भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

(सड़क परिवहन और राजमार्ग मंत्रालय, भारत सरकार)
NATIONAL HIGHWAYS AUTHORITY OF INDIA
(Ministry of Road Transport and Highways, Govt. of India)
Project Implementation Unit-Ambala / परियोजना कार्यान्वयन इकाई–अम्बाला
#16, Prem Nagar, Ambala City -134003, Haryana
#16, प्रेमनगर, अम्बाला शहर– 134003, हरियाणा

दूरभाष / Phone:– 0171–2521361
ई–मेल / E-mail:-amb@nhai.org
&:-piuambala@gmail.com

भारतमाला

16008/NHAI/AMB/Shamli-Ambala/Env. Clerance/2695 27 .12.2021

To

Member Secretary
Haryana State Pollution Control Board
C-11, SEC- 6, Panchkula,
Haryana-134109.

Sub:- Development of 6 lane access-controlled Highway from Shamli to Ambala in the State of Haryana and Uttar Pradesh: **Submission of Draft EIA (Environment Impact Assessment) Report for Conducting Public Hearing.**

Ref.:- Terms of Reference (TOR) Issued by MOEF&CC vide letter no.10-33/2021-IA.III on dated 22nd Sept, 2021 and amended 6th Dec 2021.

Sir,

With reference subject matter above, DPR Consultant has completed baseline monitoring and has formatted the draft EIA/EMP report in accordance with the terms of reference prescribed by MOEF & CC.

2. The proposed project highway falls in Karnal, Kurukshetra, Yamuna Nagar & Ambala districts in the State of Haryana. As per EIA Notification 2006, project requires Public Hearing for this purpose and following documents for Karnal, Kurukshetra, Yamuna Nagar & Ambala districts in the state of Haryana are being submitted:

a. Hardcopy of draft EIA /EMP report
b. Hardcopy of executive summary in Hindi & English
c. Soft copies of above documents in CD—X
d. Demand Drafts amounting to Rs. 1.5 lakh each & bearing nos. 071550, 071551, 071552 & 071553 dt. 23.12.2021 drawn on Canara Bank

3. It is requested that Public Hearing for EC of the project highway may kindly be conducted at the earliest please.

Encls:- As above

Yours faithfully,

General Manager (Tech) &
Project Director

Copy to:-

(i) **Deputy Commissioner, Karnal, Kurukshetra, Yamuna Nagar & Ambala:** for information please.
(ii) **Regional Officer, Haryana State Pollution Control Board, Karnal, Kurukshetra, Yamuna Nagar & Ambala:** - for information & necessary action please.
(iii) **M/s Egis India Consulting Engineer Pvt. Ltd - (JV) with K&J Projects Pvt. Ltd.:** with a direction to coordinate with concerned department for early needful in the matter.

केनरा बैंक Canara Bank

पंचकूला मुख्य शाखा, पंचकूला-134109 (हरियाणा)
PANCHKULA MAIN BRANCH, PANCHKULA-134109 (HARYANA) (1624) CB
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MEMBER SECRETARY,HARYANA STATE POLLUTION CONTROL BOARD

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PANCHKULA SECTOR 20(2831)
NAAA
DRAWEE BRANCH, D.P. CODE

Lalit SP 62778

प्राधिकृत हस्ताक्षर कर्ता AUTH. SIGNATORY | नाम NAME | पदनाम DESIGNATION | ह.अ.सं. S.P. No.

जसपाल सिंह चहल
Jaspal Singh Chahal
वरि० प्रबंधक / Sr. Manager
ह.सं./S.P. No.46498

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Jaspal Singh Chahal
वरि० प्रबंधक / Sr. Manager
S.P. No. 45498

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PANCHKULA SECTOR 20(2831)

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Draft Environmental Impact Assessment (EIA) Report

(Baseline period - January to March 2021)

Development of 6 lane Access Controlled Greenfield Highway of Shamli-Ambala Sec. from Ch. 0+000 to Ch. 120+970 (Total length: 120.970 km) under Bharatmala Pariyojana Phase II (Lot-9/Package-I) in the States of Uttar Pradesh, Haryana and Punjab

Project Proponent — National Highway Authority of India
Ministry of Road, Transport & Highways, Govt. of India

Environmental Consultan — Mantras Green Resources Ltd.

December 2021

For National Highway Authority of India
Mantras Green Resources Limited

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ABBREVIATIONS

AAQ	Ambient Air Quality	MoRTH	Ministry of Road Transport and Highways
ADT	Average Daily Traffic	NAAQS	National Ambient Air Quality Standards
BOD	Biochemical Oxygen Demand	NBWL	National Board of Wildlife
BPL	Below Poverty Line	NHAI	National Highways Authority of India
BoQ	Bill of Quantities	NH	National Highway
BDL	Below detectable limit	NPV	Net Present Value
COD	Chemical Oxygen Demand	NHAI	National Highway Authority of India
CO	Carbon Monoxide	PM	Particulate Matter
CGWB	Central Ground Water Board	PIU	Project Implementation Unit
DO	Dissolved Oxygen	PAP	Project Affected Persons
DFO	Divisional Forest Officer	PM	Particulate Matter
EIA	Environmental Impact Assessment	RoW	Right of Way
EC	Environmental Clearance	R&R	Rehabilitation and Resettlement
EA	Executing agency	RAP	Resettlement Action Plan
EMP	Environmental Management Plan	ROW	Right of Way
GoI	Government of India	SEIAA	State Environmental Impact Assessment Authority
IMD	India Meteorological Department	SPCB	State Pollution Control Board
IRC	Indian Road Congress	SH	State Highway
KLD	Kilo Liter per day	SC	Scheduled Caste
Leq	Level Equivalent	SQ	Soil Quality
LVUP	Light Vehicular Under pass	ST	Scheduled Tribe
LPG	Liquefied petroleum gas	SVUP	Small Vehicular Under pass
MSL	Mean Sea Level	TCS	Typical Cross section
MoEF&CC	Ministry of Environment' Forest & Climate Change	TDS	Total Dissolved Solids
		ToR	Terms of Reference
		VEC	Valued Environment Components
		VUP	Vehicular Under pass

1 INTRODUCTION

1.1 The Project

The Ministry of Road Transport and Highways (MoRTH) through National Highways Authority of India (NHAI) has decided to develop the proposed project to improve the efficiency of freight movement in India under Bharatmala Pariyojana. The National Highways Authority of India (NHAI) has entrusted M/s K & J Projects Pvt Ltd with the assignment of preparation of feasibility study / Detailed project report of road stretch which starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli district and ends at Sadopur village in Ambala district (Ch:120+970) in the State of Uttar Pradesh, Haryana and Punjab. Total length of the proposed alignment is 120.97 km.

The proposed 6 lane highway (greenfield) will be a prime link connecting many small villages to major cities, which after development will provide commercial enhancement to the Project Influence area. The project highway passes through the Shamli and Saharanpur districts of Uttar Pradesh; Karnal, Kurukshetra, Yamuna Nagar and Ambala districts in Haryana and SAS Nagar district in Punjab State.

The salient features of the existing project have been presented in **Table 1.1**.

Table 1-1: Salient Features of the Project Road

S. No.	Particular	Details
1.	Project Road	Development of 6 lane Access Controlled Greenfield Highway of Shamli – Ambala Section from Ch. 0+000 to Ch. 120+970 (Total length - 120.970 km) in the states of Uttar Pradesh, Haryana and Punjab under Bharatmala Pariyojana Phase II (Lot-9/Package-1).
3.	Location of the project road	The proposed highway starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli district of Uttar Pradesh and ends at Sadopur village in Ambala district in Haryana.
4	Total length	120.970 km
5.	Total land required	824.285 ha
6.	Terrain	Plain
7.	Land use	Mainly agriculture
8.	Seismic zone	Zone IV
9.	Geographical location	Start Point: 29° 32' 57.51" N 77° 26' 33.68" E End Point: 30° 24' 48.27" N, 76° 47' 1.26" E
10.	Proposed bridges	7 Major bridges, 10 Minor bridges
11.	Design Speed	100 kmph
16.	Carriageway	6 lane (3.5 m lane width)
17.	Proposed RoW	60 m (except interchange & wayside amenities)
18.	Embankment	>2 m
19.	Forest Area	7.5 ha. (Protected Forest)

S. No.	Particular	Details
20.	Eco-sensitive/protected area	Nil

1.2 Project Proponent

National Highways Authority of India (NHAI), an autonomous agency of the Government of India, is responsible for management of the network of national highways across the country. It is a nodal agency of the Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI vision is to meet the nation's need for the provision and maintenance of national highways network to global standards and to meet user expectations in time-bound and cost-effective manner, within the strategic policy framework set by the Government of India and thus promoting economic well-being and quality of life of the people. NHAI is the nodal authority / project proponent for the development of the highway project under present study

1.3 Project Location

The project road passes through the Shamli and Saharanpur districts in the state of Uttar Pradesh; Karnal, Kurukshetra, Yamunanagar, Ambala districts in Haryana and SAS Nagar district in Punjab. The location map of proposed project has been shown in Figure 1-1. The proposed alignment is superimposed on SOI map and provided in Annexure 1.1.

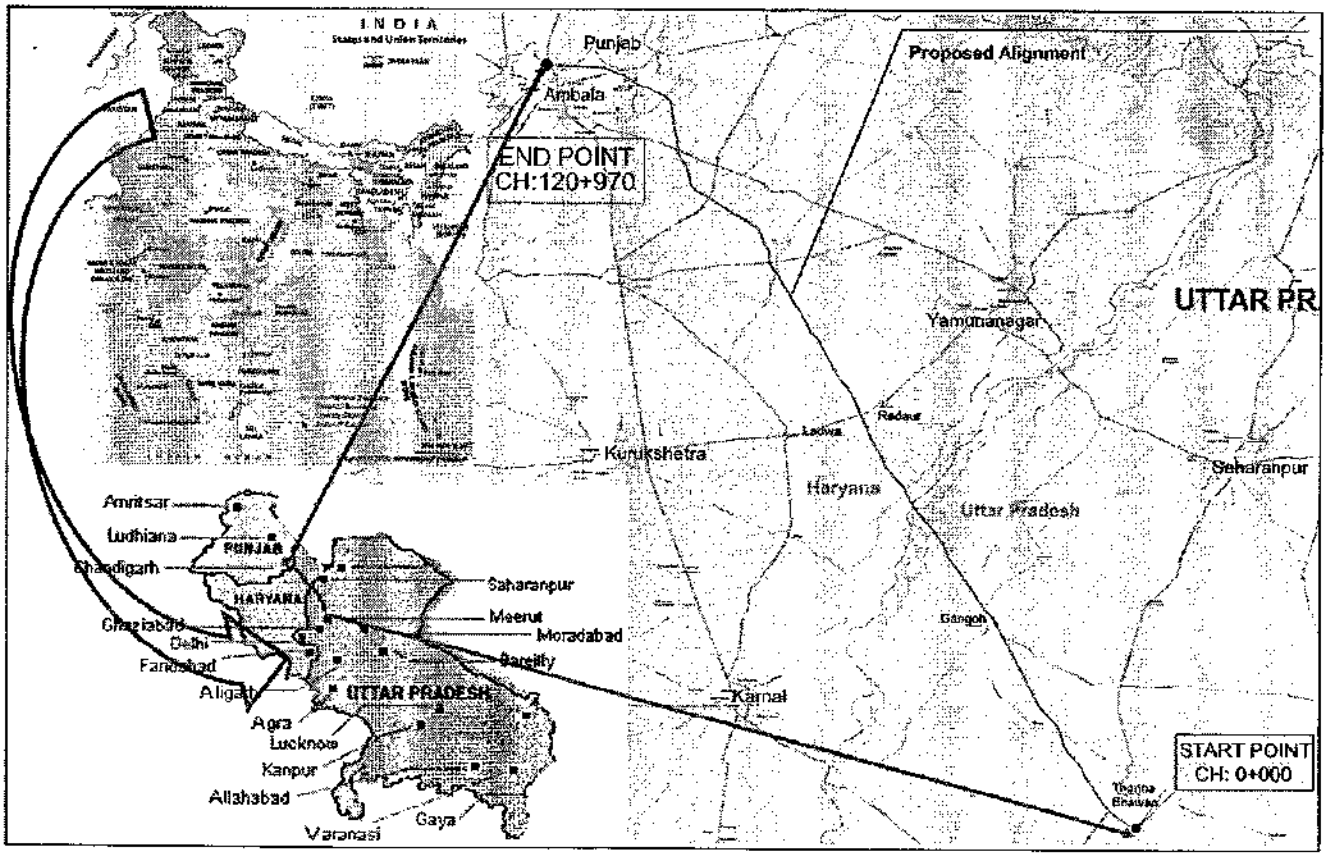


Figure 1-1: Location Map of Proposed Project Highway

1.4 Environment Impact Assessment Process

Applicability of various environmental regulations and guidelines was reviewed for the project and its allied activities. As per the EIA notification, 2006, the project is covered under serial no. 7(f) as category 'A'. The proposed project has been scoped for Terms of Reference (ToR) vide File No.10-33/2021-IA.III (Annexure 1.2) on dated 22nd Sept 2021 & amended on 6th Dec 2021. ToR compliance is presented as Annexure 1.3.

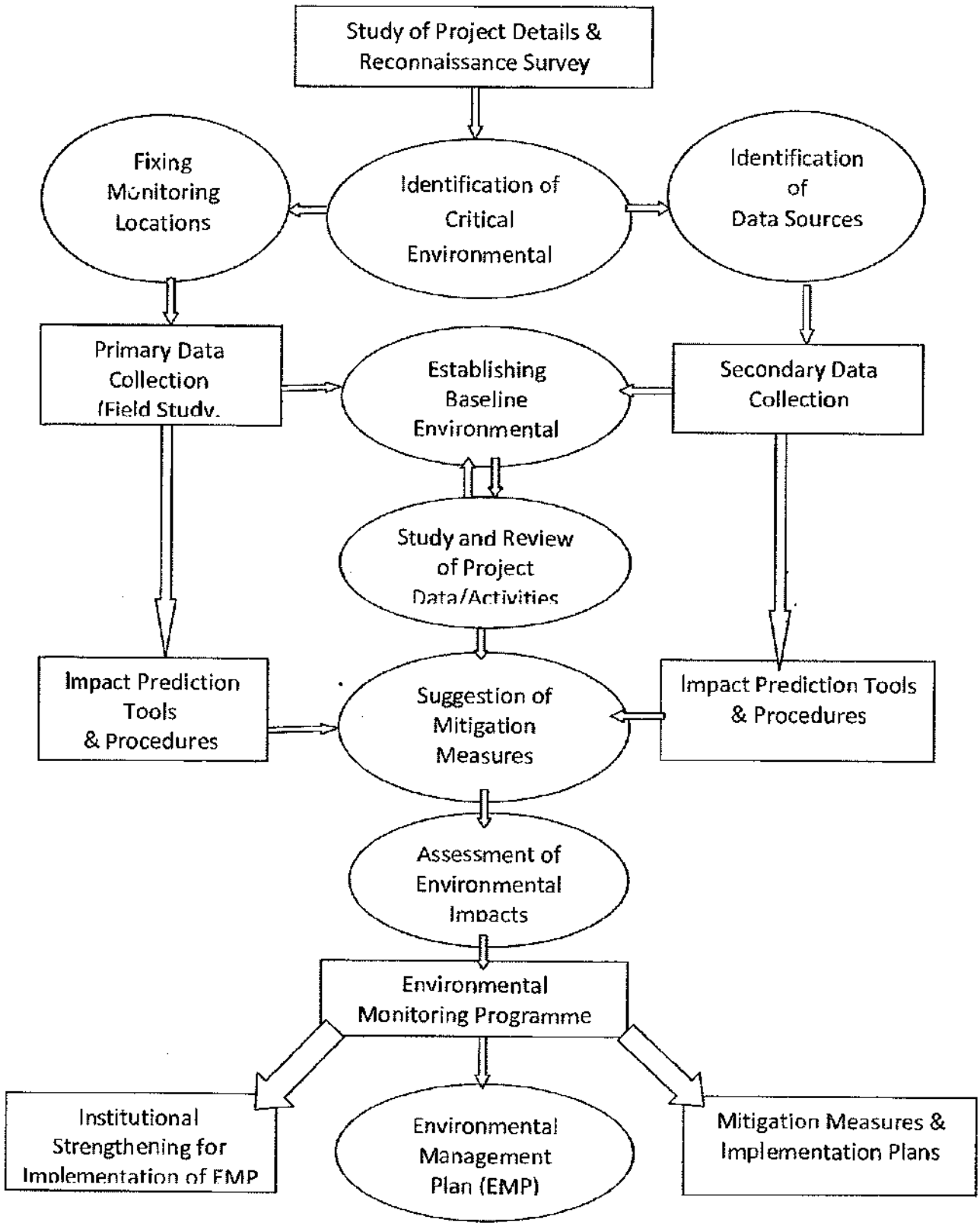
1.5 EIA Methodology

The EIA study was carried out simultaneously with design of the project road and methodology is shown in below Figure 1.2. The important findings of the assessment provided important feedback to the design team, especially in terms of the sensitive receptor, forest and wildlife area, archaeological sites and religious properties. It helped in modification of the designs report and incorporated mitigation measures, wherever the impacts are avoidable.

1.6 Approach and Methodology

Present EIA study has been undertaken based on EIA Notification, 2006 (amended thereof), ToR accorded for the project from MoEF&CC and Environmental Impact Assessment Guidance Manual for Highways prepared by Administrative Staff College of India. The sections below detail out the methodology adopted for the assessment of environment for the project.

Figure 1-2 : Methodology of EIA



1.6.1 Reconnaissance Survey

A reconnaissance survey has been undertaken for identification of Valued Environment Components (VECs) falling within the RoW of proposed highway. Locations of environmentally protected areas (National Parks, Wildlife Sanctuaries, Biosphere Reserves, Reserved / Protected Forest, Important Bird Areas, World heritage Sites, Archaeological Monuments, etc.); surface water bodies; environmentally sensitive receptors (educational institutions, religious structures, medical facilities, etc.) along the green field alignment have been identified during the survey. The Consultant conducted preliminary analysis of the nature, scale and magnitude of the impacts that the project is likely to cause on the environment, especially on the identified VECs.

1.6.2 Review of the Project Information

Project information from Technical Design Report and other secondary information were reviewed and assess the project status and various Technical aspects. Accordingly, major impact areas were identified for detailed assessment in present EIA report.

1.6.3 Review of Applicable Environmental Regulations

Applicability of various environmental regulations and guidelines were reviewed for the project and its allied activities. Review analysis in respect to Govt. of India guidelines and regulatory environment framework is presented in the Table 1-2.

1.6.4 Assessment of Alternatives

With and without project scenarios have been assessed. The assessment of alternatives included that of Process Technology (pavement, cross-sections, etc.), sources of materials from an environmental management perspective, selection of alignment, etc.

1.6.5 Assessment of Baseline Environmental Profile

Secondary data such as Survey of India Toposheets, District Planning Maps, Forest Working Plans, booklet of Central Ground Water Board, details of Archaeological Monuments etc. have been collected from various secondary sources. Further, secondary data, which are relevant to understand the baseline as pertaining to physical and biological environments has been collected and reviewed.

Data pertaining to all facets of environment which include physical, ecological and socioeconomic environment, both through primary and secondary sources were collected. Sources of key relevant information have been summarized in Table 1-3.

Ambient air & noise, ground and surface water samples were monitored at various locations identified along the corridor. The monitoring and analysis for each component were carried out as per MoEF&CC and CPCB guidelines during the study period from January to March 2021. The results of the monitoring were compared with the relevant national standards.

In order to quantify the impacts of the project road on various receptors, a receptor identification survey was carried out. The receptors included the information for educational institutes, hospitals, cultural & religious properties, community properties, water bodies, major pollution generating sources, ecological receptors etc.

Table 1-2: Applicability and Regulatory Environmental Framework

S. No.	Act/Rules	Applicable Yes/No	Reason for Applicability	Implementing / Responsible Agency
1	Environment Protection Act1986	Yes	The project activities should maintain emission standards	MoEF&CC; State Govt.; SPCB
2	Environmental ImpactAssessmentNotification-14thSep 2006 and subsequent Amendments	Yes	Project Highway is a new National Highway project. Hence, Environment Clearance is required from MoEF&CC.	MoEF&CC
3	Forest (Conservation) Act,1980. The Forest (Conversion) Rules 1981	Yes	The proposed project is passing through strip plantation declared as protected forests alongside roads, canals and railway lines	State Forest Department, MoEF&CC
4	Wildlife Protection Act 1972	No	The proposed alignment is neither passing through nor falling within 10 km radius of any protected or ecological sensitive area.	Chief Wildlife Warden; State Forest Department
5	Air (Prevention and Control of Pollution) Act, 1981	Yes	Consent required for establishing and operation of crushers, hot mix and batching plants etc. and not polluting ground and surface water during construction	SPCB
6	Water (Prevention and Control of Pollution) Act 1974	Yes	Consent required for establishing and operation of crushers, hot mix and batching plants etc.	SPCB
7	Noise Pollution (Regulation and Control) Act, 1990, 2010 and its subsequent amendments	Yes	Construction machineries and vehicles to conform to the standards for construction	SPCB
8	Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	No	The project route is not falling within 300 m of any Ancient Monument, declared protected under the Act.	Archaeological Dept. GoI, & State Dept. of Archaeology
9	Notification for use of Fly ash, 3rd November 2009, and its amendment on 25th January 2016	Yes	TPS are located within 300km from the proposed highway alignment	MoEF&CC
10	The Explosives Act (& Rules) 1884	Yes	Use of blasting materials (if required) for	Chief Controller of

S. No.	Act/Rules	Applicable Yes/No	Reason for Applicability	Implementing / Responsible Agency
			new quarrying operation and storing/transportation of Diesel / Petrol, bitumen etc. in the camp site	Explosives
11	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Yes	Handling of hazardous (flammable, toxic and explosive) chemicals during road construction	District & Local Crisis Group headed by the DM
12	Public Liability Insurance Act, 1991	Yes	Contractors need to stock hazardous material like diesel, Bitumen, Emulsions etc. safely.	Labour Commissioner / District Magistrate
13	Mines & Minerals (Regulation & Development) Act, 1957 & amended thereof,	Yes	Mining of sand, soil or aggregates shall require permission from mining dept.	State Department of Mining
14	Hazardous and Other Wastes (Management . and Transboundary Movement) Rules, 2016	Yes	Storage and handling of hazardous waste during construction, Hazardous wastes shall be generated due to activities like of maintenance and repair work on vehicles	SPCB
15	Solid Waste Management Rules,2016	Yes	For disposal of solid waste generated during construction	SPCB
16	Construction and Demolition Waste Management Rules, 2016	Yes	Construction and demolition waste due to demolition of existing structures & construction activities and municipal waste shall be generated from the construction worker camp	SPCB
17	Central Motor Vehicles Act, 1988	Yes	This rule will be applicable to road users and construction machinery	Motor Vehicle Department
18	The Mining Act, 1952	Yes	The construction of proposed highway will require aggregates. These will be procured through mining from quarries	State Department of mining,
19	Batteries (Management & Handling) Amendment Rules,2010	Yes	Safe disposal of used lead batteries	SPCB
20	The Right to Fair Compensation and Transparency in Land Acquisition, R&R Act, 2013	Yes	Requirement for land acquisition to accommodate to project	Revenue /State Department

Table 1-3: Primary and Secondary Information Sources

Parameters	Information Source
Technical information	Design Report
Inventory of features like water Bodies, Community structures, environmentally sensitive locations areas, congested locations *etc.*	Total station surveys, Google Earth, Bhuvan, Survey of India Maps, Primary Transect Walk
Climatic Condition & Meteorological data	India Meteorological Department, Districts Groundwater Brochure of CGWB, Primary data collection
Geology, Seismicity, Soil and Topography	Districts Groundwater Brochure of CGWB, Seismicity data available of National Disaster Management Authority Website and Primary survey & Investigation
Land Use / Land Cover	Survey of India Toposheet, Google Earth, Bhuvan and Ground Truthing
Drainage Pattern	Survey of India Toposheet, Total Station Survey at Site, Districts Groundwater Brochure of CGWB, field observation and consultation with stakeholders
Ecology & Biodiversity and identification of Forest Area	Onsite survey, Consultations in DFO/wildlife office, Research generals and I-BAT
Air quality Noise, Soil and Water	Onsite monitoring and Analysis of Field samples, SPCB & CPCB published data
Borrow Areas, Quarries and other construction material source	Material Surveys
River geo-morphology, hydrology, drainage, flood patterns	Water resource Dept., Districts Groundwater Brochure of CGWB, outcome of the consultation and field observations
Socioeconomic Environment	Census of India and Public Consultation during the Field survey

1.6.6 Assessment of Impacts

Assessment of potential impacts has been carried out based on the project design and baseline environment data as collected from primary and secondary sources. Assessment of the environmental impacts were carried out to ascertain the direct and indirect impacts likely to be induced due to proposed development. The general impacts are land acquisition & allied impacts on society, dust & air pollution due to removal of structures, trees & vegetation and other construction activities; noise pollution due to construction activities, loss of flora and its impacts on the ecology and impacts on water resources.

For each impact predicted, feasible and cost-effective mitigation measures have been suggested to reduce potentially significant adverse environmental impacts to acceptable levels.

1.6.7 Consultations

Consultations on environmental issues with community members, institutional stakeholder and PAPs in the form of focused group discussions, stakeholder meetings etc. were carried out.

Consultation process were involved both formal and non-formal discussion. The feedback generated through these meetings has been incorporated as far as possible in the design and construction of the highway. The consultation process shall continue even during the implementation stage to gauge the general opinion. The outcome of consultation activities is elaborated in Chapter 7- Additional Studies.

1.6.8 Environment Management and Monitoring Plan

All affirmative action's not only to avoid and deter but also to capitalise on the opportunities provided by the project in order to improve the environmental conditions have been deliberated. The various mitigation and enhancement measures proposed have been included in the EIA report. Based on their applicability, both general and case specific measures were incorporated.

The EMP action plan has been prepared to detail out the implementation plan of the proposed mitigation and enhancement measures. Monitoring indicators have been identified to have a continuous check on impacts associated with project activities.

1.7 Structure of the Report

The EIA report excluding the first chapter has been structured into the following chapters:

Chapter- 2 **Project Description** describes the project design features related to environment, health and safety aspects.

Chapter-3 **Analysis of Alternatives** details out the various alternatives for the project stretch, construction technology alternative, etc.

Chapter- 4 **Baseline Environmental Profile** describes the existing environmental set up of the study area.

Chapter-5 **Anticipated Environmental Impact & Mitigation Measures** details out about impacts associated with the proposed developmental activities. Mitigation measures for identified impacts are also covered in this chapter.

Chapter- 6 **Environmental Monitoring programme** discuss about the monitoring indicators, reporting mechanism and responsibility distribution for successful implementation of Environment Management Plan

Chapter-7 **Additional Studies** covers details about the Public Consultation and Hearing. Chapter also contains the brief of additional studies suggested by MoEF&CC during ToR appraisal meeting.

Chapter- 8 **Project benefits** to the local community and environment are discussed in this chapter

Chapter- 9 **Environmental Management Plan** details both the generic and specific EMPs for the project Highway. Implementation arrangements give a brief about the implementation methodology. This chapter also discusses about the Environmental Budget.

Chapter- 10 **Summary and Conclusion** briefs the EIA study outcome along with recommendation for the project.

Chapter- 11 **Disclosure of the Consultant** provides the details of the consultants engaged along with their capabilities and experiences.

2 PROJECT DESCRIPTION

2.1 The project

The Ministry of Road Transport and Highways (MoRTH), Government of India, is the apex body for formulation and administration of the rules, regulations and laws relating to road transport and transport research, in order to increase the mobility and efficiency of the road transport system in India. The Ministry of Road Transport and Highways (MoRTH) / National Highways Authority of India (NHAI) have decided to develop new national highways with access control, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana.

The proposed highway with new alignment has been envisaged through an area which shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel. The proposed highway is greenfield project with 6 lanes carriageway. The proposed project starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli district of Uttar Pradesh and ends at Sadopur village (Ch:120+970) in Ambala district of Haryana State. District wise length of the proposed alignment is given below table.

Table 2-1: Location of the Proposed Project

S. No.	State	District	Chainage (km)		Length (km)
			To	From	
1.	Uttar Pradesh	Shamli	0.000	14.422	14.422
		Saharanpur	14.422	47.668	33.246
2.	Haryana	Karnal	47.668	55.037	7.369
		Yamunanagar	55.037	71.168	16.131
		Kurukshetra	71.168	74.533	3.365
		Ambala Cantt.	74.533	108.450	33.917
3.	Punjab	SAS Nagar	108.450	111.800	3.35
4.	Haryana	Ambala	111.800	120.970	9.17
				Total Length (km)	**120.970**

Location of the proposed alignment is shown in above Figure 1.1. Alignment duly marked on google satellite imagery is shown as Figure 2.1.

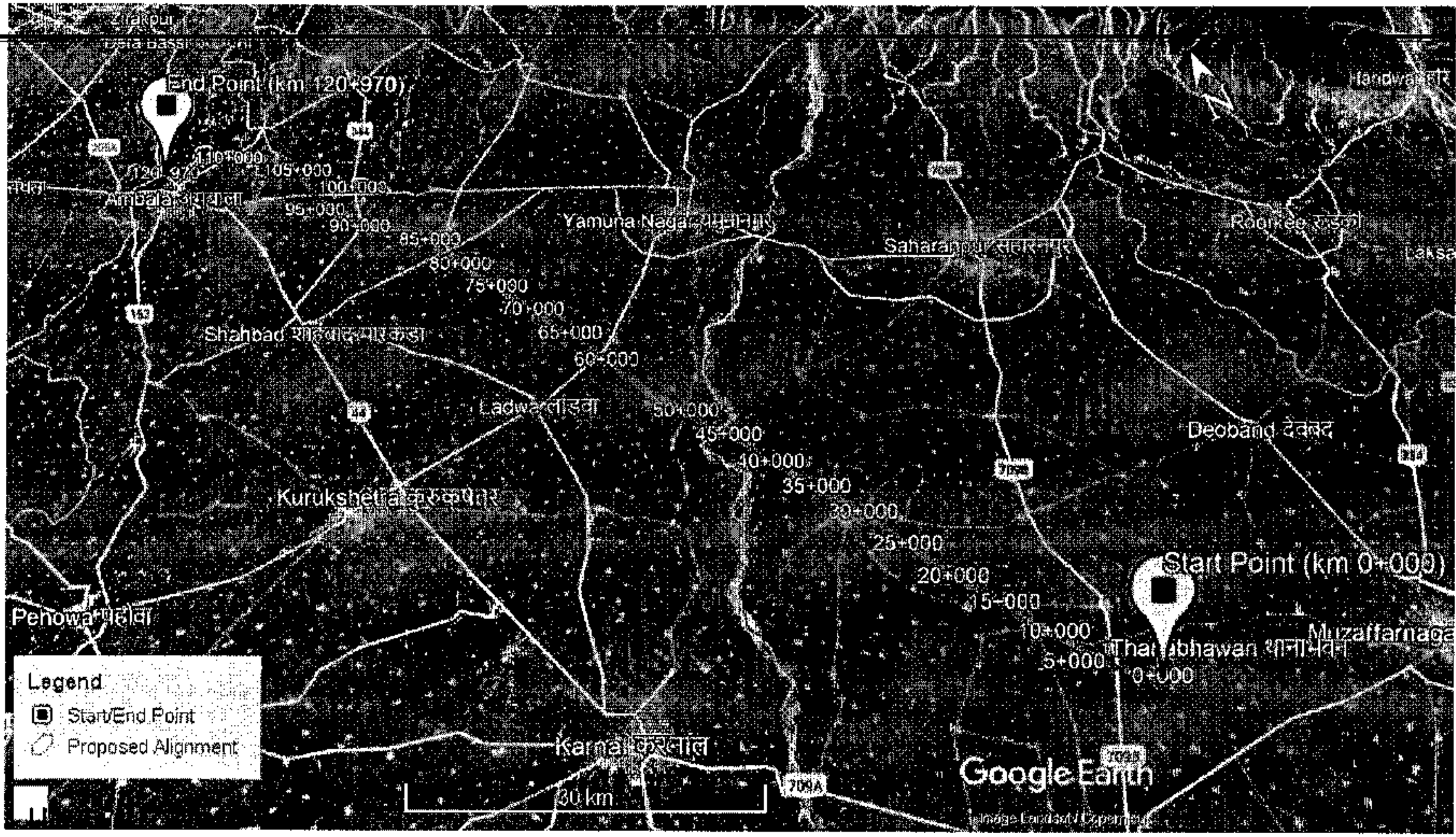


Figure 2-1: Proposed alignment marked on Satellite Imagery (Google Earth)

2.2 Project Features

The project highway is a green-field access control highway with 6 lane configuration and shall follow the National Highway standards as per IRC SP 87-2019. The various aspects of design that have been considered in the development of design for the proposed highway are brought out in this section. It mainly consists of geometrics of National Highway, interchange design, junction design, cross sections, drainage design, pavement design, structure design for culverts, bridges, flyover, VUP's, LVUP's and interchanges.

2.2.1 Design Speed

The project corridor passes through plain terrain. The adopted design speed is 100 kmph throughout the stretch. Design speed for various terrains is given in Table 2-2.

Table 2-2: Design Speed

Nature of Terrain	Design Speed (Kmph)
Plain	100

2.2.2 Right of Way

The recommended minimum Right of Way is 60m throughout the project stretch. However, Additional land shall be acquired at interchanges way side amenities and diversion.

2.3 Typical Cross Sections

The proposed greenfield project is a development of 6 lane divided carriageway. Each roadway section must be individually analyzed, and its cross section determined based on the volume and type of projected traffic, capacity, desired level of service, and available right-of-way. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. The details of the cross section are given in Table 2.3. The design of typical Cross section (TCS) are attached as **Annexure 2.1.**

Table 2-3: Details of Proposed Cross Section

Cross Sectional Elements	Width(m)	Total Width (m)
6-Lane Divided Carriageway (New Construction)		
Main Carriageway	10.5x2	21
Paved shoulder / Edge strip	0.5x2	1.0
Earthen shoulder	3.0x2	6.0
Median (Depressed)	5.0x1	5.0
Kerb Shyness	0.5x2	1.0
Concrete Drain	1.5x2	3.0
Utility Corridor	2.0x2	4.0
6-Lane Divided Carriageway with Structures - New Construction		
Main Carriageway	13.5x2	27
RE Wall	1.8x2	3.6
Median	3.0x1	3.0

Source: Design Report

2.4 Bridges and Culverts

There are 7 Major and 10 Minor bridges are proposed on the River, Canals/Nala crossing the proposed alignment. Further, 2 ROB & 110 Culverts are proposed for the project. The details of the major and minor bridges proposed along the proposed alignment is given in **Table 2-4.**

Table 2-4: List of Major Bridge & Minor Bridges

S. No	Chainage (km)	Length (m)	Vertical Clearance	Type	Remarks
Major Bridge					
1.	11+885	70	5.5	PSC-Girder	Canal + Road
2.	46+290	1000	5.5	PSC-Girder	Yamuna River
3.	47+710	160	5.5	PSC-Girder	Stream
4.	53+833	80	5.5	PSC-Girder	Cart Track + Canal + Cart Track
5.	58+985	200	5.5	PSC-Girder	Canal + Cart Track + Canal
6.	90+580	270	5.5	PSC-Girder	Markanda River
7.	108+450	120	5.5	PSC-Girder	Tangdi River
Minor Bridge					
1.	0+725	17	4.0	RCC-Girder	Canal + Road
2.	3+000	50	-	PSC-Girder	Stream
3.	12+917	25	4.0	RCC-Girder	Cart Track + Canal + Road
4.	16+872	12	4.0	RCC-Girder	Canal + Cart Track
5.	18+894	31	5.5	RCC-Girder	Village Road + Canal
6.	64+586	35	--	RCC-Girder	Nala
7.	73+660	15	-	PSC-Girder	Nala
8.	83+215	30	-	RCC-Girder	Canal
9.	101+414	30	-	PSC-Girder	River
10.	106+423	25	-	BOX	Nala

Source: Design Report

2.4.1 VUP, LVUP & Culverts

The proposed road has 19 VUP, 33 LVUP & 110 Culverts. The crossings have been provided with VUP. The lesser important roads have been provided with LVUP.

Table 2-5: Locations of VUP

S. No	Chainage (km)	Length (m)	Vertical Clearance	Type	Description
1	3+335	20	5.5	RCC-Girder	Babri - Thanabhawan
2	5+160	20	5.5	PSC-Girder	Raseedgarh - Thanabhawan
3	9+440	20	5.5	RCC-Girder	Unn - Thanabhawan
4	15+120	20	5.5	RCC-Girder	Gangoh - Jalalbad
5	30+857	20	5.5	PSC-Girder	Gangoh - Daidnor
6	32+878	20	5.5	PSC-Girder	Gangoh - Ambheta
7	34+650	20	5.5	RCC-Girder	Gangoh - Nakur
8	50+066	20	5.5	RCC-Girder	Karnal - Yamunanagar

9	57+148	20	5.5	RCC-Girder	Dhanaura - Potli
10	76+307	20	5.5	RCC-Girder	Alawalpur - Talheri Rangran
11	78+914	20	5.5	RCC-Girder	Talheri - Thamber
12	80+954	20	5.5	RCC-Girder	Adhoya - Kambassi
13	82+471	60	5.5	RCC-Girder	SH-4 Shahbaad Markanda - Jagadhri
14	85+657	20	5.5	RCC-Girder	Tandwal - Barara
15	95+182	20	5.5	RCC-Girder	Haldari - Bihta
16	103+120	20	5.5	RCC-Girder	Khuda Kalan - Kapuri
17	111+803	31	5.5	RCC-Girder	Ambala - Doshpur
18	113+895	31	5.5	RCC-Girder	Ambala - Panchkula
19	118+205	20	5.5	RCC-Girder	Panjokhara - Jharmari

Source: Design Report

Table 2-6: Locations of LVUP

Sl. No.	Chainage (km)	Length (m)	Type	Remarks
1.	2+740	12	Box	Maisani Ismailpur - Thanabhawan
2.	8+023	12	Box	Yarpur - Manath
3.	20+724	12	Box	Tabarrukpur - Thollafatehpur
4.	22+375	12	Box	Mohammadpur Guzar - Dhola Fatehpur
5.	23+354	12	Box	Mohammadpur Guzar - Balu
6.	26+256	12	Box	Akbarpur - Sangathera
7.	29+970	12	Box	Gangoh - Deoband
8.	31+755	12	Box	Gangoh - Khanpur Guzar
9.	37+080	12	Box	Meghan Majra - Salarpura
10.	40+740	12	Box	Sanauli - Bishanpura
11.	42+653	12	Box	Chau Sahaspur - Rasulpur Guzar
12.	59+932	12	Box	Dhaulra - Radaur
13.	61+980	12	Box	Radaur - Sadhura
14.	64+104	12	Box	Bapa - Bubka
15.	66+507	12	Box	Jogi Majra - Dhanupura
16.	69+305	12	Box	Ghillaur Majri - Hartan
17.	72+233	12	Box	Gangori - Gajlana
18.	77+742	12	Box	Talheri - Malakpur
19.	81+463	12	Box	Kambassi- Adhoya
20.	83+495	12	Box	Raju Kheri - Barara
21.	84+982	12	Box	Diodpur - Barara
22.	87+523	12	Box	Chahal Majra - Rajouli
23.	88+930	12	Box	Tandwal - Ghelri
24.	92+867	12	Box	Ghaseetpur - Jawahargarh
25.	95+808	12	Box	Dalara - Bihta
26.	98+180	12	Box	Akbarpur - Tepla
27.	99+611	12	Box	Sambhalkha-Mithapur
28.	105+115	12	Box	Chandpura - Rattenheri
29.	106+270	12	Box	Khalen Rajapur - Rattanheri
30.	107+747	12	Box	Khalen Rajapur - Utalen
31.	110+430	12	Box	Dhulkot - Nagla
32.	115+180	12	Box	Panjokhara - kasoli

Sl. No.	Chainage (km)	Length (m)	Type	Remarks
33.	119+340	12	Box	Ambala - Jaraut

Source: Design Report

Table 2-7: Locations of Proposed Culverts

Sl. No.	Design Chainage (km)	Length (m)	Height (m)	Feature Type
1.	0+964	6	3.0	Village Road
2.	1+446	6	3.0	Cart Track
3.	5+890	6	4.0	Cart Track
4.	6+778	6	3.0	Canal + Road
5.	7+033	6	3.0	Cart Track
6.	7+594	6	3.0	Cart Track
7.	8+855	6	3.0	Cart Track
8.	11+120	6	3.0	Cart Track
9.	11+504	6	4.0	Cart Track
10.	13+397	6	3.0	Cart Track
11.	17+228	6	3.0	Village Road
12.	17+909	6	3.0	Village Road
13.	19+524	6	3.0	Village Road
14.	21+566	6	3.0	Cart Track
15.	23+905	6	3.0	Chuck Road
16.	24+860	6	3.0	Cart Track
17.	25+365	6	3.0	Chuck Road
18.	25+935	6	3.0	Cart Track
19.	27+010	6	3.0	Cart Track
20.	28+058	6	3.0	Cart Track
21.	29+713	6	3.0	Cart Track
22.	31+526	6	3.0	Cart Track
23.	32+465	6	4.0	Cart Track
24.	35+688	6	3.0	Chuck Road
25.	35+876	6	3.0	Chuck Road
26.	36+165	6	3.0	Cart Track
27.	36+805	6	3.0	Village Road
28.	37+843	6	3.0	Chuck Road
29.	40+005	6	3.0	Cart Track
30.	43+394	6	3.0	Cart Track
31.	44+785	6	3.0	Cart Track
32.	45+303	6	3.0	Chuck Road
33.	47+217	6	3.0	Cart Track
34.	48+897	6	3.0	Cart Track
35.	49+312	6	3.0	Cart Track
36.	51+050	6	3.0	Stream
37.	51+653	6	3.0	Cart Track

Sl. No.	Design Chainage (km)	Length (m)	Height (m)	Feature Type
38.	52+337	6	3.0	Cart Track
39.	53+464	6	3.0	Village Road
40.	54+720	6	3.0	Chuck Road
41.	56+976	6	4.0	Canal
42.	58+446	6	3.0	Cart Track
43.	59+143	6	3.0	Chuck Road
44.	59+517	6	3.0	Chuck Road
45.	62+586	6	3.0	Chuck Road
46.	63+298	6	3.0	Chuck Road
47.	65+035	6	3.0	Chuck Road
48.	65+372	6	3.0	Cart Track
49.	66+051	6	3.0	Cart Track
50.	67+190	6	3.0	Chuck Road
51.	68+263	6	3.0	Chuck Road
52.	70+877	6	3.0	Chuck Road
53.	71+420	6	3.0	Cart Track
54.	72+695	6	3.0	Cart Track
55.	73+400	6	3.0	Chuck Road
56.	75+757	6	3.0	Cart Track
57.	77+256	6	3.0	Cart Track
58.	81+830	6	3.0	Cart Track
59.	83+150	6	3.0	Cart Track
60.	86+840	6	3.0	Cart Track
61.	87+707	6	3.0	Cart Track + Canal + Cart Track
62.	88+400	6	3.0	Chuck Road
63.	88+641	6	3.0	Cart Track
64.	89+995	6	3.0	Cart Track
65.	90+230	6	4.0	Chuck Road
66.	91+560	6	3.0	Cart Track
67.	91+892	6	4.0	Village Road
68.	92+230	6	3.0	Cart Track + Canal
69.	94+800	6	4.0	Village Road
70.	97+897	6	3.0	Nala
71.	99+318	6	3.0	Cart Track
72.	101+365	6	3.0	Chuck Road
73.	102+440	6	3.0	Cart Track
74.	103+500	6	3.0	Cart Track
75.	105+877	6	3.0	Cart Track
76.	106+998	6	4.0	Chuck Road
77.	108+255	6	3.0	Cart Track

Sl. No.	Design Chainage (km)	Length (m)	Height (m)	Feature Type
78.	108+923	6	4.0	village Road
79.	109+037	6	3.0	Cart Track
80.	109+825	6	3.0	Chuck Road
81.	110+280	6	4.0	Canal
82.	112+410	6	3.0	Cart Track
83.	119+685	6	3.0	Chuck Road
84.	3+504	4	4.0	Cart Track
85.	8+530	3	2.0	Cart Track
86.	13+820	6	2.0	Stream
87.	23+775	4	3.0	Stream
88.	25+025	6	4.0	Stream
89.	27+372	3	2.0	Cart Track
90.	31+256	4	3.0	Village Road
91.	37+265	3	3.0	Chuck Road
92.	37+910	4	2.0	Kurali Nala
93.	38+916	3	2.0	Chuck Road
94.	39+290	4	2.0	Saindli River
95.	43+500	4	3.0	Budhi River
96.	43+970	3	2.0	Chuck Road
97.	49+003	6	4.0	Stream
98.	53+044	3	2.0	Chuck Road
99.	54+345	3	2.0	Chuck Road
100.	55+040	3	2.0	Stream
101.	55+580	3	2.0	Chuck Road
102.	74+873	4	2.0	Chuck Road
103.	79+900	3	2.0	Chuck Road
104.	84+289	3	2.0	Chuck Road
105.	92+470	3	2.0	Stream
106.	96+850	3	2.0	Chuck Road
107.	99+728	4	3.0	Chuck Road
108.	103+900	4	2.0	Chuck Road
109.	114+468	3	2.0	Chuck Road
110.	116+003	4	2.0	Nala+Cart Track

Source: Design Report

2.4.2 Interchanges

There are 8 intersections are proposed *i.e.* Starting junction on Delhi- Saharanpur Greenfield Alignment (Ch: 0+000) and End point on Ambala -Chandigarh highway (Ch: 120+970).

Table 2-8: Locations of Interchanges

S. No.	Design km	Feature Type	Vertical Clearance (m)	Intersecting Road
1	0+000	Clover Leaf	5.5	Delhi - Saharanpur 6 Lane Hwy
2	3+896	Dumbbells on inside road	5.5	Delhi - Saharanpur
3	28+957	Dumbbell on Intersecting Road	5.5	Gangoh - Deoband
4	60+979	Rotary	5.5	Kurukshetra - Yamunanagar
5	93+450	Dumbbell	5.5	SH- 31 Shahbaad Markanda - Saha
6	100+525	To be decided	5.5	Ambala - Jagadhri
7	107+444	Single Trumpet	5.5	Ambala - Kala Amb
8	120+950	Underpass and Overpass	5.5	Ambala - Chandigarh

Source: Design Report

2.5 Need of the Project & Brief About the Project

2.5.1 Need of the Project

The proposed access-controlled highway is a complete greenfield project falls in Uttar Pradesh, Haryana & Punjab State. The proposed highway project has been envisaged through an area which shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel. The proposed highway would act as the prime artery for the economic flow to this region. It will enhance economic development, provide employment opportunities to locals, strengthen tourist development, ensure road safety, and provide better transportation facilities and other facilities such as way side amenities. Vehicle operating cost will also be reduced due to improved road quality.

2.5.2 Proposed Pavement & Overlay

The proposed highway is designed by both flexible and concrete pavement options. The flexible pavement is adopted for proposed main carriageway, ramp roads and slip roads – 20 years Design in accordance with IRC:37-2018. Rigid Pavement is designed for New Construction near Toll Plaza with granular sub-base (GSB), base as DLC and PQC Slab (M-40 grade PCC) in accordance with IRC:58-2015.

2.5.3 Traffic Control, Road Marking, Traffic Signs and Safety Measures

Indian Road Congress (IRC) codes are followed in proposing and designing road safety features. Pavement markings are done for traffic lane line, edge lines and hatching. The marking shall be with hot applied thermoplastics materials. The pavement markings shall be reinforced with raised RR pavement markers and shall be provided for median and shoulder edge longitudinal lines and hatch markings. Highway lightings including high masts shall be provided at intersections in order to improve the night time visibility. All the urban locations as well grade separated structure locations shall be provided lighting arrangements.

2.5.4 Proposal for Wayside Amenities cum Rest Area

The wayside amenities like petrol pump, first aid medical facilities, police office, restaurant and vehicle parking *etc.* shall be provided on every 30-50 km interval.

2.5.5 Toll Booths and Weighing Stations

After studying the merits and demerits of both the methods of toll collection, closed tolling was recommended. The toll gates have been planned in open areas with lesser height of embankment for construction of the toll gate at normal elevation. The details of Toll Booths are given in **Table 2-8.**

Weighing stations shall be located near toll booths so that overloaded vehicles can be easily identified and suitably penalized / unloaded before being allowed to proceed further. The type of weighing system suitable for the project shall be brought out giving merits of each type of the state-of-the art and basis of recommendations for the chosen system.

Table 2-9: Details of Toll Plaza

S. No.	Location of Toll Booths	Minimum Number of Toll Lanes	
	Chainage (km)	Entry	Exit
1	0+000	2	2
2	3+896	2	2
3	3+900	2	2
4	29+000	2	2
5	61+000	2	2
6	93+450	2	2
7	100+500	2	2
8	116+000 (on Main Carriageway) Cloverleaf	2	2

Source: Design Report

2.5.6 Geometric Design Standards for 6-lane Highway

The design of the road geometry for the assigned project shall cover the following main principles, which form the basis of desirable standard of highway design.

- Road safety and the smooth flow of traffic are of prime concern in the design. The selection of optimum design standards reduces the possibility of undesirability of the facility to be provided.
- Both horizontal and vertical geometry shall be accorded due importance as per selected standards. It shall not be compromised unless it becomes formidable to accept for the particular situation.
- Consistent Design shall be adopted and abrupt changes in the design speed to be avoided.
- The proposed design will minimise the total transportation cost, including initial construction costs, costs for the maintenance of the facility and the costs borne by the road users. "Ruling" standards are adopted and "Minimum" standards are allowed only where serious restrictions are imposed by technical or economic considerations.

