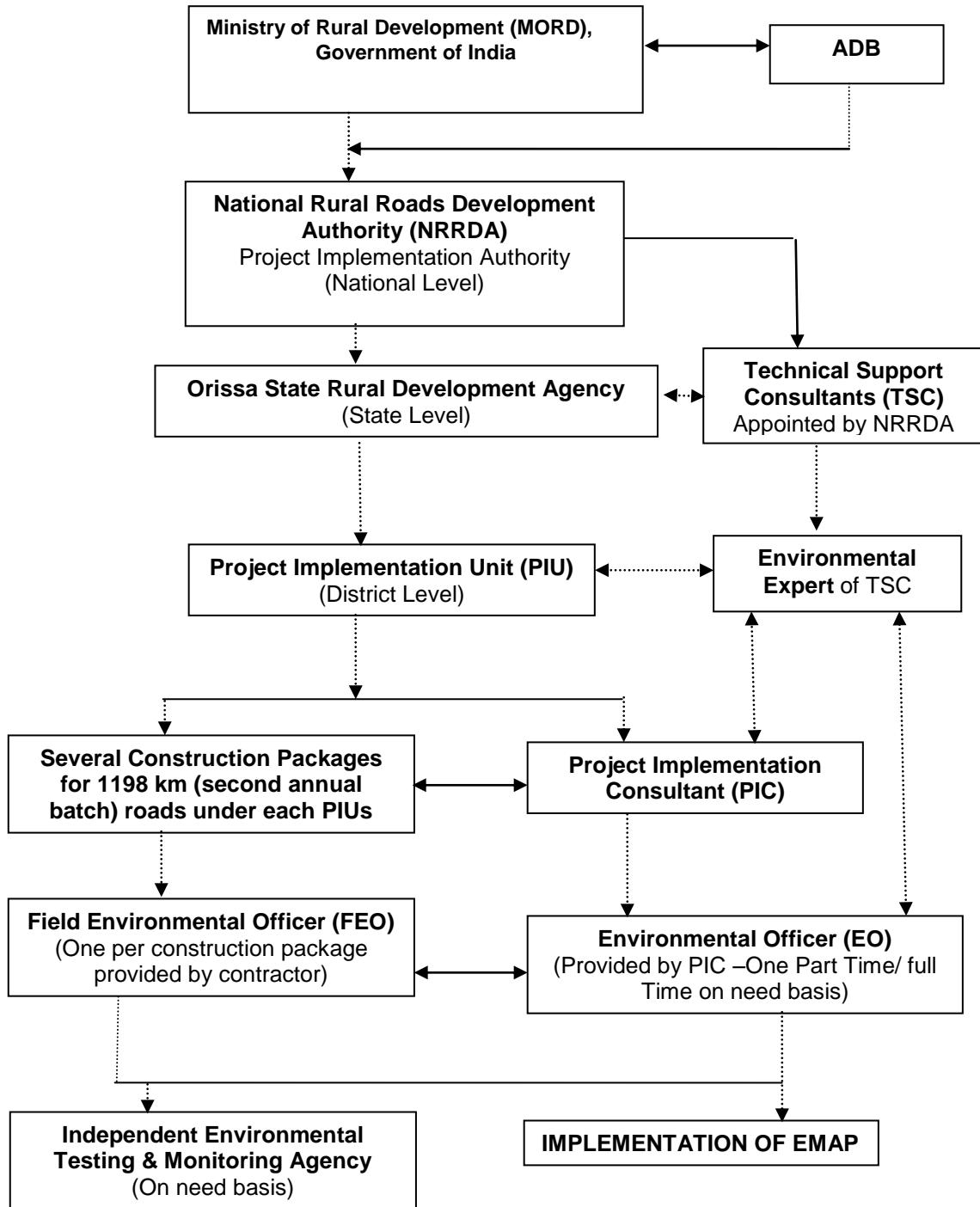


Figure 5.1 : Institutional Requirements for Implementation of EMAP

TABLE 5.1 : 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	PIU, Govt. of Orissa, NGOs and other agencies recommended in RAP report Environmental officer under the PIC will also coordinate and ensure implementation
Setting out and clearing RoW	<ul style="list-style-type: none"> Trees' falling within RoW and other vegetative cover are to be removed except those, clearance on both sides of proposed median edge. Compensatory plantations within proposed vegetation strip of RoW to be undertaken by Forest Department on behalf of OSRDA. 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. 	All through the Rural roads excepting in stretches of habitations	Pre Construction Phase	Necessary cost provisions has been made. All other costs are included under project cost.	PIC, PIU, Forest Department NGOs shifting of utilities shall be carried out by respective governmental bodies at cost to be reimbursed by project, implementing agency.