2.6 Land Requirement for the Proposed Project

The proposed RoW is 60 m. The total land to be acquired for the development of highway with all facilities is ~824.285 ha. The entire alignment is passing through plain terrain. The land use along the road is mostly agricultural and barren at some stretches.

2.7 Water Requirement for the Proposed Project

The peak water requirement for the project shall be about 27091578 KLD during construction stage. The water requirement shall be extracted from local surface water after taking necessary permission. The breakup of the water requirement has been presented in Table 2-10.

Table 2-10: Water Requirement for the Project

Purpose	Peak (KLD)	Source
Road making	18964105.10	Local surface water
Dust suppression	5418315.74	
Others (including drinking and domestic) purposes)	2709157.87	
Total	**27091578.7**	

2.8 Traffic Survey

In order to capture and assess the traffic characteristics, travel pattern, the Consultants have conducted the following primary traffic surveys.

- Classified Traffic Volume Count Surveys
- Origin - Destination and Commodity Movement Surveys
- Axle Load Data

These features facilitated a framework for carrying out the necessary count surveys in accordance with the guidelines specified in IRC codes of practice. The various survey locations have been selected with careful assessment of the traffic of competing road of project. These points were further refined jointly at site as required by the NHAI. The survey location and duration have been presented in Table 2-11.

Table 2-11: Location for Traffic Survey

S. No	Type of survey	Duration	Location
1	Classified Traffic Volume Count (TVC)	24/05/2021 to 1/06/2021	Shamli (Ch: 80+900), Murthal Toll Plaza, Gharaunda Toll Plaza, Jiwana Toll Plaza
2	Origin-Destination (O-D) Survey	30/05/2021 to 1/06/2021	
3	Axle Load Survey	30/05/2021 to 1/06/2021	Jiwana Toll Plaza, Shamli (Ch: 80+900)

Source: Design Report

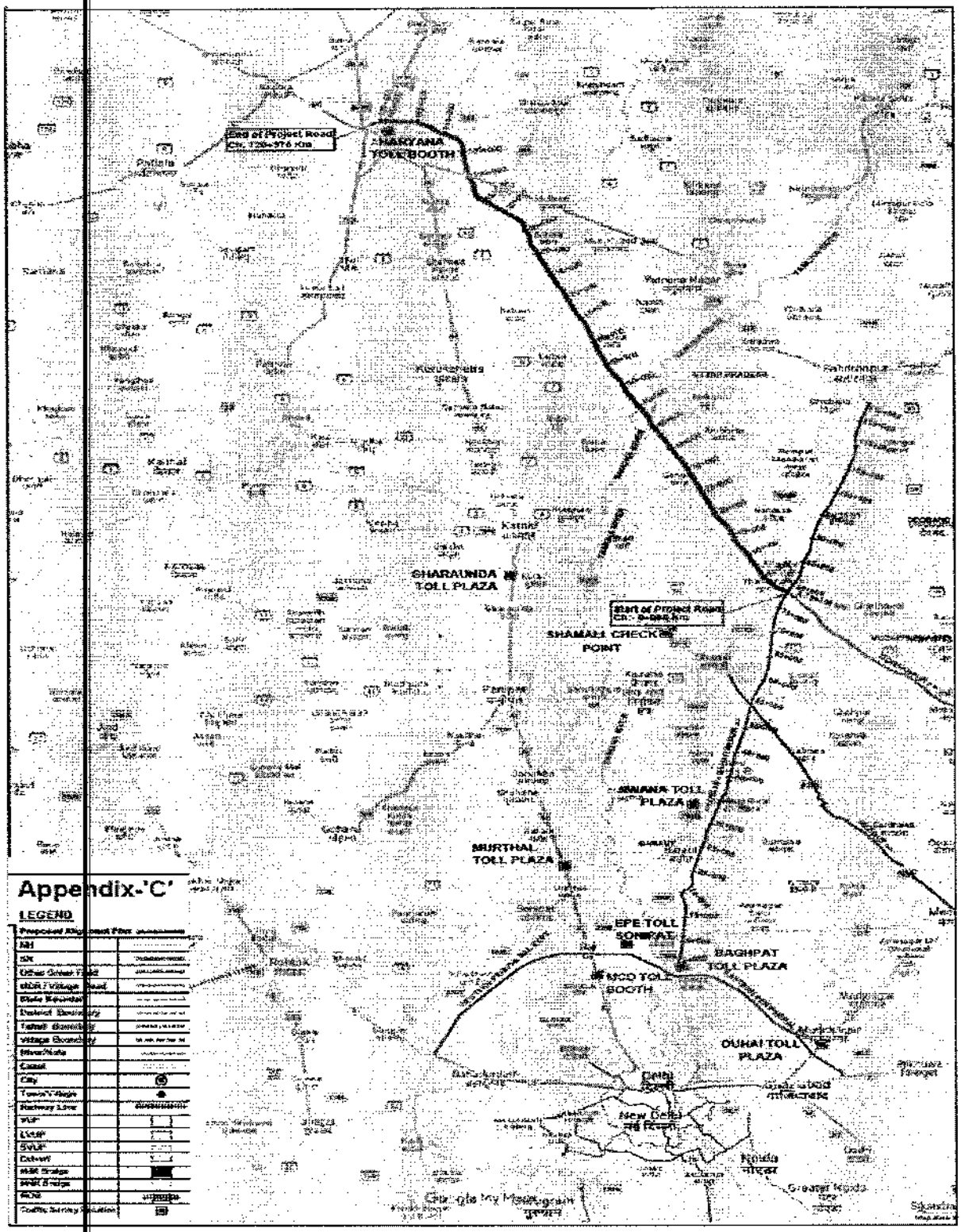


Figure 2-2: Traffic Survey Locations

2.8.1 Average Daily Traffic (ADT)

The classified traffic volume count data collected is analyzed to assess the traffic intensity along the project corridors. The summary of Average Daily Traffic (ADT) at 4nos survey locations are given in Table 2-12.

Table 2-12: Details of Average Traffic

Vehicle Group	Shamli		Jiwana		Murtal		Gharaunda	
	ADT	AADT	ADT	AADT	ADT	AADT	ADT	AADT
Passenger Vehicles	7442	7442	11357	11357	43481	43481	38299	38299
Goods vehicles	3256	3256	900	900	14903	14903	14901	14901
Slow moving vehicles	439	439	663	663	516	516	409	409
Toll exempted vehicles	20	20	18	18	112	112	74	74
Total vehicles	11157	11157	12937	12937	59012	59012	53682	53682
Total PCUs	15506	15506	11341	11341	80268	80268	75262	75262

Source: Design Report

2.8.2 Traffic Projection

Capacity analysis for the project corridor is carried out in order to assess the Level of Service (LOS) offered by road sections under prevailing roadway and traffic conditions. Capacity and Design Service Volumes (DSV) specified in IRC: SP:87-2019, "Manual of Specifications and Standards for Six Laning of Highways" have been adopted for determining the Level of Service offered by road sections during the design period. The capacity and design service volumes for various lane configurations in case of plain terrain are presented below.

- As per IRC: 87-2019, the PCU for six lane LOS B is 60,000

Table 2-13: Projected Traffic Analysis

Year	Car	Mini Bus	Buses	LMV	LCV	2 Axle	3 Axle	4-6 Axle	Total	PCU's
2021	7151	75	187	500	1556	507	716	1822	12514	22527
2022	7509	79	196	525	1634	532	752	1913	13140	23653
2023	7884	83	206	551	1715	559	789	2009	13797	24835
2024	8692	91	227	608	1891	616	870	2215	15211	27381
2025	9127	96	239	638	1986	647	914	2325	15971	28750
2026	9583	101	251	670	2085	679	960	2442	16770	30188
2027	10062	106	263	704	2189	713	1007	2564	17608	31697
2028	10565	111	276	739	2299	749	1058	2692	18489	33282
2029	11094	116	290	776	2414	787	1111	2827	19413	34946
2030	11648	122	305	814	2535	826	1166	2968	20384	36693
2031	12231	128	320	855	2661	867	1225	3116	21403	38528
2032	12842	135	336	898	2794	910	1286	3272	22473	40454
2033	13484	141	353	943	2934	956	1350	3436	23597	42477
2034	14158	148	370	990	3081	1004	1418	3607	24777	44601

Year	Car	Mini Bus	Buses	LMV	LCV	2 Axle	3 Axle	4-6 Axle	Total	PCU's
2035	14866	156	389	1039	3235	1054	1489	3788	26016	46831
2036	15610	164	408	1091	3397	1107	1563	3977	27316	49173
2037	16390	172	429	1146	3566	1162	1641	4176	28682	51631
2038	17210	180	450	1203	3745	1220	1723	4385	30116	54213
2039	18070	190	473	1263	3932	1281	1809	4604	31622	56923
2040	18974	199	496	1327	4129	1345	1900	4834	33203	59770
2041	19922	209	521	1393	4335	1412	1995	5076	34864	62758
2042	20919	219	547	1463	4552	1483	2094	5330	36607	65896
2043	21964	230	574	1536	4779	1557	2199	5596	38437	69191
2044	23063	242	603	1613	5018	1635	2309	5876	40359	72650
2045	24216	254	633	1693	5269	1717	2425	6170	42377	76283
2046	25427	267	665	1778	5533	1803	2546	6478	44496	80097
2047	26698	280	698	1867	5809	1893	2673	6802	46720	84102
2048	28033	294	733	1960	6100	1988	2807	7142	49056	88307
2049	29434	309	770	2058	6405	2087	2947	7500	51509	92722
2050	30906	324	808	2161	6725	2191	3095	7875	54085	97358
2051	32452	340	849	2269	7061	2301	3249	8268	56789	102226
2052	34074	357	891	2382	7414	2416	3412	8682	59628	107337
2053	35778	375	936	2502	7785	2537	3582	9116	62610	112704

Based on the annual growth rate, the up-graduation requirement was assessed. Hence, it is decided to develop the access control highway with 6 lane configurations as per IRC: SP:87-2019.

2.9 Traffic Management Plan

The overall traffic management plan is designed and intended to specify adequate safety measures in advance against identified hazards and stipulated implementation of the said safety measures to ensure safe movement of traffic during the construction and operations of 6 lanes highway from Gogwan Jalalpur (Ch: 0+000) village in Shamli district to Sadopur village (Ch:120+970) in Ambala district in the State of Uttar Pradesh, Haryana and Punjab.

The objective of safety standards is to provide safe travel to the drivers of vehicles plying on the Project Highway at all times of the day, throughout the year and provide protection to the Project workers when they are on the work. This overall traffic management plan delineates the safety standards in terms of Construction zones, Signs and Safety measures in work zones and during normal operations. Road safety features, including Traffic Signs, Road Markings, Road lighting & Crash Barriers are proposed and designed as per relevant IRC codes and standards. During construction it is usual that the operating traffic will be affected to some extent and nearby public and commuting transportation will suffer the inconvenience, additional time, cost and distance. Contractor shall at all-time carry out construction work on the road in manner creating least interference to the free flow of traffic as per the approved Traffic Management Plan.

2.9.1 Traffic Management Practices

The traffic management strategies include the following fundamental principles:

i. Making the traffic safety an integral and high priority element of the project.
ii. Avoid inhibiting traffic as much as possible.
iii. Guide Drivers in a clear and positive way.
iv. Routine inspection of traffic control element and traffic operations
v. Protection to Project workers on work site.

IRC SP55 is the guideline to be followed for circulating traffic during construction. Following picture gives the work zone safety criteria during construction.

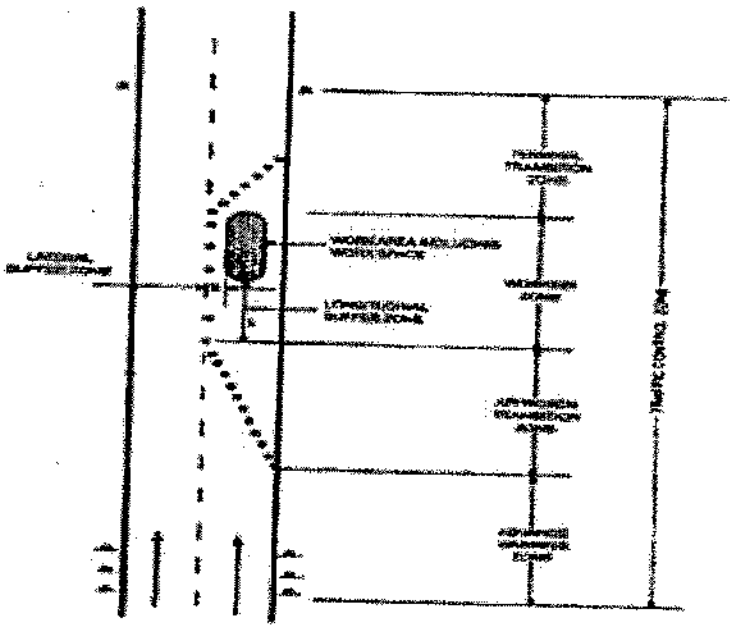


Figure 2-3: Work Zone safety during Construction

2.10 Cost Estimate

The estimted cost of the project is about 2847.24 Crore.

3 ANALYSIS OF ALTERNATIVES

This chapter presents a comparative analysis of various alternatives considered to avoid, prevent or minimize impacts that would be inevitable if technically (based on design speed and geometrics) best-fit alignment is followed. The consideration of alternatives to a proposal is a requirement of the EIA report.

During the scoping process, alternatives to a proposal can be generated or refined, either directly or by reference to the key issues identified. A comparative analysis of alternatives will help to determine the best method of achieving project objectives while minimizing environmental impacts. Various alternatives selected for analysis usually includes the "no project" or "no action" alternative. The relative impact of each alternative is compared against the baseline environment to select a preferred alternative.

The proposed alignment starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli district of Uttar Pradesh and ends at Sadopur village (Ch:120+970) in Ambala district of Haryana state. The main objective of the proposed project is to reduce the distance and travel time between the state of Uttar Pradesh, Punjab and Haryana and to give connectivity to major cities.

The study was undertaken to studying the project scenario and without project scenario. Environmental Considerations such as Flora and fauna likely to be impacted; Land availability; and engineering alternatives have been undertaken in terms of alternative cross-sections of road, highway-design principles (such as embankments for soil erosion, minimum width of road ride drainage, adequacy of roadway width at cross drainage structures, minimum gradient, etc.), comparison between flexible and rigid pavements (cement-concrete built rigid pavement as being environmentally superior then traditional flexible pavement), and selection of environmental friendly road construction methods.

Therefore, discussion in this chapter includes the project with alternatives related to the design. Besides this an evaluation has been carried out for the 'with' and 'without' project situation-in terms of the potential environmental impacts for the justification of the project. This chapter discusses how environmental parameters were assigned due importance and were carefully considered in the analysis of alternatives. The objective of this chapter is to highlight some of the salient issues considered for exercising options.

3.1 'With Project' And 'Without Project' Scenario

3.1.1 With Project' Scenario

The 'with Project' scenario includes construction of new six lane greenfield access control highway from Shamli to Ambala. The 'with project' scenario has been assessed to be economically viable and will alleviate the existing conditions. It would thereby, contribute to the development goals envisaged by the Government of Uttar Pradesh, Haryana& Punjab as well as Government of India, and enhance the growth potential of the state.

3.1.2 'Without Project' Scenario

In the case of 'without project' scenario the existing highways will be considered for travelling. Considering the present traffic volume and potential for growth in near future, the capacity of the present road is insufficient for handling expected traffic volume and calls in for immediate improvements.

The population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will put pressure on the existing road condition. The existing unsafe conditions and the adverse environmental consequences, in terms of the environmental quality along the roads, would continue to worsen in the absence of the proposed improvements.

Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to failure to initiate any further improvements and impede economic development. Keeping in view the site conditions and the scope of development of the area, the 'With' and 'Without' project scenarios have been compared as shown in Table 3.1. By looking at the table it can be concluded that "With" project scenario with positive/beneficial impacts will vastly improve the environment and enhance social and economic development of the region compared to the "Without" project scenario, which will further deteriorate the present environmental setup and quality of life. Hence the "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be definitely advantageous to achieve all – round development of the economy and progress of the State.

Table 3-1: Comparison of Positive and Negative Impacts of 'With' and 'Without' Project Scenario

With Project		Without Project	
Positive Impacts	**Negative Impacts**	**Positive Impacts**	**Negative Impacts**
• The construction of new highway will reduce the traffic congestion and wastage of fuel. • Flourish in trade and Commerce. • Providing better level of service in terms of improved riding quality and smooth traffic flow. • Reduction in accident rate. • Access to new employment opportunities.	• About 822.72 ha of land shall be acquired. • Trees will be cut down due to development of green field alignment. • Increase of traffic will lead to air and noise pollution. • Removal of trees and vegetation due to construction of proposed project. • Changes in land use pattern along the new green field	• No acquisition of land or properties and hence no displacement of families. • No felling of existing trees and vegetation.	• Travel time and fuel consumption level will be more due to bottlenecks. • Increased air pollution in the close proximity of the existing roads due to slow moving traffic and congestion. • Rise in noise levels due to more traffic congestion on the existing roads. • Chances of accidents on existing transport infrastructure will be more in absence

With Project		Without Project	
Positive Impacts	**Negative Impacts**	**Positive Impacts**	**Negative Impacts**
• Employment of local workers for the execution of project • Better access to health care and other social services. • Improved quality of life of the local people. • Better way side amenities with facilities. • Adequate underpasses flyovers for cross over.	alignment. • Increase in dust and noise pollution during construction period. However, this will be for short term.		of the planned highway. • Further deterioration of project road. • Slowdown in overall economic development of region • Reduce employment opportunity

3.2 Location and Alignment Alternatives

3.2.1 Alignment Modifications due to Environmental Considerations

The selection of the alignment options along various sections has been worked out based on continuous interaction between the engineering design team and environmental study teams. Various alignment improvement alternatives (left/right) for the project road have been analyzed along entire project road considering rural sections, urban sections, alignment in forest areas and junction improvements. The factors considered for evaluation of alternatives are:

- Flora and fauna likely to be impacted
- Productive agricultural land likely to be impacted
- Impact on water resources and surface water bodies
- Environmental quality
- Land availability
- Land uses along the alignment
- Residential / Commercial structures Impacted
- Religious structures affected

3.2.2 Engineering / Technological Alternatives

The formulation and analysis of engineering alternatives have been undertaken in terms of alternative cross-sections of road, highway-design principles (such as embankments for soil erosion and slope protections, minimum width of road ride drainage, adequacy of roadway width at cross drainage structures, minimum gradient, etc.), comparison between flexible and rigid pavements, and selection of environmentally friendly road construction methods.

3.2.3 Criteria for Fixing Alignment for Greenfield Highway

1. The Greenfield alignment between two terminal stations should be short and straight as far as possible, but due to engineering, social and environmental considerations some deviations may be required.
2. The project should be constructible and easy to maintain; the Greenfield project should reduce the vehicle operation cost with respect to the existing option already available i.e. using the NH/SHs in combination to reach from point A to point B.
3. It should be safe at all stages i.e. during design, construction and operation stages. Safety audits at each stage should confirm the same.
4. The project initial cost, maintenance cost, and operating cost should be optimum so as to be considered economical with respect to its options.
5. The Greenfield alignment should be finalized giving due consideration to siting/location of major structures including Major/Minor Bridges, Interchanges and ROBs. The space requirement of interchanges to be kept into consideration to avoid major resettlement.
6. The alignment should follow the unused / barren land to the extent possible to reduce the cost of land acquisition.
7. The highway shall be as far as possible fully access controlled to enhance safety of traffic
8. The geometric design should be for higher possible speed to save time & VOC

3.2.4 Obligatory points through which Greenfield alignment options should not pass are detailed below:

Habitations: Proposed alignment is fixed in such a way that it traverses away from built up areas avoiding community buildings & structures. However, few isolated buildings falling along the alignment cannot be avoided due to geometric requirements.

Wildlife Sanctuaries, National Parks, Reserve Forest and other Eco Sensitive Zones: Utmost care is taken while fixing the alignment near wildlife sanctuaries and National Parks (NP). The MoEF&CC guidelines have been adhered to and the alignment has been fixed keeping it away from NP, Sanctuaries and Tiger Reserves. No Wildlife Sanctuary or National Park is located within 10 Km radius from the project alignment. About 7.5 Ha of Protected Forest (road-side and canal side plantation declared as forest) shall be affected by the crossing of the proposed highway.

Water Bodies: The Greenfield alignment has been fixed taking due consideration & importance of retaining the existing water bodies as far as feasible.

Railway Crossings and Important Structures: The components which increases the project cost are the presence of the Major bridges, ROBs and other structures. In order to reduce the project cost number of structures and its length were given due consideration while finalizing the Greenfield Option.

3.2.5 Option analysis

Three alignment options were studied and compared in order to finalize the proposed alignment. The detailed analysis of alternative options is provided in Table 3-2. Alignment options were compared considering following parameters:

- Least impact on forest area
- Minimum impact on habitations
- Less number of structures affected
- Better connectivity to major towns
- Least distance so that lesser carbon footprint is generated

Table 3-2: Alternative Options Analysis

S. No.	Description	Option - 1	Option - 2	Option - 3
1.	Length (km)	120.970	121.300	121.600
2.	Connectivity	Ambala, Kurukshetra, Karnal, Shamli, Saharanpur and its nearby districts	Ambala, Kurukshetra, Karnal, Shamli, Saharanpur and its nearby districts	Ambala, Kurukshetra, Karnal, Shamli, Saharanpur and its nearby districts
3.	Proposed Right of Way	60 m	60 m	60 m
4.	Design Speed	100 km/h	100km/h	100km/h
5.	Terrain	Plain	Plain	Plain
6.	Total land to be acquired (ha)	750	758	762
7.	Govt. land (ha)	65	70	75
8.	Pvt. Land (ha)	677.5	680	678.8
9.	Forest land-PF (ha)	7.5	8.0	8.2
10.	Eco-Sensitive/ Protected Area	No within 10 km radius	No Within 10 km radius	No Within 10 km radius
11.	No. of approx. trees within ROW	7966	8224	8758
12.	Area under water bodies (ha)	3 Rivers, 29 Canals/Streams/ Nalahs	3 Rivers, 8 Canals, 6 Nalahs and 15 ponds	3 Rivers, 8 Canals, 6 Nalahs and 17 ponds
13.	Approx. No. of structure to be impacted due to proposed alignment	284	160	185
14.	Approx No. of families affected	3517	800	925
15.	No. of structure to be constructed (the structure list may vary to an extent for underpasses and culverts)	ROBs (02) Major Bridges (07) Minor Bridges (10) VUP (19) LVUP (33) Interchanges (08) Culverts-110	ROBs (02) Major Bridges (05) Minor Bridges (14) VUP (26) LVUP (27) Interchanges (08) Culverts-223	ROBs (02) Major Bridges (05) Minor Bridges (13) VUP (28) LVUP (29) Interchanges (08) Culverts-225
16.	Project Cost (Cr.)	Rs. 2847.24	Rs. 4050	Rs. 4100
17.	Recommendation	Recommended	Not Recommended	Not Recommended

Option -1 is recommended and best suitable due to following reasons:

- No settlements affected
- Less forest area diversion required
- No stagnant of water bodies affected
- Minimum number of trees affected
- Access controlled highway
- Greenfield so acquisition cost is less
- Least project cost

4 DESCRIPTION OF THE ENVIRONMENT

4.1 General

This chapter presents a brief description of the existing environment, including its physical resources, ecological resources, socio-economic development and social and cultural resources. Broad aspects on various environmental parameters such as geography, climate and meteorology, geology, physiography, seismology, ecology, socio-cultural and economic development parameters which are likely to be affected by the proposed road are presented. Secondary information was compiled from relevant government agencies like the Forest Department, State Environment Protection and Pollution Control Boards, and Meteorological Department.

Baseline conditions define the characteristics of the existing environment. They provide the basis from which project impact comparisons are made. Baseline analysis has taken into account:

- Past trends in environmental quality.
- Other current or proposed development programs in the project area.

Environmental components to be considered in relation to highway projects are: (a) land, (b) water, (c) air and meteorological (d) biological (e) noise (f) solid waste management (g) socio economic and health environment.

Hence, baseline data has been collected through actual physical surveys and observations, literature surveys, interaction with locals, government agencies and departments. This chapter describes the baseline environment settings in the area and will throw light, its effect on day-to-day environment.

4.2 Study Area

The proposed alignment is passing through the Shamli & Saharanpur districts in the State of Uttar Pradesh, Karnal, Yamunanagar, Karnal, Kurukshetra and Ambala districts in the State of Haryana and SAS Nagar district of Punjab State.

As per the EIA Guidance Manual for Highways (MoEF&CC, 2010); a study area of 15 km radius from the project road was considered for secondary data collection. Primary data has been collected within 500 meters on either side of the proposed alignment. Secondary data were collected from published reports, research papers, working plans, consultations and discussions with govt. officials. Primary baseline environment monitoring was carried out for the period of January 2021 to March 2021.

4.3 Physical Environment

4.3.1 Physiography and Landforms

Shamli district was carved out from Muzaffarnagar District. The entire Shamli district is a flat terrain falling in middle Yamuna plain. The district can be sub divided into five geographic units i.e., sand bars, flood plain, ravines, younger alluvial plains, older alluvial plains.

Saharanpur district is characterized with the Shiwalik, Bhabar, Tarai, Khadar and the plain. Hilly tract of the Shiwalik, range along the northern border is stretching from west to east directions, which have a breadth of 10-16 kilometers. The whole range is forested. Lying immediately below the Siwaliks is the Bhabar tract intersected by numerous torrents that drain rainy water into the Yamuna River and its numerous tributaries. This once forested, sub-mountainous belt stands, almost denuded with the great extension of village. The maximum area of the district consists of plain.

Karnal district is a plain area, which slopes from northeast to southwest. The Plain is a flat and within it, there is a narrow low lying flood plain area known as khadar of the Yamuna River. Topographically, the district can be sub-divided into three parts viz. Karnal Plain; Karnal Bhangar and Yamuna Khadar. Karnal Plain extends over western part of the district. The area is a level land having a gentle slope towards southwest. Karnal Bhangar covers the major portion of the district lying between Karnal Plain and Yamuna Khadar covering the district in north-south direction. Yamuna Khadar extends over eastern parts of the district along the Yamuna River. Its slope is towards south in which direction the Yamuna River flows. The region is built and drained by Yamuna River, so it contains various interlocking channels of streams, ponds and swamps as its characteristic features. The flood plain is low-lying and slightly undulating in topography.

Yamunanagar district has Siwalik Hills and Foothill Rolling Plain in the north and north-east; and Flood Plain along the Yamuna River in the east and south-east. Physiographically, we can sub-divide the district as Yamunanagar Siwalik; Sadaura Plain, Yamunanagar Plain, Yamunanagar Khadar and Bet Yamunanagar. Yamunanagar Siwalik lies in parts along the northern border of the district with Himachal Pradesh. It has hilly topography and highest concentration of rainfall. Mostly it is covered with reserved forests. Only foot paths and minor tracks lead towards plain along the river beds and boundary of reserved forests. Sadaura Plain is a piedmont plain (alluvial fan) and is traversed by a large number of rainfed streams. Yamunanagar Plain extends over Jagadhri and Chhachhrauli tahsils, lying to the south-west of Sadaura Plain. The region slopes towards south-west. Yamunanagar Khadar lies along Yamuna River in the eastern part of the district. But Yamunanagar lies in the south-western corner of the district. It is a low-lying plain area.

Kurukshetra district is part of Eastern Haryana Plain, remarkably flat, sloping gently from Northeast to South and Southwest, having low lying flood-plains formed by seasonal rivers flowing through it. Average elevation of the plain is about 245 metres above mean sea level. There are many shallow topographical depressions in the area. The Bet along the Markanda river is a low-lying flood plain. Naill circle is a low-lying area along the Saraswati stream. The Dangri and the Chautang seasonal rivers also show their presence in the district. On the basis of Physiography, the district is divided into two regions Bet Kurukshetra and Kurukshetra Bhangar. Bet Kurukshetra is a low-lying plain area extending over Pehowa, Shahbad and large parts of Thanesar tahsils. Kurukshetra Bhangar area is somewhat undulating which lies in the southern part of the district. The region extends over southern part of Thanesar tahsil.

Ambala district is bounded by Panchkula district and Himachal Pradesh in the North, Yamunanagar district in the East, Patiala district (Punjab) in the West and Kurukshetra district in

the South. The district has foot-hill rolling plain in the north- east and flood plain of Markanda, Dangri and BegnaNadis in the South and South-West part of the district in which direction most of the nadis/rainfed torrents flow down and spread much gravels and pebbles in their beds. Physiographically, the district can be divided into Naraingarh Plain, Ambala Plain and the Ghaggar Flood plain. Naraingarh Plain, which lies in the northern part of the district, is a piedmont plain (alluvial fan). It is traversed by a large number of rainfed streams. It is an undulating sand plain with a perceptible slope near the hills. The Ambala Plain lying south of Naraingarh Plain slopes towards south-west in which direction rainfed rivers/streams flow. Soils are coarse loam. The Ghaggar Flood Plain lies in patches at three places in the district, first a small area in the western part of the district near Ambala City and making boundary with Punjab State, second part is the westernmost fringe of the district and third part is village Bhuni surrounded by Punjab State in the south-west corner of the district.

SAS Nagar district is sub-divided into following two sub-micro regions on the basis of soils, topography, climate and natural vegetation. SAS plain region spreads over the northern and north western parts of SAS district, occupying the whole tahsils of Kharar, Dera Bassi and Mohali. The region is a flat featureless plain having alluvial and most fertile soils.

Ghaggar flood plain, the chief stream which traverses this district is the Ghaggar. It rises in Sirmaur district of Himachal Pradesh and is known by the name of Kaushalaya in the upper reaches. After flowing through Himachal territory and Ambala district of Haryana it enters plains near Dera Bassi (Mubarikpur).

The proposed alignment follows the plain terrain. The elevation varies from ~240 m to ~288 m above msl at different locations. Average elevation of the project stretch is ~250 m above msl.

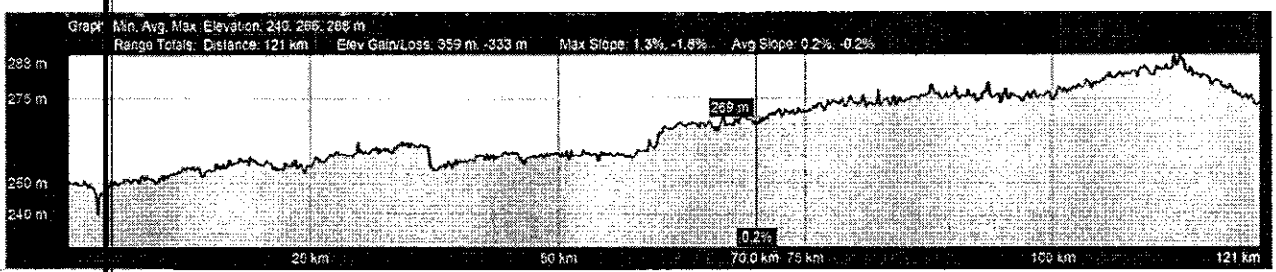


Figure 4-1: Elevation Profile of the Proposed Alignment

4.3.2 Geology

Shamli block virtually forms a flat terrain forming a part of Yamuna Plains. Geologically the area is underlain by thick fluvial Quaternary sediments, deposited by Yamuna River and its tributaries. Sediments comprise sand, silt, clay and kankars (calcareous concretions) in varying proportions and show quick alteration from finer to coarser at places. The alluvium is subdivided into Older Alluvial and Younger Alluvial Plain. Older alluvium occupies higher elevation whereas newer alluvium is of recent origin and is restricted to river courses

Saharanpur; Nakur block in Saharanpur district occupies Gangetic Alluvium, comprising of a thick pile of Quaternary sediments. The Siwalik group of sediments is well known sequence of

Cenozoic fresh water sediments deposited under four environments- piedmont, outwash Plains, flood plains and lacustrine

Karnal district is formed of alluvium rocks of Recent period. Minor occurrences of saltpetre are reported from villages of Assandh tehsil and western parts of the district which occurs as thin white encrustation on the surface of the earth.

Kurukshetra district falls in the Upper Yamuna and Ghaggar Basins. The district is occupied by geological formations of Quaternary age comprising of Recent alluvial deposits belong to the vast Indus alluvial plains. Ground water at shallow depth occurs under unconfined and semi-confined condition and under confined conditions in deeper aquifers.

Yamunanagar district shows clay group of formations dominates over the sand group. Sand, silt, gravels and kankar associated with clay and form highly potential aquifers. In alluvium, the permeable granular zones comprise fine to medium grained sand and occasionally coarse sand and gravel. In Kandi belt, which has not been explored fully boulders cobbles and pebbles, constitutes the major aquifer horizon. Siwalik Hills occupy marginal areas in the northeastern parts of the district constitute a low potential zone.

Ambala district is occupied by Indo-Gangetic alluvial plain of Quaternary age. Seismic surveys conducted in the area reveal that alluvial thickness in the district is large and the basement rock is estimated to be encountered at 3000 m depth below MSL and thickness of alluvium thins down towards southwest. In south west and western parts of the district the sediments are more fine grained in nature, and constituted of fine to medium grained sands, clays, silts and kankars with occasional gravel. The clays are usually brown to yellowish in colour and sticky to silty in nature. The sands are usually fine grained, hence it becomes difficult to develop wells so as to give sand free water with conventional well designs.

4.3.3 Climatology

The study of micro meteorological conditions of a particular region is of utmost importance to understand the variations in ambient air quality status in that region. The prevailing micrometeorology at project site plays a crucial role in transport and dispersion of air pollutants released from the project site. The persistence of predominant wind direction and wind speed will decide the direction and extent of air pollution impact zone. The principal variables which affect the micrometeorology are horizontal transport and dispersion (average wind speed and directions), connective transport and vertical mixing (atmospheric stability) and topography of the area towards local influences.

The climate of the project area is quite hot in summer and sufficiently cold in winter. The temperature starts rising in March and continues rising till end of June. Hot winds blow during summer, occasionally accompanied by dust storms. The temperature may touch 45°C or more on some days. Generally, pre-monsoon showers are experienced in the middle or end of June which may bring down temperature considerably. Rains set in by the first week of July which may continue up to the middle of September. During the rainy season temperatures are considerably lower during the rainy days but it becomes very hot and sultry when it is not raining. From early October, the weather becomes very pleasant as the winter season sets in.

November and December are pleasant but nights are cold. There is considerable difference between day and night temperatures during this period. The winter rains are also experienced during these months but these are only shade of rains experienced during July to September. Sometimes hail storms are experienced in winter months which may cause extensive damage to the standing crops.

The micrometeorological data recorded by IMD corresponding to nearest available observatories are procured and appropriately used in this study. The IMD observatories are identified within the project's districts. The average climatological data recoded at Karnal & Ambala observatories are presented below Table 4-1.

Table 4-1: Long-Term Climatological Data Recoded by Nearest IMD Observatories (1981-2010)

Month	Temp (°C)		Humidity (%)		Average Wind Speed (kmph)	Dominant Direction	Avg. Rainfall (mm)
	Max	Min	Morg.	Eveg.			
Karnal, Haryana							
January	24.2	3	83	64	3.3	NW	26.7
February	27.3	5.6	79	58	3.5	NW	24.8
March	33	9.2	73	51	3.7	NW	17.8
April	40.3	13.2	51	31	4.4	NW	8.4
May	42.9	18.4	52	33	6	NW, SE	24.2
June	43.1	20.9	62	44	5.8	SE, NW	65.7
July	38	22.4	80	67	5.3	SE, NW	171.8
August	35.8	22.6	83	73	3.7	SE, NW	157.5
September	35.4	19.6	81	68	3.5	W, NW	115.9
October	34.6	13.2	75	54	2.3	NW	3.5
November	30.5	7.9	77	53	2.1	NW	1.9
December	25.4	4.4	81	60	2.5	NW	9
Total / Avg.	**43.4**	**3**	**73**	**55**	**3.8**	**NW, SE**	**627.1**
Ambala, Haryana Observatory							
January	24.1	2.7	87	63	3.4	**NW**	27.3
February	27.3	5	81	54	4.7	NW	35.1
March	33	8.9	70	45	5.1	NW	27.2
April	40.1	13.7	51	28	4.9	NW	12.3
May	42.6	18	50	31	5	NW	31.5
June	42.8	20.3	62	42	5	E, NW	86.6
July	38.9	21.8	81	67	4.2	E, SE	264.7
August	36.3	22.2	84	72	3.4	E, SE	239.2
September	35.7	19.3	82	64	3.5	E, W, NW	134.8
October	34.6	12.4	76	51	2.6	W, NW	15.1
November	30.5	6.6	81	53	2.3	W	4.5
December	25.5	3.3	86	60	2.5	W, NW	19.7
Total / Avg.	**43.5**	**2.1**	**74**	**52**	**3.9**	**E, NW**	**898.2**

Source: Climatological Normal (1981-2010), India Meteorological Dept., Govt. of India

4.3.4 Soil

The region slopes towards south-west. It is a plain area with relatively richer loamy soils. Khadar lies along Yamuna river, it is formed by deposition of alluvium sediments, clay and sand. Silty loam is easily workable and productive. The soil along the bank of river beds is usually light and sandy, while elsewhere it is mainly a productive loam stiffened by the action of water into clay in the lower levels. All along the old high bank of the Yamuna lies a belt of stiff-swampy clay of varying width producing excellent vice but elsewhere the Yamuna Khadar consists of light loam and in places includes patches of sand and reh. The light rich loam or sandy loam soil covers nearly three fourth of the area of the district. It is called by the local name of rausli and ranges from a light friable soil with a considerable admixture of sand to the softer kinds of clay in which all crops can be grown with equal facility.

The study on soil quality establishes the baseline characteristics in the study area surrounding the project site. The study has been addressed with the following objectives to determine:

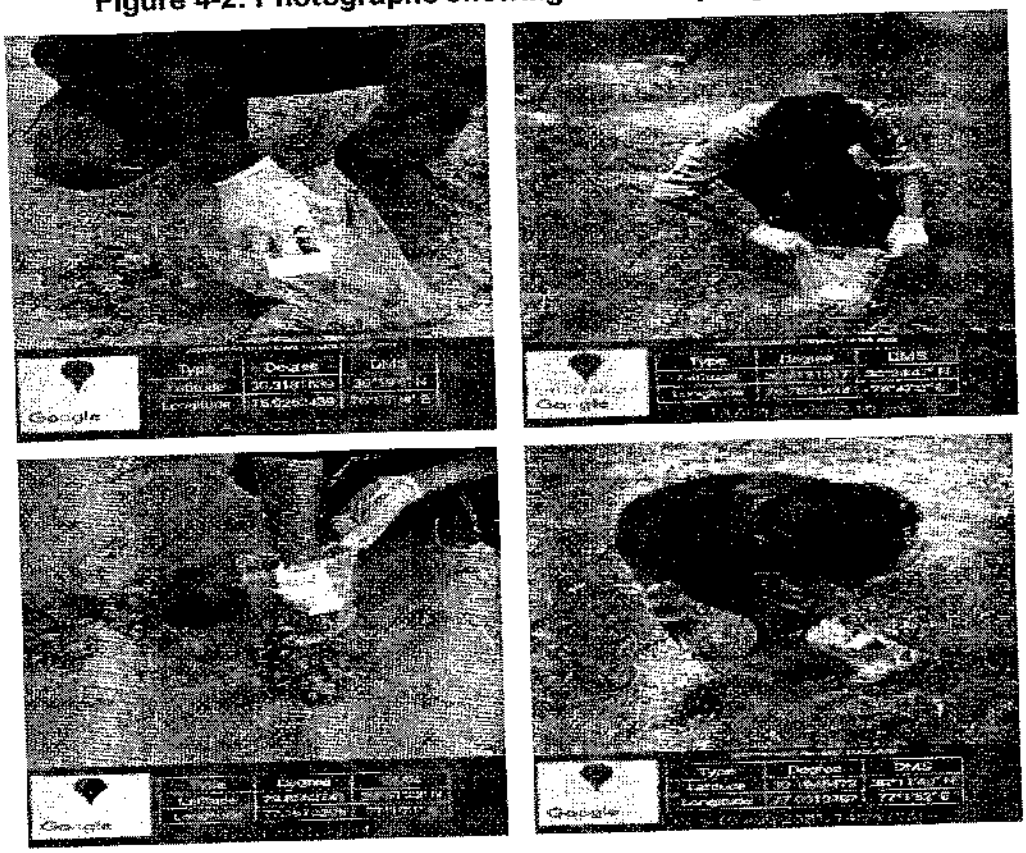
- The baseline characteristics of the soil.
- The soil characteristics of proposed project site.
- The impact of Industrialization/ urbanization on soil characteristics.
- The impacts on soils from agricultural productivity point of view.

Soil samples were taken from nine (9) locations to assess the existing soil conditions. The sample was collected by ramming a core-cutter into the soil up to 90 cm depth. The sample collection, preservation, storage, transportation and analysis were carried out as per the standard methods. Soil sample was packed in a separate labeled plastic zipper bags and transported to the laboratory for further analysis. The details of the sampling locations are given in **Table 4-2** and location map is presented in Figure 4.2.

Table 4-2: Soil Sampling Locations along the Proposed Project

Sl. No.	Monitoring Station Code	Location Sampling	Date of Sampling
1	SQ-01	Gogwan, Jalalpur	25.03.2021
2	SQ-02	Manakpur	25.03.2021
3	SQ-03	Kalsi	25.03.2021
4	SQ-04	BhogiMazra	25.03.2021
5	SQ-05	Khokhani	25.03.2021
6	SQ-06	Bapa	25.03.2021
7	SQ-07	Gajlana	26.03.2021
8	SQ-08	Tandwal	26.03.2021
9	SQ-09	Razapur	26.03.2021

Figure 4-2: Photographs showing Soil Sampling Locations



Soil is an essential component of our ecosystem, as it serves as an anchorage and source of nutrients for plants. Thus, it is the fundamental raw material for plant growth and maintenance of forest ecosystem by different ecological processes. The physio-chemical characteristics of the soil samples collected along the proposed alignment are given in Table 4-3.

Table 4-3: Soil Quality Monitoring Report

S. No.	Parameter	Unit	SQ-01	SQ-02	SQ-03	SQ-04	SQ-05	SQ-06	SQ-07	SQ-08	SQ-09
1	pH*	---	7.21	7.35	7.35	7.50	7.65	7.65	7.65	7.80	7.95
2	Bulk Density*	g/cm3	1.89	2.04	1.98	1.97	2.12	2.06	2.42	2.04	2.21
3	Water Holding Capacity (WHC)*	%	12.1	13.19	12.83	12.58	13.72	13.34	15.73	13.09	14.27
4	Sodium, (Na)	mg/kg	85.8	95.24	92.66	89.23	99.05	96.37	91.02	92.80	103.01
5	Potassium, (k)*	mg/kg	69.9	75.49	76.19	72.70	78.51	79.24	74.15	75.60	81.65
6	Total Nitrogen, (N)*	mg/kg	6.45	6.97	6.84	6.71	7.24	7.11	8.39	6.98	7.53
7	Chloride, (Cl)*	ml/kg	458.5	499.77	486.01	476.84	519.76	505.45	486.38	495.91	540.55
8	Magnesium, (Mg)*	ml/kg	54.1	58.43	57.35	56.26	60.77	59.64	57.39	58.51	63.20
9	Organic Matter, (OM)*	%	0.62	0.69	0.66	0.64	0.72	0.68	0.73	0.67	0.75
10	Aluminium, (Al)	mg/kg	0.23	0.25	0.28	0.26	0.29	0.32	0.27	0.30	0.33
11	Cadmium, (Cd)	mg/kg	0.4	0.47	0.42	0.42	0.49	0.44	0.45	0.43	0.51
12	Chromium, (Cr)	mg/kg	0.27	0.31	0.29	0.28	0.32	0.30	0.49	0.29	0.33
13	Copper, (Cu)	mg/kg	0.72	0.78	0.82	0.75	0.81	0.85	0.76	0.78	0.84
14	Iron, (Fe)	mg/kg	178	202.92	192.24	185.12	211.04	199.93	188.82	192.52	219.48
15	Lead, (Pb)	mg/kg	0.22	0.24	0.24	0.23	0.25	0.25	0.42	0.24	0.26
16	Manganese, (Mn)	mg/kg	1.8	2.12	1.91	1.87	2.21	1.98	1.91	1.95	2.30
17	Zinc, (Zn)	mg/kg	1.65	1.78	1.78	1.72	1.85	1.85	1.75	1.78	1.93
18	Nickel, (Ni)	mg/kg	1.81	3.22	1.92	1.88	3.35	2.00	2.35	1.96	3.48
19	Calcium, (Ca)	mg/kg	395.2	545.38	446.58	411.01	567.19	464.44	419.23	427.45	589.88
20	Phosphorus (PO4)	mg/kg	32.0	44.16	33.92	40.00	55.20	42.40	49.60	50.00	69.00

Source: Primary Survey

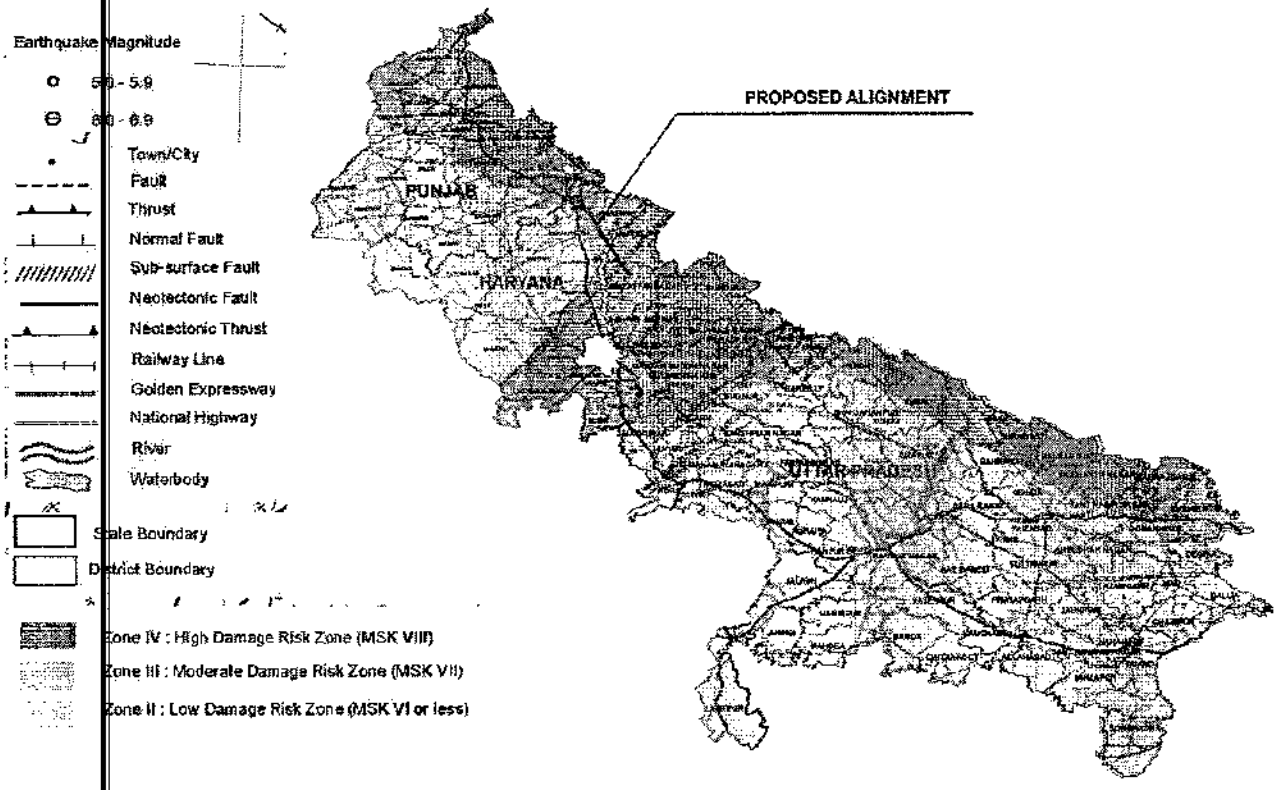
The pH of soil is an important property as plants cannot grow in low and high pH soils. On the basis of pH measurements, the degree of soil acidity may be indicated. The pH of soils in the range 7.21 to 7.95 is called normal to saline soils. Most of the essential nutrients like N, P, K, are available for plants. Soils having pH below 7 are considered to be acidic from the practical standpoint, those with pH less than 5.5 and which respond to liming may be considered as acid soils.

The total organic carbon in the study area varied from 0.62 to 0.75 % indicating that sample falling in low level. Other important parameters for characterization of soil for irrigation are Nitrogen, Phosphorus and Potassium which are known as primary nutrients whereas Calcium, Magnesium and Sulphur are known as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance and not on their relative importance.

4.3.5 Seismic Profile of the area

Bureau of Indian Standards [IS-1893 Part 1:2002] categorizes the country into four seismic zones viz. Zone-II, Zone-III, Zone-IV and Zone-V. Seismicity increases from Zone-II (Least active) to Zone-V (Highest Active). Alignment of proposed highway is found in Seismic Zone III (Moderate Damage Risk Zone) and Zone IV (High Damage Risk Zone). The project road falls in Seismic zone IV & III as per the Seismic Zoning Map of India and this is classified as high damage risk zone.

Figure 4-3: Seismic Zone Map of Uttar Pradesh, Haryana & Punjab



Source: Building Materials and Technology Promotion Council MoH&UA, GoI

Earthquakes in the recent past have occurred in the project region.

1. M: 3.1 - Sonipat, Haryana on dated 2021-11-20 13:09:31 (IST)
2. M: 2.8 - Baghpat, Uttar Pradesh on dated 2021-11-16 22:06:07 (IST)
3. M: 2.4 - Baghpat, Uttar Pradesh on dated 2021-11-14 17:31:46 (IST)
4. M: 3.9 - Mandi, Himachal Pradesh on dated 2021-11-23 22:02:00 (IST)

4.3.6 Land use/ Land cover

The land use along the project highway and in study area were found to be agricultural land, waste land, Built-up area, plantation / protected forests, etc. The Land Use & Land Cover along the project alignment are presented from Table 4-4 and Table 4-5. The LULC maps is given in Annexure 4.1.

Table 4-4: Land Use and Land Cover of 500m buffer

Sl. No.	Category	Area (ha.)	Percentage (%)
1.	Built-up Area	936.55	7.25
2.	Road/Rail	69.81	0.54
3.	Dense Vegetation	225.05	1.74
4.	Agricultural Land	11612.36	89.95
5.	Scrub Land	2.07	0.02
6.	Fellow Land	19.27	0.15
7.	Water Bodies	44.14	0.34
	Total Area (ha.)	**12909.25**	**100.00**

Table 4-5: Land Use and Land Cover of 10.0 km buffer

Sl. No.	Category	Area (ha.)	Percentage (%)
1.	Built-up Area	32187.72	11.78
2.	Agricultural Land	218612.42	79.98
3.	Dense Vegetation	20150.64	7.37
4.	Natural Vegetation	205.39	0.08
5.	Scrub Land	331.55	0.12
6.	Fellow Land	382.90	0.14
7.	Water Bodies	1468.14	0.54
	Total Area (ha.)	**273338.75**	**100.00**

4.4 Air Environment

All air pollutants emitted by point and non-point sources are transported, dispersed or concentrated by meteorological and topographical conditions. In order to assess the impact on existing air environment due to the proposed projects, it is necessary to have baseline air status of various pollutants. The prime objective of baseline air quality survey was to assess the existing air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality.

Evaluation of the resultant air quality due to the proposed project requires the determination of the existing air quality in terms of PM_{10}, $PM_{2.5}$, Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_2), and Carbon Monoxide (CO). The methodology for the monitoring instruments and techniques has been in accordance to the guidelines laid by the Central Pollution Control Board (CPCB). The equipment was placed at a height of 4-5m above ground level at each monitoring station, for negating the effects of windblown ground dust.

A network of ten (10) AAQ monitoring stations were selected for assessment of the existing status of air environment within the study zone. The selections are based on consideration of meteorological data and present human activity and settlement along the proposed project area.

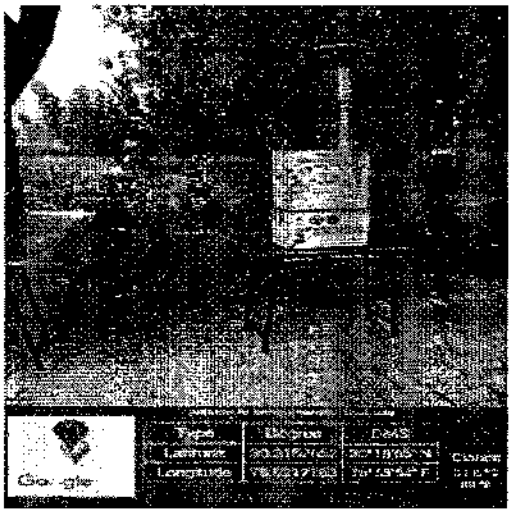
At such locations and each sampling day, continuous 24 hours sampling was conducted for PM10, PM2.5, Sulphur Dioxide (SO2), Oxides of Nitrogen (NO2), and Carbon Monoxide (CO). Sampling and Analysis of air samples were conducted as per established standard method and procedure. The 24-hourly summarized ambient air quality monitoring results for each station is presented in Table 4-6.

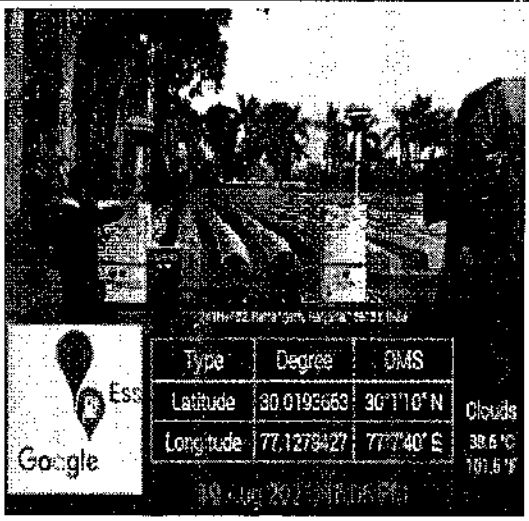
Table 4-6: Ambient Air Quality Monitoring Locations

Sl. No.	Station Code	Location
1.	AAQ1	Gogwan Jalalpur
2.	AAQ2	Manakpur
3.	AAQ3	Kalsi
4.	AAQ4	BhogiMazra
5.	AAQ5	Khokhani
6.	AAQ6	Bapa
7.	AAQ7	Gajlana
8.	AAQ8	Tandwal
9.	AAQ9	SapenraSijra
10.	AAQ10	Razapur

Source: Primary survey

Figure 4-4: Photographs showing AAQ Monitoring Stations




Type
Degree
DMS
Latitude
30.0195663
30°1'10" N
Longitude
77.1278427
77°7'40" E
Clouds
38.6 °C
101.5 °F
Google

The ambient air quality monitoring results shows that PM 2.5 & PM 10 concentrations are found higher at various locations and SO2, NOx & CO concentrations are found well within the limit at all locations as per National Ambient Air Quality Standards (NAAQS), 2009. The results are given in **Table 4-7 & Figure 4-6.**

Table 4-7: Ambient Air Quality along the Project Corridor

Sl. No.	Station Code	Pollutant Concentration														
		PM2.5 (µg/m³)			PM10 (µg/m³)			SO2 (µg/m³)			NOx (µg/m³)			CO (mg/m³)		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
1.	AAQ1	39.3	60.2	60.2	74.6	102.0	100.2	6.29	9.42	9.40	14.5	22.6	21.5	0.31	0.74	0.69
2.	AAQ2	41.4	53.3	53.2	76.7	104.1	102.3	5.50	9.58	9.19	14.9	23.0	22.3	0.32	0.76	0.70
3.	AAQ3	36.4	56.6	56.4	74.3	96.0	94.2	6.51	8.84	8.82	14.7	21.2	20.8	0.31	0.69	0.64
4.	AAQ4	38.6	59.2	59.2	73.0	100.4	98.6	6.71	9.26	9.24	14.2	22.2	21.2	0.31	0.73	0.67
5.	AAQ5	46.9	70.7	70.0	90.0	117.4	115.6	7.52	10.90	10.89	17.4	26.1	25.2	0.38	0.87	0.80
6.	AAQ6	43.1	65.4	65.1	82.3	109.7	107.9	6.90	10.16	10.15	15.9	24.3	23.3	0.35	0.80	0.74
7.	AAQ7	51.3	76.8	75.8	99.0	126.4	124.6	8.2	11.8	11.8	19.1	28.2	27.3	0.41	0.94	0.87
8.	AAQ8	47.9	72.0	71.3	92.0	119.4	117.6	7.7	11.1	11.1	17.8	26.6	25.7	0.38	0.88	0.82
9.	AAQ9	45.9	69.3	68.7	88.0	115.4	113.6	7.4	10.7	10.7	17.0	25.6	24.7	0.37	0.85	0.79
10.	AAQ10	39.8	54.9	54.8	80.0	107.4	105.6	5.3	9.9	9.5	11.5	17.7	17.6	0.34	0.79	0.73
	NAAQS	**60**			**100**			**80**			**80**			**4**		

Source: Primary Survey

Particulate Matter (PM2.5) The minimum and maximum concentrations for PM2.5 were recorded as 36.4µg/m3 and 76.8µg/m3 respectively. The minimum concentration was recorded at Kalsi (AAQ3) and the maximum concentration was recorded at Gajlana (AAQ7). Average concentrations are found slightly higher at Gogwan Jalalpur, Khokhani, Bapa, Gajlana, Tandwal & Sapenra Sijra locations, when compared to the standard limit of 60µg/m3 as per latest NAAQS 2009.

Particulate Matter (PM10) The minimum and maximum concentrations for PM10 were recorded as 73.0 µg/m3 (AAQ-3) and 126.4 µg/m3 (AAQ-7) respectively. Average results at all locations are found higher except two locations at Kalsi & Bhogi Mazra villages, when compared to the standard limit of 100µg/m3 as per latest NAAQS 2009.

Sulphur Dioxide (SO2) The minimum concentration was recorded as 5.3 µg/m3 at Razapur village location and maximum concentration was recorded as 11.8 µg/m3 at Gajlana village location. All results are found to be below the range as compared to standard limit of 80 µg/m3 as per latest NAAQS 2009.

Nitrogen Dioxide (NOx) The Minimum concentration was recorded at 11.5 µg/m3 at Razapur village location and maximum concentration were recorded as 28.2 µg/m3 at Gajlana village location. All stations results are found to be below the range as compared to standard limit of 80 µg/m3 as per latest NAAQS 2009.

Carbon Mono-oxide (CO) The minimum and maximum concentrations for CO were recorded as 0.31 mg/m3 and 0.94mg/m3 respectively. The minimum concentration was recorded at Gogwan Jalalpur, Manakpur & Kalsi village locations and the maximum concentration was recorded at Gajlana village location. All the results are found to be within limit when compared to the standard limit of 4 mg/m3 as per latest NAAQS 2009.

4.5 Noise Environment

Noise can be defined as any sound that is undesirable because it interferes with speech and hearing, and is intense enough to damage hearing or is otherwise annoying. Noise impacts can be of concern during construction and operational phases of the project. Factors those are important in determining noise levels include distance from the noise source, natural or manmade barriers between the source and the receptors, whether conditions, etc.

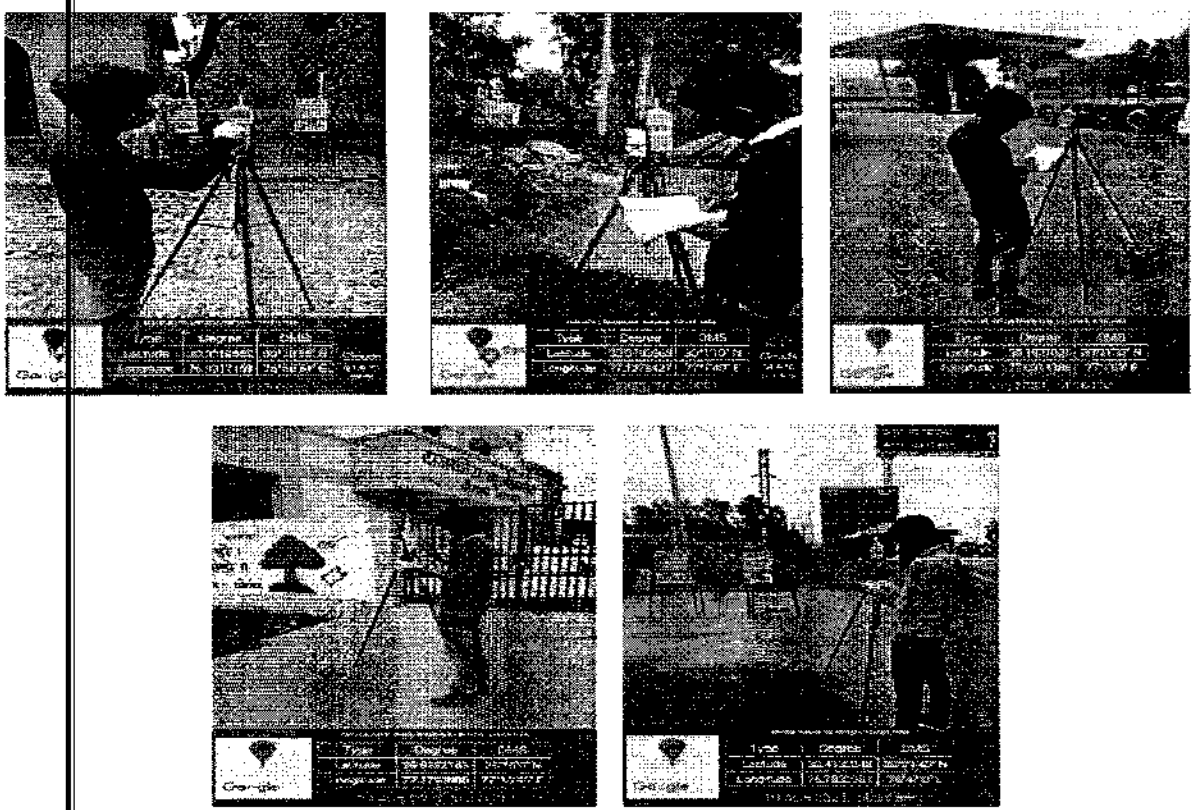
An assessment of baseline noise level was undertaken to (a) establish the status of exposure of the major sensitive receptors, and (b) to identify the noise pollution levels in and around the site. The noise monitoring was conducted at Ten (10) locations as per CPCB guidelines. A sound level meter (SLM 100) was used for monitoring of background noise level. The measurements were carried out for 24 hours. The details of the monitoring locations and results are presented in **Table 4-8**.

Table 4-8: Observed Noise Levels along the Proposed Alignment

Sl. No.	Station Code	Location	Area Category	Observed Noise Levels in dB(A)		Noise Quality Standards in dB(A)	
				Leq Day	Leq Night	Leq Day	Leq Night
1.	NQ-1	Gogwan Jalalpur	Residential	50.8	41.9	55 (Max.)	45 (Max.)
2.	NQ-2	Manakpur	Residential	49.3	38.4		
3.	NQ-3	Kalsi	Residential	51.0	40.4		
4.	NQ-4	BhogiMazra	Residential	49.2	37.9		
5.	NQ-5	Khokhani	Residential	50.1	38.9		
6.	NQ-6	Bapa	Residential	48.4	37.0		
7.	NQ-7	Gajlana	Residential	52.0	41.1		
8.	NQ-8	Tandwal	Residential	49.4	40.4		
9.	NQ-9	SapenraSijra	Residential	48.9	40.1		
10.	NQ-10	Razapur	Residential	50.6	41.8		

The day noise levels were recorded between 6 am to 10 pm and night noise levels were recorded between 10 pm and 6 am at all locations. Leq day and Leq night calculated for various locations in the area are presented below which has been compared with the standards prescribed by CPCB for various zones. There are no industrial enterprises in and around the project area. It was observed that ambient noise levels are well within the prescribed noise standards as per Noise Rules 2000.

Figure 4-5: Photographs Showing Noise Quality Monitoring Stations (ZONE Silence, residential and commercial)



4.6 Water Environment

The proposed alignment is crossing 7 rivers and 25 nala/ stream/Canal/drains are being crossed by the proposed alignment. The list of waterbodies crossed by the proposed project highway is given in Table 4-9.

Table 4-9: List of Water Bodies being Crossed

S. No.	Chainage (km)	Description	Type
1.	0+725	Masavi Distributary Canal	Canal
2.	3+000	KrishniNala	Stream
3.	6+778	Sijud Distributary Canal	Canal
4.	11+885	Eastern Yamuna Canal	Canal
5.	12+917	Bunta Distributary Canal	Canal
6.	16+872	Papri Distributary Canal	Canal

S. No.	Chainage (km)	Description	Type
7.	18+894	Hangauli Distributary	Canal
8.	25+025	Village name: Kalsi	Stream
9.	26+480	Tabrakpur Canal	Canal
10.	37+890	KuraliNala	Nala
11.	39+300	Saindli	Stream
12.	43+515	Budhi	Stream
13.	46+445	Yamuna River	River
14.	51+050	Village name:HansooMajra	Stream
15.	53+833	Augmentation Canal	Canal
16.	55+040	Thaska Canal	Canal
17.	56+976	PotliDrian	Drain
18.	58+985	Western Yamuna Canal	Canal
19.	64+586	ChetangNala	Nala
20.	73+660	SaraswatiNala	Nala
21.	83+215	Sahabad Feeder	Canal
22.	87+707	Village name:Rajauli	Canal
23.	90+450	Hema Majra Gallery Link Drain	Stream
24.	90+580	Markanda River	River
25.	92+230	HardaHardiAllapur Drain	Canal
26.	92+470	HardaHardiAllapur Drain	Stream
27.	97+897	Tepla Drain	Nala
28.	101+414	Amri	Stream
29.	106+423	Omla	Stream
30.	108+450	Tangdi River	River
31.	110+280	Village name: Nagla (Punjab)	Canal
32.	116+003	Panjokra Minor	Nala

Source: Primary Survey

Surface water samples were taken at four (4) locations. Water quality can be expressed in terms of physical, chemical and biological characterization of water. Precautions were taken to avoid any contamination during the sampling. Water samples were collected from sampling locations in plastic bottles for complete physico-chemical and bacteriological tests respectively. Sample for DO was collected in a pre-cleaned BOD bottle. The physical and chemical parameters of the collected samples were tested as per established standard methods and procedures prescribed by CPCB and relevant IS Codes. The details of the ground & surface water sampling locations are given in **Table 4-10.**

Table 4-10: Ground & Surface Water Sampling Locations

Sl. No.	Location Code	Source Type	Location	Date of Sampling
1.	SW-1	Surface	Tangri River	25.03.2021
2.	SW-2	Surface	Yamuna River	25.03.2021
3.	SW-3	Surface	Canal-1	25.03.2021
4.	SW-4	Surface	Canal-2	25.03.2021
5.	GW-1	Ground	Gogwan Jalalpur	25.03.2021
6.	GW-2	Ground	Kalsi	25.03.2021

Sl. No.	Location Code	Source Type	Location	Date of Sampling
7.	GW-3	Ground	Tandwal	25.03.2021
8.	GW-4	Ground	Razapur	25.03.2021

Figure 4-6: Photographs Showing Water Sampling Stations

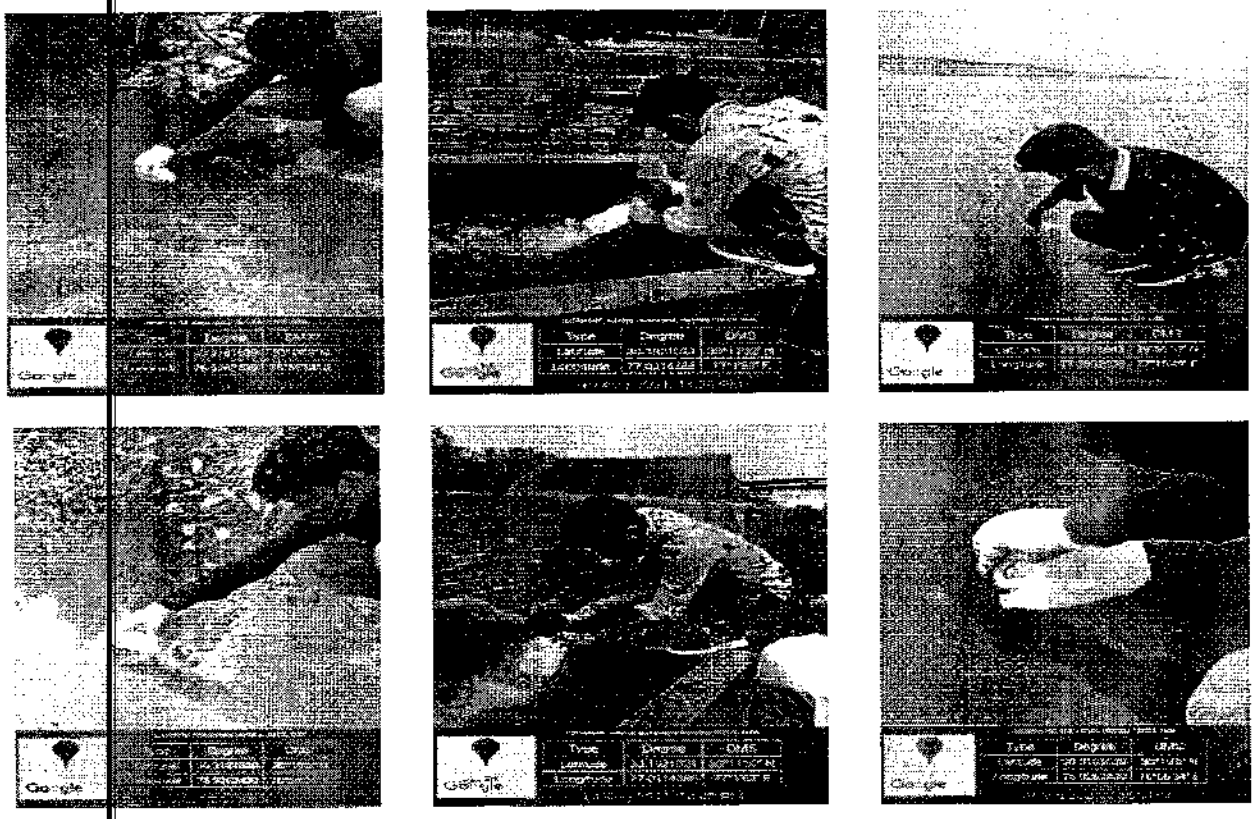


Table 4-11: Surface Water Quality Results of the Study Area

Sl. No.	Parameters	Unit	SW-1	SW-2	SW-3	SW-4
1	Temperature	°C	26.7	28.8	28.0	32.8
2	Colour	Hazen	<5.0	<5.0	<5.0	<5.0
3	Odour	...	Odourless			
4	pH	...	7.25	7.40	7.54	7.32
5	Total Dissolve Solids, (TDS)	mg/L	541.3	584.6	568.4	665.8
6	Biological Oxygen Demand, (BOD 3d 27°C)	mg/L	6.85	7.40	10.62	11.9
7	Chemical Oxygen Demand, (COD)	mg/L	23.0	24.8	40.9	42.1
8	Calcium, (Ca)	mg/L	75.0	81.0	108.8	114.8
9	Turbidity	NTU	8.0	8.0	9.0	9.8
10	Total Hardness, ($CaCO_3$)	mg/L	205.0	221.4	379.3	375.2
11	Dissolved Oxygen (DO)	mg/L	6.5	7.02	8.8	9.9
12	Anionic Detergent, (MBAS)	mg/L	N.D	N.D	N.D	N.D
13	Magnesium, (Mg)	mg/L	4.2	4.54	25.8	21.2
14	Chloride, (Cl)	mg/L	61.2	66.1	82.6	112.0

Sl. No.	Parameters	Unit	SW-1	SW-2	SW-3	SW-4
15	Conductivity	µs/cm	820.2	899.4	835.8	1073.9
16	Nitrate, (NO_3)	mg/L	2.1	2.2	4.0	3.8
17	Sulphate, (SO_4)	mg/L	38.5	41.6	71.2	70.5
18	Potassium, (K)	mg/L	14.2	15.3	22.0	26.0
19	Fluoride, (F)	mg/L	0.2	0.2	0.4	0.4
20	Chromium, (Cr+6)	mg/L	BDL	BDL	BDL	BDL
21	Cyanide, (CN)	mg/L	BDL	BDL	BDL	BDL
22	Cadmium, (Cd)	mg/L	BDL	BDL	BDL	BDL
23	Sodium, (Na)	mg/L	66.2	71.5	96.0	94.7
24	Copper, (Cu)	mg/L	BDL	BDL	BDL	BDL
25	Iron, (Fe)	mg/L	0.1	0.2	0.2	0.3
26	Boron, (B)	mg/L	BDL	BDL	BDL	BDL
27	Zinc, (Zn)	mg/L	BDL	BDL	BDL	BDL
28	Manganese, (Mn)	mg/L	BDL	BDL	BDL	BDL
29	Phenolic Compound, (C_6H_5OH)	mg/L	BDL	BDL	BDL	BDL
30	Mineral Oil	mg/L	BDL	BDL	BDL	BDL
31	Total Confirm Count	MPN/100mL	290.0	350.0	790.0	850.0
32	Fecal Coliform (FC)	MPN/100mL	340.0	395.0	560.0	730.0

Four (4) representative ground water sampling locations were identified along the project area to ascertain the ground water quality. All physical and general parameters were compared with the desirable limit and permissible limits as per IS10500:2012. The ground water qualities along the proposed locations were analyzed and have been presented in **Table 4-12**.

Table 4-12: Ground Water Quality Results of the Study Area

Sl. No.	Parameters	Unit	SW-1	SW-2	SW-3	SW-4
1	Temperature	°C	26.8	26.3	27.9	29.0
2	Colour	Hazen	<5.0	<5.0	<5.0	<5.0
3	Odour	...	Agreeable	Agreeable	Agreeable	Agreeable
4	Taste	...	Agreeable	Agreeable	Agreeable	Agreeable
5	pH	...	7.36	7.16	7.69	7.16
6	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0
7	Total Dissolved Solids, (TDS)	mg/L	481.3	298.0	588.0	298.0
8	Fluoride, (F)	mg/L	0.45	0.26	0.58	0.26
9	Total Alkalinity, ($CaCO_3$)	mg/L	195.0	180.0	315.0	180.0
10	Total Hardness, ($CaCO_3$)	mg/L	190.0	140.0	442.0	140.0
11	Calcium, (Ca)	mg/L	39.0	15.0	72.0	15.0
12	Chloride, (Cl)	mg/L	51.2	20.4	37	20.4
13	Magnesium, (Mg)	mg/L	22.2	24.6	62.88	24.6
14	Nitrate, (NO_3)	mg/L	1.3	1.0	4.16	1.01
15	Sulphate, (SO_4)	mg/L	28.4	19.3	17.2	19.3
16	Boron, (B)	mg/L	BDL	BDL	BDL	BDL
17	Aluminium, (Al)	mg/L	BDL	BDL	BDL	BDL
18	Arsenic, (As)	mg/L	BDL	BDL	BDL	BDL

Sl. No.	Parameters	Unit	SW-1	SW-2	SW-3	SW-4
19	Cadmium, (Cd)	mg/L	BDL	BDL	BDL	BDL
20	Chromium, (Cr)	mg/L	BDL	BDL	BDL	BDL
21	Copper, (Cu)	mg/L	0.21	0.2	0.21	0.15
22	Iron, (Fe)	mg/L	0.14	0.2	0.14	0.23
23	Lead, (Pb)	mg/L	BDL	BDL	BDL	BDL
24	Manganese, (Mn)	mg/L	BDL	BDL	BDL	BDL
25	Mercury, (Hg)	ug/L	BDL	BDL	BDL	BDL
26	Selenium, (Se)	mg/L	BDL	BDL	BDL	BDL
27	Zinc, (Zn)	mg/L	BDL	BDL	BDL	BDL
28	Anionic Detergent, (MBAS)	mg/L	BDL	BDL	BDL	BDL
29	Mineral Oil	mg/L	BDL	BDL	BDL	BDL
30	Phenolic Compound, (C_6H_5OH)	mg/L	BDL	BDL	BDL	BDL
31	Fecal Coliform, (FC)	MPN/100mL	Absent	Absent	Absent	Absent
32	Escherichia coli	MPN/100mL	Absent	Absent	Absent	Absent

Based on the test data comparison study, it is interpreted that the water quality in the project area is satisfactory and the major physico- chemical parameters are within limits set by the Bureau of Indian Standards for drinking water.

4.7 Biological Environment

Biological environment is the study of the biotic factors prevailed in the study area. Biotic factors are the community of different organisms under two broad categories i.e. flora and fauna. Biological assessment of a study area is an essential part of EIA studies to understand the status of the living communities in the area as well as to determine the probable impacts of the proposed projects on the same.

4.7.1 Forest

As per the Champion & Seth Classification of Forest Types (1968), the forests in Uttar Pradesh belong to five Forest Type Groups, which are further divided into 28 Forest Types. Major part of the State is agrarian. Recorded Forest Area (RFA) in the State is 16,582 sq km of which 12,070 sq km is Reserved Forest, 1,157 sq km is Protected Forest and 3,355 sq km is Unclassified Forests. In Uttar Pradesh, during the period 1stJanuary 2015 to 5th February 2019, a total of 163.76 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF& CC, 2019).

Haryana is primarily an agricultural State of India and 80% of the total geographical area is under agriculture. As per the Champion & Seth Classification of Forest Types (1968), the forests in Haryana belong to three Forest Type Groups *i.e.* Tropical Dry Deciduous Forest, Tropical Thorn Forest and Subtropical Pine Forests which are divided into 10 Forest Types. Recorded Forest Area (RFA) in the State is 1,559 sq km of which 249 sq km is Reserved Forests, 1,158 sq km is Protected Forests and 152 sq km is Unclassed Forests. In Haryana, during the period 1stJanuary 2015 to 5thFebruary 2019, a total of 1,529 hectares of forest land was diverted for

non-forestry purposes under the Forest Conservation Act, 1980 (MoEF& CC, 2019).

Punjab is predominantly an agricultural State, with 83% of the total geographical area is under agriculture. As per the Champion & Seth Classification of Forest types (1968), the forests in Punjab belong to three Forest Type Groups *i.e.* Tropical Dry Deciduous Forests, Tropical Thorn Forests and Subtropical Pine Forests which are further divided into seven Forest Types.

Recorded Forest Area (RFA) in the State is 3,084 sq km of which 44 sq km is Reserved Forest, 1,137 sq km is Protected Forest and 1,903 sq km is Unclassed Forests. In Punjab, during the period 1st January 2015 to 5th February 2019, a total of 1,525 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980 (MoEF& CC, 2019).

Table 4-13 : Forest cover of State and Districts under Proposed Project (km^2)

District	Geographical Area (km^2)	Very Dense Forest (km^2)	Mod. Dense Forest (km^2)	Open Forest (km^2)	Total (km^2)	% of GA
Muzaffarnagar*	4,008	0.00	14	52.11	66.11	1.65
Saharanpur	3,689	0.00	174	269.26	443.26	12.02
Uttar Pradesh	**2,40,928**	**2,616.43**	**4,080.04**	**8,109.18**	**14,805.65**	**6.15**
Karnal	2,520	0.00	4.00	28.24	32.24	1.28
Yamuna Nagar	1,768	22.00	89.00	82.36	193.36	10.94
Kurukshetra	1,530	0.00	17.60	22.15	39.75	2.60
Ambala	1,574	0.00	18.00	33.35	51.35	3.26
Haryana	**44,212**	**28.00**	**450.90**	**1,123.54**	**1,602.44**	**3.62**
SAS Nagar	1,094	0.00	74.50	66.23	140.73	12.86
Punjab	**50,362**	**8.00**	**800.97**	**1,039.66**	**1,848.63**	**3.67**

**Shamli district data is not available as it is curved from Muzaffarnagar district of Uttar Pradesh*
Source: India State of Forest Report 2019

The proposed alignment is passing through the strip plantation notified as protected forest along the roads & canals. Hence, diversion of forest land shall be applicable under Forest Conservation Act 1980.

4.7.2 Protected Area

The notified protected area in the project states are 25 Wildlife Sanctuary, 1 National Park, 2 Tiger Reserve and 2 Zoological Parks in the state of Uttar Pradesh. In Haryana, 8 Wildlife Sanctuary, 2 Conservation Reserve, 1 Deer Park, 3 Zoo and 5 breeding centres and Punjab state having 13 Wildlife Sanctuary, 1 Zoological Park, 1 Tiger Safari 3 Deer park, 3 Community Reserve and 4 Conservation Reserve.

The proposed alignment neither passing thorough nor falling within 10.0 km radius of any eco-sensitive/ protected area notified under Wildlife Protection Act 1972. Hence, recommendations from NBWL shall not be required for the development of proposed alignment.

4.7.3 Flora & Fauna in the Project Area

List of flora found around project area are as follows:

Table 4-14 : List of Flora in the Project Area

S. No.	Botanical Names	Family
Trees		
1.	*Acacia leucophloea*	Fabaceae
2.	*Acacia nilotica*	Fabaceae
3.	*Aegle marmelos*	Rutaceae
4.	*Albizia lebbeck*	Fabaceae
5.	*Albizia procera*	Fabaceae
6.	*Azadirachta indica*	Meliaceae
7.	*Bauhinia variegata*	Fabaceae
8.	*Bombax ceiba*	Bombacaceae
9.	*Capparis decidua*	Capparaceae
10.	*Cassia fistula*	Caesalpiniaceae
11.	*Cordia dichotoma*	Boraginaceae
12.	*Dalbergia sissoo*	Fabaceae
13.	*Emblica officinalis*	Euphorbiaceae
14.	*Erythrina indica*	Fabaceae
15.	*Ficus benghalensis*	Moraceae
16.	*Ficus racemosa*	Moraceae
17.	*Ficus religiosa*	Moraceae
18.	*Jacaranda mimosifolia*	Bignoniaceae
19.	*Kigelia pinnata*	Bignoniaceae
20.	*Melia azedarach*	Meliaceae
21.	*Moringa oleifera*	Moringaceae
22.	*Phoenix sylvestris*	Arecaceae
23.	*Pithecellobium dulce*	Fabaceae
24.	*Polyalthia longifolia*	Annonaceae
25.	*Pongamia pinnata*	Fabaceae
26.	*Prosopis cineraria*	Fabaceae
27.	*Prosopis juliflora*	Fabaceae
28.	*Syzygium cumini*	Myrtaceae
29.	*Tamarindus indica*	Fabaceae
30.	*Tectona grandis*	Verbenaceae
31.	*Terminalia arjuna*	Combretaceae
32.	*Ziziphus mauritiana*	Rhamnaceae

S. No.	Botanical Names	Family
33.	*Zizyphus xylopyra*	Rhamnaceae
34.	*Cassia siamea*	Fabaceae
35.	*Mangifera indicaL.*	Anacardiaceae
36.	*Bauhinia variegate*	Fabaceae
37.	*Boerhavia diffusa*	Nyctaginaceae
38.	*Bougainvillea spectabilis*	Nyctaginaceae
39.	*Brachiaria ramosa*	Poaceae
40.	*Butea monosperma*	Fabaceae
41.	*Cassia occidentalis*	Fabaceae
42.	*Cassia siamea*	Fabaceae
43.	*Chenopodium ambrosioides*	Chenopodiaceae
44.	*Citrus limon*	Rutaceae
45.	*Commelina diffusa*	Commelinaceae
46.	*Conyza canadensis*	Asteraceae
47.	*Croton bonplandianum*	Euphorbiaceae
48.	*Cyanotis axillaris*	Commelinaceae
49.	*Cynodon dactylon*	Poaceae
50.	*Cyperus alopecuroides*	Cyperaceae
51.	*Cyperus cyperoides*	Cyperaceae
52.	*Dactyloctenium aegyptium*	Poaceae
53.	*Datura innoxia*	Solanaceae
54.	*Datura metel*	Solanaceae
55.	*Echinochloa stagnina*	Poaceae
56.	*Eclipta prostrata*	Asteraceae
57.	*Eleocharis dulcis*	Cyperaceae
58.	*Eleusine indica*	Poaceae
59.	*Euphorbia hirta*	Euphorbiaceae
60.	*Ficus virens*	Moraceae
61.	*Ipomoea aquatica*	Convolvulaceae
62.	*Adina cordifolia*	Rubiaceae
63.	*Albizia spp*	Fabaceae
64.	*Anogeissus latifolia*	Combretaceae
65.	*Bauhinia acuminata*	Fabaceae
66.	*Bauhinia vahlii*	Fabaceae
67.	*Buchanania lanzan*	Anacardiaceae
68.	*Celtis australis*	Cannabaceae

S. No.	Botanical Names	Family
69.	*Colebrookea oppositifolia*	Lamiaceae
70.	*Dendrocalamus strictus*	Poaceae
71.	*Diospyros tomentosa*	Ebenaceae
72.	*Dodonaea viscosa*	Sapindaceae
73.	*Ehretia laevis*	Boraginaceae
74.	*Flacourtia indica*	Salicaceae
75.	*Garuga pinnata*	Burseraceae
76.	*Grewia optiva*	Tiliaceae
77.	*Holoptalia integrifolia*	Ulmaceae
78.	*Justicia adhatoda*	Acanthaceae
79.	*Mallotus philippensis*	Euphorbiaceae
80.	*Miliusa velutina*	Annonaceae
81.	*Murraya koenigii*	Rutaceae
82.	*Nyctanthes spp*	Oleaceae
83.	*Ougeinia oojeinensis*	Fabaceae
84.	*Shorea robusta*	Dipterocarpaceae
85.	*Terminalia chebula*	Combretaceae
86.	*Toona ciliata*	Meliaceae
87.	*Ziziphus nummularia*	Rhamnaceae
88.	*Eucalyptus umbellata*	Myrtaceae
89.	*Ipomoea carnea*	Convolvulaceae
90.	*Lemna perpusilla*	Lemnaceae
91.	*Leucas aspera*	Lamiaceae
92.	*Madhuca logifolia*	Sapotaceae
93.	*Monochoria hastata*	Pontederiaceae
94.	*Morus alba*	Moraceae
95.	*Nerium indicum*	Apocynaceae.
96.	*Oplismenus burmannii*	Poaceae
97.	*Oxalis corniculata*	Oxalidaceae
98.	*Pentanema indicum*	Asteraceae
99.	*Polygonum minus*	Polygonaceae
100.	*Ricinus communis*	Euphorbiaceae
101.	*Mangifera indica*	Anacardiaceae
102.	*Acacia catechu*	Fabaceae
103.	*Terminalia belerica*	Combretaceae
104.	*Embelica officinalis*	Amla

S. No.	Botanical Names	Family
105.	*Albizzia procera*	Fabaceae
106.	*Salmalia malabarica*	Simal
107.	*Delonix regia*	Fabaceae
108.	*Leucaena leucocephala*	Fabaceae
Shrubs and Herbs		
1.	*Adhatoda vasica*	Acanthaceae
2.	*Annona squamosa*	Annonaceae
3.	*Argemone mexicana*	Papaveraceae
4.	*Calotropis gigantea*	Apocynaceae
5.	*Calotropis procera*	Asclepiadaceae
6.	*Crotalaria juncea*	Fabaceae
7.	*Euphorbia neriifolia*	Euphorbiaceae
8.	*Ipomoea fistulosa*	Convolvulaceae
9.	*Nyctanthes arbor-tristis*	Oleaceae
10.	*Opuntia dillenii*	Cactaceae
11.	*Sida acuta*	Malvaceae
12.	*Abutilon indicum*	Malvaceae
13.	*Adhatoda vasica*	Acanthaceae
14.	*Ageratum conyzoides*	Asteraceae
15.	*Alternanther aparonychioides*	Amaranthaceae
16.	*Alternanther apungens*	Amaranthaceae
17.	*Amaranthus spinosus*	Amaranthaceae
18.	*Annona squamosa*	Annonaceae
19.	*Argemone mexicana*	Papaveraceae
20.	*Berberis vulgaris*	Berberidaceae
21.	*Bougainvillea spectabilis*	Nyctaginaceae
22.	*Brachiaria ramosa*	Poaceae
23.	*Calotropis gigantea*	Apocynaceae
24.	*Calotropis procera*	Asclepiadaceae
25.	*Cannabis sativa*	Cannabaceae
26.	*Cassia occidentalis*	Fabaceae
27.	*Cassia tora*	Fabaceae
28.	*Chenopodium album*	Amaranthaceae
29.	*Colocasia esculenta*	Araceae
30.	*Crotalaria juncea*	Fabaceae
31.	*Croton bonplandianum*	Euphorbiaceae
32.	*Cynodon dactylon*	Poaceae
33.	*Datura innoxia*	Solanaceae
34.	*Eleusine indica*	Poaceae
35.	*Euphorbia neriifolia*	Euphorbiaceae

S. No.	Botanical Names	Family
36.	*Grangeam aderaspatana*	Asteraceae
37.	*Imperata cylindrica*	Poaceae
38.	*Ipomoea fistulosa*	Convolvulaceae
39.	*Nyctanthes arbor-tristis*	Oleaceae
40.	*Opuntia dillenii*	Cactaceae
41.	*Physalis minima*	Solanaceae
42.	*Saccharum spontaneum*	Poaceae
43.	*Sida acuta*	Malvaceae
44.	*Solanum virginianum*	Solanaceae
45.	*Ziziphus mauritiana*	Rhamnaceae
46.	*Achyranthes aspera*	Amaranthaceae
47.	*Agave americana*	Agavaceae
48.	*Cannabis sativa*	Cannabaceae
49.	*Cassia glauca*	Fabaceae
50.	*Cassia tora*	Fabaceae
51.	*Chenopodium album*	Amaranthaceae
52.	*Datura stramonium*	Solanaceae
53.	*Tephrosia purpurea*	Fabaceae
54.	*Tribulus terrestris*	Zygophyllaceae
55.	*Tridax procumbens*	Asteraceae
56.	*Adhatoda vasica*	Acanthaceae
57.	*Agave americana*	Agavaceae
58.	*Annona squamosa*	Annonaceae
59.	*Argemone mexicana*	Papaveraceae
60.	*Asparagus racemosus*	Asparagaceae
61.	*Calotropis gigantea*	Apocynaceae
62.	*Calotropis procera*	Asclepiadaceae
63.	*Cannabis sativa*	Cannabaceae
64.	*Cassia glauca*	Fabaceae
65.	*Cassia tora*	Fabaceae
66.	*Chenopodium album*	Amaranthaceae
67.	*Crotalaria juncea*	Fabaceae
68.	*Cuscuta reflexa*	Convolvulaceae
69.	*Datura stramonium*	Solanaceae
70.	*Euphorbia neriifolia*	Euphorbiaceae
71.	*Ipomoea fistulosa*	Convolvulaceae
72.	*Momordica charantia*	Cucurbitaceae
73.	*Parthenium hysterophorus*	Asteraceae
74.	*Sida acuta*	Malvaceae
75.	*Tephrosia purpurea*	Fabaceae

S. No.	Botanical Names	Family
76.	*Tinospora cordifolia*	Menispermaceae
77.	*Lantana camara*	Verbenaceae
78.	*Tribulus terrestris*	Zygophyllaceae
79.	*Tridax procumbens*	Asteraceae
Grasses		
1.	*Cymbopogon martini*	Poaceae
2.	*Cynodon dactylon*	Poaceae
3.	*Dichanthium annulatum*	Poaceae
4.	*Heteropogon contortus*	Poaceae
5.	*Digitaria sp.*	Poaceae
Climbers		
1.	*Asparagus racemosus*	Asparagaceae
2.	*Cuscuta reflexa*	Convolvulaceae
3.	*Momordica charantia*	Cucurbitaceae
4.	*Tinospora cordifolia*	Menispermaceae

Table 4-15 : List of Fauna in the Project Area

S. No.	Scientific Name	Common Name	Family
Mammals			
1.	*Apodemus sylvaticus*	Wood mouse	Muridae
2.	*Boselaphus tragocamelus*	Nilgai	Bovidae
3.	*Canis aureus*	Jackal	Canidae
4.	*Felis chaus*	Jangli Billi	Felidae
5.	*Funambulus palmarum*	Indian Palm Squirrel	Sciuridae
6.	*Funambulus pennanti*	Gilhari	
7.	*Funambulus pennanti*	Squirrel	Sciuridae
8.	*Gazelle gazelle*	Indian Gazelle	Bovidae
9.	*Hemiechinus auritus*	Long-eared hedgehog	Erinaceidae
10.	*Herpestes edwardsi*	Mangoose	Herpestidae
11.	*Lepus nigricollis*	Indian Hare	Leporidae
12.	*Macaca mulatta*	Rhesus Monkey	Cercopithecidae
13.	*Mus musculus*	Gharelu Musa	Muridae
14.	*Pteropus conspicillatus*	Flying fox	Pteropodidae
15.	*Rattus rattus*	Black Rat	Muridae
16.	*Rousettus leschenaulti*	Chamgadar	Pteropodidae
17.	*Semnopithecus entellus*	Langur	Cercopethicidae
18.	*Sus scrofa*	wild boar	Suidae
19.	*Vulpes bengalensis*	Indian fox	Caninae
Reptiles & Amphibians			
1.	*Bufo bufo*	Toad	Bufonidae

S. No.	Scientific Name	Common Name	Family
2.	*Bufo melanostictus*	True toad	Bufonidae
3.	*Bungaru scaeruleus*	Elapid snakes	Elapidae
4.	*Bungarus fasciatus*	Banded krait	Elapidae
5.	*Calotes versicolor*	Eastern Garden Lizard	Agamidae
6.	*Duttaphrynus melanostictus*	Common toads	Bufonidae
7.	*Euphlyctis cyanophlyctis*	True frog	Dicroglossidae
8.	*Hemidactylus frenatus*	Gecko	Gekkonidae.
9.	*Hoplobatrachus tigerinus*	Indian bullfrog	Dicroglossidae
10.	*Naja naja*	Spectacled Cobra	Elapidae
11.	*Ptyas mucosa*	Oriental ratsnake	Colubridae
12.	*Ramphotyphlops braminus*	Long-tailed blindsnakes	Typhlopidae
13.	*Varanus benagalensis*	Common Indian Monitor	Varanidae
14.	*Vipera russelli*	Russell's Viper	Viperidae
Avifauna			
1.	*Accipiter badius*	Shikra	Accipitridae
2.	*Acridotheres tristis*	common myna	Sturnidae
3.	*Alcedo atthis*	Kingfisher	Alcedininae
4.	*Alcippe poioicephale*	Brown-cheeked fulvetta	Alcippeidae
5.	*Amaurornis phoenicurus*	White-breasted waterhen	Rallidae
6.	*Anas acuta*	The common pintail, duck	Anatidae
7.	*Anas crecca*	The Eurasian teal	Anatidae
8.	*Anas platyrhynchos*	The mallard	Anatidae
9.	*Anas poecilorhyncha*	Spot-billed duck	Anatidae
10.	*Ardeola grayii*	Indian pond heron or paddybird	Ardeidae
11.	*Athene brama*	The spotted owlet	Strigidae
12.	*Aythya ferina*	The common pochard	Anatidae
13.	*Bubo bubo*	True owl	Strigidae
14.	*Bubulcus ibis*	The western cattle egret	Ardeidae
15.	*Butastur teesa*	The white-eyed buzzard	Accipitridae
16.	*Cinnyris asiaticus*	The purple sunbird	Nectariniidae
17.	*Clamator jacobinus*	The Jacobin cuckoo	Cuculidae
18.	*Columba livia*	The rock dove	Columbidae
19.	*Copsychus saularis*	Oriental magpie-robin	Muscicapidae
20.	*Coracias benghalensis*	The Indian roller	Coraciidae
21.	*Corvus splendens*	The house crow	Corvidae
22.	*Coturnix coturnix*	The common quail	Phasianidae
23.	*Cuculus canorus*	The common cuckoo	Cuculidae

S. No.	Scientific Name	Common Name	Family
24.	*Cuculus varius*	The common hawk-cuckoo	Cuculidae
25.	*Cyornis tickelliae*	Tickell's blue flycatcher	Muscicapidae
26.	*Dendrocitta vagabunda*	Indian Tree Pie	Corvidae
27.	*Dicrurus adsimilis*	The fork-tailed drongo	Dicruridae
28.	*Dicrurus leucophaeus*	The ashy drongo	Dicruridae
29.	*Dicrurus paradiseus*	The greater racket-tailed drongo	Dicruridae
30.	*Egretta garzetta*	The little egret	Ardeidae
31.	*Eudynamys scolopacea*	The Asian koel	Cuculidae
32.	*Halcyon pileata*	The black-capped kingfisher	Alcedinidae
33.	*Halcyon smyrnensis*	The white-throated kingfisher	Alcedinidae
34.	*Lanius excubitor*	The great grey shrike	Laniidae
35.	*Lonchura malabarica*	The Indian silverbill	Estrildidae
36.	*Merops orientalis*	The Asian green bee-eater	Meropidae
37.	*Milvus migrans*	The black kite	Accipitridae
38.	*Motacilla alba*	The white wagtail	Motacillidae
39.	Motacilla capsica	The white-browed wagtail	Motacillidae
40.	*Motacilla flava*	The western yellow wagtail	Motacillidae
41.	*Ocyceros birostris*	The Indian grey hornbill	Bucerotidae
42.	*Oriolus oriolus*	Golden Oriole	Oriolidae
43.	*Passer domesticus*	the house sparrow	Passeridae
44.	*Pavo cristatus*	The Indian peafowl	Phasianidae
45.	*Pericrocotus cinnamomaus*	The small minivet	Campephagidae
46.	*Phalacrocorax fuscicollis*	The Indian cormorant	Phalacrocoracidae
47.	*Phalacrocorax niger*	The little cormorant	Phalacrocoracidae
48.	*Ploceus philippinus*	The baya weaver	Ploceidae
49.	*Psittacula krameri*	The rose-ringed parakeet	Psittaculidae
50.	*Pycnonotus cafer*	The red-vented bulbul	Pycnonotidae
51.	*Pycnonotus jocosus*	The red-whiskered bulbul	Pycnonotidae
52.	*Saxicoloides fulicatus*	The Indian robin	Muscicapidae
53.	*Sturnus contra*	Pied myna	Sturnidae
54.	*Sturnus pagodarum*	The brahminy myna	Sturnidae
55.	*Tringa stagnatilis*	The marsh sandpiper	Scolopacidae
56.	*Turdoides caudatus*	The jungle babble	Leiothrichidae
57.	*Turdoides striata*	The jungle babbler	Timaliidae
58.	*Upupa epops*	The common hoopoe	Upupidae

Table 4-16 : Schedule I Species in Project Area

S. No.	Family	Common Name	Scientific Name	IUCN 3.1	WL Schedule 1972
Mammals					
1	Bovidae	Indian Gazelle	*Gazelle gazelle*	-	I
Reptiles & Amphibians					
1	Varanidae	Common Indian Monitor	*Varanus benagalensis*	-	I
Avifauna					
1	Phasianidae	The Indian peafowl	*Pavo cristatus*	-	I

4.8 Socio-Economic Profile of the Project Area

Socio-economic analysis has been conducted along the proposed project alignment for the project influence districts Shamli & Saharanpur of Uttar Pradesh State, Yamuna Nagar, Karnal, Kurukshetra & Ambala of Haryana State and SAS Nagar of Punjab State. The primary purpose of socio-economic analysis is to provide an overview of the socio-economic setup of the affected districts. The population forms the basic planning parameter for the preparation of any transport related plan/study and indicates the scale of required development.