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> • The species shall be endemic and very similar to the trees, which have been removed unless they are inappropriate for valid reasons. • List of species for both roadside and median and may be finalized in consultation with Forest Department, Govt. of Orissa. • 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 Orissa 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 Orissa. • All public utilities like power transmission cables, telephone cables, water/sewerage lines, drains, tube wells etc falling within RoW to be relocated to services corridor within RoW or outside as the case may. Public utilities will be generally shifted by respective agencies like Electricity board, telecom dept., public health dept. etc and all such costs are to be reimbursed from project cost. 				<p>Environmental officer under the PIC will coordinate and ensure implementation. To increase survival rate of new saplings, a core Tree Management Committee is to be created to ensure complete retrieval of vegetative cover and timely replacement of perished plantations. The TMC is to be represented by project implementation Unit (PIU) of OSRDA, officials of Forest Department, Contractor and local NGOs and coordinated by Environmental officer of Construction Supervision</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					Consultant for specific package.
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 are to be diverted as per the norms stipulated by Government of India/State Government. • The compensatory afforestation shall be undertaken by Orissa 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. 	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>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.</p>				
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 visible particularly at night. 	All through the alignment of rural roads (in specific stretches as per progress of construction work)	Construction Phase	Borne by Contractor	Diversion schemes shall be prepared by Contractor and approved by PIC/PIU/ TSC
Construction Camp Sites	<ul style="list-style-type: none"> • The construction campsites shall be away from any local human settlements and preferably located on lands, which are not productive barren/waste lands presently. The camps shall have adequate water supply, sanitation and all requisite infrastructure facilities. This would minimize dependence of construction personnel on outside resources, presently being used by local populace and minimize undesirable social friction thereof. • The camps shall be located at a minimum 1.5 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 	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>facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible.</p> <ul style="list-style-type: none"> • The construction camps shall have health care facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The camps shall have septic tank/soak pit of adequate capacity so that it can function properly for the entire duration of its use. • All construction camps shall have rationing facilities particularly for kerosene/LPG so that dependence on firewood for cooking is avoided completely to the extent possible. • The construction camps shall have health care facilities for adults, pregnant women and children. • All construction personnel shall be subjected to routine vaccinations and other preventive/healthcare measures. • The construction camps shall have in house community/common entertainment facilities. Dependence of local entertainment outlets by construction camps should be discouraged /prohibited to the extent possible. 				
Haul roads	<ul style="list-style-type: none"> • Existing tracks / roads are to be used for hauling of materials to extent possible. • The alignment of haul roads (in case of new ones transportation link shall be finalized to avoid agricultural lands to the extent possible. In unavoidable circumstances, suitable 	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

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>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.</p> <ul style="list-style-type: none"> • Prior to construction of roads, topsoil shall be preserved or at least shall be used for any other useful purposes like using in turfing of embankment rather than allowing its loss by construction activities. • Water tankers with suitable sprinkling system are to be deployed along haul roads. Water may be sprinkled for at least 3 times per day all along the route to suppress the airborne dust due to the vehicular movement particularly on unpaved roads. • The vehicles deployed for material transportation shall be spillage proof to avoid or minimize the spillage of the material during transportation. In any case, the transportation links are to be inspected at least twice daily to clear accidental spillage, if any. • The borrow and material dumping sites must be access controlled to keep away unauthorized entry of people, grazing cattle and any other stray animals. 				<p>roads are responsibilities of 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 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 Orissa. 	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

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> All such quarries shall have occupational safety procedures/practices in place and regular inspection shall be carried to ensure compliance. Large material draws should not be a cause for neglect of safety procedures which is otherwise common. 				contractor under approval of PIC /PIU/TSC Environmental officer and other team members of PIC will monitor and ensure appropriate implementation of mitigation actions.
Work sites	<ul style="list-style-type: none"> All personnel in work sites shall have protective gears like helmets, boots etc. so that injuries to personnel are minimized. Children and pregnant women shall not be allowed to work under any circumstances. No personnel shall be allowed to work at site for more than 10 hours per day (8 hour makes one work shift). Personnel who are likely to exposed to noise levels beyond stipulated limits shall be provided with protective gears like ear plugs etc and regularly rotated. Regular water sprinkling of water shall be ensured so that dust levels are kept to minimum. 	As determined by contractor under approval of PIC /PIU	Construction Phase	Borne by Contractor	All facilities are to planned and implemented by contractor under approval by PIC / PIU / TSC Environmental officer and other team members of PIC will monitor and ensure appropriate implementation.
Construction Equipment Vehicles	<ul style="list-style-type: none"> All equipment / vehicles deployed for construction activities shall be regularly maintained and not older than 5 years. Vehicles/equipment shall be regularly subjected for emission tests and shall have valid POLLUTION UNDER CONTROL certificates. 	As determined by contractor under approval of PIC /PIU	Construction Phase	Borne by Contractor	Contractor is responsible for ensuring provision of facilities under approval by PIC / PIU