4.8.1 Demographic features

The demographic features of Shamli & Saharanpur districts in the state of Uttar Pradesh, Yamuna Nagar, Karnal, Kurukshetra and Ambala districts in the state of Haryana and SAS Nagar district of Punjab State forming an immediate influence. As per Census. 2011, the total population of Haryana is 2,53,51,462 with the density as 573 /km^2, Uttar Pradesh is 15,53,17,278 with a density of 829/km^2 and Punjab is 2,77,43,338 with a density of 551/km^2.

Table 4-17: Demographics of Project Influence districts

Sl. No	State	District	Population 2011		
			Persons	Male	Female
1.	Uttar Pradesh	Saharanpur	34,66,382	18,34,106	16,32,276
		Shamli	12,73,578	6,87,732	5,85,846
2.	Haryana	Yamuna Nagar	12,14,205	6,46,718	5,67,487
		Kamal	15,05,324	7,97,712	7,07,612
		Kurukshetra	9,64,655	5,10,976	4,53,679
		Ambala	11,28,350	5,98,703	5,29,647
3.	Punjab	SAS Nagar	9,94,628	5,29,253	4,65,375

The increase in population in the districts can be marked as follows:

Table 4-18: Population Details

Sl. No	State	District	Population Density		
			2011	2001	Increase %
1	Uttar Pradesh	Saharanpur	940/km^2	785/km^2	19.75
		Shamli	1125/km^2	884/km^2	27.26
2	Haryana	Yamuna Nagar	687/km^2	556/km^2	23.56
		Karnal	630/km^2	506/km^2	24.51
		Kurukshetra	597/km^2	541/km^2	10.35

Sl. No	State	District	Population Density		
			2011	2001	Increase %
		Ambala	717/km^2	644/km^2	11.34
3	Punjab	SAS Nagar	909/km^2	-	-

4.8.2 Gender ratio

The ratio of male and female has increased from 2001 to 2011.

Table 4-19: Gender Ratio

Sl. No	State	District	Gender Ratio		
			2011	2001	Increase %
1	Uttar Pradesh	Saharanpur	890	865	2.89
		Shamli	889	871	2.07
2	Haryana	Yamuna Nagar	877	863	1.62
		Karnal	887	864	2.66
		Kurukshetra	888	866	2.54
		Ambala	885	869	1.84
3	Punjab	SAS Nagar	879	842	4.39

4.8.3 Literacy

The census shows impressive growth in literacy.

Table 4-20: Literacy Rate

Sl. No	State	District	Literacy		
			2011	2001	Increase %
1	Uttar Pradesh	Saharanpur	70.5	61.2	15.20
		Shamli	71.0	60.7	16.97
2	Haryana	Yamuna Nagar	77.99	72.2	8.02
		Karnal	74.7	68.2	9.53
		Kurukshetra	76.3	70.0	9.00
		Ambala	81.75	76.2	7.28
3	Punjab	SAS Nagar	83.8	-	-

4.9 Use of Natural Resources

The objective was to locate suitable materials for the construction of embankment, sub-grade and top layers of pavement and bridge structures. The study was carried out to determine the engineering properties of the following materials, which are to be used in construction.

- Borrow
- Quarries for locating hard stone / granular materials for use in sub bases, bases, bituminous mixes and concrete works.

4.9.1 Borrow Area

As the alignment is greenfield, borrow materials should be used for construction of embankment. However as fly ash was readily available within 100 km radius of the road, it is proposed to use fly ash as filling material in embankments except for RE walls. An earth

cushion of 1 m width has been provided on all sides of fly ash embankment as per IRC SP 58: 2001.

The investigation was also carried out for locating and ascertaining the suitability of the borrow soil in areas along or near the project road section for design and construction of sub-grade and embankment of widening/up-gradation portion of pavement as well as foundation for various road cross-section elements. Details have been provided in the feasibility report.

4.9.2 Quarry & Crushers

Road construction activities are closely linked with quarry sites around the work sites. The stone materials including sand and granular ones are needed in large quantities for the pavement construction. The other area of requirement is concrete structures, which call for a good quality stone. Extensive survey was conducted to locate the availability of stone metal near the project site. As a result of local enquiries and discussion with the local official's stone metal was identified at various locations. Existing quarries that are already in operation with requisite environmental clearances have been recommended for this project and no new quarries have been proposed.

5 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

5.1 Introduction

This chapter assesses the nature, type and magnitude of the potential impacts likely on physical, biological and cultural environmental components along the project corridor. Chapter also discusses about suitable mitigation. For superimposition of the impacts, the baseline information was collected through primary and secondary data.

The impacts on the various environmental components were assessed considering following stages of the project:

- Planning and design stage;
- Construction stage; and
- Operation stage

The description and magnitude of likely impacts on various environmental components along with mitigation measures are presented in the following sections.

5.2 Physical Environment

5.2.1 Meteorological Parameters

Impact

The climate of the project area is generally having four Season. The Summer season is from March to May. From March onwards it is a period of continuous rise in the temperature and May is generally the hottest month of the year. Though no significant change in the macro-climatic setting (regional precipitation, temperature and wind) is envisaged due to the project, however, microclimate is likely to be temporarily modified by vegetation removal and addition of increased pavement surface. An increase in daytime temperature near the road surface due increased pavement surface, which in turn might lead to formation of heat islands especially near the inhabited sections. This increase in the daytime temperature assumes significant especially in close vicinity of proposed highway, as the project area experiences temperatures as high as 40-46°C during summer season.

Mitigation

Although the impact is significant but reversible in nature and shall be compensate by avenue plantation & shrubs in median & alongside the proposed highway as per IRC SP-21:2009 to compensate the micro-climatic impacts. It must be noted that the impact is unavoidable. However, it may be pointed out that the project has taken care to minimise tree felling as no tree felling shall be done beyond corridor of impact. Considering the access control highway, no slow-moving traffic or pedestrians are likely on proposed highway.

5.2.2 Land

5.2.2.1 Physiography

Project highway follows the plain terrain. Highway construction activities involve alterations in the local topography and drainage patterns. The impacts on physiography may include de-stabilization of slopes due to cut and fill operations. Major bridges, Minor bridges and Culverts are proposed to avoid any impact on local hydrology.

5.2.2.2 Geology and Seismology

The entire stretch of the project traverses through Seismic Zone IV (High Risk Zone) as defined by the Indian Standard (IS) seismic zoning classification system. The project does not have any direct impact on the geological or seismic stability of the area. However, associated mining activities for construction material may alter the local geology to some extent. The structure as proposed for the project are being designed considering the seismic magnitude of the region.

5.2.2.3 Quarries

Impact

Existing quarries that are already in operation with the required clearances have been recommended for this project. No new quarries are proposed and hence no major impacts, which arise in making new quarries operational, are likely. In case Contractor / Concessionaire decides in opening new stone quarries stipulated GoI norms should be followed as mining in non-scientific manner may unstable the soil condition and affect the terrain of the area.

Dust, in addition to associated health impacts also reduces visibility thereby increasing safety concerns. As no new quarry is proposed to be opened for this project, therefore, no new impacts are likely to arise due to quarrying operations. It will be ensured that quarry contractor is following environment management system to take care of the working conditions of workers in the existing quarry areas selected for the project. Raw material requirements for the construction activities are detailed in Table 5-1.

Table 5-1: Tentative Raw Material Requirement

Sl. No.	Item	Unit	Total Qty
1	Earthwork/Borrow/	Cum	22736198
2	Flyash	Cum	4647838
3	Aggregate	Cum	9446968
4	Stone for pitching	MT	142599
5	Cement	MT	1719334
6	Steel	MT	392814
7	Bitumen	MT	38480704
8	Sand	Cum	5133409

Source: Design report

Mitigation

Existing approved quarries which are already in operation with the required environmental clearances have been recommended for this project, hence no new quarries have been

proposed. It needs however, to be noted that recommendation on use of quarries is a guideline only and has been done to establish the feasibility of construction. The issue of dust generation etc. along the haul roads needs to be addressed through proper enforcement of dust suppression measures.

Sand required for the construction will mostly be procured from the approved operating river quarries. As an alternative to borrowing of sand from river-bed the possibility of using stone crusher dust and fly ash shall be explored. Stone dust from crusher can be used for the construction works provided the quantity and the quality produced is certified by Monitoring consultant to be satisfactory for all construction works, else river sand shall be used from the identified quarry. The long leads mean that care would have to be taken to prevent spillage of material and damage to the haul roads during transportation. No additional adverse environmental impact except those resulting from spillage during transportation is expected to occur. Hence proper care for transportation should be taken into account.

Guidelines for Existing Quarry Management & Guidelines for New Quarry Management have been presented in Annexure 5.1 & Annexure 5.2 respectively.

5.2.2.4 Borrow Area

Impact

Borrow areas may become potential breeding ground for mosquitoes and other bacterial infection disease if not reclaimed properly in a scientific manner. The transportation of borrow materials may also cause dust nuisance. Top-soil as removed from the borrow area may lose its fertility if not handled properly.

Mitigation

The borrow areas are selected in a scientific manner with due care of local environment and social sensitivity. The excavation of soil shall be conducted as per the EMP and will be fully rehabilitated with proper NOC from the respective land owner / authority. The top soil from the borrow area shall be preserved separately and will be re-used for rehabilitation. MoEF&CC norms & guidelines shall be followed for borrow area opening and management. The detailed plan for borrow area management has been attached as Annexure 5.3.

5.2.2.5 Soil Erosion

Pre-Construction Stage

Impact

The removal of vegetation will cause erosion and increased run-off due to paved surface would in turn lead to erosion of productive soil from nearby areas. The direct impact of erosion is the loss of embankment soil and danger of stability loss for the road itself. This impact is generally restricted to the RoW. No vegetation clearance or tree felling is proposed beyond the construction zone.

Mitigation

The project has taken care of this issue at the engineering design stage itself, as at design gradients of 1:1.5, the slopes of the embankments are perceived to be stable. Tree felling shall

be limited for the corridor of impact only. High embankment section of the road shall be suitably turfed by stone pitching or any other suitable turfing materials.

Construction Stage

Impact

Elevated sections of the highway, high embankments along the bridges and the bridge approaches would be vulnerable to erosion and need to be provided proper slope protection measures to prevent erosion. Construction of new bridges involves excavation of riverbed and banks for the construction of the foundations and piers. If the residual spoil is not properly disposed off, increased sedimentation downstream of the bridge is likely.

Mitigation

Adequate slope protection measures are proposed as part of engineering design. Silt fencing shall be provided to prevent eroded material from entering watercourses. Though during construction period, drainage alteration and downstream erosion / siltation is anticipated, however, cross drainage structure based on hydrology study shall compensate the drainage alteration in the surrounding area. River protection work are planned.

Operation Stage

No soil erosion is envisaged when the road is in operation as all the slopes and embankments of the project road shall be stabilized through sound engineering techniques. The regular cleaning of the drains by the Contractor will ensure that these structures are not overloaded or rendered ineffective due to overload.

5.2.2.6 Compaction of Soil

Impact

Compaction of soil may take place due to movement of heavy machinery and vehicles on nearby agricultural land. Similarly, compaction will take place during setting up of construction camps and stockyards.

Mitigation

The movement of construction vehicles shall be limited to designated road. So that compaction of nearby productive land can be saved. Provision of reclaiming of nearby land has also been suggested to cure the soil compaction in nearby productive lands.

5.2.2.7 Contamination of Soil

Impact

Soil contamination may take place due to waste disposal from the labour camp set up during pre-construction stage. The sites where construction vehicles shall be parked and serviced are likely to be contaminated because of leakage or spillage of fuel and lubricants. Fuel storage areas are also susceptible to the soil contamination by accidental spillage and run-off. Unwarranted disposal of construction spoil and debris will add to soil contamination. During the operation stage, soil pollution due to accidental vehicle spills or leaks is also having a low probability.

Mitigation

Following mitigation strategies are proposed to control soil contamination.

- Fuel oil shall be stored in separately designated covered area with RCC surface to prevent any soil contamination due to spillage
- Overflow of service and washing areas shall be passed through the oil interceptors
- Septic tank with soak pit facility will be provide in labour camps to prevent any soil contamination due to sewage discharge
- Waste management system was per Solid Waste Management Rules, 2016 will be adopted in construction camps
- Scarified bitumen (if any) waste shall be disposed-off at designated landfill site only

The quality of the soil shall be monitored on regular basis to find out the effectiveness of the mitigation measures and further improvement in measures (if required). The monitoring plan shall be functional in construction as well as in operation stages. The frequency, duration and responsibility will be as per the Environmental Management Plan.

Guidelines for Identification of Debris Disposal Sites & Precautions and Guidelines for Rehabilitation of Dumpsites & Quarries have been attached as Annexure- 5.4 & Annexure- 5.5 respectively.

5.2.3 Air Quality

Air quality along the project corridor will be impacted both during the construction and operation stages of the project. Construction stage impacts will be of short term and have adverse impacts on the construction workers as well as the habitation located near to the proposed highway, especially those in the down wind direction. Operation stage impacts will not be as severe as the construction stage impacts and will generally be confined to a strip of up to 100m from the edge of the lane on either side of the corridor.

5.2.3.1 Generation of Dust

Pre-Construction Stage

Impact

Generation of dust is the most likely impact during this stage due to:

- Site clearance and use of heavy vehicles and machinery etc.
- Transport of raw materials from quarries to construction sites

Mitigation

Adequate measures such as regular sprinkling of water, covering of dumpers carrying construction & excavated materials, use of PUC certified vehicles, etc. are proposed for abatement of dust emission.

Construction Stage

Impact

Construction activities to be carried out during the dry season when the moisture content would be less, dust generation, particularly due to earthworks will be significant. Dust is likely to be

generated due to the various construction activities including:

- Movement of construction vehicles and machineries on unpaved surface;
- Transportation of construction materials;
- Mixing of construction materials;
- Construction and allied activities.

Mitigation

Generation of dust is a critical issue and is likely to have adverse impact on health of workers working in dust prone areas. The Environmental Action Plan to be prepared by Contractor / Concessionaire must lay emphasis on enforcement of measures such as provision of pollution masks, regular sprinkling of water to suppress dust, transportation of construction material in covered trucks, etc. to mitigate the impact.

Operation Stage

No dust generation is envisaged during the operation stage as shoulders shall be compacted & paved and all slopes & embankments shall be turfed as per best engineering practices. The air quality shall further also be improved due to the plantation activity to be carried out in the available RoW at the end of construction phase.

5.2.3.2 Generation of Exhaust Gases

Impact

Generation of exhaust gases is likely during the pre-construction stage due to movement of heavy vehicles & machinery, oil tankers, etc. SO_2, NO_2 and HC are likely to be emitted from hot mix plant operations. Volatile toxic gases may also be released due to heating process during bitumen production. Although the impact is much localized however, it can spread downwind depending on the wind speeds. Construction vehicles shall also be releasing exhaust gases.

The major impact on air quality during operation stage will be due to plying of vehicles. The impacts on air quality will at any given time depend upon traffic volume / rate of vehicular emission within a given stretch and prevailing meteorological conditions. Air pollution impacts arise from two sources: (i) inadequate vehicle maintenance; and (ii) use of adulterated fuel in vehicles.

Mitigation

- Regular maintenance and pollution check is proposed for construction vehicles and machineries
- No bad quality fuel shall be used in construction vehicles and machinery
- Hot mix Plant to be installed in downwind direction from nearby settlement at minimum 1000m distance.
- Broad-leaved pollution resistant species, which can grow in high pollutant concentrations or even absorb pollutants, shall be planted as they help settle particulates with their higher surface areas along with thick foliage.
- *Cassia fistula* (Amaltas), *Ficus religiosa* (Peepal), *Ficusbengalensis* (Banyan), *Tamarindusindica* (Imli) and *Azadirachtaindica* (Neem) are recommended. However,

plantation shall be carried out in close communication with the forest dept. with the help of native species.

Other measures such as the reduction of vehicular emissions, ensuring vehicular maintenance and upkeep, educating drivers about driving behaviour. However, these methods are beyond the scope of the project but will be far more effective in reducing the pollutant levels. NHAI together with the Motor vehicles Department and SPCB can arrange for provision for inspection for PUC certificates at the toll plazas.

5.2.3.3 AAQ Impact Prediction Modelling of CO Using CALINE 4 Dispersion Model

CALINE 4 (Caltrans, 1989) is a simple line source Gaussian plume dispersion model that predicts air impacts near roadways. The model is broadly divided into five screens such as Job Parameters, Run Conditions, Link Geometry, Link Activity and Receptor Positions.

Job Parameters

- **Run Type:** determine averaging times and how the hourly average wind angle(s) will be determined. In the present case modelling exercise were made to predict the impact on worst case scenario. Multi-Run / Worst Case Hybrid type was used for CO impact modelling.
- **Aerodynamic Roughness Coefficient:** determine the amount of local air turbulence that affects plume spreading. CALINE 4 offers the 4 choices for aerodynamic roughness coefficient namely; Rural, Suburban, Central Business District and Other. For the present modelling rural roughness options have been considered.
- **Altitude above Sea Level:** Define the altitude above mean sea level. This input is used to determine the rate of plume spreading.

Run conditions

- **Wind Speed:** Expressed in meters per second. USEPA recommends a value of 1 m/s as the worst-case wind speed.
- **Wind Direction:** The direction the wind is blowing from, measured clockwise in degrees from the north. As the model study is on "Worst Case scenario", therefore CALINE 4 will consider this input by default.

Link Geometry

- **Link Type:** 5 choices available such as At Grade, Fill, Depressed, Bridge and Parking lot. In this particular model study At Grade link type is used.
- **Link Height:** For the project link height is being considered as zero.
- **Mixing Zone Width:** Mixing zone is defined as the width of the roadway, plus 3m on either side.

Link Activity

- **Traffic Volume:** The hourly traffic volume anticipated to travel on each link, in units of vehicles per hour.
- **Emission Factor:** The weighted average emission rate of the local vehicle fleet, expressed in terms of grams / mile per vehicle.

Receptor Positions

Receptors positions expressed in Cartesian (x, y) coordinate system. Z value can also be

provided to assess the proposed impacts at various heights. For the present case incremental GLCs were assessed at every 10m interval from the edge of the project highway.

Approach and Methodology

Emission Factors were arrived using standard values prescribed by The Automotive Research Association of India, Pune under Air Quality Monitoring Project-Indian Clean Air Programme (ICAP). Project Stretch is considered one section. Traffic load and emission factors were estimated for all the traffic sections for the projection year 2052-53 to assess the worst-case scenario analysis. Table 5-2 presents the Traffic and emission factor considered for the modeling.

Table 5-2: Traffic and Emission Factors for Traffic Sections

Year	Traffic volume per day	Emission Factor (gm/mile) for CO
2052-53	62610	3.60

Results

Dispersion model software was run by using data as discussed in previous sections. The output results at various distances along the project highway for projected year 2051-52 are presented in Table 5-3.

Table 5-3: Predicted Pollutant Concentration

Resultant CO Concentration (mg/m^3) at various distance from RoW Edge					
10m	20m	40m	60m	80m	100m
0.68	0.63	0.57	0.52	0.49	0.45

Conclusion

Considering that maximum 98th percentile CO concentration in study area was 0.67 mg/m3 and predicted maximum incremental concentration outside PRoW (nearest possible receptor) of 0.68 mg/m3, the maximum resultant CO concentration shall be in the tune of 0.68 mg/m3 in respect to 2 mg/m3 of Ambient Air Quality Standards. Hence, predicted CO concentration including ambient level shall remain within the National Ambient Air Quality Standards for the projected years 2052-53. The predicted concentration is based on Emission Level of the vehicle as present scenario. However, there is enough possibility of the advancement towards cleaner fuel and technology.

5.2.4 Water Resources

5.2.4.1 Physical Loss of Surface Water Bodies

Impact

- Alteration of the surface water regime is expected due to proposed highway construction
- Surface water bodies along the project road might be subject to adverse impacts due to the various construction activities
- Project section is crossing 3 rivers and 29 nala/ stream/Canal/drains as detailed location provided in Table 4.9.

Mitigation

- Total 7 major bridges, 10 minor bridges and 110 culverts are proposed to avoid any impact on local hydrology.
- Cross drainage structures are designed to avoid any compromise on the flow part.
- Cross-drainage structure is proposed at pond locations to limit the affected area and to maintain the catchment unaffected. Compensatory digging is proposed to maintain the storing capacity of the ponds.
- Continuous both side drain has been proposed along the proposed highway. Surface runoff shall be drained to the nearest cross drainage structure. The engineering design includes design of cross drainage structures, which should take care of the extra flow.
- Structure on the Irrigation Canals and Minors shall be designed in concurrence of Irrigation dept.
- Silt fencing during construction period will be provided between road and water bodies to avoid any siltation due to run-off from construction area

5.2.4.2 Water Required for the Project

Impact

The construction works requires a considerable quantity of potable water for the various activities including construction of the pavement, dust suppression, curing etc. The total demand of water to be used during the construction phase will be around 27091578.7 KLD. The demand though is only indicative in nature and shall differ during the period of construction. The demand shall be met through availability of supply both from surface and ground sources. However, mostly surface water shall be used for the construction work.

Mitigation

Prior approval for taking adequate quantities of water from surface and ground water sources shall be taken from respective authority before start of construction. The road operation does not make a demand on the available water resources apart from time to time requirement during works such as maintenance of roadside tree plantations. Rainwater harvesting structures all along the proposed alignment as per as per MoEF&CC guidelines and are a cost-effective method for recharging of ground water level in the project area. The rainwater-harvesting chamber shall be placed at every 1000m interval c/c (500m interval in a staggered way) with dimensions of 2 x 2 x 0.75m^3 all throughout the project corridor. A perforated RCC Slab covers the chamber. There is a 20cm filling, which also acts as sediment trap. There is another sediment trap in the bottom from where debris can be removed manually after certain period. A vertical drain (PVC pipe) is then sunk from the bottom of the chamber to a depth which varies as per the water table. Drains interconnect these chambers.

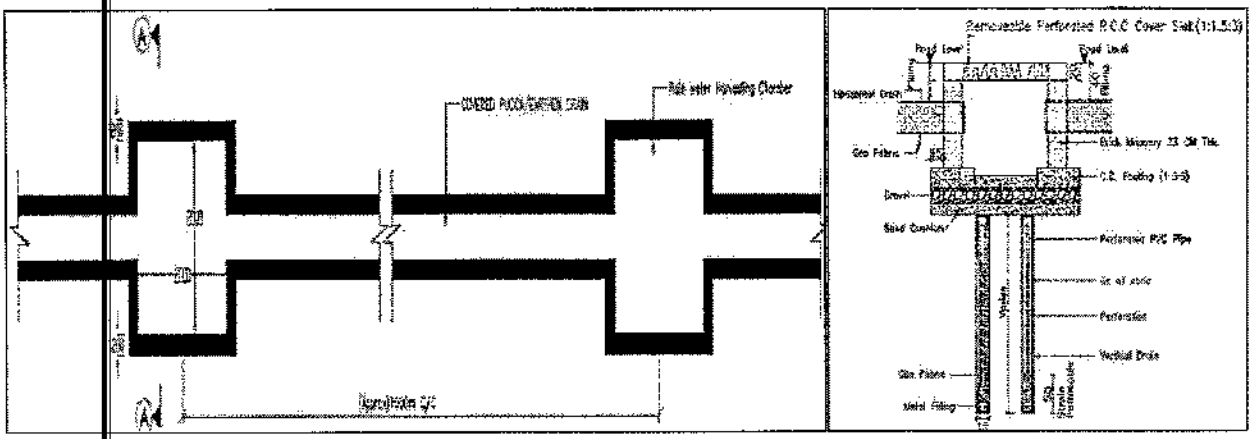


Figure 5-1: Rainwater Harvesting Structure

5.2.4.3 Loss of Drinking/Household Water Resources

Impact

The impact on the local water supply sources like hand pumps, wells and tanks is likely due to proposed development. Relocations of all these water supply sources have been recommended and the cost of the relocation shall be paid as per LARR, 2013 provisions.

Mitigation

The losses have been covered under the utility relocation process. Compensatory water supply sources will be set up before the start of construction and shall be as close as possible to the original location.

5.2.4.4 Water Quality

Impact

Due to site clearing activities, soils around the surface water regime will be exposed, due to which, the suspended sediments and the associated pollutants can be transported into these water sources. The impacts due to the increased sediment load will be significant to some extent. Contamination of groundwater is another likely impact of road construction and allied activities. The contamination of the water resources due to the project is likely from following reasons:

- Concentration of suspended solids in receiving water bodies due to soil erosion from site clearing area
- Run-off from the construction site near the water bodies and sources of water supply
- Disposal of solid and liquid wastes by labour, spills or leaks can affect the water quality
- Run-off from fuel storage and work-shop area as Oil and grease form a film on the water surface and hinder the transfer of oxygen into water
- Contamination by fuel and oil containing discharge or accidental spillage from construction vehicles or bitumen from hot-mix plants
- Sewage discharge from the labour camp

Increased sediment load, lesser sunlight, difficulty to settle, etc. will make the surface water more turbid. If the concentrations are higher, smaller fish may be harmed. Large, heavy sediment, particularly with slow moving water may smother algae and eventually alter the nature of the sub-stratum. Excessive sediment loads may also mean disruption to areas where fish lay their eggs. The water quality of surface drainage channels is likely to be impaired as long as the construction period continues.

Mitigation

The engineering design shall ensure protection of embankment slopes. Loose soil and construction material heaps around the construction sites are prone to erosion and contribute to the increased sediment load in the near-by water bodies. The major parameter of concern would be the sediment load from the spoils. The major pollutants of concern are suspended solids, oil and grease, lead and other heavy metals.

Silt fencing shall be provided along the river and ponds. Silt fencing shall be provided on either side of the crossing water body to the affected length plus 5 m on either side to control the sediment load. Locations of silt fencing as identified along the water body are presented in Table 4-9.

Silt fencing of about 1500m will be provided to prevent sediments during construction period near the water bodies. The silt fencing consists of geo textile with extremely small size supported by a wire mesh mounted on a panel made up of angle / wooden frame and post. It is expected a single person will be able to drive the angles by pressing from the top. The frame will be installed at the edge of the water body along which construction is in progress. The number of such units to be installed shall be decided depending upon the length of the water body along the side of the road construction. Guidelines for Sediment Control has been attached as Annexure 5.6.

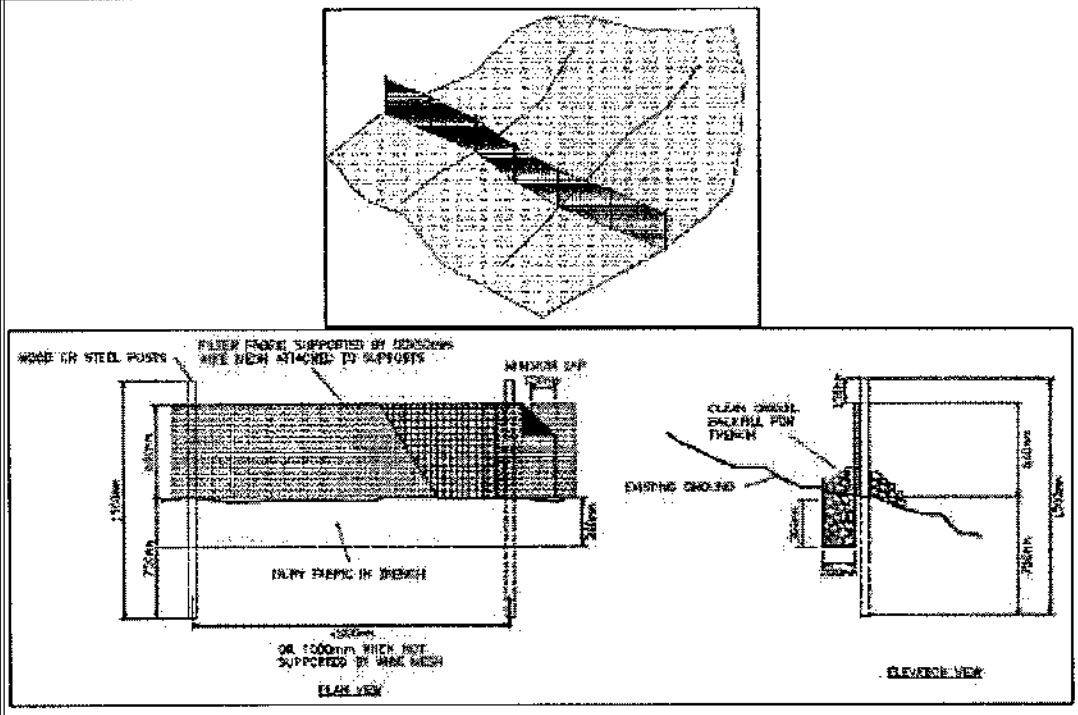


Figure 5-2: Schematic diagram of Silt Fencing

Oil interceptor: Oil and grease from road run-off is another major concern during construction as well as operation. During construction, discharge of oil and grease is most likely from workshops, oil and waste oil storage locations, and vehicle parking areas of construction camps. Waste having hazardous properties will be stored in designated area only. 8 nos. (2 nos. for each construction package site) of oil interceptors shall be provided at camp sites to arrest oil and grease, as per Figure 5-2. The arrested products shall be disposed as per MoEF&CC and SPCB guidelines. The location of fuel storage and vehicle cleaning area will be at least 500 m from the nearest drain / water body.

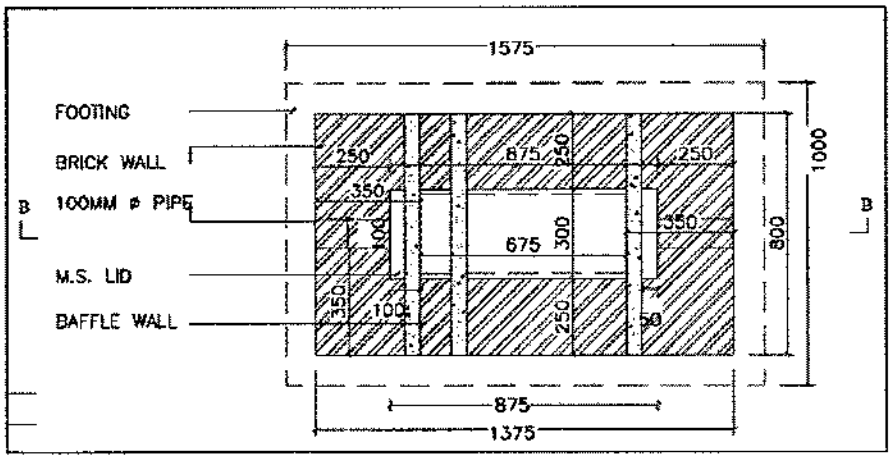


Figure 5-3: Schematic diagram of Oil Interceptor

No contamination of any water source is envisaged during the operation period. However, water

quality may be impacted due to washing of the vehicles near the water bodies, run-off from the oil spillage area due to wear and tear of vehicles, etc. Road run-off can contain oil, which may end up reaching into local water bodies.

5.2.5 Noise levels

5.2.5.1 Pre-construction and Construction Stage

Site clearing activities, movement of man and machineries, crusher & mixing plants operation, etc. are likely to increase the noise level of project region. Noise pollution is matter of concern, where alignment is passing near to settlement areas.

About 90 dB (A) of noise shall be generated from construction activity which shall attenuate to less than 55 dB(A) *i.e.* day time prescribed noise level at about 100m and less than 45 dB (A) *i.e.* night time prescribed noise level at about 300 m. Comparison of distance vs Noise level (considering two Noise source of Intensity 90 dB(A) are working in parallel) for day and night time are shown in figures below.

Figure 5-4: Day-time Construction Noise Intensity vs Distance from the Source

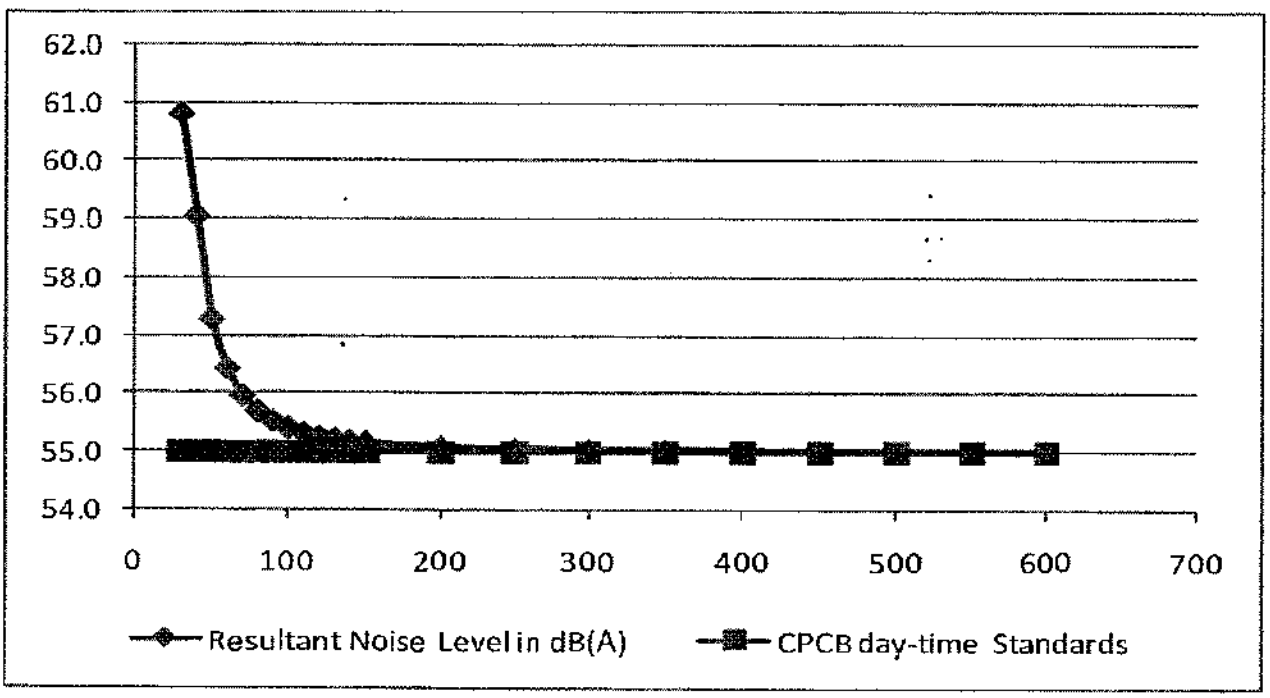
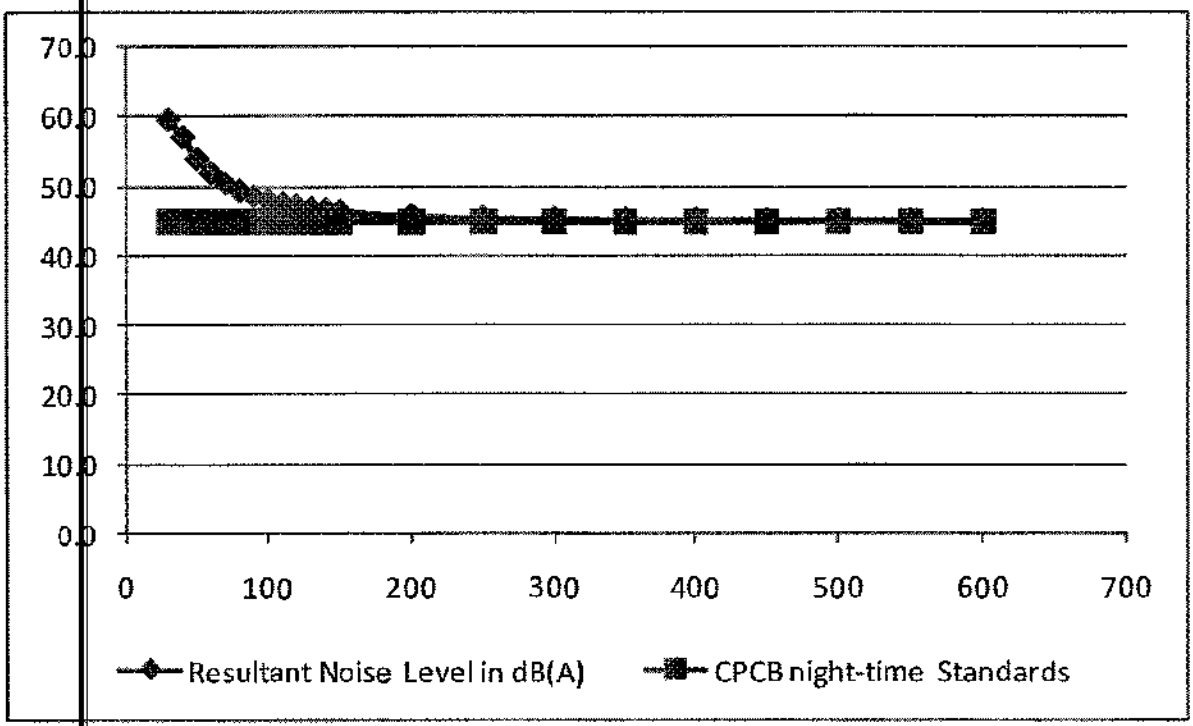


Figure 5-5: Night-time Construction Noise Intensity vs Distance from the Source



Prior mitigation measures shall be required for neutralizing the affects near settlement areas.

Mitigation Measures

Construction camp shall be established at least 1000m away from nearest habitation and forest area. Temporary noise barriers should be provided surrounding the high noise generating construction equipment during work near to settlement area. Stationary noise source like generator sets shall be provided with an acoustic shield around them. The plants, equipment and vehicle used for construction should strictly conform to CPCB standards. Vehicles and equipment should be fitted with silencer and maintained accordingly.

Noise generating activities should be scheduled based on community welfare. Noise level should regularly be monitored as per monitoring plan and if the noise level at any time found to be higher, then immediate measure to reduce noise in that area should be ensured. The following mitigation measures as given in table below need to be worked out for the noise impacts associated with the various construction activities.

Table 5-4: Summary of Mitigation Measures for Construction Stage

Source of Noise Pollution	Impacts	Generic Mitigation Measures
• Utilisation of heavy construction machinery. • Construction of structures and	Increased Noise Levels causing discomfort to residents and workers	• All construction equipment, plants, machinery, and vehicles will follow prescribed noise standards. • All construction equipment used for an 8-hour shift shall conform to a standard of less than 90

Source of Noise Pollution	Impacts	Generic Mitigation Measures
facilities. • Crushing plants, asphalt production plants; and • Loading, transportation and unloading of construction materials		dB (A). If required, machinery producing high noise as concrete mixers, generators etc. must be provided with noise shields. • At construction sites within 1000 m of human settlements, noisy construction activities shall be stopped between 9.00 PM and 6.00 AM. • Vehicles and construction machinery shall be monitored regularly with particular attention to silencers and mufflers to maintain noise levels to minimum. • Workers in the vicinity of high noise levels must wear ear plugs, helmets and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90 dB (A) per 8-hourshift. • Hot mix plant, batching or aggregate plants shall not be located within 1000 m of sensitive land use and settlements. • Project is an access control highway project and shall facilitate free flow of the traffic. Therefore, proposed development is likely to reduce the noise associated with Traffic Jam on existing roads.

5.2.5.2 Operation Stage

Impact

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. Noise is a major area of concern, especially since sensitive receptors (school, hospital, etc.) have been identified in proximity of the road.

CoRTN (Calculation of Road Traffic Noise) model developed by UK Department of Transport is used for assessment of Noise Impact Intensity at various distances from the proposed highway. Traffic Noise has been estimated for uninterrupted traffic flow condition.

Limitations: Metrological conditions and background noise level are not considered by the model.

Classification of Vehicles: In CoRTN model vehicles are classified onto two categories:

- Light vehicles
- Heavy vehicles

Approach, Methodology & Validation: The model has been validated for Indian Conditions by CSIR Central Road Research Institute and published the validation in 2008 vide paper titled

"Validation of Noise Prediction Model for an Urban Area". The present model used for the project is derived from the CSIR CRRI validated and modified model.

Input Traffic: CoRTN model software was run by using traffic forecast data of year 2052-53, which has the maximum generated traffic for assessment of worst-case scenario. The assessment of traffic along the corridor is based on the interchanges proposed along the road, as they are going to act as points where traffic will join or leave the highway. The sections based on interchanges is provided in Table 5-5.

Table 5-5: Traffic Distribution Across the Project

Start Chainage (Km)	End Chainage (Km)	Length (Km)	Projected Traffic 2052-53
0+000	120+970	120.970	62610

Result Discussion: Considering individual sections have different traffic intensity, therefore, variation in the noise level increments is observed along the proposed corridor. The increment noise level will attain to the standards of residential i.e. 55 dB(A) at 2m from the RoW edge in project stretch.

Mitigation Measures

Though the level of discomfort caused by noise is subjective, however, there is a definite increase in discomfort with an increase in noise levels. No sensitive receptor like educational, health facilities, etc. in the immediate vicinity of project highway. Therefore, no significant impact on is expected due to proposed development. Further, Contractor will undertake the consultation in nearby residential for scheduling of the construction activities.

5.3 Biological Environment

5.3.1 Protected Areas

The proposed alignment is neither passing through nor falling within 10.0 km radius of any National Park or Wildlife Sanctuary. Therefore, Wildlife Clearance is not required under Wildlife (Protection) Act, 1972. Hence, no significant impact on biodiversity of these area is expected due to proposed development.

Forest Areas

About 7.5 ha of protected forest land shall be affected due to the proposed development. Need for diversion of forest land is envisaged for this project. Hence Forest Clearance under the purview of Forest (Conservation) Act, 1980 is not applicable.

5.3.2 Impacts on Biological Environment

Development activities of a road project implies direct impacts on the biological environment in its vicinity. Road projects are linear in nature and it traverses several types of landscapes depending on the length of the project stretch. The degree of impact on biological environment thus depends on the type of the landscapes *i.e.* forest/wooded area, agricultural, urbanized, rural, wastelands & barren areas. The proposed road project is a greenfield project that will pass mainly through the agriculture fields. In this scenario and based on the observations following

impacts on the terrestrial flora, fauna and aquatic life have been envisaged in the construction and operation phases of the project.

5.3.2.1 Construction Phase

In construction phases various impacts take place on flora and fauna due to the anthropological activities like movement of machines, storing of material, living camp formation, movement of staff/workers and other group of people during project construction phase.

Felling of Trees and Habitat Destruction

At the first place, trees and vegetations area on the RoW shall be cleared for the road. About **7966 nos.** of trees are likely to be felled. The tree enumeration list shall be provided during final EIA report.

The felling of trees shall have manifold impact. 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. The removal of trees also increases the degree of soil erosion. Trees act as micro-ecosystems and habitat/shelter for birds, small mammals and insects which depend on these trees, removal of which will also affect these faunal species.

Habitat destruction and loss of trees also takes place under the demand of firewood and timber for cooking by workers. Moreover, there are chances for bush fire-accidents that may spread due to uneducated/unaware workers.

Impact on Fauna

The removal of trees will result in loss of micro-ecosystems *i.e.* habitat/shelter for birds, small mammals and insects which depend on these trees. Therefore, removal of vegetation, ultimately affects the terrestrial fauna, avifauna and insects etc. which are dependent on these habitats. The movements of the worker and sounds of the machines also scares the fauna that interfere with their routine habits.

As the study area is mainly agricultural land and devoid of any natural forest, wild animals / larger animals are not commonly seen while domesticated animals were commonly seen. No Schedule-I Avifauna species was found in the project affected area. The construction of the highway may have negligible/minimum impacts on the domesticated habitat.

Impact on Aquatic Life

Road development activity is likely to disturb the aquatic habitat depending on the extant and design of the project. A large quantity of construction material like stones, pebbles, gravel and sand are stored & used in construction phase. There are possibilities of contamination of the waterbodies like ponds, canals etc. due to spillage of the construction material. This sediment loading & increased turbidity shall result in decline in the number and diversity of aquatic flora and fauna.

5.3.2.2 Operation Phase

Roads are considered as the major cause of the pollution due to the vehicular movement. This affects the biotic components in the surrounding. The noise caused by the vehicular movements shall disturb and frighten the fauna & their habitats.

Moreover, road kills & accidents are also a common phenomenon where the domesticated and wild fauna get injured or killed while crossing the roads. Roads also isolate the habitats, and act as barrier in the corridors/migratory routes.

5.3.3 Mitigation Measures

5.3.3.1 Construction Phase

State Forest and Wildlife department has been contacted and informed about the proposed project. The proposed project is neither passing through nor falling within 10.0 km radius of the any eco-sensitive/protected areas notified under Wildlife Protection Act. 1972.

Following Measures will also be taken carefully during the construction phase;

- Clearing of the proposed RoW and propagation of the road structure will be carried carefully to cause least possible disturbance to the soil, water and air environment. Disposal of construction wastes shall be done in approved wastelands besides recycling & reuse of certain materials as per the approval obtained from SPCB.
- Labour camps shall be setup only after obtaining proper permissions from the Engineer and alternate fuel shall be provided to the labourers in the labour camps to ensure that no firewood will be used for cooking etc. The camps shall have proper toilets with sanitary disposal of wastes. Smoking, hunting & fishing in the wild are prohibited and the contractor shall conduct regular awareness trainings related to non-use of firewood, prohibition on smoking in natural areas, bush fires accidents, safe handling of animals (if encountered), prohibition of fishing etc.
- No labour camps shall be permitted in the vicinity of any water body in order to avoid the deterioration of water quality and any human induced impact on aquatic life nor shall workers be permitted to use waterbodies for bathing and washing. Silt fencing has also been proposed to ensure that siltation and hence turbidity doesn't increase.
- The Contractor shall regularly service the construction vehicles & machinery and maintain these in good condition to avoid high level noise. The construction activities shall not be permitted after 8 PM in normal circumstances. In case of exigencies permissions for the same shall be accorded by the Project Director & the TL of the Authority Engineer. Moreover, all EMP provisions made for the air, water, noise pollution control will be implemented, and thus will be also helpful to control the negative impacts on the flora and fauna.
- The loss of trees and ecosystem shall have to be compensated through compensatory plantations in accordance with the principles of the Forest (Conservation) Act, 1980 and Indian Forest Policy. Compensatory plantation/afforestation shall be undertaken for each tree to be felled as per forest department's directive. Such compensation shall be done with

native species and proper care of the saplings will be taken to ensure survival. Plantation along the proposed highway shall act as a new habitat for avifauna, lesser mammals & insects.

- The avenue and median plantation shall also be undertaken as per SP-21:2009. Adequate provisions for the maintenance & monitoring of the same must be worked out. Co-operation of locals to ensure that local cattle does not damage the saplings during the early stages of growth will be required. Tree Plantation strategy has been attached as Annexure 5.7. List of local native floral species are recommended for taking up afforestation has been presented in table below. Local forest authority and populace may also be consulted by the Contractor for selection of species types.

Table 5-6: Species Recommended

Scientific name	Common Name	Reason
Azadirachtaindica	Neem	Noise barrier, Pollution sink, Economic & Medicinal Value
Butea monosperma	Dhak	Aesthetic value, Pollution sink
Cassia fistula	Indian laburnum	Landscaping, Flowering plant, Pollution sink
Dalbergia sissoo	Sheesham	Economic Value, Pollution Sink
Ficusbengalensis	Banyan	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Ficus religiosa	Peepal	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Magniferaindica	Mango	Noise barrier, Pollution sink, Economic Value (fruit bearing), Shade
Morus alba	Shahtut	economic value, shade
Millettiapinnata	Karanj	Economic Value
Syzygiumcumini	Jamun	Pollution sink, Economic Value (fruit bearing)
Tamarindusindica	Imli	Noise barrier, Pollution sink, Economic & Medicinal Value
Terminalia arjuna	Arjun	Noise barrier, Pollution sink

5.3.3.2 Operational phase

The provisions for the mitigation measures as described in the EMP shall be complied. The compensatory plantation work will replenish the loss of greenery. This will also recreate the habitat for the small animals and avifauna. Therefore, the plantation/compensatory afforestation along the proposed highway and other areas shall act as new habitat for these faunal species and after a period of time the negative impact due to the road construction shall be mitigated with more aesthetic advantages.

There will be proper embankment with crash barriers & other barricades to stop the wild & domesticated animals to enter or cross the road. Project is an access-controlled highway. Therefore, entry and exit at the highway shall only be allowed through interchanges. Also, the project doesn't pass through any Reserve Forest area. VUP/LVUP shall be provided &

maintained for crossings of domesticated animals. Therefore, no roadkill is likely due to the proposed improvement. Roadkill data of the proposed highway shall be recorded during operation stage of the project. Format for reporting of Roadkill is provided in Annexure 5.10.

5.4 Social Environment

5.4.1 Land Acquisition & Extent of Loss to Properties

The Land required for construction of proposed highway is about 824.285 ha.

5.4.2 Project Affected Families

About 3517 nos. of Titleholders are likely to be affected due to proposed development. Compensation shall be provided as per LARR Act, 2013. Details of mitigation measures are provided in SIA & RAP report being submitted separately with this EIA report.

5.4.3 Public Amenities

All public utilities like electricity lines, telephone lines or electric transformer which are likely to be impacted shall be replaced before the start of work. The poles will be shifted after taking approval from the concerned department.

5.4.4 Cultural and Community Properties

There is no impact on cultural and community properties due to development of the proposed project.

5.4.5 Land use Change

Considering the access-controlled status, ribbon development near the proposed highway is having very less possibility. However, interchanges locations are likely to induce ribbon development. The availability of labour and easy access to markets in the city will make roadside areas quite an incentive for the industrialist and investors of their sectoral development. Reduced transportation costs and availability of high-class transportation facilities for raw materials and products will be the most important advantage of the proposed highway.

5.4.6 Exploitation of Resources

Improvement in the connectivity will have an impact on the natural resources. Easy accessibility of the area will increase the migration and population of the region. This means more and more use of the natural resources like ground water and energy needs like fuel, etc. While the medium-term impacts may not be large enough to be noticed, the long-term implications are potentially noticeable. Separate labour camp away from habitation shall be constructed. All day-to-day need shall be procured from nearby city markets. No fuelwood shall be permitted for the cooking and other purpose.

5.4.7 Traffic congestion during construction

Traffic congestion due to construction activities is common phenomena for any developmental activities. Safe and convenient passage for public vehicles, pedestrians and livestock to and from crossing roads and property access connecting the project highway is the mostly required. The construction activities that shall affect the use of crossing roads and existing access to individual properties shall not be undertaken without providing adequate provisions.

Detailed Traffic Control Plans will be prepared prior to commencement of works on any section of the project highway. These plans shall be approved by the consultant and employer prior to execution. The traffic control plans will contain details of temporary diversions details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day.

Temporary diversion will be constructed with the approval of the Monitoring consultant before undertaking the construction activities at any existing roads. Special consideration will be given in the preparation of the traffic control plan to the safety of pedestrians and workers at night. The road safety measured to be adopted during construction for traffic control and safety during construction are provided under Annexure 5.8.

5.4.8 Working conditions

Contractor is required to comply with all the precautions as required for the safety of the workmen as per the International Labour Organization (ILO) Convention No.62 as far as those are applicable to this contract. Contractor supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. Contractor shall comply with all regulation regarding sage scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.

5.4.9 Risk from Electrical Equipment

Adequate precautions will be taken to prevent danger from electrical equipment. No material or any of the sites will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public.

5.4.10 Risk at Hazardous Activity

All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc, will be provided with protective footwear and protective goggles. Workers, who are engaged in welding works, would be provided with welder's protective eye-shields. The use of any toxic chemical, if any will be strictly in accordance with the manufacturer's instructions. The Monitoring consultant will be given at least 6 working days' notice of the proposed use of any toxic chemical.

5.4.11 Malarial Risk

Gravid, blood-laden mosquitoes cannot fly very far, so they generally bite within a kilometer or so of their breeding place. Pits dug up nearby settlement will be adequately drained to prevent water logging. Proper preventive measures are to be taken as per the malaria prevention guidelines adopted in the State Govt. Suitable direction of the medical authorities will also be taken. The people in the camps should also be informed and educated on the prevention of malaria.

5.4.12 First Aid

At every workplace, a readily available first aid and unit including an adequate supply of sterilized dressing material and appliances will be provided as per the Factory and Safety Rules.

5.4.13 Potable Water

In every workplace, at suitable and easily accessible places, potable water (as per IS) supply will be provided. If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided.

5.4.14 Construction Camp

Contractor during the progress of work will provide, erect and maintain necessary living accommodation and ancillary facilities for labour to standards and scales approved by monitoring consultant. All temporary accommodation shall be constructed and maintained in such a fashion that quality water is available for drinking and other domestic purpose. The sewage system for the camp shall be properly designed, built and operated so that no water related health hazard occurs and no pollution to the air, ground or adjacent watercourses take place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins shall be provided in the camp and regularly emptied and the garbage disposed-off in hygienic manner. Guidelines for Sitting and Layout of Construction Camp have been presented in Annexure 5.9.

5.4.15 Safety

Project would be the access controlled and no entry shall be provided to the highway except interchange locations. Further, smooth geometry of the project will be helpful in reduction of accident probability.

5.5 Conclusion

Based on the analysis of environmental impacts in the above sections, it can be concluded that the project is anticipated to cause the following environmental impacts:

- About 824.285 ha of land required for the development of proposed highway.
- Project shall affect livelihood of about 3517 title holders carrying out agricultural activities in project PRoW.
- About 7966 nos. of trees are likely to be felled. Compensatory plantation shall be undertaken in 1:10 ratio for each tree to be felled.
- Avenue plantation on both side of the highway is proposed as per Green Highway Policy 2015 and IRC Guidelines.
- About 7.5 ha. of protected forest land diversion shall be involved.

6 ENVIRONMENTAL MONITORING PROGRAMME

6.1 General

The environmental monitoring programme is devised to ensure that the envisaged purpose of the environment management plan is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP;
- To suggest improvements in the management plans, if required;
- To satisfy the statutory and community obligations; and,
- To provide feedback on adequacy of Environmental Impact Assessment

6.2 Monitoring Indicators

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Physical, biological and environmental management components, identified as of significance in affecting the environment at critical locations have been suggested as Performance Indicators. The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures to control air, noise, water and soil pollution
- Environmental management indicators to determine compliance with the suggested environmental management measures
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed

For each of the environmental condition indicator, the monitoring plan specifies the parameters to be monitored, location of the monitoring sites, frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities.

The Environmental Monitoring Programme has been detailed out in Annexure 9.2 along with stipulated standards for Air, Water and Noise, etc. level. Successful implementation of the Environmental Monitoring Programme is contingent on the following:

- The Monitoring Consultant / Authority Engineer or equivalent consultant to request the Concessionaire / Contractor to commence all the initial tests for monitoring of air, water quality, soil and noise levels within 3 months of receiving Appointed date (unless the period within 3 months is monsoon season, in which case, it shall be after monsoon season) to establish the 'baseline' i.e. to assess the existing conditions prior to effects from the Construction activities being felt
- The Monitoring Consultant / Authority Engineer or equivalent consultant to request the Concessionaire / Contractor to submit for approval a proposed schedule of subsequent

periodic tests to be carried out

- Monitoring by the Monitoring Consultant / Authority Engineer or equivalent consultant of all the environmental monitoring tests, and subsequent analysis of results
- Where indicated by testing results, and any other relevant on-site conditions, Monitoring Consultant /Authority Engineer or equivalent consultant to instruct the Concessionaire / Contractor to:
- Modify the testing schedule (dates, frequency)
- Modify (add to or delete) testing locations
- Verify testing results with additional testing as/if required
- Require recalibration of equipment, etc., as necessary
- Request the Concessionaire / Contractor to stop, modify or defer specific construction equipment, processes, etc., as necessary, that are deemed to have contributed significantly to monitoring readings in excess of permissible environmentally "safe" levels.

6.3 Monitoring of Earthworks Activities

Earthworks activities like quarries and borrow areas may cause some environment issues. Details regarding the guidelines and procedures adopted to minimize the environmental impacts of opening, operating and closing of Quarries and Borrow Areas are presented in **Annexure 5.1, 5.2, 5.3, 5.4, 5.5 & 5.6.** Contractor / concessionaire shall ensure that measures proposed in these procedures are being followed in addition to law of lands. Other environmental effects associated with the earthworks include the development of adequate temporary drainage to minimize detrimental effects (e.g. erosion) due to run-off, and safety aspects related to Works implementation.

6.4 Monitoring of Concessionaire / Contractor's Facilities, Plant and Equipment

All issues related to negative environmental impacts of the Concessionaire / Contractor's facilities

- Plant and equipment are to be controlled through the Concessionaire / Contractor's self-imposed quality assurance plan
- Regular / periodic inspection of the Concessionaire / Contractor's plant and equipment
- Monthly appraisal of the Concessionaire / Contractor

Other environmental impacts are to be regularly identified and noted on the monthly appraisal inspection made to review all aspects of the Concessionaire / Contractor's operation. The Monitoring Consultant / Authority Engineer or equivalent consultant is to review all monthly appraisal reports and instruct to the Concessionaire / Contractor to rectify all significant negative environmental impacts.

7 ADDITIONAL STUDIES

7.1 General

As per the conditions of the Standard Terms of Reference for the preparation of the EIA/EMP Report, several studies were to be conducted to provide a clear picture of the project area. The additional studies conducted in this project are as below:

- Disaster Management and Risk Assessment
- Social Impact Assessment
- Public Consultation

7.1 Public Consultation

7.1.1 General

As a part of the project preparation and to ensure that the community support is obtained, and the project supports the felt needs of the people; public consultations were undertaken as an integral component for input to the project development. The information gathered in the consultation process has led to substantial inputs for the project preparation including, influencing designs. Consultations involve soliciting people's views on proposed actions and engaging them in a dialogue. It is a two-way information flow, from project authorities to people and, from people to project authorities. While decision making authority would be retained by the project authority, interaction with people and eliciting feedback allows affected populations to influence the decision-making process by raising issues that should be considered in designing, mitigation, monitoring and management plans and the analysis of alternatives.

Major purpose of the public consultation on environmental issues in the EIA study is to appraise the stakeholders on potential environmental impacts and collect their feedback so that adequate safeguards can be considered during the planning phases. The objectives of consultation sessions, the procedure adopted, and the outputs of the consultation conducted have been described in the following sub-sections.

7.1.2 Objectives

The main objective of the consultation process is to minimize negative impacts of the project and to maximize the benefits from the project to the local populace. The objectives of public consultation as part of this project are:

- To obtain the information on baseline scenario;
- Promote public awareness and improve understanding of the potential impacts of proposed projects;
- Solicit the views of affected communities / individuals on environmental and social aspects;
- Improve environmental and social soundness;
- Identify contentious local issues which might jeopardize the implementation of the project;

- Establish transparent procedures for carrying out proposed works;
- Inform the affected populace about the entitlement framework and to settle problems with mutual consent; and
- Create accountability and sense of local ownership during project implementation.

7.1.3 Type of Stakeholders

For the project, following major groups of stakeholders were identified for consultations at screening stage:

- **Primary Stakeholders** are local people including project affected people, local residents, shopkeepers, farmers, etc.; and
- **Institutional Stakeholders** such as concerned Govt. departments etc. and local authorities

The stakeholder consultation adopted was rapid appraisal methodology which included community meetings and in-depth interviews institutional stakeholders.

Consultations was undertaken using various tools including, interviews with government officials, dialogues were set-up with the community through structured questionnaire on general environment & social aspects related questions. The public consultation carried out at the various stages of the study has been summarized in this section.

7.1.4 Methodology

Project affected villages were selected for conducting public consultation. Affected communities and potential stakeholders such as local residents, panchayat members, etc. were invited to attend the meeting. Effort was made to make the gathering representative of the local population directly or indirectly affected by the potential impacts. During the meetings, no person was prevented from entering and /or leaving the meeting as he / she desired.

Discussions, Questions and Answers: During consultation meeting, the participants were explained the proposed project and potential environmental impacts due to the proposed highway. Thereafter, a session for question and answer was kept facilitating interaction with the stakeholders, exchange of information & direct communication and collect their opinion on the environmental issues. The issues broadly covered in questionnaire included the following topics

- Disturbance due to present traffic scenario with respect to environmental pollution and road safety
- Anticipation of disturbance due to the proposed green field highway with respect to environmental pollution and road safety
- Expectation on road safety measures in the improvement proposal
- Accidents and conflicts involving wildlife, if any
- Preference of avenue trees, if any
- Forest, Wildlife and environmental sensitive area.
- Historical and Archaeological sites
- Flora & fauna of the area

7.1.5 Consultations with Institutional Stakeholders

Several institutional level consultations were held with officials of State Govt. Departments and their inputs have been incorporated in the Reports.

7.1.6 Consultations with Community / Primary Stakeholders

Consultations were held with the affected population and community residing in near the vicinity of project. Probable Management plan to avoid or minimize the negative impacts were also discussed during consultation.

7.1.7 Outcome of the Consultation

Major findings related to key issues such as general perception about the project; suggestions to mitigate hardships resulting from dislocation and loss of livelihood are presented below:

- It was observed that people were not only aware of the project but also welcomed the project in general.
- People suggested for service road along the side of proposed highway
- Affected people demanded for vehicular underpass for day to day activities
- People requested for acquisition of complete khasra rather than partial acquisition
- People requested for provision for quality drinking and irrigation facilities
- Air & Noise pollution was not a big concern. However, dust pollution in dry season and noise due to traffic movement sometime disturbs immediate roadside dwellers.
- The potential PAPs in general were very much concerned about the mode and amount of compensation
- People suggested that adequate safety measures should be provided. In brief, it was felt during consultation that regular meeting with the local population / community could easily resolve any dispute between the community people and implementing agency settlements.
- Green Belt development along the highway
- Site specific EMP has been designed to address environmental and social related issues

7.2 Public Hearing

7.2.1 Purpose of Public Hearing

Public consultation is an integral part of the project and required to conduct prior to Environmental Clearance. Public consultation is the process by which the concerns of local affected persons and others who have reasonable stake in the environmental impacts of the project or activity are ascertained. The proposed project falls under Category 'A' and Public Hearing was organized as per the provisions of EIA Notification 14th September, 2006 & its subsequent amendments. The project proponent shall be submitted the draft EIA report along with executive summary in local & national language to State Pollution Control Board for its wide circulation. Public hearing shall be conducted in project districts as per provisions of EIA Notification, 2006 (amended thereof).

7.3 Disaster Management and Risk Assessment& Mitigation Procedures

Risk assessment is a process that seeks to estimate the likelihood of occurrence of adverse effects as a result of major road mishaps, gas tanker explosions, fire hazards, floods, cyclones, earthquakes etc. at Highway projects. Fatality rate on Indian highways is very high mainly due to road accidents. The other adverse impacts due to gas tanker explosions, fire hazards, floods, cyclones, earthquakes etc. are nominal. Elimination of the risk (avoidance of accidents) is given prime importance.

Contractor shall conduct Risk Assessment for all works to decide on priorities and to set objectives for eliminating hazards and reducing risks.

7.3.1 The Risk Assessment Process and Hazard Identification

A critical observation/study of the structure/process/site under consideration by the risk assessment team is an essential part of hazard identification as is consultation with the relevant section of the workforce. It is important that unsafe conditions are not confused with hazards, during hazard identification.

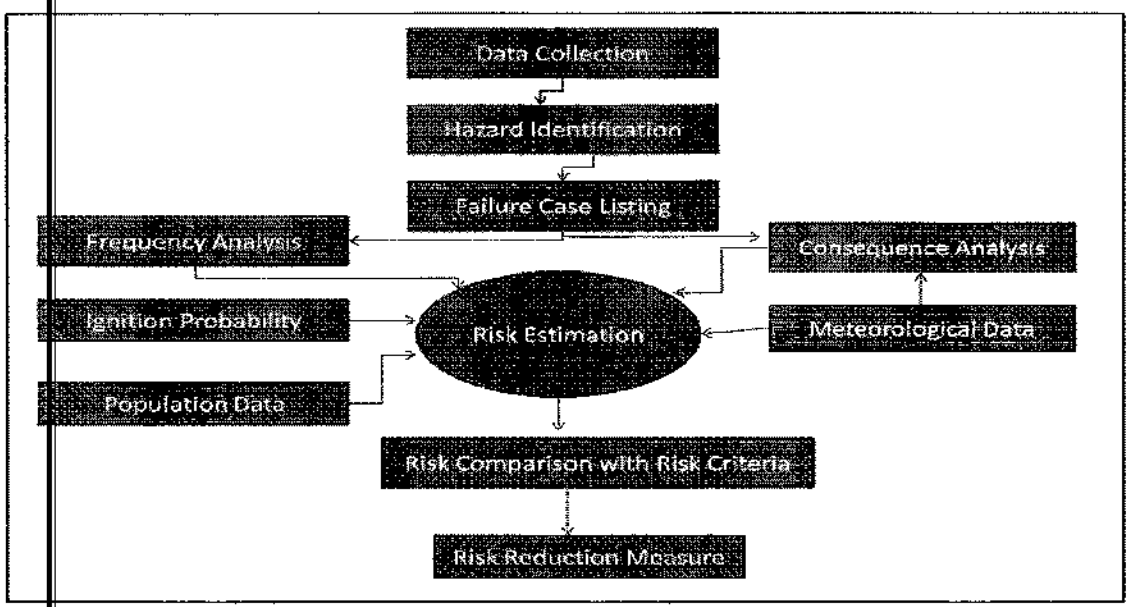


Figure 7-1: Risk Assessment Process

7.3.2 Person(s) at Risk

On a construction area, the persons at risk could be site operatives, supervisors, transport drivers, other visitors and the general public. The risk assessment must include any additional controls required due to vulnerability of any of these groups, perhaps caused by inexperience or disability.

7.3.3 Risk Control Measures and Hierarchy of Risk Control

The next stage in the risk assessment is the control of the risk. When assessing the adequacy of existing controls or introducing new controls, a hierarchy of risk controls should be

considered. The principles are:

- Avoiding risks.
- Evaluating the risks which cannot be avoided.
- Combating the risks at source.

Adapting the work to the individual, especially as regards the design of the workplace, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work rate and to reducing their effects on health.

7.3.4 Emergency Response Plan

Concessionaire / Contractor will prepare Emergency Response Plans for all work sites as a part of the Safety procedures. The plan shall integrate the emergency response plans of the contractor and all other sub-contractors. Each Emergency Response Plan shall detail the procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the site. This includes where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue. Emergency plans and Fire Evacuation plans shall be prepared and issued. Mock drills shall be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the telephone number of the local fire brigade should be prominently displayed near each telephone on site. The Emergency Response Plan is prepared to deal with emergencies arising out of:

7.3.5 Fire and Explosion

Fire Safety Procedures will be developed and shall be integrated into Emergency Response Plan.

7.3.6 Road Accident

In case of Road Accident, the emergency contact no of will be displayed at the roadside.

Table 7-1: Emergency Contact Number

Help Line No	Description
100	Police
101	Fire
102	Ambulance
103	Traffic Police
1033	Emergency Relief Centre on National Highways
104	State level helpline for Health
104	Hospital On Wheels
1066	Anti-poison
1070	Central Relief Commissioner for Natural Calamities
1070	Relief Commissioners of Central/State/Union territory
1073	Road Accident
1073	Traffic Help Line
1077	Control room of District Collector/Magistrate

Help Line No	Description
108	Disaster management
1090	Anti-terror Helpline/Alert All India
1091	Women in Distress
1092	Earth-quake Help line service
1096	Natural disaster control room
1099	Central Accident and Trauma Services
1099	Catastrophe & Trauma service
112	General emergency Department of Telecommunications (DoT)
112	All in one Emergency Number
1910	Blood bank Information
1911	Dial a doctor
1913	Tourist Office (Govt. of India)

Source:http://www.newincept.com/helpline-numbers-all-over-in-india.html

7.3.7 Operation Control Procedure for Traffic Management

Hazards Due to External Traffic Are as Follows

- Construction workers hit by external vehicles while working.
- Injury to Pedestrians:
- Due to fall of the cutting hill material
- Hit by construction equipment / vehicle.
- As they use carriageway due to blockage / absence of footpath.
- Collision due to improper traffic management.
- Between external vehicle and construction equipment / vehicle.
- Between external vehicles.
- External vehicle with other stationery objects in the side of the road

Objectives

- Warn the road user clearly and sufficiently in advance.
- Provide safe and clearly marked lanes for guiding users.
- Provide safe and clearly marked buffer and work zones.
- Provide adequate measures that control driver behavior through construction zones

7.3.8 Traffic Control Plan

This plan gives the detailed guideline for traffic management in most of the common situations at our Projects. Traffic Control Plan for a specific road sections should be prepared based on this general guideline and applying the following variables, which may vary from project to project. Thevariables are:

- Average Vehicular Traffic Density in peak and non-peak hours.
- Maximum width of lane required for construction during various activities.
- Number and types of junctions in the road.
- Availability of standard footpath and its location and dimensions.
- Change in the lane width if any and its location.

- Regulatory and advisory speed limits etc.

The following traffic control devices used to regulate the traffic in Road Construction Zones include,

1. Road Signs
2. Delineators
3. Barricades
4. Cones
5. Pavement markings

For the uninterrupted flow of traffic and avoid accident, the flagmen should be posted. The flagman should be authorized personnel at least average intelligence, be mentally alert and good in physical condition be selected, since flagmen are responsible for public and workmen safety. The flagmen should be equipped with yellow helmet with green reflective sticker fixed around and reflective jacket along with hand signalling devices such as flags and sign paddles. The typical specification are given below,

- Flagmen need to maintain the flow of traffic continuous past a work zone at relatively reduced speeds by suitably regulating the traffic. He shall stop the traffic for a short while whenever required (e.g. for entry and exit of construction equipment in to work zone).
- Flagman should be positioned in a place where he is clearly visible to approaching traffic and at a sufficient distance to enable the drivers to respond for his flagging instructions. A flagman never leaves his post until properly relieved,
- The standard distance shall be maintained at 60 – 100 m but can be altered depending upon the approach speed and site conditions. In urban areas this distance shall be taken as 20 m to 50 m.

7.3.9 Traffic Management Practices

Definitions: Road traffic control involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public.

Working zone: The Plant Site, construction zone of road etc. at which workmen will be working.

Working space: The space around the works area that will require storing tools, excavated material and other equipment. It is also the space to allow workmen, movement and operation of plant, (e.g. swing of jibs, excavator arms) to move around to do the job. Materials and equipment must not be placed in the zone either. Workmen will only need to enter the zone to maintain cones and another road sign.

Safety zone: The zone that is provided to protect workmen from the traffic and to protect from them.

Approach Transition zone: This will vary with the speed limit and the width of the works as given in (diag: Traffic Control zone)

Longitudinal buffer zone: This is the length between the end of the lead-in taper of cones (T) and the working space. It will vary with the speed limit as given in table (Traffic Control zone).

Lateral buffer zone: This is the width between the working space and moving traffic. It will vary with the speed as given in table (Traffic Control zone). The lateral buffer zone safety clearance is measured from the outside edge of the working space to the bottom of conical sections of the cones on the side nearest to the traffic.

7.3.10 Road and Construction Safety

To achieve these objectives, Indian Road Congress (IRC) codes will be followed in proposing and designing road safety features. Pavement markings will be done for traffic lane line, edge lines and hatching. The marking will be with hot applied thermoplastic materials. The pavement markings will be reinforced with raised RR pavement markers and will be provided for median and shoulders edge longitudinal lines and hatch markings.

During the construction stage, the general safety rules and regulations to be followed are as below:

- No drugs, alcohol or alcoholic beverages are permitted on work site.
- All connection for electricity, water supply and other temporary facilities made by authorized persons only and shall be in accordance with legal and contractual requirements.
- Work shall only be carried out if an authorized person has ordered it.

General Safety Hints to the Workers

- Wear protective clothing or apparel where required to do so.
- Must wear other safety gear where required / indicated.
- Keep work site and work areas tidy.
- Maintain personal hygiene e.g. washing hands before meals.
- Report an unsafe condition to your supervisor and stop unsafe actions immediately.
- Think before you act.
- Don't horseplay or distract others.
- Don't take shortcuts, your safety and that of others is more important.
- Obey all safety rules and signs.

Details of Public Hearing if Applicable

7.4 Disaster Management Manual

Primarily disasters are triggered by natural hazards or human-induced or result from a combination of both. In particular, human-induced factors can greatly aggravate the adverse impacts of a natural disaster. Even at a larger scale, globally, the UN Inter-Governmental Panel on Climate Change (IPCC) has shown that human-induced climate change has significantly increased both the frequency and intensity of extreme weather events. While heavy rains, cyclones, or earthquakes are all natural, the impacts may, and are usually, worsened by many factors related to human activity. The extensive industrialization and urbanization increase both the probability of human-induced disasters, and the extent of potential damage to life and property from both natural and human-induced disasters. The human society is also vulnerable to Chemical, Biological, Radiological, and Nuclear (CBRN) disasters.

7.4.1 Natural Hazards

The widely accepted classification system used by the Disaster Information Management System of DesInventar classified disasters arising from natural hazards into five major categories (DesInventar, 2016).

- **Geophysical:** Geological process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Hydro-meteorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize; although they are triggered by undersea earthquakes, and other geological events, they are essentially an oceanic process that is manifested as a coastal water-related hazard.
- **Hydrological:** Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up
- **Meteorological:** Events caused by short-lived/small to meso-scale atmospheric processes (in the spectrum from minutes to days)
- **Climatological:** Events caused by long-lived meso- to macro-scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)
- **Biological:** Process or phenomenon of organic origin or conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

A brief description of these five major categories of the disasters arising from natural factors with the sub-categories is given in Table 7-2. The below classification is not a water tight one. In real life situations, many disasters are a combination of different types of disasters. In addition, secondary disasters may occur after a disaster has occurred.

Table 7-2: Categories of Natural Hazards

Sl. No.	Family	Main Event	Short Description/ Secondary Disaster
1	Geophysical	Earthquake/Mass movement of earth materials	• Landslide following earthquake; • Urban fires triggered by earthquakes; • Liquefaction - the transformation of (partially) water-saturated soil from a solid state to a liquid state caused by an earthquake; • Mass movement of earth materials, usually down slopes; • Surface displacement of earthen materials due to ground shaking triggered by earthquakes.
2	Hydrological	Flood, Landslides and Wave Action	• **Flood Hydrological-** A general term for the overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher-than normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash floods)

Sl. No.	Family	Main Event	Short Description/ Secondary Disaster
3	Meteorological	Hazard caused by short- lived, micro- to meso-scale extreme weather and atmospheric conditions that may last for minutes to days	• Cyclone, Storm Surge, Convective Storm, Extratropical Storm, Wind Lightning, Heavy Rain
4	Climatological	Unusual, extreme weather conditions related to long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal (long-term) climate variability	• Extreme hot/cold conditions • Subsidence
5	Biological	Exposure to germs and toxic substances	• Epidemics: viral, bacterial, parasitic, fungal, or prion infections • Insect infestations

7.4.2 Human-Induced Disasters

The NPDM (2009) notes that rise in population, rapid urbanization and industrialization, development within high-risk zones, environmental degradation, and climate change aggravates the vulnerabilities to various kinds of disasters. Due to inadequate disaster preparedness, communities, and animals are at increased risk from many kinds of human-induced hazards arising from accidents (industrial, road, air, rail, on river or sea, building collapse, fires, mine flooding, oil spills, etc.). Chemical, Biological, Radiological, and Nuclear (CBRN) hazards rank very high in among the human-induced risks. Terrorist activities and secondary incidents add to these risks and call for adequate preparedness and planning.

7.4.3 Levels of Disasters

The disaster management and its planning at various tiers must take into account the vulnerability of disaster-affected area, and the capacity of the authorities to deal with the situation. Using this approach, the High-Power Committee on Disaster Management, in its report of 2001, categorized disaster situations into three 'levels': L1, L2, and L3. The period of normalcy, L0, should be utilized for disaster risk reduction.

- **Level-L1:** The level of disaster that can be managed within the capabilities and resources at the district level. However, the state authorities will remain in readiness to provide assistance if needed.

- **Level-L2:** This signifies the disaster situations that require assistance and active mobilization of resources at the state level and deployment of state level agencies for disaster management. The central agencies must remain vigilant for immediate deployment if required by the state.
- **Level-L3:** This corresponds to a nearly catastrophic situation or a very large-scale disaster that overwhelms the State and District authorities.

The categorization of disaster situations into levels L0 to L3 finds no mention in DM Act 2005. Further, the DM Act does not have any provision for notifying any disaster as a national calamity or a national disaster.

7.4.4 Project Specific Provisions for Disaster Management Plan/provisions

7.4.4.1 Nodal Operation Control Rooms

Nodal Control Canters should be equipped with the latest Communication facilities and will be manned 24 x 7 during the Construction and Operations Phase. During the Construction Phase, these rooms will be manned by the Contractor's personnel along with the Supervisory staff of the Disaster Management Cell. These Nodal Operation Control Rooms will maintain effective communication at all times with the various agencies listed in Disaster Management Plan viz.

- Police Commissionerate
- Traffic Police
- Municipal Corporation
- Home Guards and Civil Defense
- District Collectorates (City & Suburban)
- Indian Meteorological Department (Regional Office)
- Railways (Central & Western)
- Fire Brigade
- Telecom Service Providers
- Hospitals
- Radio & TV Centre

7.4.4.2 Standard Operating Procedures during Road Construction

Standard Operating Procedures (SOPs) as stipulated in MORT&H Specifications – Revision 5, a document which is largely used in India for construction of Highways, shall be used during the Construction Phase. These also include precautions to be taken for safeguarding the environment. A summary of provisions is given in Table 7-3.

Table 7-3: SOP Requirement

Sl. No.	Description	Reference Clause No. of MORT&H Specification
1	Borrow Pits for Embankment Construction	111.2
2	Quarry Operations	111.3
3	Control of Soil Erosion, Sedimentation & Water Pollution	111.4

Sl. No.	Description	Reference Clause No. of MORT&H Specification
4	Pollution from Plants and Batching Plants	111.5
5	Substances hazardous to health	111.6
6	Use of Nuclear Gauges	111.7
7	Environment Protection	111.8
8	Occupational Health and Safety of the Workforce	111.9
9	Control & Disposal of Waste	111.10
10	Transport of hazardous materials	111.11
11	Emergency Response	111.12

It is expected that the Contractor will prepare an exhaustive project specific Health & Safety Management Plan before commencement of Construction activities and implement the same rigorously.

7.4.5 Mitigation Measures Undertaken

Relief measures shall be taken with co-ordination of all Departments.

Table 7-4: Role and Action Plan of Various Departments

Sl. No.	Department	Disaster Specific Action Plan
1.	Disaster Management & Relief (DM&R)	• Ensure coordinated movement of all departments, officials and agencies for combating the disaster • Issue necessary directions and ensure effective and coordinated response of all departments. • Arrange regular meetings for updating the apex body on a daily basis. • Provide inputs to concerned departments for effective implementation of the rehabilitation plans. • Document the experiences and best practices.
2.	Animal Husbandry	• Prepare contingency plan • Constitute veterinary mobile teams with required resources like medicines, doctors, subordinate staff, laboratories, protective gears, antibiotics, vaccines and antitoxins, etc. in abundance. • Constitute technical groups at state, zone and district levels. • Identification of affected areas. • Safe disposal of dead carcasses. • Focused attention to veterinary health. • Mass vaccination programme of animals in affected areas Make arrangements for rescue and evacuation of stranded livestock. • Pool in sufficient doctors for treatment of sick animals/ poultry. • Control spread of animal disease. • Carry out epidemiological surveillance to evade biological disasters.

Sl. No.	Department	Disaster Specific Action Plan
		• Promote awareness through IEC activities.
3.	Public Health Engineering Department (PHED)	• Prepare Contingency plan • Enforce ground water legislation • Strict monitoring and vigilance on water for drinking purpose only. • Identify additional sources of water for maintenance of regular supply. • Ensure supply of sufficient water through tankers for habitats and cattle camps. • Provide household water purification tablets. • Augmentation of existing Resources • Hiring of Private Wells • Hand Pump repair programme • Installation of New Hand Pumps and Tube wells • Transportation of water through road tankers and by Rail • Earmark water for drinking purpose available in the tanks and ensure no illegal pumping takes place. • Provide adequate quantity of bleaching powder to PRI, especially Gram Panchayats to protect spread of water and vector borne diseases. • Promote awareness on safe hygienic practices and sanitation.
4.	Department of Health and Family Welfare	• Health and epidemiology surveillance • Constitute mobile teams with required resources like medicines, doctors, paramedics, subordinate staff, laboratories, protective gears, antibiotics, vaccines, etc. in abundance. • Mobile clinics for health check-ups • Organise regular rural health camps and keep public informed of such camps. • Check & monitor the nutritional status of affected people especially for women and children and give treatment. • Check samples of food grains, cooked food in community kitchens, etc. • Promote general awareness of health and hygiene • Manning of control room 24x7. • Maintain regular contact with EOC. • Keep all ambulances, mobile teams, specialists, blood, medicines, paramedics, etc. in a state of readiness. • Carry out triage. • Provide first aid to minor injuries. • Evacuate injured to hospitals. • Constitute and effectively deploy mobile teams having Doctors

Sl. No.	Department	Disaster Specific Action Plan
		paramedical, • Set up health centres in relief camps and assure hygiene and sanitation. • Prevention/ control of epidemics and vaccination, availability of adequate x-ray machines and orthopaedic, neurology equipment. • Availability of stretchers, blood, medicines, ambulances. • Arrange additional beds and medical treatment in local and nearby hospitals as required. • Psychosocial counselling to distressed people. • Maintain continuous supply of medicines and emergency services till normalcy is restored.
5.	Disaster Management & Relief (DM& R)	• Ensure coordinated movement of all concerned departments, officials and agencies for combating Drought. • Make sufficient funds available for Drought response • Arrange regular meetings for updating the apex body and issue directions to all concerned departments regularly. • Document experiences and best practices
6.	Public Works Department (PWD)	• Listing of works that could be done as under relief programmes as per the priority • Carry out sudden checks and supervise the relief works. • Provide temporary employment opportunity to employable people from affected families • Manning of control room 24x7 • Maintain regular contact with EOCs at district / state levels • Keep all resources in the state of readiness • Assessment of damage to infrastructure, roads, bridges and buildings and commencement of restoration work. • Carry out search, rescue, evacuation, relief operation. • Clearance of roads and debris of collapsed infrastructures. • Identification and demolition of unsafe buildings/ infrastructures. • Barricade the disaster site and unsafe areas. • Identification and demarcation of safe areas and preparation of temporary shelters for relief camps. • Prepare temporary roads and bridges, helipads and air strips on the need basis for effective relief operations. • Deployment of heavy equipment like dozers, excavators, cranes, pulleys, power saws, gas cutters, L&Ts, JCBs and other specialist equipment and vehicles. • Restoration of buildings, roads, bridges and other Government buildings. • Ensure close monitoring of response and rehabilitation

Sl. No.	Department	Disaster Specific Action Plan
		operations and relief camps.
7.	Civil Supplies and Public Distribution System (PDS)	• Distribution of food packets, dry rations, fuel, oil and other essential items • Take precautionary steps against hoarding and profit mongering and ensure normal prices of commodities in the market. • Adequate supply and reserves of FOL and coordinate with all the national agencies for smooth transportation of food and civil supplies. • Supply daily necessities of food items, stock position and ensure continuous supply, in relief camp too. • Coordination with FCI/ warehouses. • Make public aware through media about food distribution and about the availability of items at subsidized rates.
8.	Municipal Corporation	• Coordination and supply of safe drinking water using tankers, etc. • Manning of control room 24x7. • Issue warnings to all Fire Service stations. • Keep all resources in a State of readiness • Assist in evacuation, search and rescue operations. • Ensure availability of all types of extinguishers for fire following earthquakes. • Appoint labourers for excavation works; dismantle unsafe buildings, disposal of solid garbage and liquid waste, disposal of dead persons and carcasses. • Control other potential hazardous situations that might arise from oil, gas and hazardous material spills. • Organise relief camps wherever required; ensure pure drinking water, Sanitation, food, temporary shelters, basic relief materials as per requirements and needs. • Assist in post disaster response and rehabilitation work
9.	District Administration	• Prepare Drought Contingency Plan. • Issue necessary directions/ instructions to all concerned departments to be proactive to combat the upcoming situation in an effective and coordinated manner. Ensure effective coordination with all departments, agencies, NGOs and stakeholders. • Arrange/mobilize equipment and resources like water tankers, trucks/ vehicles to transport food supply, fodder, mobile medical vehicles, ambulances, etc. • Arrange for disposal of dead carcasses. • Generate daily reports of relief activities and disseminate. • Organise relief camps wherever required; ensure pure drinking water, Sanitation, food, temporary shelters, basic relief

Sl. No.	Department	Disaster Specific Action Plan
		materials as per requirements and need. • Media Management • Procure tents, sanitation block, essential materials, etc. for relief camps.
10.	Department of Information and Public Relation	• Information dissemination, issue periodic bulletins to media. • Ensure information given to media are facts and true to avoid rumours. Arrange visit for media personnel in affected areas. • Information dissemination, update public on various relief interventions. • Operate the Control Room round the clock. • Nodal person to be designated as spokesperson for the Government. • Information dissemination, issue periodic bulletins to media.
11.	Emergency Operation Centre (EOC)	• Coordinate and issue direction to all concerned stake holders/ departments regularly • Brief the Disaster Management & Relief Commissioner regularly. • Coordinate the relief and rescue operation. • EOC to function as control room where all SDMA members and experts from various departments are available and take charge for effective coordination monitoring and implementation of rescue operations. • Prepare, forward and compile reports and returns from time to time. • Brief media regularly about the situation' • Brief/ Update the Govt.
12.	Police	• Manning of control room 24x7. • Maintain regular state of readiness • Communication to EOC and stakeholders instantly. • As first responder assume command for security and law and order • Demarcate entries and exits for rescue and relief operation and proper traffic management. • Support SDRF, Civil Defence, Home Guard, Army, Sainik Kalyan and other first responders for search and rescue. • Take necessary actions to avoid rumours. • Ensure prevention of theft and loot. Deployment of lady police personnel in relief camps for Gender concerns.
13.	Electricity Board	• Issue direction to all officials/ staff. • Manning of control room 24x7. • Keep all resources in a state of readiness • Immediately shut down the supply of electricity in the area

Sl. No.	Department	Disaster Specific Action Plan
		• Start restoration work of the damaged lines • Simultaneously, make electricity arrangements at the rehabilitation, relief camp areas.
14.	Rural Development Department (RDD)	• Issue warnings to all officials/ staff. • Manning of control room 24x7. • Keep all resources in a state of readiness. • Distribution of relief materials • Relief equipment, tractors, labour, digging/ excavation tools, etc. to be arranged to mobilise and Support in organizing relief camps wherever required • Ensure pure drinking water, Sanitation, food, temporary shelters, basic relief materials as per requirements and needs. • Arrangement of Rural relief camps • Arrangement of community kitchens. • Assist in post disaster response and rehabilitation work
15.	India Meteorological Department	• Transmit updated information to EOC • Mass media publicity/ issue bulletins at regular intervals.
16.	Railways & Transport Department	• Manning of control room 24x7. • Alert officials/ staff and keep all resources in a state of readiness. • Search, rescue and evacuate injured persons to safer places. • Assess the situation for appropriate actions. • Regulate the movement of all trains and passenger buses • Carry out inspection of railway bridges and lines. • Deployment of equipment like generators sets, pump sets, cranes pulleys, dozers, gas cutters, earthmovers, labourers for clearance of fallen bogies, electricity Poles, damaged tracks, etc. • Transport and provide emergency tents, water, medicines, food, etc. to the accident site. • Adequate arrangement of specialized trains, truck and buses for transportation of rescue and relief material. • Restoration of damaged railway lines, electricity poles to restart services as soon as possible.
17.	NGOs	• Provide first aid, health services, arrangement and distribution of food and relief materials, assistance to authorities, financial assistance, etc.

8 PROJECT BENEFITS

8.1 Introduction

Community will accrue the benefit from proposed development project by way of improvement in the physical infrastructure; social infrastructure; development of economy; reduced pollution, vehicle maintenance, fuel saving, lesser carbon footprint, employment potential and other tangible benefits. In general Project will have following benefits at national and regional level:

- **High-speed connectivity and access:** The proposed project is a greenfield access controlled highway. This will avoid traffic congestion and speed-up the freight movement. It is expected that overall, the proposed project will reduce the travel time between these places by half.
- **Aiding economic growth:** The seamless connectivity will provide better access to vehicles. The Project will reduce travel time and provide boost to trade, tourism and commerce linked to the regions.
- **Decongestion of existing National and State Highways:** The proposed corridor will take away traffic pressures from existing SH and NH passing through various cities. Also, long-distance traffic will shift to the proposed highway, thereby reducing traffic and congestion on the existing NH and SH for regional and local usage.
- **Usage shift:** Long-distance traffic will shift from existing National Highways to the proposed highway, resulting in lesser congestion leading to higher fuel savings and reduced travel time.
- **Improved safety:** Due to access control, the road & travel safety of the traffic connecting the region will be enhanced as there will be minimum distractions & conflict zones.
- **Support to industry:** Different types of industries like Tourism, Manufacturing, warehouse facilities, etc. along the proposed corridor will be facilitated in their business operation and reachability.

Detailed environmental and social benefits associated with the proposed highway development are described in sections below.

8.2 Socio-Economic Benefits

The socio-economic benefits from the proposed project have been detailed as below:

- The proposed development project will provide better connectivity, which in turn will benefit all sections of the society like general population, farmers, businessman etc.
- The proposed project would act as the prime artery for the economic flow to this reason.
- Improved access to higher education facilities and modern heath care facilities.
- Strengthening of rural economy which in turn will improve economic scenario of the State and country.

- Faster transportation will strengthen tourist development in the area.

8.3 Employment Opportunity (Direct and Indirect)

Highway projects require large number of local people during construction stage. The proposed upgradation requires large number of people from nearby areas during construction stage of the project. Thus, there will be increase in employment opportunity for the project area.

- During the construction phase, the employment opportunities will be created for skilled (engineers, transport, mechanical), semi-skilled (technician, road Inspectors, plant operator, office support etc.) and unskilled (general labour) labourers. Most of the skilled labourers may come from other parts of the country; the opportunities for semi-skilled and unskilled sections of the work-force will primarily be available from the local communities.
- Apart from these temporary employment opportunities, there would be permanent employment opportunities for the local community.
- There will be development of wayside amenities with more commercial establishments such as shops, restaurants, small workshop serving the vehicles moving along the Highway. These activities will provide additional socio-economic development and increased wages in the project area.

8.4 Reduction in Vehicle Operating Cost (VOC)

Vehicle Operating Cost (VOC) will be reduced when a road is improved. Fuel consumption, wear and tear of tyres, suspension will be benefited when geometry of the road is improved. VOC consist of the following components:

- Fuel consumption
- Lubricating oil consumption
- Spare part consumption
- Tyre consumption
- Vehicle depreciation

8.5 Indirect Benefits

In addition to the direct benefits, there are number of indirect benefits attributed to Highway project. Lowering transportation cost for users and improving access to goods and services enables new and increased economic and social activity.

After the development of state highway, the land prices may increase and there would be changes in development of business in order to take advantage of improved speed and reliability in the transportation system. Hence these benefits will lead to increase property values, increased productivity, employment and economic growth.

The indirect benefit of the proposed highway would work through the dynamic developmental externalities generated through the forward and backward linkages. A better connectivity will increase the business, which will reflect in the changes in the pattern of economic activities, income generation, price evolution, and employment condition. There will be also increase in greater accessibility to market, health and educational facilities.

8.6 Environmental Benefits

The environmental benefits from the proposed project have been described as below:

- Faster transportation will ultimately lead to savings in the form of reduced wear and tear of vehicles, reduced vehicle operating cost (VOCs) and total reduction in transportation costs etc.
- Better level of service in terms of improved riding quality and smooth traffic inflow;
- With the improvement of road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and wastage due to increased fuel emission from vehicles will be reduced thereby reducing air pollution and improving air quality and health of locals.
- Plantation in the project area will improve the tree density and which will improve aesthetics as well as tree act as pollution absorber.
- Increased road landscaping and safety features.
- The compensatory plantation and plants in the vicinity of camps and facilities including projects for affected families shall further improve the air quality of the region.
- Overall environment improvement of the region.

8.7 Road Safety

The widening of the proposed road project will ensure smooth flow of traffic. Installation of proper road safety through the road signages, barricades, and crash barrier will add safety to the road users. Bus bays and rest areas are proposed in the project which shall enhance the road safety.

9 ENVIRONMENT MANAGEMENT PLAN

9.1 General

The Environmental Management Plan (EMP) is required to ensure managing environment impacts within acceptable limits in addition to environmental enhancement during construction and operational phases. EMP is location and time specific. In general, NHAI (with assistance from Contractor/Concessionaire and Project Monitoring Consultant (PMC) / Supervision Consultant (SC) / Authority Engineer (AE) is the responsible entity for ensuring that the mitigation measures are carried out. Impact mitigation measures are provided in Annexure 9.1. The list provides reference (MoRT&H specification), implementing organization and responsible entity.

9.2 Specific Activities by Contractor / Concessionaire and Monitoring Consultant

The role of NHAI (Project Implementing Authority) in the implementation of EMP involves the following activities:

- Environment and Forest Clearances from Ministry of Environment, Forest and Climate Change
- Permission from Forest / District Administrative Department for felling of trees by Contractor / Concessionaire
- Supervision of implementations of EMP with the help of Project Monitoring Consultant / Supervision Consultant / Authority Engineer

9.3 Specific Activities by Concessionaire / Contractor

The activities to be performed by the Concessionaire / Contractor to implement the EMP shall comprise the following:

- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Obtain approval from PMC / SC / AE for setting up of Plant and camp area
- Obtain permission of change of land use of the camp & plant areas from the Revenue authorities
- Confirm the Tree Cutting Schedule based on the final design and provide the same to NHAI
- Felling of trees after NHAI secures Forest Department's / District Administrative Department's permissions
- Selection of material sources (quarry, water, sand, etc.) and obtain approval of the same by PMC / SC / AE
- Obtain Prior EC for new quarries areas from MoEF&CC / SEIAA as applicable
- Obtain Consent to Establish & Operate from State Pollution Control Board under Air and Water Act
- Apply for and obtain all the necessary clearances from the agencies concerned including but not limited to handling of hazardous waste from SPCB, permission for use

of water, labour permits, permission for disposal of construction wastes & blasting permits

- Planning traffic diversions and detours including arrangements for temporary land utilization on lease basis
- Plant and maintain flowering, shade, medicinal, ornamental & fruit bearing trees in suitable areas as per contractual requirement

9.4 Site Specific Management Plan

9.4.1 Cultural Properties

The relocation & mitigation issue of the cultural properties directly or partially impacted shall be taken up in RAP. Wherever possible the concessionaire / contractor shall try to enhance the aesthetic of the cultural properties.

9.4.2 Sensitive Features

Project section is crossing 7 rivers and 25 nala/ stream/Canal/drains. Elevated structures are proposed along the water bodies being crossed. Silt fencing is proposed near major canals and pond.

9.4.3 Water Quality

Oil Interceptor at Camp site have been proposed to control the entry of oily waste in nearby water bodies and soil. Rainwater harvesting structure is proposed at every 500m interval of the project corridor.

9.4.4 Community properties

The relocation / rehabilitation of affected community resources shall be undertaken as per the Rehabilitation Action Plan.

9.5 Implementation of EMP

The key issues that require special attention along with the mitigations and enhancement measures to be implemented have been detailed in Annexure 9.1. It is presumed that for effective implementation for the project, the proponent shall be dividing the section into number of construction packages. A construction package shall have a single contractor or a JV of contractors. A single or multiple PMC / SC / AE shall be appointed either package wise or for the entire section who shall supervise and monitor the works of the contractor. The PMC / SC / AE shall be headed by a Team Leader who shall ideally be assisted by a Resident Engineer along with other key & sub key professionals including an Environmental expert. In turn the PMC / SC / AE shall be reporting to the NHAI's Project Implementation Unit, headed by a Project Director. Depending on the work's status & exigencies, the project proponent may decide to entrust the monitoring works to one or multiple Project Implementation Units. The physical, financial & the environmental compliance status of the works of the Project Implementation Units shall be monitored at the Head office of the NHAI at New Delhi.

For effective implementation and management of the EMP, the individual contractor / lead contractor (for JV) for each package shall establish an Environment, Health and Safety cell

headed by an Environment Officer to deal with the environmental issues of the project and implement the various environmental mitigation and enhancement measures. The Environmental Officer of the Contractors shall be primarily responsible for compliance of EMP and should be available for the entire duration of the project. The environmental officer of the Contractor shall be assisted in his daily endeavour by safety & health officers besides other environmental assistants. The Environmental officer shall interact with NHAI, AE / SC / PMC and other line departments to ensure that the mitigation and enhancement measures mentioned in the EMP are adhered.

The designated environmental expert of the PMC / SC / AE based on the periodic reports received from the contractor & site visits shall apprise the Project Director on the status of the compliance of the EMP. In the absence of the Environmental Expert of the PMC / SC / AE, the responsibility shall be entrusted with the Resident Engineer & the Team Leader of the PMC / SC / AE. The Project Director of NHAI or his legal representatives shall be the official responsible for the compliance of the EMP from the project proponent's side at the site level.

9.6 Environmental Monitoring Programme

The Environmental Monitoring Programme has been detailed out in Chapter 6.

9.7 EMP Budget

The estimated budget of EMP is INR 45.696 Cr. The detailed budget for EMP implementation is given in Table 9-2.