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>Revalidation of certificates shall be done once in a month.</p> <ul style="list-style-type: none"> • 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. 				<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. • 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 	At all locations of CD structures along the rural roads	Construction Phase	To be borne by contractor	<p>The planning, and construction / up gradation of existing/new cross drainage structures roads are responsibilities of contractor under approval by PIC /PIU/ TSC</p> <p>Environmental</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>are reviewed and designed to negate any heading up or flooding problems.</p> <ul style="list-style-type: none"> • 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>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 area/zones to be excavated areas is to be demarcated with signboards. All such operational areas are to be access controlled particularly for locals and for grazing cattle. • Through this project, the borrow areas / pits may be converted into surface / ponds wherever possible, as a derivative of development. Some of the ponds could serve as source of water for agriculture, a practice prevalent in Orissa. • The top soil recovered from newly acquired land areas for road construction is preserved and 	As determined by contractor under approval of PIC / PIU	Construction Phase	To be borne by Contractor	<p>Sourcing of borrowing materials and all related activities like planning & deployment of the most optimum, number of vehicles without disregarding the existing users in case of existing linkages and construction / upgradation of existing / new</p>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>used for turving of embankment(s) of project highway</p> <ul style="list-style-type: none"> 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 Orissa is given in Table 4.4 Section 4.0 of IEE. The Rural Road manual specifies design and construction procedures for construction of fly ash embankments. 				<p>haulage roads under approval by PIC /PIU. 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. 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, N O_x, HC, CO etc. does not exceed permissible limits and therefore does not contribute to build up of pollutants 	All operational areas as determined by PIC /PIU	Construction phase	Necessary cost provisions have been made	Contractor is responsible for ensuring a healthy environment for all personnel irrespective of category under approval of PIC /PIU/TSC Environmental officer and other team members of PIC will monitor and ensure appropriate implementation Environmental

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
					officer shall requisition services of private / governmental agencies for undertaking periodic environmental monitoring if necessary to ensure compliance of contractor in this 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 	At all sections of road construction involving embankment section.	Construction phase	Forms part of project cost	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 Environmental officer and other team members of PIC will monitor and ensure

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> a) Minimizing area of ground clearance only to the extent required. b) Balancing the filling and cutting of earth to the extent possible. c) Avoiding creation of cut slopes and embankment which are of an angle greater than natural angle of repose for locally available soil type. d) Replanting disturbed area(s) immediately after disturbance due to construction has stopped and NOT after construction has been completed. 				<p>appropriate implementation.</p> <p>Environmental officer may consult with the regional forest officers of Forest Department, Govt. of Orissa in selecting endemic species, which also can serve engineering functions.</p>
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 dampners ;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 Orissa should be immediately informed and all 	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>

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<p>activities in and around such stretches site is cleared by Department of Archeology.</p> <ul style="list-style-type: none"> Any coins, artifacts or any other chance find will be notified by the contractor. The work will be stopped and instruction will be taken from archeological department. Number of small temples / and idols falling within RoW are to be transplanted / relocated to suitable places acceptable to local community. Interactions with local community leaders are to be initiated well in advance and necessary measures required for relocation of structures to complete satisfaction of local community. Governmental agencies such as Department of Archeology, Government of Orissa will also be contacted in case assistance required. 				<p>Environmental officer and other team members of PIC will monitor and ensure appropriate implementation.</p>
Hot Mix Plants	<ul style="list-style-type: none"> Hot mix plants shall be at least 1.5 km away from any human settlements and preferably located on leeward side. Hot mix plants / sites shall be located on barren / uncultivable lands. Diversion of cultivable/agricultural lands, even preferred by local people for economic gain shall not be allowed unless otherwise warranted by specific local conditions. 	As determined by contractor under approval of PIC /PIU	Construction phase	To be borne by contractor	<p>Contractor is responsible for ensuring a 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</p>

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 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. 	All through the RoW of roads and at Borrow areas	Pre construction and construction phase	To be borne by contractor	Contractor is responsible for ensuring a proper utilization of fertile soil under approval of PIC /PIU Environmental officer shall requisition services of private / governmental

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	The topsoil can also be used for supporting re-plantation activities within RoW/median.				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 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 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). 				