Table 9-1: Project Environmental Budget

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR) Detail Cost	Total cost (INR) Crores
1	**MITIGATION / ENHANCEMENT COST**						
1.1	**Pre-construction Stage**						
1.1.1	Land acquisition		Covered in RAP Budget			0.00	0.000
1.1.2	Water	Relocation and construction of affected hand pumps, water storage tanks, open wells, water taps, OHT etc. as per directions of the Engineer.	Covered in Utility Shifting Budget			0.00	0.000
1.2	**Construction Stage**						
1.2.1	Horticulture	Avenue plantation with flowering, shade, medicinal, ornamental & fruit bearing trees @ 1000 numbers per Km as per IRC SP21:2009 and Green Highways (Plantation & Maintenance) Policy-2015 including compensatory plantation to offset the loss of trees due to clearing of proposed RoW at locations & as per directions of the forest department tree cut) including Plantation and maintenance at locations & as per directions of the forest department or administrative department	No.	121000	1,500.00	18,15,00,000.00	18.150
1.2.2		Planting of flowering, medicinal, ornamental shrubs in the median @ 666 numbers per km as per IRC SP21:2009 and Green Highways (Plantation & Maintenance) Policy-2015 17.01.2018) and Green Highways (Plantation & Maintenance) Policy-2015	No.	80586	1,500.00	12,08,79,000.00	12.088
1.2.3		Circular tree guard & /other for protection of plantation	No.	121000	1,000.00	12,10,00,000.00	12.100
1.2.4		Landscaping and aesthetics of junctions and at other locations as per design, drawings and direction of the Environmental Engineer /	LS	-	5,00,000.00	5,00,000.00	0.050

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Crores
		Environmental Specialist of the Engineer					
1.2.5	Slope / Embankment protection	Turfing of embankment with grasses and herbs.	sq.m. (Covered in Engineering Cost)			0.00	0.000
1.2.6	Soil & Ground Water	Providing Oil Interceptors as per design and drawing at vehicle parking areas and as per directions of the Environmental Specialist / Environmental Engineer of the Engineer.	Nos.	2	30,000.00	60,000.00	0.006
1.2.7	Surface Water	Silt Fencing for Water Bodies adjacent to the road	running m	2420	1,100.00	26,62,000.00	0.266
1.2.8	Flora	Cost of transport & distribution of cooking fuel to construction workers to prevent indiscriminate felling of trees	Months	24	20,000.00	4,80,000.00	0.048
1.2.9	Air	Dust Management with sprinkling of water, covers for vehicles transporting construction material	Km	121.000	30,000.00	36,30,000.00	0.363
1.2.10	Solid Waste Disposal	Disposal of Sewage and other wastes in the construction yard and labour camps as per directions of the Environmental Specialist / Environmental Engineer of the Engineer.	Nos.	2	30,000.00	60,000.00	0.006
1.2.11	Cultural properties	Relocation of cultural properties	Covered in RAP Budget				0.000
1.2.12	Roadside amenities	Construction of Bus Bays	Covered in Engineering Cost			0.00	0.000
TOTAL MITIGATION / ENHANCEMENT COST						**43,10,71,000.00**	**43.107**

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Crores
2	MONITORING COST						
2.1	Construction Stage						
2.1.1	Air	Sampling and monitoring ambient Air Quality and gaseous pollutants as per CPCB Standard Procedures at 6 locations including approved hot mix plant locations, sensitive area and chainages as per direction by Environmental Specialist / Environmental Engineer of the Monitoring Consultant for two time in a season for three seasons in a year for 2 years as per the Monitoring Plan given in EMP	No. of Samples	120	2,000.00	2,40,000.00	0.024
2.1.2		Analysis charges of Ambient air from samples collected for parameters as per AAQ Standards Notification, 2009 and CPCB manual.	No. of Samples	120	4,000.00	4,80,000.00	0.048
2.1.3	Water Quality	Collection of grab samples of water quality at 6 locations at chainage identified by the engineer for 2 years (twice a year) in pre & post monsoon seasons as per the Monitoring Plan given in EMP /as per direction of Environmental Specialist / Environmental Engineer of the Monitoring Consultant	No. of Samples	32	400.00	12,800.00	0.001
2.1.4		Analysis of water quality at locations in the monitoring plan for pH, Turbidity, total solids, turbidity COD, BOD, DO, Chlorides, Hardness, Oil & Grease, TSS, TDS, Total Coliform, Iron, Fluorides, Nitrates, E. coli, Total coliform and faecal coliform as specified in "Standard Methods for Examination of Water and Wastewater" published by WEF, AWWA and APHA as per direction of Environmental Specialist / Environmental	No. of Samples	32	6,000.00	1,92,000.00	0.019

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Crores
		Engineer of the Engineer and as per MoEF&CC rate list.					
2.1.5	Noise	Monitoring Noise level at Equipment Yards, Sensitive area and Settlements using hand held noise meters at 6 locations at chainage identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant for one time in a season for three seasons in a year for 2 years as per the Monitoring Plan given in EMP	Nos.	60	1,500.00	90,000.00	0.009
2.1.6	Soil	Monitoring Soil at 3 locations at chainage identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant for twice a year for 2 years as per the Monitoring Plan given in EMP	Nos.	24	2,000.00	48,000.00	0.005
2.1.7	Transportation Cost	Transportation cost for monitoring of noise, air and water during construction period	L.S.	-	1,50,000.00	1,50,000.00	0.015
2.2	**Operation Stage**						
2.2.1	Air	Sampling and monitoring ambient Air Quality and gaseous pollutants as per CPCB Standard Procedures at 3 locations including sensitive area and chainage as per direction by Environmental Specialist of Consultant for once in a season for 3 seasons in every year for 10 years	No. of Samples	90	2,000.00	1,80,000.00	0.018
2.2.2		Analysis charges of Ambient air from samples collected for parameters as per AAQ Standards Notification, 2009 in consultations and directions of the Consultant and PWD as per MoEF&CC charges.	No. of Samples	90	4,000.00	3,60,000.00	0.036

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Crores
2.2.3	Water Quality	Collection of grab samples of water quality at 4 locations at chainages for twice a year in pre & post monsoon seasons in every year for 10 years as per direction of Environmental Specialist / Environmental Engineer of the Consultant	No. of Samples	60	400.00	24,000.00	0.002
2.2.4		Analysis of water quality at locations in the monitoring plan for pH, Turbidity, total solids, COD, BOD, DO, Chlorides, Hardness, Oil & Grease, TSS, TDS, Total Coliform, Iron, Fluorides, Nitrates, E. coli, Total coliform and faecal coliform etc. as specified in "Standard Methods for Examination of Water and Wastewater" published by WEF, AWWA and APHA as per direction of Environmental Specialist / Environmental Engineer of the Consultant and as per MoEF&CC rate list.	No. of Samples	60	6,000.00	3,60,000.00	0.036
2.2.5	Noise	Monitoring Noise level at Sensitive area and Settlements using hand held noise meters at 3 locations for once in a season for three seasons in a year for 10 years as per directions of Environmental Specialist / Environmental Engineer of the Monitoring Consultant	Nos.	90	1,500.00	2,25,000.00	0.023
2.2.6	Soil	Monitoring Soil at 2 locations at chainages identified by the Engineer as per directions of Environmental Specialist / Environmental Engineer of the Engineer for once a year for 10 year as per the Monitoring Plan given in EMP	Nos.	30	2,000.00	60,000.00	0.006
2.2.7	Transportation Cost	Transportation cost for monitoring of noise, air and water during operation period for 10 years considering every year.	L.S.	1	2,50,000.00	2,50,000.00	0.025

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Crores
TOTAL MONITORING COST						**26,71,800.00**	**0.267**
3	**MISCELLANEOUS COST**						
3.1	Training	Training	L.S.	-	2,50,000.00	2,50,000.00	0.025
3.2	Advocacy and Policy Making	Holding meetings for policy planning and subsequent review meetings with Revenue Department, Forest Department, local representatives, NGOs, etc. regarding development controls.	Year	24	15,000.00	3,60,000.00	0.036
3.3	Administrative Charges including logistics	Maintenance of vehicle with the Environment Cell, Data processing, administrative support, stationery etc.	Months	24	35,000.00	8,40,000.00	0.084
3.4	Miscellaneous Items	Digital Camera for the Environment Cell	No.	1	5,000.00	5,000.00	0.001
3.5		Portable sound level meter	No.	1		0.00	0.000
TOTAL MISCELLANEOUS COST						**14,55,000.00**	**0.146**
TOTAL COST						**43,51,97,800.00**	**43.520**
Contingency @ 5% on Total Environmental Cost						**21759890.00**	**2.176**
GRAND TOTAL						**456957690.00**	**45.696**

10 SUMMARY AND CONCLUSION

10.1 Introduction

National Highway Authority of India (NHAI) is responsible for management of national highways and is the nodal agency of Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI aims at provision and maintenance of national highways network to meet user expectations in the most time-bound and cost-effective manner within the strategic policy framework. NHAI is the nodal authority/proponent for the Development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-9/Package-1).

The proposed highway with new alignment has been envisaged through an area which shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel. Proposed highway follows the greenfield alignment with 6 lanes carriageway configurations. The proposed project starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli (district of Uttar Pradesh and ends at Sadopur village (Ch:120+970) in Ambala district of Haryana State. The RoW for the project is 60m. The proposed project is falling in the state of Uttar Pradesh, Haryana & Punjab.

10.2 Need of the Project

The proposed highway is essential as it connects the three major agriculture producing states of Northern India. This project is being developed as economic corridor to boost the industrial development and freight movement in the project area by National Highways Authority of India under Bharatmala Pariyojna. The key highlights of the scheme are:

- Improving the quality of existing roads
- Construction of direct new roads to complete 34000 km
- Better connectivity to ports, coastal regions, etc.
- The main stress will be given on the construction and development of greenfield highway for better management of traffic and freight.

Further, the proposed project will have multi-fold benefits for the local and regional economies as follows:

- Connectivity to the important towns
- Lower transport costs for freight and passengers of motorized and non-motorised vehicles;
- Improved Road network connectivity to the villages in the vicinity of the road;
- Enhanced traffic facilities and volume in the project road;
- Enhancement in economic opportunities/activities of the local people;
- Enhanced basic amenities to the villages along the proposed road;
- Rural prosperity of the project influence area;

- Elevate tourism
- Improve the economy of the area like agriculture, commerce, education, health, social welfare and public safety

10.3 Project Area

Project section covers 120.970 Km of length distributed across Shamli & Saharanpur district of Uttar Pradesh State, Karnal, Yamunanagar, Kurukshetra & Ambala districts of Haryana & SAS Nagar district of Punjab State.

10.4 Project Proponent

National Highways Authority of India (NHAI), an autonomous agency of the Government of India, is responsible for management of the network of national highways across the country. It is a nodal agency of the Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI vision is to meet the nation's need for the provision and maintenance of national highways network to global standards and to meet user expectations in time-bound and cost-effective manner, within the strategic policy framework set by the Government of India and thus promoting economic well-being and quality of life of the people.
NHAI is the nodal authority / project proponent for the development of the highway project under present study.

10.5 Environmental Impact Assessment (EIA) Study

The study methodology for the EIA employs a simplistic approach in which the important environmental issues have been identified before initiation of the baseline study. Based on the identification baseline data for proposed project was collected during the study period from January to March 2021. This data has analyzed to predict and quantify the impacts and suggest best suited mitigation measure to mitigate the identified impacts.

10.6 Policy, Legal and Administrative Framework

As part of the project execution, the following clearances and NOCs has to be obtained by NHAI & the contractors:

- Prior Environmental Clearance from MoEF&CC under the purview of EIA Notification 2006 & its subsequent amendments, as the proposed project is a development of new national highway
- Prior permission for felling of trees from Forest dept. / District Authorities
- Compensate the affected households as per entitlement matrix based on Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act 2013
- Prior Environmental Clearance from MoEF&CC / SEIAA by the Contractors for sand and aggregate quarries, wherever and if required
- NOC and Consents under Air & Water Acts for establishing and operating the construction plants including but not limited to hot mix plants, WMM, crushers etc. from State Pollution Control Board
- NOC under the Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 from PPCB

- PUC certificate for use of vehicles for construction from Transport department
- NOC for water extraction for construction and allied works from Irrigation department
- Conversion of land use from the revenue department for setting camps and plants
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for location and layout of Camps & plants before start of Construction
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for Traffic Management Plan before start of Construction
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for the Emergency Action Plan for accidents responding to involving fuel & lubricants before the construction starts

10.7 Baseline Environmental Profile

10.7.1 Physical Environment

Climatology

The climate of the project area is generally hot. As per climatic conditions, the year may be divided into four seasons. The hot season is from March to May. From March onwards it is a period of continuous rise in the temperature and May is generally the hottest month of the year. Hot winds blow during summer, occasionally accompanied by dust storms. The temperature may touch 45°C or more on some days. Generally, pre-monsoon showers are experienced in the middle or end of June which may bring down temperature considerably. From early October, the weather becomes very pleasant as the winter season sets in. November and December are pleasant but nights are cold

Topography

The proposed alignment follows the 'plain' terrain. The elevation varies from ~240 m to ~288 m above msl at different locations. Average elevation of the project stretch is ~250 m above msl.

Soil

The region slopes towards south-west. It is a plain area with relatively richer loamy soils. Khadar lies along Yamuna river, it is formed by deposition of alluvium sediments, clay and sand. Silty loam is easily workable and productive. The soil along the bank of river beds is usually light and sandy, while elsewhere it is mainly a productive loam stiffened by the action of water into clay in the lower levels. All along the old high bank of the Yamuna lies a belt of stiff-swampy clay of varying width producing excellent vice but elsewhere the Yamuna Khadar consists of light loam and in places includes patches of sand and reh. The light rich loam or sandy loam soil covers nearly three fourth of the area of the district. It is called by the local name of rausli and ranges from a light friable soil with a considerable admixture of sand to the softer kinds of clay in which all crops can be grown with equal facility. Soil samples were collected from 9 representative locations for assessment of soil characteristics for the proposed highway.

Ambient Air Quality (AAQ)

Ambient air quality monitoring has been done at evenly distributed 10 locations along the proposed alignment. The results indicate that all air quality parameters are within the standards specified in the NAAQS in absence of any major pollution generation activities near study area.

Ambient Noise Level (ANL)

Noise monitoring has been carried out once during the entire study period at 10 locations along the proposed alignment for a period of 24 hours. Day & Night-time Leq has been computed from the hourly Leq values as per standards. The Noise quality result shows that Leq Day time varies from 48.4 to 51.0 dB(A) and Leq Nighttime varies from 38.4 to 40.9 dB(A). Noise level was found within the standards.

Surface Water

Surface water quality along the project stretch was monitored at 4 representative locations along the proposed alignment as per the parameters laid down by Central Pollution Control Board for surface water quality criteria. The surface water in the project was found alkaline with pH varying from 7.25 to 7.54.

Ground Water

Keeping in view the importance of ground water to the local population, 4 representative ground water sampling locations along the proposed alignment were identified and samples were analysed for assessment of ground water quality.

10.7.2 Biological Environment

Protected Areas

The proposed alignment is neither passing through nor falling within 10.0km radius of any National Park or Wildlife Sanctuary. Therefore, Wildlife clearance is not required under Wildlife (Protection) Act, 1972.

Forest Area

About 7.5 ha of protected forest land shall be diverted for the development of proposed project. The proposed alignment is passing through the strip plantation notified as protected forest along the roads & canals. Hence, diversion of forest land shall be applicable under Forest Conservation Act 1980.

10.7.3 Social Environment

Census Profile

The demographic features of Shamli & Saharanpur districts in the state of Uttar Pradesh, Yamuna Nagar, Karnal, Kurukshetra and Ambala districts in the state of Haryana and SAS Nagar district of Punjab State forming an immediate influence. As per Census 2011, the total population of Haryana is 2,53,51,462 with the density as 573 /km^2, Uttar Pradesh is 15,53,17,278 with a density of 829/km^2 and Punjab is 2,77,43,338 with a density of 551/km^2.

Table 10-1: Demographics of Project District

Sl. No	State	District	Population 2011		
			Persons	Male	Female
4.	Uttar Pradesh	Saharanpur	34,66,382	18,34,106	16,32,276
		Shamli	12,73,578	6,87,732	5,85,846
5.	Haryana	Yamuna Nagar	12,14,205	6,46,718	5,67,487

		Karnal	15,05,324	7,97,712	7,07,612
		Kurukshetra	9,64,655	5,10,976	4,53,679
		Ambala	11,28,350	5,98,703	5,29,647
6.	Punjab	SAS Nagar	9,94,628	5,29,253	4,65,375

10.8 Public Interactions & Consultation

Public Interactions & consultations were conducted during the project preparations. The main purpose of these consultations was to know the community's reaction to the perceived impact of proposed project on the people at individual and settlement level.

10.9 Potential Environmental Impacts

The environmental components are mainly impacted during the construction and operational stages of the project and must be mitigated for and incorporated in the engineering design. Environmental mitigation measures represent the project's endeavour to reduce its environmental footprint to the minimum possible. These are conscious efforts from the project to reduce undesirable environmental impacts of the proposed activities and offset these to the degree practicable. Enhancement measures are project's efforts to gain acceptability in its area of influence. They reflect the pro-active approach of the project towards environmental management. Slight change in the micro-climate of the area is expected due to heat island effect as unpaved area will be converted into the paved road. However, Impact on the climate conditions from the proposed road project will not be significant in long run as removal of vegetation will be compensated by compensatory plantation.

10.9.1 Impact on Air Quality

There will be rise in PM levels during the construction activities, which shall again be within prescribed limit after the construction activities are over. The level of CO is likely to be increased, however, level shall remain within prescribed standards.

10.9.2 Impact on Noise Levels

The area is likely to experience an increment in noise level due to increase in vehicle density after road strengthening. Construction camp shall be established at least 1000m away from nearest habitation and forest area. Temporary noise barriers should be provided surrounding the high noise generating construction equipment during work near to settlement area. Avenue plantation have been proposed on either side of the highway to control the associated air and noise pollution.

10.9.3 Impact on Water Resources and Quality

The construction and operation of the proposed project roads will not have any major impacts on the surface water and the ground water quality in the area. Design made to avoid physical loss to the water bodies to the extent possible. Contamination to water bodies may result due to spilling of construction materials, oil, grease, fuel and paint in the construction camp. This will be more prominent in case of locations where the project road crosses drains, ponds, etc. Silt fencing shall be provided along the major canals and pond. Oil interceptors are proposed near fuel handling areas.

10.9.4 Impact on Ecological Resources

Trees within ROW are likely to be affected due to the proposed development leading temporally loss of micro ecosystem. However, on the long run the impacts will be compensated in terms of compensatory and avenue plantation.

10.9.5 Impact on Land

During the construction of the proposed project, the topography will change due to cuts & fills for project road and construction of project related structures etc. Provision of construction yard for material handling will also alter the existing topography. The change in topography will also be due to the probable induced developments of the project.

10.9.6 Social Impacts

About 824.285 ha of land shall be required for proposed highway

10.10 Analysis of Alternatives

Detailed analyses of the alternatives have been conducted taking into account both with and without project. The proposed development of greenfield highway is likely to have a positive impact on the economic value of the region. However, there are certain environment and social issue, these needs to be mitigated for sustainable development.

10.11 Mitigation Avoidance & Enhancement Measures

Mitigation and enhancement measures have been planned for identified adverse environmental impacts. The construction workers camp will be located at least 1000 m away from nearby habitations. Hot mix plants, batching plants, etc. will also be located more than 1000 m away from habitations and in downwind directions. Existing cross drainage structures have been planned to maintain for proper cross drainage. In order to compensate negative impacts on flora due to cutting of trees the project plans compensatory plantation in the ratio of 1:10 i.e. for every tree to be cut, ten trees will be planted. The project shall also witness the plantation of trees for providing aesthetic beauty and shade. As the space for compensatory plantation might not be adequate along the project road, this plantation shall be taken up by the forest department, after payment of the cost for raising and maintaining the saplings for five years. The project will take an opportunity to provide environmental enhancement measures to improve aesthetics in the project area. The planned environmental enhancement measures include plantation in available clear space in ROW, enhancement of water bodies etc. In order to avoid contamination of water bodies during construction Silt fencing, oil interceptors at storage areas and at construction yard have been proposed. The affected households shall be compensated as per the entitlement matrix based on Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act 2013.

10.12 Institutional Requirements & Environmental Monitoring Plan

The responsibility of implementing the mitigation measures lies with environment team duly appointed by the Contractor/Concessionaire. The overall supervision of Environmental monitoring works during construction and operation stage shall be carried out by NHAI with the help of the Monitoring Consultant / Supervision Consultant / Authority Engineer. To mitigate the

potential negative impacts of proposed development and measurement the performance of mitigation measures, an Environmental Monitoring and Management Plan is developed. The formulation of an appropriate environmental monitoring plan and its diligent implementation are keys to overall success for the project.

10.13 Environmental Management Plan

Project specific environmental management plan have been prepared for ensuring the implementation of the proposed measures during construction phase of the project, implementation and supervision responsibilities. The cost for environmental management during construction has been indicated in EMP. The project impacts and management plan suggested thereof are summarized in next section.

10.14 Environment Impact & Management Matrix

Table 10-2: Environment Impact & Management Matrix

Particulars	Stages	Potential Impacts	Mitigation Measures
Physiographic Environment			
Topography	Preconstruction & Construction	• Slight changes are expected due to development of the road • Impacts are marginal, but permanent.	• Proper planning to keep the land reformation upto bare minimum • No new quarry for the project
Geology	Preconstruction & Construction	• Impacts are moderate because of extraction of sand	-
Climate			
Temperature / Rain fall / Humidity	Preconstruction & Construction	• Tree felling will have an impact of micro-climate of the area • Heat island effect due to increase in paved roads • Low spatially restricted short-term impact	• Compensatory plantation in 1:10 ration of the trees to be cut • With the proposed avenue plantation scheme, the micro climate of the project corridor will be smoothened
Land			
Loss of Other Land	Design, Preconstruction & Construction	• Loss of Property & Livelihood	• Compensation as per LARR, 2013
Induced Development	Preconstruction & Construction	• Insignificant change in the land use pattern	• Civil authorities to plan and guide any induced development under regulatory framework
Soil			
Soil Erosion	Preconstruction,	• In Road slopes and	• Embankment protection

Particulars	Stages	Potential Impacts	Mitigation Measures
	Construction & Operation	spoils • Erosion in excavated areas	through pitching & turfing • Regular water sprinkling in excavated areas
Contamination of Soil	Preconstruction, Construction & Operation	• Scarified bitumen wastes • Oil and diesel spills • Emulsion sprayer and laying of hot mix • Production of hot mix and rejected materials • Residential facilities for the labour and officers	• Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 • Oil Interceptor will be provided in storage areas for accidental spill of oil and diesel • Rejected material to be laid as directed by monitoring consultant. • Septic tank to be constructed for waste disposal.
Water			
Impact on Water Resource	Design, Preconstruction, Construction & Operation	• Depletion of ground water recharge • Contamination from fuel and lubricants & waste disposal in camp area . • Contamination of surface water system due to run-off from road construction area	• Provision of Storage/harvesting structure of water, wherever feasible • Oil Interceptor and Septic tank in construction camp • Enforcement of Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 • Both side drain facility to suitably divert the run-off from roads
Air			
Dust generation	Preconstruction& Construction	• Shifting of utilities, removal of trees & vegetation, transportation of material	• Regular Sprinkling of Water • Fine materials to be completely covered, during transport and stocking. • Hot mix plant to be installed in down wind direction with at least 1000m distance from nearby settlement. • Regular monitoring of particulate matter in Ambient Air
Gaseous	Preconstruction,	• Operation of Hot mix	• Air pollution Norms will be

Particulars	Stages	Potential Impacts	Mitigation Measures
pollutants	Construction & Operation	plant and vehicle operation for material transportation	enforced. • Only PUC certified vehicle shall be deployed • Labourers will be provided with mask. • Regular gaseous pollution monitoring in ambient air
Ambient air quality	Operation	• Air pollution from traffic • CO level is likely to increase	• Compliance with statuary regulatory requirements
Noise			
Pre-Construction Activity	Pre-Construction	• Man, material and machinery movements • Establishment of labour camps, onsite offices, stock yards and construction plants	• No Horn Zone sign, Speed Barriers near sensitive receptors • Camps will be setup more than 1000m away from settlements.
Construction Activity	Construction	• Operation of high noise equipment like hot mix plant, diesel generators etc. • Community residing near to the work zones.	• Camp will be setup more than 1000m away from the settlements, in down wind direction. • Noise pollution regulation to be monitored and enforced.
Operation Stage	Operation	• Indiscriminate blowing of horn near sensitive area	• Restriction on use of horns • No Horn Zone sign.
Ecology			
Flora	Preconstruction, Construction	• Loss of vegetation cover • Felling of appprox. 7966 of trees	• Felling of only unavoidable trees • Compensatory Plantation in the ratio of 1:10
Fauna	Preconstruction, Construction & Operation	• Loss of insect, avian and small mammalian species due to felling of trees • Accidental run over	• Compensatory Plantation • Speed breaker, Signage and limit in sensitive areas
Social			
Socio Environment	Design, Preconstruction & Construction	• Loss of Property & Livelihood • Loss of CPRs, Religious Structures	• Compensation as per LARR, 2013 • Relocation of CPRs, Religious Structures to

Particulars	Stages	Potential Impacts	Mitigation Measures
			suitable place
Public Health and Road Safety			
Health and safety	• Preconstruction, Construction & Operation	• Psychological impacts on project affected people • Migration of worker may lead to sanitation problem creating congenial condition for disease vectors • Discomfort arising of air and noise pollution • Hazards of accident	• Continued consultation with PAPs and the competent authority for speedier settlements of appropriate compensation package and resettlement. • Ensuring sanitary measures at construction camp to prevent water borne disease and vector borne disease. • Provision for appropriate personal protective equipment like earplugs, gloves gumboot, and mask to the work force. • Safe traffic management at construction area. • Drive slow sign and speed barriers near community facilities like school, hospital, etc.

10.15 Conclusions

Based on the EIA study and surveys conducted for the Project, it can be safely concluded that associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA 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. The proposed project shall improve trade efficiency and bring economic growth. In terms of air and noise quality, the project shall bring considerable improvement to possible exposure levels to population.

11 DISCLOSURE OF CONSULTANT

Declaration by experts contributing to the EIA for development of 6 lane Access Controlled Greenfield Highway of Shamli - Ambala Sec. from Ch. 0+000 to Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh, Haryana and Punjab under Bharatmala Pariyojana Phase II (Lot- 9/Package-I) (Length 120.970 km) by M/s National Highway Authority of India

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator:

Name : Abha G.

Signature & Date :

Period of Involvement : April 2021 to till Date

Contact information : **Mantras Green Resources Ltd.**
Hall No. 1, 1st Floor, NICE Sankul,
Plot No. A -9, Opp. Nashik Merchant Co-op Bank Ltd.,
ITI Signal, MIDC Satpur, Nasik-422007

Functional Area Experts:

Sl. No.	Functional Area	Name of the Expert/s	Signature and Dates
1	AP	Mr. Vipin Kumar	
2	WP	Prajakta Rajesh Chitnis	
3	SW	Mr. Vipin Kumar	
4	SE	Roshan Kumawat	
5	EB	Rupal Amar Raizada	
6	HG	Mr. Nilesh Laxmanrao Maske	
7	GEO	Mr. Nilesh Laxmanrao Maske	

Sl. No.	Functional Area	Name of the Expert/s	Signature and Dates
8	SC	Prajakta Rajesh Chitnis	
9	AQ	Mr. Vipin Kumar	
10	NV	S. C. Sharma	
11	RH	S. C. Sharma	

Declaration by the head of the accredited consultant organization/authorized person

I, Dr. U.K. Sharma hereby, confirm that the above-mentioned experts prepared the **EIA for** development of 6 lane Access Controlled Greenfield Highway of Shamli - Ambala Sec. from Ch. 0+000 to Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh, Haryana and Punjab under Bharatmala Pariyojana Phase II (Lot- 9/Package-I) (Length 120.970 km) **by M/s National Highway Authority of India** and also confirm that the consultant organization shall be fully accountable for any mis-leading information mentioned in this EIA Report.

Signature :

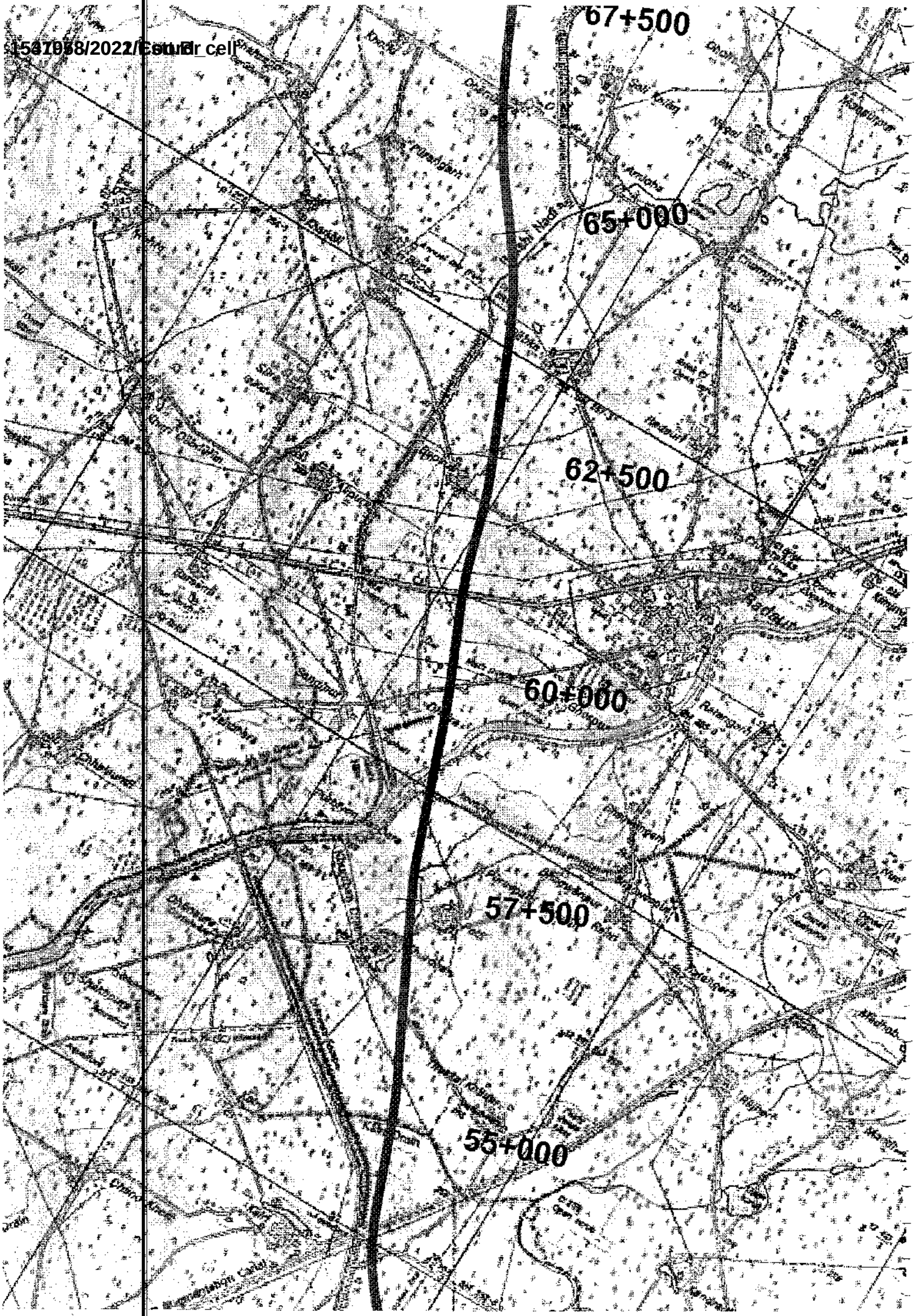
Name : U.K. Sharma

Designation : Managing Director

Name of the EIA Consultant Organization : **Mantras Green Resources Ltd.**

LIST OF ANNEXURE

Annexure 1.1: Proposed Alignment of SOI Map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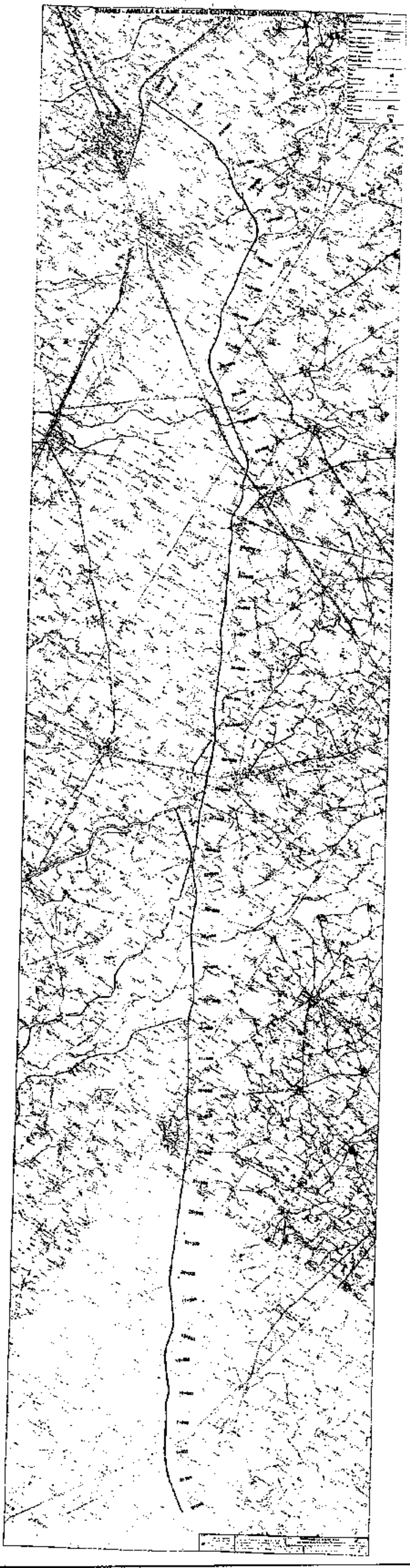

Annexure 1.2: Term of Reference (ToR) Issued by MoEF&CC

File No. 10/33/2021-IA.III
[Proposal No. IA/HR/NCP/221492/2021]
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)

Indira Paryavaran Bhawan,
Jor Bagh Road, Aliganj
New Delhi - 110 003

Dated: 22nd September, 2021

To

Dr. B. Mukhopadhyay
General Manager
National Highways Authorityof India
G-5 & 6, Sector-10, Dwarka, New Delhi-110 075

Subject: Development of 6 lane Access Controlled Greenfield Highway of Shamli – Ambala Sec. from Km Ch. 0+000 to Km Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1) by M/s National Highways Authority of India (NHAI) - Terms of Reference

Sir,

This has reference to your online proposal submitted to this Ministry on 23rd July 2021, seeking Terms of Reference (TOR) for the aforementioned project as per the provisions of the Environment Impact Assessment (EIA) Notification, 2006 and subsequent amendments under the Environment (Protection) Act, 1986.

2. The above mentioned proposal was considered by the Expert Appraisal Committee (EAC) for Infrastructure, CRZ and other miscellaneous projects in its 271st meeting on 26th August, 2021, in the Ministry of Environment, Forest and Climate Change, New Delhi.

3. The project proponent along with EIA consultant M/s Ambiental Global Private Limited, GZB made a presentation through Video Conferencing and submitted the following information.

i. The proposed project is for development of 6-Lane Access Controlled Greenfield Highway of Shamli– Ambala Section from Km Ch. 0+000 to Km Ch. 120+970 in the States of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1)". The proposed highway starts (Start Location: 29° 32'57.51" N 77°26'33.68"E) from Village Gogwan Jalalpur near Thanabhawan in district Shamli of Uttar Pradesh State and terminates (End Location: 30°24'48.27" N, 76° 47'1.26"E) on Ambala-Chandigargh Highway near village Sadopur near Ambala City in State of Haryana. The alignment passing through six districts namely Shamli and Saharanpur in the State of Uttar Pradesh and Yamunanagar, Karnal, Kurukshetra and Ambala in the State of Haryana. The total length of the project alignment is approx. 120.970 km.

ii. The proposed project falls under 7(f) - Highway, Category-A, as per EIA notification 2006. Total investment/cost of the project is Rs 396380 Lakhs (3963.80 Cr).

iii. Land use/ Land cover (approx. area) of the project site is as following:

S. No	Landuse/Landcover	Area (ha)	Percentage %	Remarks if any
1.	Private land	65	90.33	Agriculture Land
2.	Government land	677.5	8.67	Agriculture/Barren/other Land
3.	Forest land	7.5	1.0	Strip Plantation
	Total	**750**	**100**	-

iv. The land use pattern on 10 km either side of the project road is predominately agriculture followed by habitation, waste land. The area is alluvial plains of Yamuna river basin. The streams run north to south. The terrain of the alignment is basically plain with minor undulating in nature.

v. Water bodies: The proposed alignment consists of 03 nos. of rivers, 10 Nos. of Canals, and about 05 Nos. of Nalahs. Details of number of Nalas (seasonal & perennial) are being worked out by detailed topographic surveys. There shall be no major impact on the drainage system as sufficient numbers of structures (such as culverts, minor bridges and major bridges) will be constructed. The balancing culverts shall be provided to ensure no water logging in the area and all storm water shall be channelized systematically to the nearest natural stream.

vi. Water requirements: Approx. 24900 KLD Water will be extracted from suitable surface sources (river/canals) or ground water after obtaining necessary permissions from the competent authority. Ground water proposed to be used only for camp site for transient period after obtaining the permissions from appropriate authority.

vii. Tree cutting: The alignment will require cutting of approximately 7966 trees out of which approx. 400 nos. of trees falls in protected forest land and remaining 7566 falls in the private agriculture field. Most of the trees falling along the alignment are the part of agro forestry such as Mango, Poplar and other fruit bearing trees. The actual no. of trees proposed to be felled will be submitted in Final EIA after joint enumeration with appropriate authorities of respective State Government. Efforts will be made to minimize the trees loss by restricting trees cutting within formation width. Avenue plantation shall be carried out as IRC: SP: 21:2009"Guidelines on Landscaping and Tree Plantation" on available RoW apart from statutory requirements.

viii. Diversion of forest land: The proposed project highway passes through protected forest land of approx. 7.5 ha where it crosses canal side/roadside/railway side plantation. The actual land area data may be worked out once all land record data are compiled. Application will be submitted after joint survey with forest department.

ix. The alignment does not pass through any wild life sanctuary, protected area and its eco sensitive zone. Yamuna Nagar Thermal Power Plant, Panipat Thermal Power Plant and Rajpura Thermal Power Plant at a distance of 25 km, 90 km and 100 km, respectively, of proposed project alignment.

x. Land acquisition and R&R issues: The land acquisition for the proposed project is about 750 ha. Approx. 140 nos. of structures (Pucca Building, others structures like compound walls, temporary sheds, huts etc.) are coming in the proposed RoW. The land will be acquired as per the procedures laid down in NH Act, 1956 and RFCTLARR Act, 2013. The proposed Right of Way (RoW) of the project is 60 m.

xi. The proposed road will have ROBs (02), Major Bridges (05), Minor Bridges (13), and Vehicular underpass (33), LVUP (21), Interchanges (08) and Culverts-(208).The number of structures may vary to an extent for underpasses and culverts.

xii. There will be provision of 2 X toll plaza on carriageway at starting and towards end of alignment. There will be 12 toll booths on each toll plaza as per MoRT&H policy .4 X Interchanges will have toll plaza on slip roads. The total No of Toll Booths will be 56 in 4 Interchanges. There will be provision of 6 nos. of way side amenities (3 each side) along the proposed highway as per NHAI guidelines.

xiii. The proposed road shall be constructed to IRC: SP: 87 -2019, "Manual of Specifications and Standards for Six Laning of Highway Public Private Partnership" and other relevant IRC specifications on design manual as per normal practice. The mode of execution will be decided later. All safety measures will be provided as per IRC: SP: 55, "Guidelines on Traffic Management in Work Zones" and prevailing circular/notification of govt. of India/NHAI.

xiv. Fly ash will be used in the project as per fly ash notification 2016 of MoEF&CC.

xv. Employment potential: During the construction of the road project around 1000 persons would be employed temporarily for a period of 2.5 years. However due to construction of toll plazas and Way Side Amenities approx. 300 persons will be employed on permanent basis. The total manpower requirement for the project is 1300. Preference will be given to local people for employment.

xvi. Benefits of the project: The proposed highway project shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel. The junctions with existing road will be planned in the form of interchanges and flyover to ensure uninterrupted flow of traffic. The proposed road would act as the prime artery for the economic flow to this region. It will enhance economic development, provide employment opportunities to locals, strengthen tourist development, ensure road safety, and provide better transportation facilities and other facilities such as way side amenities. Vehicle operating cost will also be reduced due to improved road quality. The compensatory plantation and road side plantation shall further improve the air quality of the region.

xvii. Details of Court cases: No court case is pending against the proposed project.

4. The EAC based on the information submitted and clarifications provided by the project proponent and detailed discussions held on all the issues during its 271st meeting on 26th August, 2021, recommended the project for grant of Terms of Reference (ToR) with stipulated specific conditions along with other Standard ToR Conditions.

5. The Ministry of Environment, Forest and Climate Change has considered the proposal based on the recommendations of the Expert Appraisal Committee (Infrastructure, CRZ and other Miscellaneous projects) and hereby decided to grant Terms of Reference for the "Development of 6 lane Access Controlled Greenfield Highway of Shamli – Ambala Sec. from Km Ch. 0+000 to Km Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1)" and for preparation of EIA/EMP report with public consultations under the EIA Notification, 2006 as amended and CRZ Notification 2011, subject to strict compliance of the following specific conditions, in addition to all standard ToR conditions applicable for such projects.

SPECIFIC CONDITIONS

i. Cumulative impact assessment study should be carried out along the entire stretch including the other packages and the current stretch under consideration.

ii. Fly ash shall be used in the project depending as per fly ash notification 2016 of MoEF&CC and details regarding this be submitted.

iii. The proponent shall carry out a detailed traffic flow study to assess inflow of traffic from adjoining areas like airport/urban cities. The detailed traffic planning studies shall include complete design, drawings and traffic circulation plans (taking into consideration integration with proposed alignment and other state roads etc.). Wherever required adequate connectivity in terms of VUP (vehicle underpass)/ PUP (Pedestrian underpass) needs to be included.

iv. Road safety audit (along with accident/black spots analysis) by any third-party competent organization at all stages namely at detailed design stage, construction stage and pre-opening stage to ensure that the project road has been proposed considering all the elements of road safety.

v. Provide compilation of road kill data on the wildlife on the existing roads (national and state highways) in the vicinity of the proposed project. Provide measures to avoid road kills of wildlife by the way of road kill management plan.

vi. The alignment of road should be such that the cutting of trees is kept at bare minimum and for this the proponent shall obtain permission from the competent authorities. Alignment also should be such that it will avoid cutting old and large and heritage trees if any. All such trees should be geo-tagged, photographed and details be submitted in the EIA –EMP report.

vii. The proponent shall carry out a comprehensive socio-economic assessment and also impact on biodiversity with emphasis on impact of ongoing land acquisition on the local people living around the proposed alignment. The Social Impact Assessment should have social indicators which can reflect on impact of acquisition on fertile land. The Social Impact Assessment shall take into consideration of key parameters like people's dependency on fertile agricultural land, socio-economic spectrum, impact of the project at local and regional levels.

viii. As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 30th September, 2020, the project proponent, based on the commitments made during the public hearing, shall include all the activities required to be taken to fulfil these commitments in the Environment Management Plan along with cost estimates of these activities, in addition to the activities proposed as per recommendations of EIA Studies and the same shall be submitted to the ministry as part of the EIA Report. The EMP shall be implemented at the project cost or any other funding source available with the project proponent.

ix. In pursuance of Ministry's OM no stated above the project proponent shall add one annexure in the EIA Report indicating all the commitments made by the PP to the public

during public hearing and submit it to the Ministry and the EAC.

x. The Action Plan on the compliance of the recommendations of the CAG as per Ministry's Circular No. J-11013/71/2016-IA.I (M), dated 25th October, 2017 needs to be submitted at the time of appraisal of the project and included in the EIA/EMP Report.

xi. Passage for animal movement has to be detailed in the report (if alignment is passing through Forest area).

xii. A comprehensive plan for plantation of three rows of native species, as per IRC guidelines, shall be provided by the state forest department. Such plantation will be over and above the compensatory afforestation. Tree species should be same as per the forest type and native to the region. A proper plan for green belt development including financial requirements should be developed by the state forest department and submitted along with EIA-EMP.

xiii. The PP shall not use groundwater/surface water without obtaining approval from CGWA/SGWA as the case may be. The project proponent shall apply to the Central Ground Water Authority (CGWA)/State Ground Water Authority (SGWA)/Competent Authority, as the case may be, for obtaining No Objection Certificate (NOC), for withdrawal of ground water.

xiv. Detailed Biodiversity assessment and conservation/mitigation plan be developed by a reputed institute or by a team of expert of national repute.

xv. The proponent has to find out whether there are any riverine bird nesting site at Upstream / Downstream in the river crossing zones of the proposed project with the help of state forest department.

xvi. Rain water harvesting structures to be constructed at the either sides of the road with special precaution of oil filters and de-silting chambers.

xvii. Air pollution monitoring stations are to be installed.

GENERAL CONDITIONS

(i) A brief description of the project, project name, nature, size, its importance to the region/state and the country shall be submitted.

(ii) In case the project involves diversion of forests land, guidelines under OM dated 20.03.2013 shall be followed and necessary action be taken accordingly.

(iii) Details of any litigation(s) pending against the project and/or any directions or orders passed by any court of law/any statutory authority against the project to be detailed out.

(iv) Detailed alignment plan, with details such as nature of terrain (plain, rolling, hilly), land use pattern, habitation, cropping pattern, forest area, environmentally sensitive areas, mangroves, notified industrial areas, sand dunes, sea, rivers, lakes, details of villages, tehsils, districts and states, latitude and longitude for important locations falling on the alignment by employing remote sensing techniques followed by "ground truthing" and also through secondary data sources shall be submitted.

(v) Describe various alternatives considered, procedures and criteria adopted for selection of the final alternative with reasons.

(vi) Land use map of the study area to a scale of 1: 25,000 based on recent satellite imagery delineating the crop lands (both single and double crop), agricultural plantations, fallow lands, waste lands, water bodies, built-up areas, forest area and other surface features such as railway tracks, ports, airports, roads, and major industries etc. alongwith detailed ground survey map on 1:2000 scale showing the existing features falling within the right of way namely trees, structures including archaeological & religious, monuments etc. if any, shall be submitted.

(vii) If the proposed route is passing through any hilly area, the measures for ensuring stability of slopes and proposed measures to control soil erosion from embankment shall be examined and submitted.

(viii) If the proposed route involves tunneling, the details of the tunnel and locations of tunneling with geological structural fraction should be provided. In case the road passes through a flood plain of a river, the details of micro-drainage, flood passages and information on flood periodicity at least of the last 50 years in the area shall be examined and submitted.

(ix) If the project is passing through/ located within the notified ecologically sensitive zone (ESZ) around a notified National Park/Wildlife Sanctuary or in the absence of notified ESZ, within 10 km from the boundary of notified National Park/Wildlife Sanctuary, the project proponent may simultaneously apply for the clearance for the standing committee of NBWL. The EC for such project would be subject to obtaining the clearance from the standing committee of NBWL.

(x) Study regarding the animal bypasses/underpasses etc. across the habitation areas shall be carried out. Adequate cattle passes for the movement of agriculture material shall be provided at the stretches passing through habitation areas. Underpasses shall be provided for the movement of Wild animals.

(xi) Study regarding in line with the recent guidelines prepared by Wildlife Institute of India for linear infrastructure with strong emphasis on animal movement and identifying crossing areas and mitigation measures to avoid wildlife mortality.

(xii) The information shall be provided about the details of the trees to be cut including their species and whether it also involves any protected or endangered species. Measures taken to reduce the number of the trees to be removed should be explained in detail. The details of compensatory plantation shall be submitted. The possibilities of relocating the existing trees shall be explored.

(xiii) Necessary green belt shall be provided on both sides of the highway with proper central verge and cost provision should be made for regular maintenance.

(xiv) If the proposed route is passing through a city or town, with houses and human habitation on either side of the road, the necessity for provision of bypasses/diversions/under passes shall be examined and submitted. The proposal should also indicate the location of wayside amenities, which should include petrol stations/service centres, rest areas including public conveyance, etc.

(xv) Details about measures taken for the pedestrian safety and construction of underpasses and foot-over bridges along with flyovers and interchanges shall be submitted.

(xvi) The possibility that the proposed project will adversely affect road traffic in the surrounding areas (e.g. by causing increases in traffic congestion and traffic accidents) shall be addressed.

(xvii) The details of use of fly ash in the road construction, if the project road is located within the 100 km from the Thermal Power Plant shall be examined and submitted.

(xviii) The possibilities of utilizing debris/waste materials available in and around the project area shall be explored.

(xix) The details on compliance with respect to Research Track Notification of Ministry of Road, Transport and Highways shall be submitted.

(xx) The details of sand quarry and borrow area as per OM No.2-30/2012-IA-III dated 18.12.2012 on 'Rationalization of procedure for Environmental Clearance for Highway Projects involving borrow areas for soil and earth" as modified vide OM of even No. dated 19th March 2013, shall be examined and submitted.

(xxi) Climate and meteorology (max and min temperature, relative humidity, rainfall, frequency of tropical cyclones and snow fall); the nearest IMD meteorological station from which climatological data have been obtained to be indicated.

(xxii) The air quality monitoring shall be carried out as per the notification issued on 16th November, 2009. Input data used for Noise and Air quality modelling shall be clearly delineated.

(xxiii) The project activities during construction and operation phases, which will affect the noise levels and the potential for increased noise resulting from this project, shall be identified. Discuss the effect of noise levels on nearby habitations during the construction and operational phases of the proposed highway. Identify noise reduction measures and traffic management strategies to be deployed for reducing the negative impact if any. Prediction of noise levels shall be done by using mathematical modelling at different representative locations.

(xxiv) The impact during construction activities due to generation of fugitive dust from crusher units, air emissions from hot mix plants and vehicles used for transportation of materials and prediction of impact on ambient air quality using appropriate mathematical model, description of model, input requirement and reference of derivation, distribution of major pollutants and presentation in tabular form for easy interpretation shall be examined and carried out.

(xxv) The details about the protection to existing habitations from dust, noise, odour etc. during construction stage shall be examined and submitted.

(xxvi) If the proposed route involves cutting of earth, the details of area to be cut, depth of cut, locations, soil type, volume and quantity of earth and other materials to be removed with location of disposal/ dump sites along with necessary permission.

(xxvii) If the proposed route is passing through low lying areas, details of filling materials and initial and final levels after filling above MSL shall be examined and submitted.

(xxviii) The water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality and likely impacts on them due to the project along with the mitigation measures shall be examined and submitted.

(xxix) The details of water quantity required and source of water including water requirement during the construction stage with supporting data and also classification of ground water based on the CGWA classification, shall be examined and submitted.

(xxx) The details of measures taken during constructions of bridges across rivers/ canals/major or minor drains keeping in view the flooding of the rivers and the life span of the existing bridges shall be examined and submitted. Provision of speed breakers, safety signals, service lanes and foot paths shall be examined at appropriate locations throughout the proposed road to avoid accidents.

(xxxi) If there will be any change in the drainage pattern after the proposed activity, details of changes shall be examined and submitted.

(xxxii) Rain water harvesting pit shall be at least 3 - 5 m above the highest ground water table. Provisions shall be made for oil and grease removal from surface runoff.

(xxxiii) If there is a possibility that the construction/widening of road may cause an impact such as destruction of forest, poaching or reduction in wetland areas, examine the impact and submit details.

(xxxiv) The details of road safety, signage, service roads, vehicular under passes, accident prone zones and the mitigation measures, shall be submitted.

(xxxv) IRC guidelines shall be followed for widening & upgradation of roads.

(xxxvi) The details of social impact assessment due to the proposed construction of the road shall be submitted.

(xxxvii) Examine the road design standards, safety equipment specifications and Management System training to ensure that design details take account of safety concerns and submit the traffic management plan.

(xxxviii) Accident data and geographic distribution shall be reviewed and analyzed to predict and identify trends - in case of expansion of the existing highway and provide Post accident emergency assistance and medical care to accident victims.

(xxxix) If the proposed project involves any land reclamation, details shall be provided of the activity for which land is to be reclaimed and the area of land to be reclaimed.

(xl) Details of the properties, houses, business activities etc likely to be effected by land acquisition and an estimation of their financial losses, shall be submitted.

(xli) Detailed R&R plan with data on the existing socio-economic status of the population in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternative livelihood

concerns/employment and rehabilitation of the displaced people, civil and housing amenities being offered, etc and the schedule of the implementation of the specific project, shall be submitted.

(xlii) The environment management and monitoring plan for construction and operation phases of the project shall be submitted. A copy of your corporate policy on environment management and sustainable development shall also be submitted.

(xliii) Estimated cost of the project including that of environment management plan (both capital and recurring) and source of funding. Also, the mode of execution of the project, viz, EPC, BOT, etc, shall be submitted.

(xliv) A copy of your CSR policy and plan for meeting the expenditure to address the issues raised during Public Hearing shall be submitted.

(xlv) Details of blasting if any, methodology/technique adopted, applicable regulations/permissions, timing of blasting, mitigation measures proposed keeping in view mating season of wildlife.

(xlvi) In case of river/creek crossing, details of the proposed bridges connecting on either banks, the design and traffic circulation at this junction with simulation studies.

(xlvii) Details to ensure free flow of water in case the alignment passes through water bodies/river/streams etc.

(xlviii) In case of bye passes, the details of access control from the nearby habitation/habitation which may come up after the establishment of road.

(xlix) Bridge design in eco sensitive area /mountains be examined keeping in view the rock classification hydrology etc.

(l) Details of litigation pending against the project, if any, with direction/order passed by any Court of Law against the Project should be given.

(li) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.

(lii) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "http://moef.nic.in/Manual/Highways".

GENERAL GUIDELINES

(i) The EIA document shall be printed on both sides, as for as possible.

(ii) All documents should be properly indexed, page numbered.

(iii) Period/date of data collection should be clearly indicated.

(iv) Authenticated English translation of all material provided in Regional languages.

(v) The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the TOR.

(vi) The copy of the letter received from the Ministry on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.

(vii) The final EIA-EMP report submitted to the Ministry must incorporate the issues in TOR and that raised in Public Hearing. The index of the final EIA-EMP report, must indicate the specific chapter and page no. of the EIA-EMP Report where the specific TOR prescribed by Ministry and the issue raised in the P.H. have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.

(viii) Grant of TOR does not mean grant of EC.

(ix) Grant of TOR/EC to the present project does not mean grant of approvals in other regulations such as the Forest (Conservation) Act 1980 or the Wildlife (Protection) Act, 1972.

(x) Grant of EC is also subject to Circulars and Office Memorandum issued under the EIA Notification 2006 and subsequent amendments, which are available on the MoEF&CC website: www.envfor.nic.in.

(xi) The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.

(xii) On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed TOR (TOR proposed by the project proponent and additional TOR given by the MoEF) have been complied with and the data submitted is factually correct (Refer MoEF office memorandum dated 4th August, 2009).

(xiii) While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF office memorandum dated 4th August, 2009). The project Coordinator of the EIA study shall also be mentioned.

(xiv) All the TOR points as presented before EAC shall be covered.

6. A detailed draft EIA/EMP report shall be prepared in terms of the above additional TOR and should be submitted to the State Pollution Control Board for Public Hearing. Public Hearing to be conducted for the project in accordance with the provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing shall be conducted based on the TOR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the website.

7. The project proponent shall submit the detailed final EIA/EMP report prepared as per TOR including issues raised during Public Hearing to the Ministry for considering the proposal for environmental clearance before expiry of validity of ToR.

8. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc. vide notification of the MoEF dated 19th July, 2013.

9. The prescribed TOR would be valid for a period of four years for submission of the EIA/EMP Reports.

10. This issues with the approval of Competent Authority.

(Amardeep Raju)
Scientist 'E'

Copy to:

1. Member secretary, Haryana State Pollution Control Board, C-11, Sector-6, Panchkula, Haryana.
2. Addl. Principal Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (NZ), Bays No. 24-25, Sector 31 A, Dakshin Marg, Chandigarh - 160030.

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File No. 10/33/2021-IA.III
[Proposal No. IA/HR/NCP/231468/2021]
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)

Indira Paryavaran Bhawan,
Jor Bagh Road, Aliganj
New Delhi - 110 003

Dated: 6th December, 2021

To

Dr. B. Mukhopadhyay
General Manager
National Highways Authorityof India
G-5 & 6, Sector-10, Dwarka, New DElhi-110 075

Subject: Development of 6 lane Access Controlled Greenfield Highway of Shamli – Ambala Sec. from Km Ch. 0+000 to Km Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1) by M/s National Highways Authority of India – Amendment in Terms of Reference – Reg.

Sir,

This has reference to your online proposal no. IA/HR/NCP/231468/2021 submitted to this Ministry on 27th Sept. 2021, seeking Amendment in Terms of Reference for the aforementioned project as per the provisions of the Environment Impact Assessment (EIA) Notification, 2006 and subsequent amendments under the Environment (Protection) Act, 1986.

2. The above mentioned proposal was considered by the Expert Appraisal Committee (EAC) for Infrastructure, CRZ and other miscellaneous projects in its 278th meeting on 27th – 28th October, 2021, in the Ministry of Environment, Forest and Climate Change, New Delhi.

3. The proposed project is for Design of 6-Lane Access Controlled Greenfield Highway of Shamli– Ambala Section from Km Ch. 0+000 to Km Ch. 120+970 in the States of Uttar Pradesh, Haryana and Punjab under Bharatmala Pariyojana Phase II (Lot-9/Package-1)". The total length of the project alignment is approx. 120.970 km and Row is 60 m.

4. The proposed highway starts from Village Gogwan Jalalpur near Thanabhawan in district Shamli of Uttar Pradesh State and terminates on Ambala-Chandigargh Highway near village Sadopurnear Ambala City in State of Haryana. The alignment passing through seven districts namely Shamli and Saharanpur in the State of Uttar Pradesh, Yamuna nagar, Karnal, Kurukshetra and Ambala in the State of Haryana and Sahibzada Ajit Singh Nagar district in the state of Punjab.

5. The proposed project falls under 7(f) - Highway, Category-A, as per EIA notification 2006. Total investment/cost of the project is Rs 3963.80 Cr. ToR was granted vide letter no. 10/33/2021-IA.III dated 22.09.2021 in favour of NHAI.

6. After detailed land acquisition it has been observed that in between a small patch of the proposed alignment from Ch. 108+450 to Ch. 111+800 (Total Length=3.35 km) falls in Sahibzada Ajit Singh Nagar District in the state of Punjab.

7. Therefore, the proponent vide a letter no. 11013/1/2k/Env./127 dated 23rd Sept., 2021 and an online application No. IA/HR/NCP/231468/2021, dated 27th September 2021 has requested for the following amendment in Terms of Reference (ToR) letter No. 10/33/2021-IA.III, dated 22.09.2021.

Ref. No.	Approved ToR	Required Amendment
Subject	Development of 6 lane access controlled Greenfield Highway of Shamli- Ambala Sec. from Ch. 0+000 to km Ch. 120+970 (Total length: 120.970 km) in the states of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1).	Development of 6 lane access controlled Greenfield Highway of Shamli - Ambala Sec. from Ch. 0+000 to km Ch. 120+970 (Total length: 120.970 km) in the states of Uttar Pradesh, Haryana and **Punjab** under Bharatmala Pariyojana Phase II (Lot-9/Package-1).
Point No. 3 sub Point (i)	The proposed project is for development of 6-lane Access Controlled Greenfield Highway of Shamli - Ambala Section from Ch. 0+000 to Ch. 120+970 in the states of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1).	The proposed project is for development of 6-lane Access Controlled Greenfield Highway of Shamli -Ambala Section from Ch. 0+000 to Ch. 120+970 in the states of Uttar Pradesh, Haryana and **Punjab** under Bharatmala Pariyojana Phase II (Lot-9/Package-1).
Point No. 3 sub Point (i)	The Alignment passing through six districts namely Shamli and Sharanpur in the state of Uttar Pradesh and Yamunanagar, Karna, Kurukshetra and Ambala in the state of Haryana.	The Alignment passing through **seven** districts namely Shamli and Sharanpur in the state of Uttar Pradesh and Yamunanagar, Karnal, Kurukshetra and Ambala in the state of Haryana and **Sahibzada Ajit Singh Nagar in the State of Punjab.**
Point No. 5	"Development of 6 lane access controlled Greenfield Highway of Shamli- Ambala Sec. from Ch.0+000 to km Ch. 120+970 (Total length: 120.970 km) in the states of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1)".	"Development of 6 lane access controlled Greenfield Highway of Shamli- Ambala Sec. from Ch.0+000 to km Ch. 120+970 (Total length: 120.970 km) in the states of Uttar Pradesh, Haryana and **Punjab** under Bharatmala Pariyojana Phase II (Lot-9/Package-1)".

8. Reason for Amendment: The PP has given the following reasons for amendment "small patch of proposed alignment from Ch. 108+450 to Ch. 111+800 (Total length = 3.35 km) falls in the state of Punjab".

9. Based on the deliberations in the meeting and information provided by the proponent in support of the project, the EAC recommended for amendment in Terms of Reference during its 278th meeting on 27th – 28th October, 2021. As per the recommendation of the EAC, the Ministry of Environment, Forest and Climate Change hereby **accords Amendment in Terms of Reference** issued by the Ministry in favour of M/s National Highways Authority of India vide F. no. 10/33/2021-IA.III, dated 22.09.2021for "Development of 6 lane Access Controlled Greenfield Highway of Shamli – Ambala Sec. from Km Ch. 0+000 to Km Ch. 120+970 (Total length: 120.970 km) in the States of Uttar Pradesh and Haryana under Bharatmala Pariyojana Phase II (Lot-9/Package-1), as Para-7 above.

7. This issues with the approval of the Competent Authority.

(Amardeep Raju)
Scientist 'E'

Copy to:

1. Member secretary, Haryana State Pollution Control Board, C-11, Sector-6, Panchkula, Haryana.
2. Member secretary, Uttar Pradesh Pollution Control Board, Building.No. TC-12V, Vibhuti Khand, Gomti Nagar, Lucknow-226 010.
3. Addl. Principal Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (NZ), Bays No. 24-25, Sector 31 A, Dakshin Marg, Chandigarh - 160030.
4. Addl. Principal Chief Addl. Principal Chief Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (CZ), Kendriya Bhawan, 5th Floor, Sector "H" Aliganj, Lucknow - 226020 .

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Annexure 1.3: Compliance to the Term of Reference (ToR)

Annexure 1.3: Compliance to Terms of Reference (ToR)

The proposed project was granted Terms of Reference vide MoEF&CC File No.10-33/2021-IA.III dated 22nd September, 2021 and amended on dated 6th December 2021. Point-wise compliance to the Terms of Reference issued by MoEF&CC is provided as follows: -

ToR Compliance

S. No.	Term of Reference	Compliance Status
A. Project Specific Conditions		
i.	Cumulative Impact Assessment study to be carried out along the entire stretch including the other packages in the current stretch under consideration	As desired, the cumulative EIA Report shall be submitted at the time of submitting Environmental Clearance (EC) application
ii.	Fly ash shall be used in the project depending as per fly ash Notification 2016 of MoEF&CC and details regarding this to be submitted.	Deenbandhu Chhotu Ram TPP, Panipat TPS, Rajiv Gandhi TPP, Jhajjar TPP, etc. are located within 100km from the project highway. Fly ash shall be taken from these Thermal Power Plant based on their availability.
iii.	The proponent shall carry out a traffic flow study to access inflow of traffic from adjoining areas like airport/urban cities. The detailed traffic planning studies shall include complete design, drawings and traffic circulation plans (taking into consideration integration with proposed alignment and other state roads etc.). Wherever required adequate connectivity in term of VUP (vehicle underpass)/PUP (Pedestrian underpass) needs to be include.	Assessment of traffic within the project area has carried out. Details of traffic study and forecast are provided under Section 2.8 of EIA report.
iv.	Road safety audit (along with accident/black spots analysis) by any third-party competent organization at all stages namely at detailed design stage, construction stage and pre opening stage to ensure that the project road has been proposed considering all the elements of road safety.	As per IRC Guidelines, Road Safety audit shall be conducted during detailed design, construction & pre-construction stage & report shall be submitted to the MoEF&CC as part of EC Compliance.
v.	Provide compilation of road kill data on the wildlife on the existing road (national and state highways in the vicinity of the proposed project. Provide provide measure to avoid road kills of wildlife by the way of road kill management plan.	The proposed project is an access-controlled National Highway. Entry and exit at the highway shall only be allowed through interchanges. Also, the project doesn't pass through any natural/reserve forest. Vehicular underpasses are provided at all the crossings. Therefore, no roadkill is likely due to the proposed development. Road-kill data collection from various dept.

S. No.	Term of Reference	Compliance Status
		is under process, which shall be submitting at the time of Environmental Clearance (EC) application
vi.	The Alignment of road should be such that the cutting of trees is kept at bare minimum and for this the proponent shall obtained permission from the competent authorities. Alignment should be also such that it will avoid cutting old and large and heritage trees if any. All such trees should be geo tagged, photographed and detailers be submitted in the EIA-EMP report.	Minimum trees are proposed to be fell and restricted only within the construction zone (RoW). Tree felling shall be initiated only after obtaining the necessary permission from competent authority. (Refer Section 5.3.2 of EIA report)
vii.	The proponent shall carry out a comprehensive socio-economic assessment and also impact on biodiversity with emphasis on impact of ongoing land acquisition on the local people living around the proposed alignment. The Social Impact Assessment should have social indicators which can reflect on impact on land acquisition on fertile land. The Social Impact Assessment shall take into consideration of key parameter like people dependency on fertile agriculture land, socio-economic spectrum, impact of the project at local and regional levels.	Demographic details of the project affected districts are provided in Section 4.8 in Chapter 4 of EIA report. Comprehensive Socio-economic study is under progress and the report shall be submitted at the time of EC application along with final EIA report.
viii.	As per the Ministry's Office Memorandum F. No. 22-65/2017.IA.III dated 30th Sept 2020, the project proponent, based on the commitments made during the public hearing, shall include all the activities required to be taken to fulfill these commitments in the Environment Management Plan along with cost estimate of these activities, in addition to the activities proposed as per recommendations of EIA studies and the same shall be submitted to the ministry as part of the EIA report. The EMP shall be implemented at the project cost or any other funding sources available with the project proponent.	The public hearing shall be conducted and issues raise during the hearing shall be address properly and same will be incorporated into the final EIA report after public hearing. Environment Management Plan has been prepared and provided in Annexure 9.1 and detailed budget provisions are provided in Table 9-1 of Chapter-9 of EIA report.
ix.	In pursuance of Ministry's OM no stated above the project proponent shall add one annexure in the EIA Report indicating all the commitments made by the PP to the public during public hearing and submit it to the	The public hearing shall be conducted and issues raise during the hearing shall be address properly and same will be incorporated into the final EIA report after Public hearing.

S. No.	Term of Reference	Compliance Status
	Ministry and the EAC.	
x.	The action plan on the compliance of the recommendations of the CAG as per ministry circular No. J-11013/71/2016-IA.I(M), dated 25th October,2017 needs to be submitted at the time of appraisal of the project included in the EIA/EMP Report.	Address the compliance point in EIA / EMP Report as per MOEFCC Circular No J-11013/71/2016-IA.I (M) dated 25.10.2017.
xi.	Passage for animal movement has to be detailed in the report (if alignment is passing through Forest area).	The proposed alignment is not passing through any natural/reserve forest area.
xii.	A comprehensive for plantation of three rows of native species, as per IRC guidelines, shall be provided. Such plantation will be over and above the compensatory afforestation. Tree species should be same as per the forest type and native to the region. A proper plan for green belt development including financial requirements should be developed by the state forest department and submitted along with EIA-EMP.	Avenue plantation with local species of flowering, shade, medicinal, ornamental & fruit bearing trees shall be done within the available ROW as per IRC SP21:2009 and Green Highways (Plantation & Maintenance) Policy-2015. Budgetary provisions of mitigation measures and tree plantations are provided in **Table 9-1 of EIA report.**
xiii.	The PP shall not use the ground water/surface water without obtaining approval/NoC from CGWA/SGWA as the case may be. The project proponent shall apply to the Central Ground Water Authority (CGWA)/State Ground Water Authority (SGWA)/Competent Authority, as the case may be, for obtaining No Objection Certificate (NOC), for withdrawal of ground water.	The total demand of water for construction phase will be about **2,70,91,578** KL. Current water demand is only indicative in nature which shall differ during construction Phase. The demand of water shall be met through surface sources after obtaining necessary permission.
xiv.	Detailed Biodiversity assessment and conservation mitigation plan be developed by a reputed institute or by team of expert of national repute.	The proposed project is neither passing through nor falling within 10km radius of any wildlife sanctuary or eco-sensitive/protected area notified under Wildlife Conservation Act 1972. The list of flora & fauna observed in the study area is provided in Chapter-04 and detailed biodiversity assessment report of the project area with mitigation & conservation plan shall be submitted at the time of EC application.
xv.	The proponent has to find out whether there is any riverine bird nesting site at upstream/ downstream in the river crossing zones of	The detailed biodiversity assessment of the project area is under progress and the report with mitigation & conservation plan

S. No.	Term of Reference	Compliance Status
	the proposed project with the help of state forest department.	shall be submitted at the time of EC application.
xvi.	Rain water harvesting structure be constructed at both sides of the road with special precaution of oil filters and de-silting chambers.	Rainwater harvesting structures are proposed on either side at every 500m interval as per IRC 42:2014 guidelines and location specific requirements. Details provided in Chapter 5 of the EIA Report
xvii.	Air pollution monitoring stations are to be installed.	AAQ monitoring shall be done during Construction & Operation stage of the project. Number of sampling station along with frequency is provided under Environmental Monitoring Programm as Annexure 9.2.
B. General Conditions		
i.	A brief description of the project, project name, nature, size, its importance to the region/state and the country shall be submitted.	Project description are provided in Chapter 2 of the EIA report.
ii.	In case the project involves diversion of forests land, guidelines under OM dated 20.03.2013 shall be followed and necessary action be taken accordingly.	About 7.5 ha of protected forest land shall be diverted for the development of proposed project. The proposed alignment is passing through the strip plantation notified as protected forest along the roads & canals.
iii.	Details of any litigation(s) pending against the project and / or any directions or orders passed by any court of law / any statutory authority against the project to be detailed out.	No litigation is pending against the project.
iv.	Detailed alignment plan, with details such as nature of terrain (plain, rolling, hilly), land use pattern, habitation, cropping pattern, forest area, environmentally sensitive areas, mangroves, notified industrial areas, sand dunes, sea, rivers, lakes, details of villages, tehsils, districts and states, latitude and longitude for important locations falling on the alignment by employing remote sensing techniques followed by "ground truthing" and also through secondary data sources shall be submitted.	Details of Physiography, topography, water bodies, land use pattern, habitation, cropping pattern, environmental sensitive location and notified industrial areas are provided in Chapter 4 of EIA Report. Land use Land Cover map of project area is given in under Annexure 4.1 of the EIA report.
v.	Describe various alternatives considered, procedures and criteria adopted for selection of the final alternative with reasons.	The details of alternative analysis provided in Chapter-3 of EIA report.

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vi.	Land use map of the study area to a scale of 1: 25,000 based on recent satellite imagery delineating the crop lands (both single and double crop), agricultural plantations, fallow lands, waste lands, water bodies, built-up areas, forest area and other surface features such as railway tracks, ports, airports, roads, and major industries etc. along with detailed ground survey map on 1:2000 scale showing the existing features falling within the right of way namely trees, structures including archaeological & religious, monuments etc. if any, shall be submitted.	Land Use Land Cover map of project area is given in under Annexure 4.1 of the EIA report.
vii.	If the proposed route is passing through any hilly area, the measures for ensuring stability of slopes and proposed measures to control soil erosion from embankment shall be examined and submitted.	Project doesn't pass through any hilly area. However, turfing is proposed in high embankment areas to control soil erosion.
viii.	If the proposed route involves tunnelling, the details of the tunnel and locations of tunnelling with geological structural fraction should be provided. In case the road passes through a flood plain of a river, the details of micro-drainage, flood passages and information on flood periodicity at least of the last 50 years in the area shall be examined and submitted.	No tunnel is proposed. Also, proposed project doesn't intersect the flood plain of any river.
ix.	If the project is passing through/located within the notified ecologically sensitive zone (ESZ) around a notified National Park/Wildlife Sanctuary or in the absence of notified ESZ, within 10 km from the boundary of notified National Park/Wildlife Sanctuary, the project proponent may simultaneously apply for the clearance for the standing committee of NBWL. The EC for such project would be subject to obtaining the clearance from the standing committee of NBWL.	No notified National Park / Wildlife Sanctuary is located within 10.0 km radius of the project highway.
x.	Study regarding the animal bypasses /underpasses etc. across the habitation areas shall be carried out. Adequate cattle passes for the movement of agriculture material shall be provided at the stretches passing through habitation areas. Underpasses shall be provided for the movement of Wild animals.	Total 7 Major Bridges, 10 Major Bridges, 19 VUPs, 33 LVUP & 110 Culverts are proposed for free passage to villagers & animals and to avoid any impact on local hydrology. The details are provided in Chapter 2 of EIA report.

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xi.	Study regarding in line with the recent guidelines prepared by Wildlife Institute of India for linear infrastructure with strong emphasis on animal movement and identifying crossing areas and mitigation measures to avoid wildlife mortality.	No wildlife corridor was found in the vicinity of the project.
xii.	The information shall be provided about the details of the trees to be cut including their species and whether it also involves any protected or endangered species. Measures taken to reduce the number of the trees to be removed should be explained in detail. The details of compensatory plantation shall be submitted. The possibilities of relocating the existing trees shall be explored.	About **7966 nos.** of trees are likely to be felled within proposed RoW. However, to reduce the number of felling trees, construction shall be limited for construction zone only as per MoRTH & IRC guidelines.
xiii.	Necessary green belt shall be provided on both sides of the highway with proper central verge and cost provision should be made for regular maintenance.	Avenue plantation on both side of the project highway and median plantation shall be undertaken as per IRC SP-21:2009. Cost provision for regular maintenance provided in CER & EMP as per NHAI letter no. NHAI/GHD/02/ 01/02-22/2016/50 dated 17th January 2018 and Green Highways (Plantation & Maintenance) Policy 2015. The detail plan provided as Annexure 5.7 of EIA report.
xiv.	If the proposed route is passing through a city or town, with houses and human habitation on either side of the road, the necessity for provision of bypasses / diversions / under passes shall be examined and submitted. The proposal should also indicate the location of wayside amenities, which should include petrol stations / service centres, rest areas including public conveyance, etc.	The proposed project is an access-controlled project and alignment has been selected in such a way that, project maintains enough distance from major settlement areas.
xv.	Details about measures taken for the pedestrian safety and construction of underpasses and foot-over bridges along with flyovers and interchanges shall be submitted.	Project is an access-controlled highway and entry & exit shall only be allowed through interchanges. Traffic control devices and road safety features, including Traffic Signs, Road Markings etc. are proposed and designed as per relevant IRC codes and standards. Details of interchanges locations are provided in Chapter 2 of the EIA report.
xvi.	The possibility that the proposed project will	Proposed road is a green field access-

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	adversely affect road traffic in the surrounding areas (e.g. by causing increases in traffic congestion and traffic accidents) shall be addressed.	controlled highway, which do not have any adverse effect on existing traffic and surrounding area. On the existing stretches the road is being overpasses. Hence no impact on existing traffic.
xvii.	The details of use of fly ash in the road construction, if the project road is located within the 100 km from the Thermal Power Plant shall be examined and submitted.	Deenbandhu Chhotu Ram TPP, Panipat TPS, Rajiv Gandhi TPP, Jhajjar TPP, *etc* are located within 100km from the proposed highway. Fly ash shall be taken from these Thermal Power Plant based on their availability.
xviii.	The possibilities of utilizing debris / waste materials available in and around the project area shall be explored.	Waste material shall be used for land filling in high embankment areas based on their specification.
xix.	The details on compliance with respect to Research Track Notification of Ministry of Road, Transport and Highways shall be submitted.	This project is being compiled all the Guidelines & Notifications issued by MoRTH.
xx.	The details of sand quarry and borrow area as per OM No.2-30/2012-1A-III dated 18.12.2012 on 'Rationalization of procedure for Environmental Clearance for Highway Projects involving borrow areas for soil and earth" as modified vide OM of even No. dated March 19, 2013, shall be examined and submitted.	The quantity of sand quarry or borrow area required (proposed for the project) are given in Section 5.2.2.3 and 5.2.2.4 of EIA report. Quarry material shall be arranged from already approved quarries.
xxi.	Climate and meteorology (max and min temperature, relative humidity, rainfall, frequency of tropical cyclones and snow fall); the nearest IMD meteorological station from which climatological data have been obtained to be indicated.	The Indian Meteorological Department's (IMD) observatories in vicinity of proposed alignment is located at Karnal and Ambala in the State of Haryana. Long-Term climatological data (Years 1981 – 2010) has been analyzed for assessment of prevailing meteorological scenario in the project region. The details of the climate and meteorology of project area are provided in section 4.3.3 of EIA report.
xxii.	The air quality monitoring shall be carried out as per the notification issued on 16th November 2009. Input data used for Noise and Air quality modelling shall be clearly delineated.	The air quality monitoring has been carried out as per the notification issued on 16th November 2009. Input data used for Noise and Air quality modelling has been defined in section 5.2.3 & 5.2.5 of EIA report.
xxiii.	The project activities during construction and operation phases, which will affect the noise	The various effects of noise during construction phase on sensitive receptors

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	levels and the potential for increased noise resulting from this project shall be identified. Discuss the effect of noise levels on nearby habitations during the construction and operational phases of the proposed highway. Identify noise reduction measures and traffic management strategies to be deployed for reducing the negative impact if any. Prediction of noise levels shall be done by using mathematical modelling at different representative locations.	are provided in section 5.2.5.
xxiv.	The impact during construction activities due to generation of fugitive dust from crusher units, air emissions from hot mix plants and vehicles used for transportation of materials and prediction of impact on ambient air quality using appropriate mathematical model, description of model, input requirement and reference of derivation, distribution of major pollutants and presentation in tabular form for easy interpretation shall be examined and carried out.	The various impacts on ambient air quality during operation and construction phase are discussed in section 5.2.3.
xxv.	The details about the protection to existing habitations from dust, noise, odour etc. during construction stage shall be examined and submitted.	The measures for minimizing the impact of dust, noise and odour includes greenbelt development, dust suppression measures, acoustic enclosures, provision of PPE to the workers, scheduling of activities, etc. The details are provided during construction in Chapter-5 of EIA report.
xxvi.	If the proposed route involves cutting of earth, the details of area to be cut, depth of cut, locations, soil type, volume and quantity of earth and other materials to be removed with location of disposal/ dump sites along with necessary permission.	Details of the material sand quarry or borrow area (proposed for the project) is given in Section 5.2.2.3 and 5.2.2.4 of EIA report.
xxvii.	If the proposed route is passing through low lying areas, details of filling materials and initial and final levels after filling above MSL, shall be examined and submitted.	The proposed project is a green field alignment, which passes through the plain area. However, the voids created by excavation shall be backfilled with the excavated soil and level of road is 1.5 m to 2.5 m from the ground level.
xxviii.	The water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality and likely impacts on them due to the project	Total 3 Rivers and 29 Canal/nalas are crossing the proposed alignment. Bridges are proposed on water bodies. Silt fencing shall be installed along the water bodies

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	along with the mitigation measures, shall be examined and submitted.	during construction phase.
xxix.	The details of water quantity required and source of water including water requirement during the construction stage with supporting data and also classification of ground water based on the CGWA classification, shall be examined and submitted.	The total demand of water for construction phase will be about **2,70,91,578** KL. Current water demand is only indicative in nature which shall differ during construction Phase. The demand of water shall be met through surface sources after obtaining necessary permission.
xxx.	The details of measures taken during constructions of bridges across rivers / canals / major or minor drains keeping in view the flooding of the rivers and the life span of the existing bridges shall be examined and submitted. Provision of speed breakers, safety signals, service lanes and foot paths shall be examined at appropriate locations throughout the proposed road to avoid accidents.	Bridges are designed based on 50 years of rainfall data. Project is access controlled highway and entry & exit shall only be allowed through interchanges. Road safety measures shall be provided as per IRC guidelines.
xxxi.	If there will be any change in the drainage pattern after the proposed activity, details of changes shall be examined and submitted.	Drainage system has been designed as per IRC SP 42:2014. Cross drainage structures have been provided based on the outcome of hydrology study.
xxxii.	Rain-water harvesting pit shall be at least 3 - 5 m above the highest ground water table. Provisions shall be made for oil and grease removal from surface runoff.	Rainwater harvesting structures are proposed on either side at every 500m interval as per IRC 42:2014 guidelines and location specific requirements. Details are provided in Chapter 5 of the EIA Report.
xxxiii.	If there is a possibility that the construction/widening of road may cause an impact such as destruction of forest, poaching or reduction in wetland areas, examine the impact and submit details.	About 7.5 ha of protected forest land shall be diverted for the development of proposed project. The proposed alignment is passing through the strip plantation notified as protected forest along the roads & canals.
xxxiv.	The details of road safety, signage, service roads, vehicular under passes, accident prone zones and the mitigation measures, shall be submitted.	Traffic control devices and road safety features, including Traffic Signs, Road Markings etc. are proposed and designed as per relevant IRC codes and standards. Along the settlement stretches various no. of underpasses have been suggested.
xxxv.	IRC guidelines shall be followed for widening & upgradation of roads.	The proposed project is a greenfield access controlled National Highway.
xxxvi.	The details of social impact assessment due	The details of existing scenario of the socio-

S. No.	Term of Reference	Compliance Status
	to the proposed construction of the road, shall be submitted.	economic environment are provided in Section 4.8 of EIA report.
xxxvii.	Examine the road design standards, safety equipment specifications and Management System training to ensure that design details take account of safety concerns and submit the traffic management plan.	Safety and Traffic management plan shall be as per IRC SP 55:2014.
xxxviii.	Accident data and geographic distribution shall be reviewed and analyzed to predict and identify trends - in case of expansion of the existing highway and provide Post accident emergency assistance and medical care to accident victims.	An Emergency Response Plan shall be prepared by the Contractor for each construction packages and same should be approved by the Monitoring consultant. Arrangements for proper assistance and medical care to the victims shall be done in order to avoid any casualty. (Refer Section 7.5 of EIA report)
xxxix.	If the proposed project involves any land reclamation, details shall be provided of the activity for which land is to be reclaimed and the area of land to be reclaimed.	The proposed project will change the land use pattern within the ROW only. The voids created due to borrowing of earth material will be reclaimed in concurrence to landowner or the community.
xl.	Details of the properties, houses, business activities etc likely to be affected by land acquisition and an estimation of their financial losses, shall be submitted.	The details of the properties, houses, business activities etc. likely to be affected by land acquisition and estimation of their financial losses has been earmarked in SIA/RAP Report.
xli.	Detailed R&R plan with data on the existing socio-economic status of the population in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternative livelihood concerns/employment and rehabilitation of the displaced people, civil and housing amenities being offered, etc and the schedule of the implementation of the specific project, shall be submitted.	The details of the properties, houses, business activities etc. likely to be affected by land acquisition and estimation of their financial losses has been earmarked in SIA/RAP Report.
xlii.	The environment management and monitoring plan for construction and operation phases of the project shall be submitted. A copy of your corporate policy on environment management and sustainable development, shall also be submitted.	The details of Environment Management and Environment Monitoring Plan are provided in Annexure 9.1 & 9.2 of the EIA report.
xliii.	Estimated cost of the project including that of environment management plan (both capital and recurring) and source of funding. Also,	Detailed EMP budget has been provide in Chapter 9 of the EIA report.

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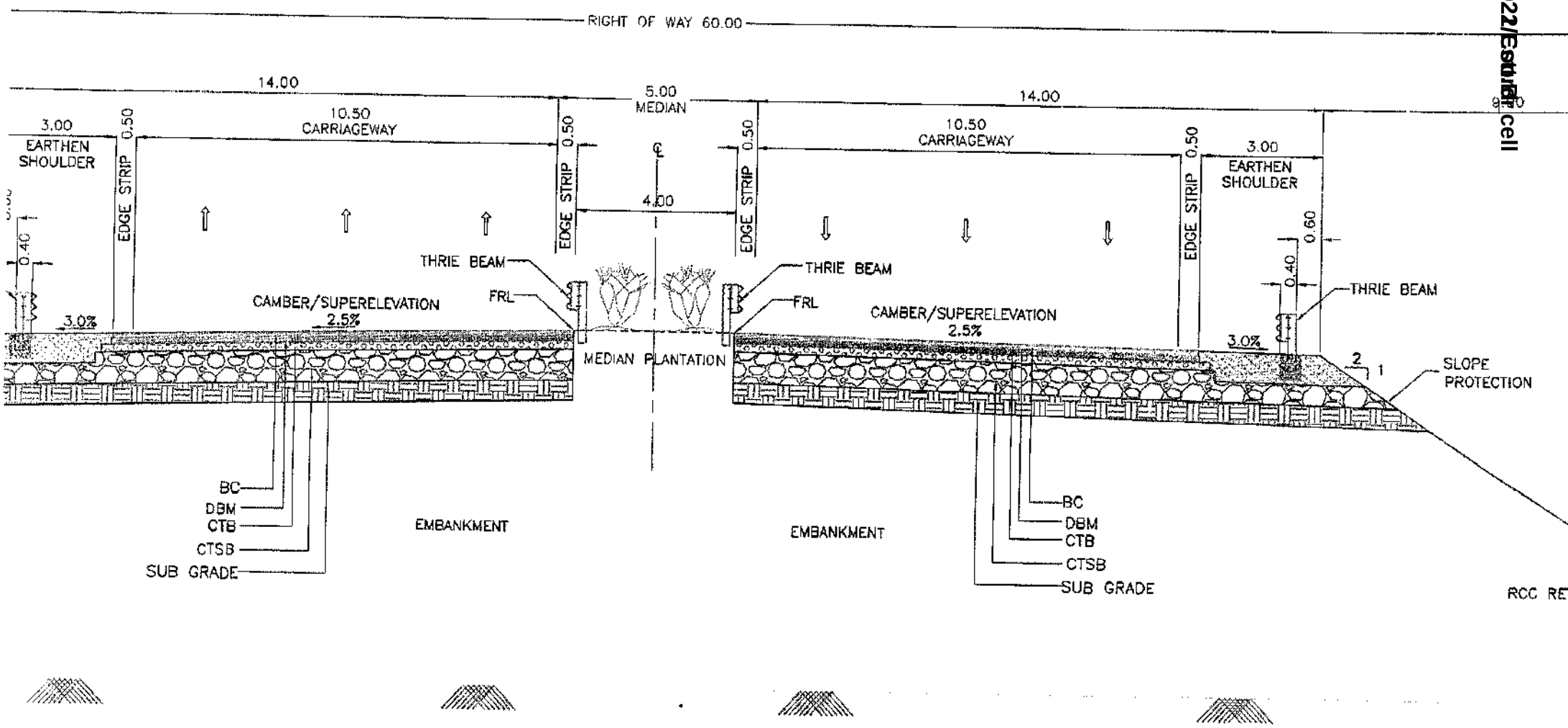
	the mode of execution of the project, viz, EPC, BOT, etc, shall be submitted.	
xliv.	A copy of your CSR policy and plan for meeting the expenditure to address the issues raised during Public Hearing, shall be submitted.	CSR is not applicable on NHAI.
xlv.	Details of blasting if any, methodology/technique adopted, applicable regulations/permissions, timing of blasting, mitigation measures proposed keeping in view mating season of wildlife.	No blasting is proposed for the project.
xlvi.	In case of river/creek crossing, details of the proposed bridges connecting on either banks, the design and traffic circulation at this junction with simulation studies.	Details of bridges proposed along the project highway is provide in Chapter 2 of EIA report.
xlvii.	Details to ensure free flow of water in case the alignment passes through water bodies/river/streams etc.	Cross drainage structures (bridges and culverts) are proposed on crossing water bodies. Details are provided in Chapter 2 of EIA report.
xlviii.	In case of bye passes, the details of access control from the nearby habitation / habitation which may come up after the establishment of road.	Project is an access controlled greenfield highway project.
xlix.	Bridge design in eco sensitive area /mountains be examined keeping in view the rock classification hydrology etc.	Project follows the plain terrain. No eco-sensitive area is located within 10.0 km radius of the project highway.
l.	Details of litigation pending against the project, if any, with direction / order passed by any Court of Law against the Project should be given.	No litigation pending against the project.
li.	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Detailed Environment Management Budget provided in Chapter 9 of EIA report.
lii.	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "http://moef.nic.in/Manual/Highways".	Noted

Annexure 2.1: Typical Cross Sections

CTSB
SUB GRADE

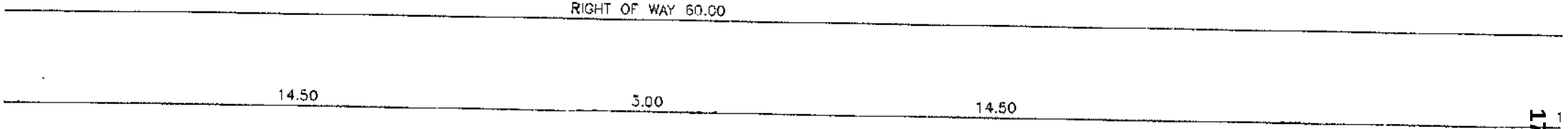
6-LANE HIGHWAY IN EMBANKMENT

CTSB
SUB GRADE



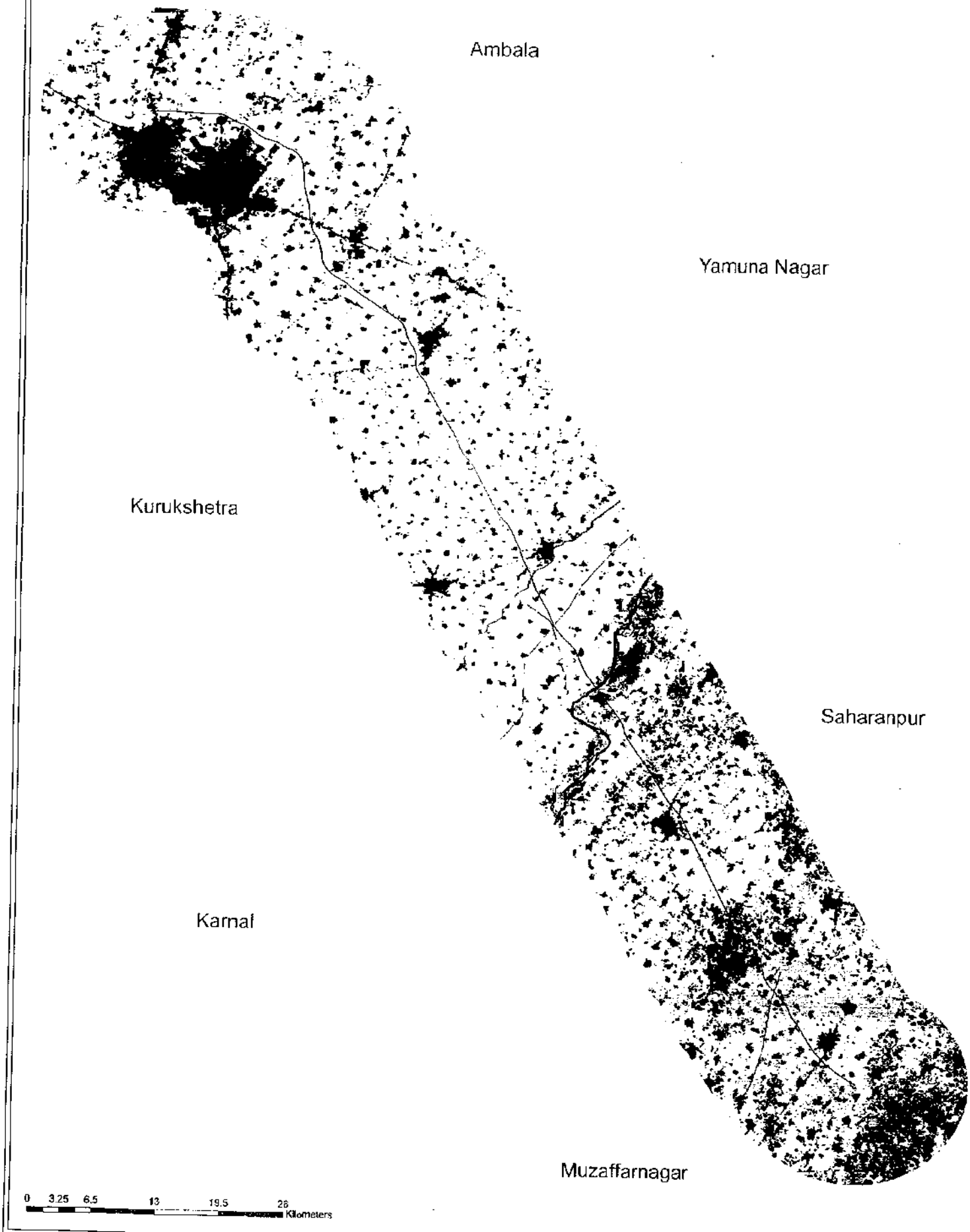
TCS-2

6-LANE HIGHWAY IN EMBANKMENT WITH RETAINING STRUCTURE



1531953/2021/sound_cell

Annexure 4.1: Land Use & Land Cover Map



Legend

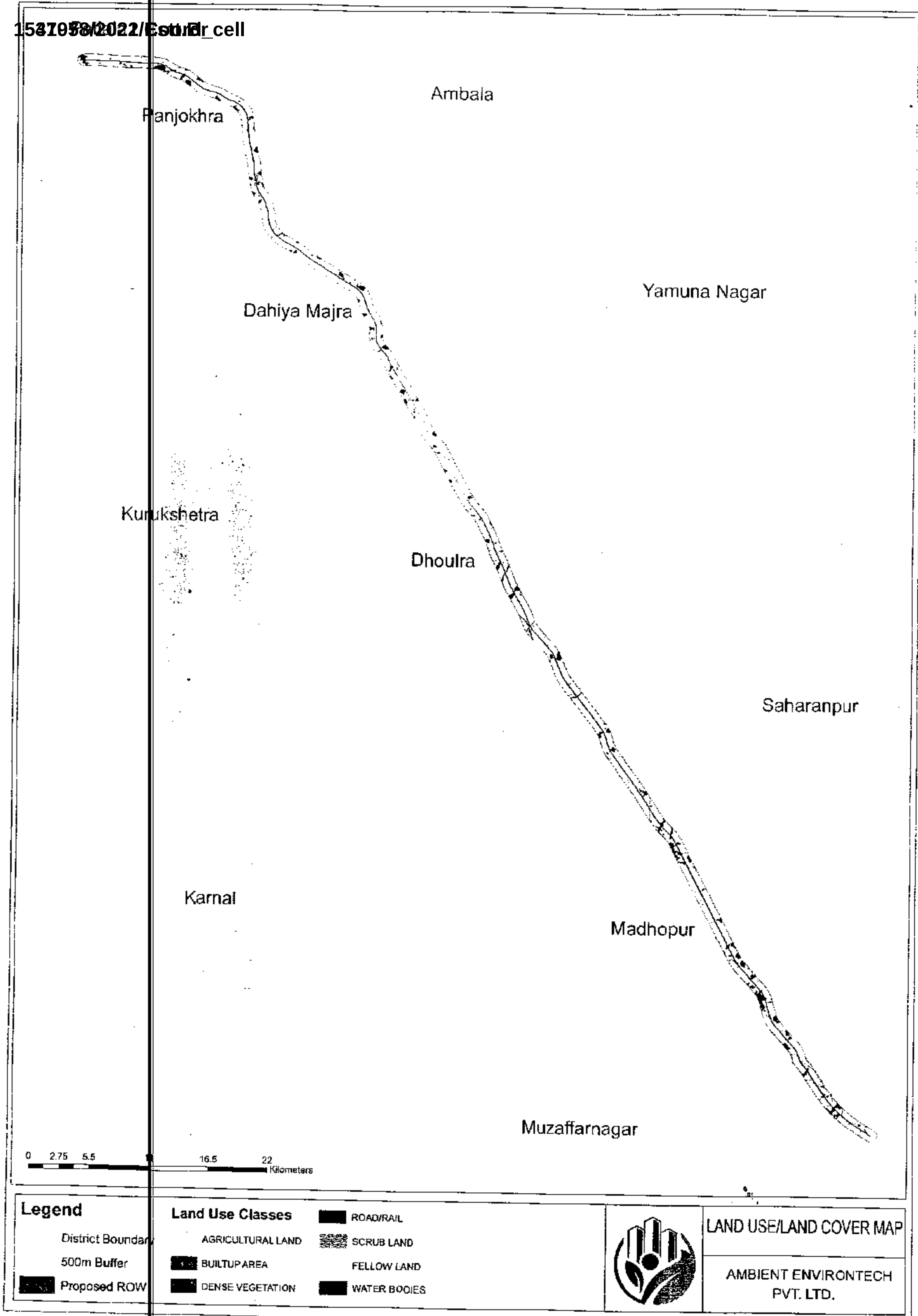
District Boundary
500m Buffer
Proposed ROW

Land Use Classes

AGRICULTURAL LAND
BUILTUP AREA
DENSE VEGETATION
NATURAL VEGETATION
SCRUB LAND
FELLOW LAND
WATER BODIES

LAND USE/LAND COVER MAP

AMBIENT ENVIRONTECH PVT. LTD.


Ambala
Panjokhra
Yamuna Nagar
Dahiya Majra
Kurukshetra
Dhoulra
Saharanpur
Karnal
Madhopur
Muzaffarnagar
0 2.75 5.5 11 16.5 22 Kilometers
Legend
District Boundary
500m Buffer
Proposed ROW
Land Use Classes
AGRICULTURAL LAND
BUILTUP AREA
DENSE VEGETATION
ROAD/RAIL
SCRUB LAND
FELLOW LAND
WATER BODIES
LAND USE/LAND COVER MAP
AMBIENT ENVIRONTECH PVT. LTD.

Annexure 5.1: Guidelines for Existing Quarry Management

Annexure 5.1: Guidelines for Existing Quarry Management

The Monitoring Consultant will finalize the locations from the list given by Contractor's/Concessionaire's for procuring materials. The Contractor/Concessionaire shall establish a new quarry only with the prior consent of the Consultant only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor/Concessionaire shall prepare a Redevelopment Plan for the quarry site and get it approved by the consultant.

The construction schedule and operations plans to be submitted to the consultant prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

CONSTRUCTION STAGE

Development of site: To minimize the adverse impact during excavation of material following measures are need to be undertaken:

i) Adequate drainage system shall be provided to prevent the flooding of the excavated area

ii) If the stockpiling locations, the Contractor/Concessionaire shall construct sediment barriers to prevent the erosion of excavated material due to runoff

iii) Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.

iv) The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.

v) In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

QUARRY OPERATIONS INCLUDING SAFETY

i) Overburden shall be removed and disposed in line with Guidelines for Debris Disposal Site and management given in Annexure-7.4 & 7.5

ii) During excavation, slopes shall be flatter than 20 degrees to prevent their sliding. In cases where quarry strata are good and where chances of sliding are less this restriction can be ignored.

iii) In case of blasting, procedure and safety measures shall be taken as per The Explosive Rules, 1983

iv) The Contractor/Concessionaire shall ensure that all workers related safety measures shall be done as per guidelines for Workers and Safety.

v) The Contractor/Concessionaire shall ensure maintenance of crushers regularly as per manufacturer's recommendation.

Topsoil will be excavated and preserved during transportation of the material measures shall be taken to minimize the generation of dust and prevent accidents.

The consultant shall review the quarry site for the management measures during quarry

operation, including the compliance to pollution norms.

POST CONSTRUCTION STAGE

- The Contractor/Concessionaire shall restore all haul roads constructed for transporting the material from the quarries to construction site to their original state.
- The Contractor/Concessionaire shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.
- The redevelopment of exhaust quarry shall be the responsibility of the agency providing the permit to ensure the implementation of Redevelopment Plan.