Project Action/Environmental Attributes	Mitigation Measures	Location	Time Frame	Cost	Implementing / Responsible Organization
	<ul style="list-style-type: none"> • 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. 				
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 for communities in and around all operational areas under approval of PIC /PIU

Table 5.2: Environmental Monitoring Control Matrix – Construction Phase

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Table 5.1- under section 5.0 of IEE)	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		✓		

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Table 5.1- under section 5.0 of IEE)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
		start and after completion of water withdrawal for the day				
9	Construction Equipment / Vehicles	Ensure vehicles are regularly maintained have pollution under control certificates revalidated every month			✓	✓
10	Air quality at all operational areas under project	Record SPM, RPM, CO, HC, Nox, SO2 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 1.5 km from settlements, barren land and not agricultural lands. Monitor air quality, waste discharge and noise levels regularly as mentioned under Sl. No. 10,11 above. Ensure all operations comply with local environmental regulations	✓	✓		
15	POL (liquid and solid waste) / Hazardous Storage Areas	POL storage areas have impervious lining, containment ditches, oil & grease traps as per EMAP. Regular inspection & maintenance. Comply all local environmental regulations	✓	✓		
16	Soil erosion and conservation	Borrow areas shall have gentle slopes connected to near by natural water bodies, re-vegetated		✓		

S. No.	Environmental Attributes / Project Actions	Mitigation measures (for detail description refer to EMAP Table 5.1- under section 5.0 of IEE)	Monitoring Frequency			
			Daily	Weekly	Quarterly	Monthly
17	Channel / River beds	Ensure most activities are scheduled for dry months reshaping of channel bed after completion of construction		✓		
18	Archeological monuments /ruins / religious structures / temples	Archeological evidence / idols /tombs if noticed / found-inform Archeological Department. Temples within RoW are relocated in consultation with community leaders. Coordinate with Social team.	As and when the situation arises			
19	Water Supply Sanitation & Health at camp sites	Adequate water supply as per norms septic tanks and soak away pits. Kerosene and LPG supply, health care facilities vaccination for work force camps		✓		
20	Construction of Noise Barriers	Consult affected parties like hospitals, educational institutions for eliciting opinion during constructing barriers	As and when the situation arises			

SECTION - 6

PUBLIC CONSULTATIONS AND INFORMATION DISCLOSURES

6.1 INTRODUCTION

The rural project comprising of 1198 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

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 Angul, Dhenkanal, Sambalpur, Bargarh, Bolangir, Rayagada and Kalahandi.

(iii) 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.

6.3.2 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.

6.3.3 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.

6.3.4 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 maximum number 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 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

Participants showed resistance for shifting of idols, burial grounds and other religious structures at certain locations.

Loss of Trees Due to Road Construction

Respondents were of the opinion that trees cutting should be avoided or else minimised. 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;

Addressal 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 safety signage's planned all along the rural road.
Land acquisition and Mode of compensation	The proposed RoW is 12m along the rural road. No land acquisition is planned in project road.
Loss of roadside idols/shrines	Idols and shrines will be relocated to the other nearby places with consultation and proper rituals
Loss of trees	Compensatory afforestation would be done at the ratio of three 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, tubewells 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
Angul, Dhenkanal, Sambalpur, Bargarh, Bolangir, Rayagada and Kalahandi	<ul style="list-style-type: none"> • Peoples Perception about the Project • Air, Water Quality • Noise level • Water Source • Health and Environment • Road Alignment 	<ul style="list-style-type: none"> • The Villagers are in favour of the Project as they see a job opportunity and faster transport. • Air and Water especially drinking water qualities are not polluted. • Primary water sources are hand pump and open well and these should be relocated first if affected. • No construction activity will be taken in the night in built up area. • Affected water sources will be relocated first and then there will be dismantling of the existing sources. • The villagers required proper traffic control at the road junctions to prevent accidents. • Villagers are sound in health 	<ul style="list-style-type: none"> • Safety measures will be provided. Adequate signages will be provided. • No construction activity planned during night time at habitation. • Water Resources will be relocated first before dismantling the existing ones. • Road alignment is planned during transect walk. • Locals will be given preference in employment during construction.

CHAPTER-7

FINDINGS AND RECOMMENDATIONS

7.0 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 1198 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 are largely generic in nature and can be mitigated by adopting suitable mitigation measures.
- The Institutional Requirements for implementation of mitigation measures has been identified along with a frequency for monitoring of EMAP. A cost provision of Rs. 35.36 million has been made for implementation of EMAP for the second annual batch of 1198 km.
- The TSC shall prepare quarterly progress report on environmental compliances. This will help in effective implementation of EMAP.
- The IEE also indicate that rural road construction works does not warrant further EIA study for subsequent rural road construction works in Orissa.

CHAPTER- 8

CONCLUSION

8.1 CONCLUSION

Based on the IEE study and screening surveys conducted for the Project, associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the IEE Report. Adequate provisions shall be made in the Project to cover the environmental mitigation and monitoring requirements, and their associated costs as suggested in environmental budget.

As already mentioned the proposed project, i.e. widening and strengthening of the road network by creating additional road capacity between different points of the road network will improve operational efficiency and can act as an effective mechanism for reducing economic and environmental costs of the road stretches. The project brings considerable improvement to possible exposure levels to population when compared with no project scenario.

Overall, the major social and environmental impacts associated with proposed projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.