For existing quarry managed directly by a third party / Contractor/Concessionaire from whom the contractor is sourcing the materials, the plan should contain the following:

Sl. No.	Item	Unit	Details	Remarks by consultant, if any
1.	Name / identity of the location			
2.	Nearest project road Chainage.			
3.	Name of the owner			
4.	Area involved			
5.	Arrangement with the owner (agreement with the third party / contractor should be attached as an Annexure and should necessarily require the adaptation of good quarry management practices - a description of the requirements should be included)	Cum		
6.	Quantity of material to be withdrawn vis-a-vis the material available			
8.	Machinery & equipment to be used	Cum		
9.	Drainage plans			
10.	Top soil management			
11.	Description of the operating practices			
12.	Health facilities			
13.	Safety provisions made including fire protection systems and the availability of different personal protective equipment			
14.	Copy of the consents to operate from PCB, licences from Mining & Geology, Police & Fire dept should be attached as an Annexure.			
15.	Conditions laid down in the clearances / licenses and plans to ensure compliance			
16.	Monitoring plans for air quality			

Sl. No.	Item	Unit	Details	Remarks by consultant, if any
17.	Information on whether or not the quarry will be closed under this project. If yes, the proposed closure & restoration plan.			
18.	Photograph of the quarry prior to commencing operations.			
19.	Sketch of the layout of the quarry			

Attach Photograph of Proposed Site, Location Map, consents, licenses and Agreement with land owner

Submitted
Name & Signature
Designation
Contractor/Concessionaire

Checked & Approved
Name & Signature
Designation
Monitoring Consultant

Annexure 5.2: Guidelines for New Quarry Management

Annexure 5.2: Guidelines for New Quarry Management

1. Management Plan for New Quarry

The Contractor/Concessionaire shall prepare a quarry management plan for operation of new quarries and submit it to the Monitoring Consultant for approval and necessary actions. The plan shall consist of the following:

1.1 Selection Details

1.1.1 Location and Layout

Sketch plans and photographs to be provided along with adequate details:

- A map and sketch plan of the area showing the location of the proposed quarry site with respect to the project road, nearby villages, crusher plants and worker accommodation locations along with indicative distances of the different sites from each other and from the road.
- A detailed sketch plan of the quarry area showing approach and haulage roads, location of the rocky outcrops to be quarried, indicating which sites will be quarried in which year or phase, location of stock piles, location of guard house, perimeter fence, location of water sources, amenities, and any further details.
- Photographs of the site

1.1.2 Selection Criteria

- A brief statement as to how the site was chosen.
- Alternative sites that were considered to be mentioned.
- Record any public consultations involved while choosing and what the public concerns were, if any.

1.1.3 Agreement with landowners

- Statement of ownership of the land along with lease / purchase agreements.

1.1.4 Licenses and permits

- Contractor/Concessionaire to state the licences and permits that are necessary for operation, and attach them as appropriate.

1.2 Operation

1.2.1 Method of extraction

- A brief method statement of extraction indicating the techniques to be used, use of explosives if any, if so how are the charges laid, how often the blasting shall be done, etc.
- Appropriate reference should be made to the contractor's safety manual.
- A copy of the operator's licence to handle explosives should be submitted to the Consultant.

1.2.2 Loading and haulage

- Contractor/Concessionaire to describe the process in a few sentences of loading of rocks fragments; means of transportation to the crusher, and from the crusher to the site.

1.2.3 Crusher Plant

- Type, manufacturer, date of manufacture and principal specifications of the plant, details on testing and commissioning (by whom, to what standard, and when).

1.2.4 Storage of explosives

- Contractor/Concessionaire to state where these are to be procured from, where they will be stored and how the supply of explosives will be kept secure (if they are to be kept off site, state what precautions will be given for transportation).

1.2.5 Products

- A list of aggregate sizes and any other products from the quarry. Make sure the sketch map states where these will be stock piled.

1.2.6 Testing and quality assurance

- Refer quality assurance plan of Contractor/Concessionaire if any.
- If not, Contractor/Concessionaire to provide details of sampling frequency, who takes the does the testing, which standards are to be complied with, and any further pertinent details.

1.2.7 Water sourcing

- Contractor/Concessionaire must indicate the operations that shall need water, and its source (an indication on the sketch map will suffice).

1.2.8 Safety

- Contactor to divulge safety measures to the Consultant.
- Ensure that workers at the quarry sites are aware of the appropriate sections of the safety plan.

1.2.9 Workers Accommodation

- Contractor/Concessionaire to provide details of how many workers will be accommodated on site and what the accommodation arrangements and standard will be.

2. Environmental Management

2.1 Environmental Management during Operation

2.1.1 Removal of trees and plants

- Contractor/Concessionaire to describe briefly the floral species that have had to be removed (it will be helpful give local names if English or scientific names are not known), and roughly how many.

2.1.2 Overburden

- Contractor/Concessionaire to state where this will be deposited (indicate on the sketch map), and what methods will be taken to contain it, if any.

2.1.3 Silt management

- Contractor/Concessionaire to state how silt arising from quarry operations will be managed, e.g. provision of a silt retention pond, and show where this is on the sketch map. Say how the silt retention pond will be managed (i.e. how often it will be dredged).

2.1.4 Surface water drainage

- If it will be necessary to provide drainage channels, contractor to show on the sketch map where these are and confirm that they will be kept free of blockages.

2.1.5 Soil and water contamination

- Contractor to list sources of possible contaminants to the soil (fuel stores, etc) and what will be done to control it (minimise spillages, control leaks from plant, etc).

2.1.6 Air pollution

- What are the sources of air pollution?
- Details of air pollution control measures in each case.
- Details of worker protection equipment along with appropriate reference to the safety plan.

2.1.7 Noise

- Sources of noise distance from settlement, labour camp and proposed mitigation to the population / workers exposed.

2.1.8 Traffic

- Impact of quarry operations on traffic and how this may be controlled.

2.1.9 Approach road

- Contractor/Concessionaire to state whether this will be maintained, and if so in what condition.

2.2 Environmental Management at Closure of the site

2.2.1 Dismantling and removal of machinery

- Contractor/Concessionaire to state whether and when this shall be done.

2.2.2 Slope stabilisation and / or protection

- Measures taken to protect the slope and to guard against any possible serious rock fall or any measures to safeguard against hazards like this.

2.2.3 Rehabilitation

- Rehabilitation plan of the quarry.
- The Contractor/Concessionaire shall be responsible for the Redevelopment Plan prior to completion. The Consultant and the NHAI shall be responsible for reviewing this case of redevelopment prior to the issuing the defect liability certificate.

2.2.4 Hand-over

- Terms of hand-over of the quarry site to the owner/authority at the end of its use.

2.2.5 Removal of debris and solid waste

- Confirmation of Contractor/Concessionaire in removal of debris and solid wastes and disposal at a suitable site.

For each aggregate-cum-quarry sand source, the plan should be the same. The table below gives the format:

S. No.	Item	Unit	Details	Remarks by IC, if any
1.	Name / identity of the location			
2.	Nearest project road Chainage.			
3.	Name of the owner			
4.	Area involved	m^2		
5.	Existing land use (verification from land records with revenue department)			
6.	Land use of the area surrounding the proposed site including a map			
7.	Access roads – existing conditions, proposed development and maintenance			
8.	Tree cutting and vegetation clearance if any, along with compensation measures	Nos.		
9.	Arrangement with the owner (agreement with land owner should be attached as an Annexure)			
10.	Quantity of material to be withdrawn vis-a-vis the material available	Cum		
11.	Particular areas to be quarried should be clearly identified			
12.	Machinery & equipment to be used			
13.	Drainage plans			
14.	Top soil management			
15.	Description of the operating practices to be adopted.			
16.	Health facilities			
17.	Safety provisions made including fire protection systems and the availability of different personal protective equipment			
18.	Monitoring plans for air, noise and water quality			
19.	Copy of the consents to establish and operate should be attached as an Annexure.			
20.	Copy of the license from Mining & Geology, Police & Fire dept.			
21.	Conditions laid down in the clearances / licenses and plans to ensure compliance			
22.	Information on whether or not the quarry will be closed under this project. If yes, the proposed closure & restoration plan.			
23.	Concerns of the local people living in the immediate / near vicinity should be identified and appropriates			

S. No.	Item	Unit	Details	Remarks by IC, if any
	measures should be reflected			
24.	Photograph of the quarry prior to commencing operations.			
25.	Sketch of the layout of the quarry			

Attach Photograph of Proposed Site, Location Map, Consents, licenses, safety plan, tree compensation plan, restoration plan, drainage plan, monitoring plan, Agreement with land owner etc. as annexure

Submitted

Signature

Name

Designation

Contractor/Concessionaire

Checked & Approved

Signature

Name

Designation

Monitoring Consultant

Annexure 5.3: Plan for Borrow Area Management

Annexure 5.3: Plan for Borrow Area Management

SITING

Specific locations of borrow areas to be used (if any) will be identified by Contractor/ Concessionaire. In case the Contractor/ Concessionaire wants to open any new borrow areas and then the selection and recommendations for borrow areas will be based on environmental as well as civil engineering considerations. 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&CC, State Govt. and as specified in IRC:10-1961.

The Contractor/ Concessionaire shall establish a new borrow areas only with the prior consent of the Monitoring Consultant only in cases when:

- Lead from existing borrow area & quarries is uneconomical and
- Alternative material sources are not available.

The Contractor/ Concessionaire shall prepare a Redevelopment Plan for the borrow area and get it approved by the Monitoring Consultant.

Certain precautions have to be taken to restrict unauthorized borrowing by the Contractor/ Concessionaire. No borrow area shall be opened without permission of the Monitoring Consultant. The borrowing shall not be carried out in cultivable lands, unless and until, it shall be agreed upon by the Monitoring Consultant that there is no suitable uncultivable land in the vicinity for borrowing or private landowners are willing to allow borrowing on their fields.

The construction schedule and operations plan to be submitted to the Consultant prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement; transportation and storage of borrow earth material. The Contractor/ Concessionaire shall provide the following:

- Selection Criteria for Evaluation of Potential Borrow Areas
- A brief statement as to how the site was chosen
- Alternative sites that were considered to be mentioned
- Record any public consultations involved while choosing and what the public concerns were, if any
- Existing land use (Agricultural / Barren / Scrub / grazing / any other type)
- Vegetation / trees to be removed
- Erosion/degradation potential
- Distance and name of the nearest settlement
- Distance from the nearest surface water body
- Drainage pattern of the area
- Distance of the nearest Reserve Forest (if any) or any other ecologically fragile area
- Distance of the nearest Sacred Tree (if any)
- Distance from the nearest school / hospital / primary health center

- Daily / Occasional use of borrow area by the community
- Any schemes or avenues for generation of income for adjoining community
- Location and Layout
- Sketch plans and photographs to be provided along with adequate details:

A map and sketch plan of the area showing the location of the proposed site with respect to the project road, nearby villages and worker accommodation locations along with indicative distances of the different sites from each other and from the road.

Probable Borrow Areas data (to be filled by Contractor/Concessionaire)

Sample No.	Name of Village	Material type	Site identification			Approximate Quantity (Cum)				Available Land /Terrain	Surrounding Land/Terrain	Remarks
			Nearest Chainage (km)	Left / Right	Offset from nearest Chainage (m)	Length (m)	Breadth (m)	Depth (m)	Total (Cum)			
.												

REMOVAL OF TREES AND PLANTS

Contractor/Concessionaire to describe briefly the floral species that have had to be removed (it will be helpful give local names if English or scientific names are not known), and roughly how many.

MITIGATIONS & REHABILITATION OF BORROW AREAS

The soils to be used, as sub-grade, select sub-grade and shoulder materials need to be hauled from designated borrow areas. Similar to the identification of suitable quarries, suitable borrow areas for supply of soil to the new road formation were also identified. Based on the total requirement and availability of each soil type, estimates of soil quantity to be obtained from each of the borrow areas were worked out in accordance with IRC: 10-1961: Recommended Practice for Borrow Pits for Road Embankments constructed by Manual Operation. In the selection of the borrow areas, care was taken to ensure that:

- Sufficient quantity of suitable soil is available from the borrow areas;
- The borrow areas are as close to the project road as possible;
- The loss of productive and fertile agricultural soil is minimum; and
- There is minimum loss of vegetation.

For opening new borrow areas other than those identified the consultant shall follow above section. The borrowing shall not be carried out in cultivable lands, unless and until, it shall be agreed upon by the Consultant that there is no suitable uncultivable land in the vicinity for borrowing, or there are private land owners willing to allow borrowing on their fields.

REHABILITATION

The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits sites in a stable condition should be a fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level.

It is important to plan restoration from the outset and coordinate restoration activities. In addition to the bio-diversity issues, land planning considerations are also taken into account when defining a rehabilitation project in order both to preserve the environment and to generate income for the local communities. In this framework rehabilitation often leads to the creation of wetlands and or recreation areas.

Special borrow pit rehabilitation plan shall be specified according to the location and shaping of the mining slopes after exploitation and overburdened dump, with different subsequent uses e.g. forest, meadow, water body etc., the re-greening and replanting methods.

Other criteria which shall be followed for rehabilitation of quarry/ borrow pits are as given below:

- Borrow pits can be backfilled with rejected construction wastes except bitumen and will be given a vegetative cover. If this is not possible, then slopes will be smoothed and depression will be filled in such a way that it looks more or less like the original ground surface.
- During works execution, the Contractor/Concessionaire shall ensure preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; re-establishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff; and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people nearby. Once the works are completed, and at own expense the Contractor/Concessionaire shall restore the environment around the work site to its original splits.
- Appropriate plant species for the planting programme have to be selected in consultation with ecological consultant and local state forest department. Depending on the limitations on the availability of appropriate plant material, harsh growing conditions (lack of irrigation and hot summer) and ongoing quarry rehabilitation operations there may be substantial loss of plantation and the planting programme may have to be continued for over 3–5 years. As plantings are progressively established, they should be monitored before undertaking the next stage to ensure maximum plant survival rates.
- The borrow pit immediate surroundings shall be developed as a low maintenance reserve, with significant areas of native trees and shrubs and areas of longer grass and tussocks forming the open spaces. Walkways around the borrow site may be constructed. Provision for a future drive-in picnic area and car parking area may be developed.

Annexure 5.4: Guidelines for Identification of Debris Disposal Sites & Precautions

Annexure 5.4: Guidelines for Identification of Debris Disposal Sites & Precautions

Guidelines for identification

The locations of dumping sites have to be selected such that:

- No residential areas are located downwind side of these locations,
- Dumping sites are located at least 1000 m away from forest areas and water bodies
- Dumping sites do not contaminate any water sources, rivers etc.
- Dumping sites have adequate capacity equal to the amount of debris generated.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.

Precautions to be adopted during Dumping of Debris / Waste Material

The Contractor/Concessionaire shall take the following precautions while disposing off the waste material

- During the site clearance and disposal of debris, the Contractor/Concessionaire will take full care to ensure that public or private properties are not damaged / affected and that the traffic is not interrupted.
- The Contractor/Concessionaire will dispose of debris only to the identified places only with prior permission of the Environmental Specialist and the Consultant.
- Contractor can also dispose of the debris for the improvements in public utilities after the proper consent of villagers and approval of Environmental Specialist and the Consultant.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor/Concessionaire will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Environmental Specialist and the Consultant.
- The Contractor/Concessionaire will at all times ensure that the entire existing stream courses and drains within and adjacent to the site are kept safe and free from any debris.
- The Contractor/Concessionaire will utilise effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not the loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- During disposal of debris, proper warning signs to be installed to the satisfaction of Environmental Specialist and the Consultant.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Environmental Specialist and the Consultant.
- During the debris disposal, contractor will take care of surrounding features and avoid any damage to it.
- While disposing debris / waste material, the Contractor/Concessionaire will take into account the wind direction and location of settlements to ensure against any dust problems.
- Adequate arrangements will be made to ensure that the debris / waste material is disposed off nearest to the designated dumping site. The report on this activity shall be prepared regularly by Environmental Specialist and the Consultant.

Annexure 5.5: Guideline for Rehabilitation of Dumpsites & Quarries

Annexure 5.5: Guideline for Rehabilitation of Dumpsites & Quarries

Dumpsites

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the consultant

- The dump sites have to be suitably rehabilitated by planting local species of shrubs and other plants so that the landscape is coherent and is in harmony with its various components.
- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Some of the dumpsites could be used either for plantation or for growing agricultural produce.
- Care should always be taken to maintain the hydrological flow in the area.

Quarries

The Contactor/Concessionaire shall use materials from the existing and licensed quarry areas only. In case any new quarries are opened by the Contactor/Concessionaire, he shall secure permissions for the same and shall follow the rehabilitation plan.

- The objective of the rehabilitation programme is to return the quarry sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing quarry sites in a stable condition should be a fundamental requirement of the rehabilitation process. This could be achieved by filling the quarry / quarry floor to approximately the access road level.
- It is important to plan restoration from the outset and coordinate restoration with quarrying activities. In addition to the bio-diversity issues, land planning considerations are also taken into account when defining a rehabilitation project in order both to preserve the environment and to generate income for the local communities. In this framework quarry rehabilitation often leads to the creation of wetlands and natural reserves or recreation areas.
- Special quarry / quarry rehabilitation plan should be specified according to the location and shaping of the mining slopes after exploitation and overburdened dump, with different subsequent uses e.g. forest, meadow, water body etc., and the re-greening and replanting methods.

  Other criteria which should be followed for rehabilitation of quarry sites are as given below:
- Quarries will be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then slopes will be smoothed and depression will be filled in such a way that it looks more or less like the original ground surface.
- During works execution, the Contactor/Concessionaire shall ensure preservation of trees during piling of materials; spreading of stripping material to facilitate water percolation and allow natural vegetation growth; reestablishment of previous natural drainage flows; improvement of site appearance; digging of ditches to collect runoff; and maintenance of roadways where a pit or quarry is declared useable water source for livestock or people

nearby. Once the works are completed, and at own expense the Contactor/Concessionaire shall restore the environment around the work site to its original splits.

- To create a safe environment under the terms of The Mines and Quarries Act the faces have to be reduced to a naturally stable slope or be adequately fenced to prevent access to the top and bottom of the faces. Such a fence must be of a height as prescribed under The Mines Act with a barbed wire top strand designed to exclude the public from the quarry area. Depending on the location of the site presence of a permanent lake is considered to be a satisfactory alternative to a fence.
- Appropriate plant species for the planting programme have to be selected in consultation with ecological consultant and local forest department. Depending on the limitations on the availability of appropriate plant material, harsh growing conditions (lack of irrigation and hot summer) and ongoing quarry rehabilitation operations there may be substantial loss of plantation and the planting programme may have to be continued for over 3–5 years. As plantings are progressively established they should be monitored before undertaking the next stage to ensure maximum plant survival rates.

The quarry or quarry immediate surroundings should be developed as a low maintenance reserve, with significant areas of native trees and shrubs and areas of longer grass and tussocks forming the open spaces. Walkways around the quarries may be constructed. Provision for a future drive-in picnic area and car parking area may be developed.

Annexure 5.6: Guidelines for Sediment Control

Annexure 5.6: Guidelines for Sediment Control

All materials shall meet commercial grade standards and shall be approved by the Engineer before being used in the work.

CONSTRUCTION STAGE

Prior to the start of the relevant construction, the Contractor/Concessionaire shall submit to the Consultant for approval, his schedules for carrying out temporary and permanent erosion / sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment / sub-grade construction, bridges and other structures across water courses, pavement courses and shoulders. The Contractor/Concessionaire shall also submit for approval his proposed method of erosion / sedimentation control on service road and quarries and his plan for disposal of waste materials. Work shall not be started until the erosion / sedimentation control schedules and methods of operations for the applicable' construction have been approved by the Consultant.

The surface area of erodible earth material exposed by clearing and grubbing, excavation, quarry and fill operations shall be limited to the extent practicable. The Contractor/Concessionaire may be directed to provide immediate control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties, or cause contamination of nearby streams or other watercourses. Such work may involve the construction of temporary berms, dikes, sediment basins, slope drains and use of temporary mulches, fabrics, mats, seeding, or other control devices or methods as necessary to control erosion and sedimentation.

The Contractor/Concessionaire shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.

Temporary erosion, sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices, but may neither be foreseen daring design stage nor associated with permanent control features on the Project.

Where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion or sedimentation control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion or sedimentation control measures may be required between successive construction stages. Under no conditions shall a large surface area of credible earth material be exposed at one time by clearing and grubbing or excavation without prior approval of the Environmental Specialist.

The Consultant may limit the area of excavation, quarry and embankment operations in progress, commensurate with the Contractor's/Concessionaire's capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion, sedimentation and pollution control measures, in accordance with the accepted schedule.

Temporary erosion is sometimes caused due to the Contractor's/Concessionaire's negligence, carelessness or failure to install permanent controls. Sedimentation and pollution control measures then become necessary as a part of the work as scheduled or ordered by the monitoring consultant, and these shall be carried out at the Contractor's/Concessionaire's own expense. Temporary erosion, sedimentation and pollution control work required, which is not attributed to the Contractor's/Concessionaire's negligence, carelessness or failure to install permanent control, will be performed as per the need.

Temporary erosion, sedimentation and pollution control may include construction work outside the right of way where such work is necessary as a result of road construction such as quarry operations, service roads and equipment storage sites.

The temporary erosion, sedimentation and pollution control features installed by the Contractor's/Concessionaire's shall be maintained by him till these are needed, unless otherwise agreed by the Consultant.

Annexure 5.7: Tree Plantation strategy

Annexure 5.7: Tree Plantation strategy

1. INTRODUCTION

Due to the proposed development, some of the existing trees are to be felled. To offset this impact, compensatory afforestation programme through tree plantation, median plantation, horticulture and landscaping strategy has been prepared, based upon the experiences of successful implementation of a number of ongoing and completed projects.

2. OBJECTIVE

The main objectives are as follows:

- Reducing the impacts of air pollution
- Natural noise barrier
- Arrest of land erosion
- Providing much needed shade during the day time
- Prevention of vehicle glare from vehicles coming from opposite direction
- Enhancement of aesthetic view of the corridors
- Climatic amelioration
- Defining of ROW especially at sharp curves during night

3. SPECIES SELECTION

Grasses, shrubs and trees are the main species that are readily available in India. Where possible, the use of non-native species should be avoided since they can out compete and displace native plants leading to loss of native biodiversity. To maximise the chances of success, one should try to select species whose growing conditions roughly match the environmental conditions of the project site. Care should also be taken to select species with root systems that match the nature of the soil movement at the project site. Homogenous avenues of trees should be selected for long stretches as it provides aesthetic qualities in the landscaping. One should also take into account the economic and other social benefits while selecting the species for plantation. During the selection of species preference should be given towards rapid growing and pest and disease resistant species. Shrub species, which are dwarf and pollution hardy, are to be planted in the median to prevent the glare of traffic moving in opposite direction. Flowering, ornamentals plants and climbers can also be planted in urban areas to provide beauty. For this purpose, the species may be decided by interaction with local authority and local populace. Few species have also been recommended in the report under section 7.2.2.

4. TASKS OF THE CONTRACTOR/CONCESSIONAIRE

As part of this project implementation, the contractor/concessionaire shall plant and maintain flowering, shade, medicinal, ornamental & fruit bearing trees in suitable area for which cost has been budgeted besides planting and maintenance of ornamental, medicinal & flowering plants and shrubs in the median for which cost has also been budgeted. The specific roles and responsibilities of the Contractor/Concessionaire include:

- Identification of the plantation stretches with NHAI and or Consultant.
- Identification of nursery area and preparation of nurseries
- Planting of saplings in the nurseries during the construction period so that the saplings are a minimum 24 months old
- Replantation of the 2-year-old saplings to the plantation stretches and
- Maintenance for three years including watering, removal of weed, litter and debris from the vicinity of the plantation.
- Ensure the protection of the tree guards provided to the saplings from trampling and browsing by the cattle.

5. GUIDELINES FOR HORTICULTURE PLANTATION AND LANDSCAPING

5.1. General

5.1.1. Scope

Contractor/Consultant to furnish all materials, labour and related items necessary to complete the work indicated on drawing and specified herein.

5.1.2. Materials

Plant Materials

- Plant Materials shall be well formed and shaped true to type, and free from disease, insects and defects such as knots, sun-scaled, windburn, injuries, abrasion or disfigurement.
- All plant materials shall be healthy, sound, vigorous, free from plant diseases, insect's pests, of their eggs, and shall have healthy, well-developed root systems. All plants shall be hardy under climatic conditions similar to those in the locally of the project. Plants supplied shall confirm to the names listed on the plant list given in section 7.2.2. Besides these plant species, the Contractor/Concessionaire shall supply other species as desired by the landscaping specialist and or the environmental specialist of the consultant. Under no circumstances non-native species which might have a negative impact on the ecology of the area shall be permitted. No plant material will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.
- Any nursery stock shall have been inspected and approved by the Environmental Specialist of the Consultant.
- All plants shall conform to the requirements specified in the plant list. Except that plants larger then specified may be used if approved, but use of such plants shall not increase the contract price if the use of the larger plant is approved, the spread of roots or ball of earth shall be increased in proportion to the size of plant. Deliver plants with legible identification labels.

Top Soil (Good Earth)

- Topsoil or good earth shall be a friable loam, typical of cultivated topsoil of the locality containing at least 2% of decayed organic matter (humus). It shall be taken from a well-drained arable site. It shall be free of subsoil, stones, earth skids, sticks, roots or any other objectionable extraneous matter or debris. It shall contain no toxic material. No topsoil shall

be delivered in a muddy condition. It shall have pH value ranging in between 6 to 8.5.

Fertiliser

- Measurement of sludge shall be in stacks, with 8% reduction for payment. It shall be free from extraneous matter, harmful bacteria insects or chemicals (Subjected to safety norms).

Root System

- The root system shall be conducive to successful transplantation. While necessary, the root-ball shall be preserved by support with Hessian or other suitable material. On soils where retention of a good ball is not possible, the roots should be suitably protected in such a way that the roots are not damaged.

5.1.3. Condition

Trees and shrubs shall be substantially free from pests and diseases, and shall and shall be materially undamaged. Tom or lacerated roots shall be pruned before dispatch. No roots shall be subjected to adverse conditions such as prolonged exposure to drying winds or subjection to water logging between lifting and delivery.

5.1.4. Supply and Substitution

Upon submission of evidence that certain materials excluding the plant Species prescribed are not available at time of contract, the Contractor/Concessionaire shall be permitted to substitute with an equitable adjustment of price. All substitutions shall be of the nearest equivalent species and variety to the original specified and shall be subjected to the approval of the Environmental Specialist of the Consultant.

5.1.5. Packaging

Packaging shall be adequate for the protection of the plants and such as to avoid heating or drying out.

5.1.6. Marking

Each specimen of tree and shrub, or each bundle, shall be legibly labelled with the following particulars:

- Its name
- The name of the supplier, unless otherwise agreed.
- The date of dispatch from the nursery.

5.2. Plantation Pattern

The type of plantation would be based upon the requirements and the feasibility of the sites along the project corridor. The availability of the space in the RoW is a major guiding factor for landscaping. The plantation pattern to be followed is:

- The first row of plants along the highways will be of small to medium height plants planted at a spacing of 3m c/c and the distance from the second row should be 3m. The second row should be in staggered. The distance from the toe of the embankment should be 1m minimum and the height should be between 1.5m to 2m.

- Flowering shrubs shall be planted in the median in rows as per width availability. Where the width is less than 1.5m grass turfing is to be done. One row of plantation to be done at a spacing of 1.5m c/c.

For special landscaping, embankment slopes and ground cover, herbaceous species to be used. Turfing to be done by grass.

5.3. Tree Planting

5.3.1. Plants and Shrubs

Trees should be supplied with adequate protection as approved. After delivery, if planting is not to be carried out immediately, balled plants should be placed back to back and the ball covered with sand to prevent drying out. Bare rooted plants can be heeled in by placing the roots in prepared trench and covering them with earth, which should be watered into, avoid air pockets round the roots and shrubs shall be planted with the approval of Environmental Specialist of Consultant.

5.3.2. Digging of Pits

Tree pits shall be dug a minimum of three weeks prior to backfilling. The pits shall be 120cms in diameter and 120cms deep. While digging the pits, the topsoil up to a depth of 30cms may be kept aside, if found good (depending upon site conditions), and mixed with the rest of the soil.

If the side of the below, it shall be replaced with the soil mixture as specified further herein. If the soil is normal it shall be mixed with manure; river sand shall be added to the soil if it is heavy. The bottom of the pit shall be forked to break up the subsoil.

5.3.3. Back Filling

The soil back filled watered through end gently pressed down, a day previous to planting, to make sure that it may not further settle down after planting. The soil shall be pressed down firmly by treading it down, leaving a shallow depression all-round for watering.

5.3.4. Planting

No tree pits shall be dug until final tree position has been pegged out for approval. Care shall be taken that the plant sapling when planted is not be buried deeper than in the nursery, or in the pot. Planting should not be carried out in waterlogged soil. Plant trees at the original soil depth; soil marks on the stem is an indication of this and should be maintained on the finished level, allowing for setting of the soil after planting. All plastic and other imperishable containers should be removed before planting. Any broken or damage roots should be cut back to sound growth.

The bottom of the planting pit should be covered with 50mm to 75mm of soil. Bare roots should be spread evenly in the planting pit; and small mound in the centre of the pits on which the roots are placed will aid on even spread. Soil should be placed around the roots, gently shaking the tree to allow the soil particles to shift into the root system to ensure close contact with all roots and prevent air pockets Back fill soil should be firmed as filling proceeds, layer by layer, care being taken to avoid damaging the roots. The balance earth shall be filled in a mixture of 1:3 (1 part sludge to 3 part earth by volume) and 50gms potash, (Mop) 50gms of Super Phosphate and 1 Kg. Neem oil cake. Aldrin or equivalent shall be applied every 15 days in a mixture of 5ml

in 5 litres of water.

5.3.5. Staking

Newly planted trees must be held firmly although not rigidly by staking to prevent a pocket forming around the stem and newly formed fibrous roots being broken by mechanical pulling as the tree rocks.

The main methods of staking shall be:

- A single vertical shake, 900mm longer than the clear stem of the tree, driven 600mm to 900mm into the soil.
- Two stakes as above driven firmly on either side of the tree with a cross bar to which the stem is attached. Suitable for bare- rooted or Ball material.
- A single stake driven in at an angle at 45 degrees and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare-rooted or Ball material
- For plant material 3m to 4.5m high with a single stem a three- wire adjustable guy system may be used in exposed situations.

The end of stake should be pointed and the lower 1 m to 1.2m should be coated with a non-injurious wood preservative allowing at least 150mm above ground level.

5.3.6. Tying

Each tree should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or Hessian, between the tree and stake. The tree should be secured at a point just below its lowest branch, and also just above ground level: normally two ties should be used for tree. These should be adjusted or replaced to allow for growth.

5.3.7. Watering

The Contractor/Concessionaire through the Landscape Contractor should allow for the adequate watering in of all newly planted trees and shrubs immediately after planting and he shall during the following growing season, keep the plant material well-watered

5.3.8. Fertilising

Fertilising shall be carried out by application in rotation of the following fertilisers, every 15 days from the beginning of the monsoon till the end of winter:

- Sludge or organic well-rotted dry farm yard manure: 0.05 cum or tussle.
- Urea 25gm.
- Ammonium sulphate 25gm.
- Potassium sulphate 25gm.

All shrubs, which are supplied pot grown, shall be well soaked prior to planting. Watering in and subsequent frequent watering of summer planted container- grown plants is essential.

5.4. Shrub Planting In Planter Beds

All areas to be planted with shrubs shall be excavated, trenched to a depth of 750mm, refilling the excavated earth after breaking clods and mixing with sludge in ratio 8:1 (8 parts of stacked volume of earth after reduction by 20%: 1 part of stacked volume of sludge after reduction by 8%.)

Tall shrubs may need staking, which shall be provided if approved by the Contracting-consulting engineer, depending upon the conditions of individual plant specimen. For planting shrubs and ground cover shrubs in planters, good earth shall be mixed with sludge in the proportion as above and filled in planters.

Positions of planters shall be planted should be marked out in accordance with the Design drawings. When shrubs are set out, precautions should be taken to prevent roots drying. Planting holes 40cm diameter and 40cm deep should be excavated for longer shrubs. Polythene and other non-perishable containers should be removed and any badly damaged roots carefully pruned. The shrubs should then be set in holes so that the soil level after settlement will be original soil mark on the stem of the shrub. The holes should be back filled to half of its depth and firmed by treading. The remainder of the soil can then be returned and again firmed by treading.

5.5. Grassing

5.5.1. Preparation

During period prior to planting, the ground shall be maintained free from weeds. Grading and preparation of the area shall be completed at least three weeks prior to the actual sowing. Regular watering shall be continued until sowing by dividing the area into portions of approximately 5m squares by constructing small bunds to retain water. These 'bunds' shall be levelled just prior to sowing of grass plants; it shall be ensured that the soil has completely settled.

5.5.2. Soil

The soil itself shall be ensured to the satisfaction of Environmental Specialist Consultant to be a good fibrous loam, rich in humus.

5.5.3. Sowing the grass roots

Grass lines will be used to provide a strong surface cover and will be planted over a well prepared surface. Slope treatments using grasses will be allowed to establish properly such that the slopes are not subject to undue stress from erosion and mass movement in its initial stages. The sowing of grasses will create a strengthened surface that will reduce the vulnerability to erosion. Median with a width of 1.5 m will have only grasses to strengthen the surface. The Contractor/Concessionaire will ensure that the condition of the site is good enough for the successful establishment of grasses.

Grass roots shall be obtained from a grass patch, seen and approved beforehand. The grass roots stock received at site shall be manually cleared of all weeds and water sprayed over the same after keeping the stock in place protected from sun and dry winds. Grass stock received at site may be stored for a maximum of three days. In case grassing for some areas is

scheduled for a later date fresh stock of grass roots shall be ordered and obtained.

5.5.4. Execution

Small roots shall be dibbled about 5cms apart into the prepared grounds. Grass will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed. The Contractor/Concessionaire through the landscape contractor shall supervise all field operations like preparation of surface, sowing of grasses and quality of grasses seeds used.

- Carry out grassing such that a cover of 25 gm of grass seed per sqm of surface is achieved.
- Carry out seed sowing before the onset of monsoon [May & June] so as to achieve the desired results. The watering of the surface will be by tankers till the onset of the monsoon.
- Ensure that a mulch of prepared and dried out herbs is laid over the whole seeded area after sowing, in a thin layer, so that the grass is not affected by direct sunlight and transpiration loss.
- The grasses recommended for are *Cynodon dactylon, Cythoclinc purpurea, Solanum nigrum, Xanthium strumerium* etc.

5.5.5. Maintenance

As soon as the grass is approximately a 3cm high it shall be rolled with a light wooden roller - in fine, dry weather - and when it has grown to 5 to 8cms, above to ground weeds must be removed and regular cutting with the scythe and rolling must be begun. A top-dressing of an ounce of guano to the square yard or well decomposed well broken sludge manure shall be applied when the grass is sufficiently secure in the ground to bear the mowing machine, the blades must be raised an inch above the normal level for the first two or three cuttings. That is to say, the grass should be cut so that it is from 4 to 5cms in length, instead of the 3cm necessary for mature grass.

In the absence of rain, in the monsoon, the lawn shall be watered every ten days heavily, soaking the soil through to a depth of at least 20cms. Damage failure or dying back of grass due to neglect of watering especially for seeding out of normal season shall be the responsibility of the Landscaping Contractor. Any shrinkage below the specified levels during the contract or defect liability period shall be rectified at the Landscaping Contractor's expense. The Landscaping Contractor is to exercise care in the use of rotary cultivator and mowing machines to reduce to a minimum the hazards of flying stones and brickbats. All rotary mowing machines are to be fitted with safety guards.

5.5.6. Rolling

A light roller shall be used periodically, taking care that the area is not too wet and sodden.

5.5.7. Edging

These shall be kept neat and must be cut regularly with the edging shears.

5.5.8. Fertilising

The area shall be fed once in a month with liquid manure prepared by dissolving 45gms of ammonium sulphate in 5 litres of water.

5.5.9. Watering

Water shall be applied at least once in three days during dry weather. Watering whenever done should be thorough and should wet the soil at least up to a depth of 20cms.

5.5.10. Weeding

Prior to regular mowing the Landscaping Contractor shall carefully remove rank and unsightly weeds.

5.6. Maintenance of Plants

5.6.1. Cultivating

The Contractor/Concessionaire through the Landscaping Contractor shall maintain all planted areas within contract boundaries for one year until the area is handed over in whole or in phases. Maintenance shall include replacement of dead plants, watering, weeding, cultivating, control of insects, fungus and other diseases by means of spraying with an approved insecticide or fungicide, pruning, and other horticulture operations necessary for proper growth of the plants and for keeping the sub-contract area neat in appearance

5.6.2. Pruning and Repairs

Upon completion of planting work of the sub-contract all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the necessary to remove dead or injured twigs and branches and to compensate for the loss of roots and the result of the transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of trees.

5.6.3. Tree Guards and Protective Fencing

According to local environment, shrubs shall be protected adequately from vandalism until established. Where the tree guards are necessary, care should be taken to ensure that they do not impede natural movement or restrict growth. The specifications of the tree guard proposed are given below:

- The tree guards shall normally be brick in urban and bamboo guards in rural and semi urban areas. The specifications of the cement guards should be as per the relevant IS specification. In certain cases, if required by the Consultant, Circular Iron Tree Guard with Bars shall be provided. The specifications of such tree guard shall be as per relevant IS specification. The Consultant shall spell out in details about the cases where such exception shall be. In absence of any proper specification the decision of the Consultant and or NHAI shall be binding.

5.7. Nursery Stack

Planting should be carried out as soon as possible after reaching the site. Where planting must be a necessity and / or be delayed, care should be taken to protect the plants from pilfering or

damage from people / animals. Plants with bare-roots should be heeled-in as soon as received or otherwise protected from drying out, and others set closely together and protected from the wind. If planting is to be delayed for more than a week, packaged plants should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly labelled. If for any reason the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

5.8. Completion

On completion, the ground shall be formed over and left tidy.

6. SPECIAL CONDITIONS AND PARTICULAR SPECIFICATIONS.

- Wherever applicable, work shall be done according to specifications in vogue, at the time of invitation of tender.
- The Plantation area should avoid the stretches within the settlement area and the Ecological Sensitive area.
- The stretches identified should be free from encumbrances and should not lead to impact on any private or community asset. No fresh land acquisition shall be made under the project for the purpose of plantation.
- Contractor/Concessionaire through the Landscaping Contractor shall make his own arrangement for drawing water from there.
- The work included in the schedule of Quantities includes grassing as well as planting of trees and shrubs. The quoted rates shall include execution of these works at different levels and nothing extra shall be paid for any item, for working at these levels
- The Landscaping Contractor shall not be entitled to any compensation for any losses suffered by him and/or revision in the rates originally quoted by him.
    - On account unforeseen delay in commencing the work, whatever the cause of such delays is.
    - On account of reduction in the scope of work.
    - On account of suspension of work, or abandon after award of work.
- The Contractor/Concessionaire shall provide all facilities to Environmental Specialist / Project Engineer and / or his authorized representatives to make frequent inspection of their Nursery and ascertain the process / quality of various categories of trees / plants etc., grown by them.
- The quote rate shall include the cost of transportation of tools and plants to and from the site, including GST. It shall be clearly understood that no claim for any extra payment on account of GST shall be entertained after the opening of the tender.
- The safe custody and up-keep of various categories of plants brought to site is the sole responsibility of the Contractor/Concessionaire and he shall employ sufficient supervisory personnel to ensure the safety of these items.
- The site of work may be handed over to the Contractor/Concessionaire in phases, as soon as the same are available and the Contractor/Concessionaire in turn shall work in these areas forthwith. Nothing extra shall be payable for such phased execution of work.
- While excavating / executing the work the Contractor/Concessionaire shall ensure that the

existing cables / pipe lines / structures / fittings are not damaged and if due to his negligence, these are damaged, the same shall be set right with no extra cost to the clients.

- The Contractor/Concessionaire shall co-ordinate his work with other agencies employed by the Clients and ensure that the works of other agencies are not hampered in any way during the duration of contract.
- The Contractor/Concessionaire shall keep the site of works neat and clean during the execution of the work. Any debris found at or near the site of work shall be moved immediately as and when so required by the Environmental Specialist / Project Engineer.
- On completion of the work, the site of work shall be thoroughly cleaned and all debris removed before the work is handed over satisfactorily.
- The Contractor/Concessionaire shall, without any additional charge to the clients, renew or replace any dead or defective plants/grass for a period of 12 months after the certified date of completion.
- "General condition of contract and standard contract Forms of shall also form part of the contract.
- All Tree saplings should be two years (2) years old before they are planted. The numbers of the plants shall be as specified in the schedule of quantities and shall be straight and symmetrical with a crown and having a persistent main stem. The size of crown shall be in good overall proportion to the height of the tree.
- Small trees and shrubs shall be well formed with the crown typical of the species or variety.

General requirements of plants

- Plants shall be typical of their species and variety, well-developed branches, and well foliated with fibrous root system. Plants shall be free from defects and injuries. Plants shall not be pruned before planting.
- Plants shall be free from defects and injuries.
- Plants shall not be freshly dug and nursery grown.
- Nursery grown plants shall have been at least once transplanted
- Bark shall be free from abrasion.
- All trees, soon after planting, shall be properly supported with bamboo stocks to ensure their safety against winds or any other factor, which may affect it adversely.

Protection of "tree to be preserved"

- The Contractor/Concessionaire through the Landscaping Contractor shall be responsible for the protection of tops, trunks and roots of existing trees on site. Existing trees subject to the construction damage shall be boxed, fenced or otherwise protected before any work is started.

General Requirements of Earth Manure and Fertilisers

- EARTH: Good earth shall be agricultural soil of loamy texture, free from kankar, morrum, shingles, rocks, stones, building rubbish and any other foreign matter. The earth shall be free from clods or lumps of sizes bigger than 50mm in any direction. It shall have pH ranging in between 6.5 to 7.5.

- MANURE: Manure shall be of well-decayed organic matter obtained in dry state from the Municipal dump or other similar source approved by the Environmental Engineer/ Project Engineer. The manure shall be free from earth, stone or other extraneous matter. Manure shall be supplied, at site well screened.
- FERTILISER: If the soil tests indicate pH value not as per the above specification namely in between 6.5 to 7.5, following measures need to be taken.
- If pH exceeds 7.5, aluminium sulphate or equivalent fertilizer should be added at the rate of 1 kg per cubic metre to lower the pH by one full point.
- If pH is below 6.5, add ground limestone or equivalent fertilizer at the rate of 1 kg per cubic metre to raise pH by one full point.

7. TEAM FOR THE ASSIGNMENT

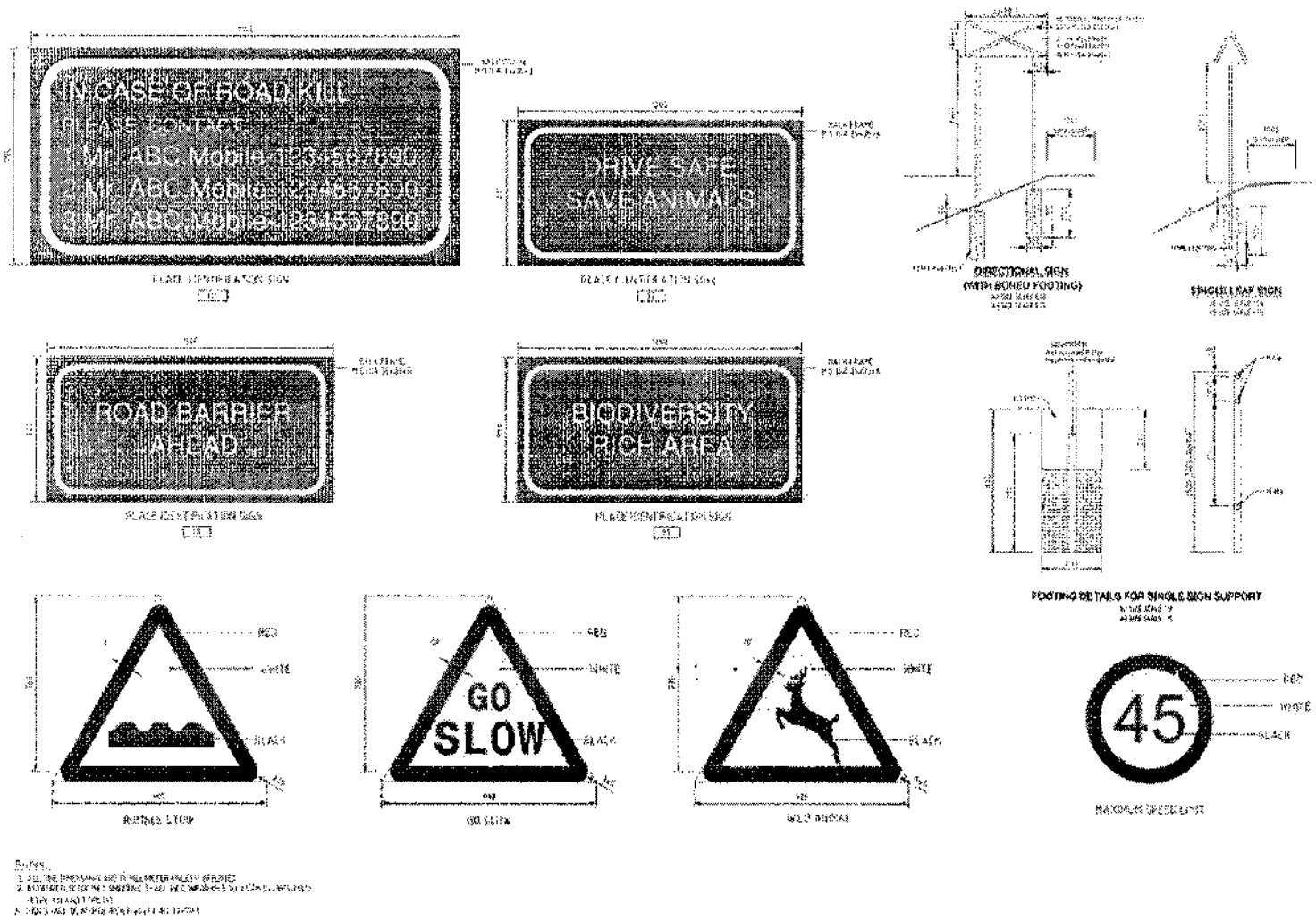
The Contractor/Concessionaire is free to recommend a team commensurate with the requirements of the project.

8. DATA TO BE PROVIDED BY THE CLIENT

Client will provide to the Contractor/Concessionaire the map showing settlements and the forest areas

Annexure 5.8: Conceptual Drawing for Roadside Signage - Wildlife

Annexure 5.8: Conceptual Drawing for Roadside Signage - Wildlife



Annexure 5.9: Traffic Control and Safety during Construction

Annexure 5.9: Traffic Control and Safety during Construction

A. TRAFFIC MANAGEMENT PRACTICES

The traffic on roads has increased manifold and most of the roads are expected to operate at their maximum capacity in the near future. Under the circumstances, the existing methods of maintenance and construction which compromise safety and cause delay are no longer acceptable and a change in work procedures and method has become inevitable. Under the existing method of maintenance and reconstruction, the traffic is invariably diverted over unprepared shoulders or forced to use part of the existing roads under maintenance. This results in the increase in vehicle operating cost and reduction in safety besides causing environmental pollution. Therefore, the existing work procedure and contract conditions are required to be changed to provide for proper management of traffic during the execution of work. The traffic management strategies to be used at traffic control zones must include the following fundamental principles:

(i) Make traffic safety an integral and high priority element of every project
(ii) Avoid inhibiting traffic as much as possible
(iii) Guide drivers in a clear and positive way
(iv) Perform routine inspection of traffic control elements and traffic operations
(v) Give care and attention to roadside safety

B. TRAFFIC CONTROL DEVICES

The primary traffic control devices used in work zones are signs, delineators, barricades, cones, pylons, pavement markings and flashing lights. The following general rules should apply to all traffic control devices within the traffic control zone.

(i) Comprehension: All traffic control devices should be capable of being easily understood. A particular device must convey one and only one meaning. Good and clean condition of the device aids comprehension.
(ii) Visibility and Stability: Devices should be within the cone of vision of the driver and be placed such that it allows adequate time at the average approach speed or the desired speed through the traffic control zone. All traffic control devices should be clearly visible by day and night, at these speeds and under the usually prevailing climatic conditions. They should be kept properly aligned and legible at all times. Foliage or any other obstruction should not be allowed to impede the view of these devices, nor should wind, road dirt or the like be allowed to obscure their face. The traffic control devices must be able to resist the local wind pressure, rain and the vibrations etc. of the passing traffic but these should not act as rigid obstacles in the event of a collision;

(iii) Installation and Removal: All traffic control devices should be installed for the minimum required time. Traffic control devices by their nature are a hindrance to the normal traffic flow and should be removed immediately after the need, being met by these is fulfilled. Existing devices like signs or lane markings should be removed during the temporary works and reinstated thereafter or covered while the temporary devices are in operation. The installation and removal of the temporary traffic control devices and the reinstatement of the pre-existing or new (where the scheme improves the road) traffic control devices must, therefore, be meticulously supervised to ensure the minimum period when there are no signs or markings

C. SIGNS

The road construction and maintenance signs fall into the same three major categories as do other traffic signs, that is Regulatory Signs, Warning Signs and Direction (or Guidance) Signs. The IRC: 67 (Code of Practice for Road Signs) provides a list of traffic signs. Where possible, the size, colours and placement of sign shall conform to IRC: 67. This also covers signs that are not included in IRC: 67 but are considered desirable to aid drivers' comprehension of the route through the road works. Each sign should be well located so that its message is seen and is clear, which will be assisted if the surroundings are devoid of "unnecessary" signs and other clutter. These signs should be of retroreflective sheets of high intensity grade or engineering grade depending upon the importance of the road as directed by the Engineer.

Annexure 8.1: Format for Reporting of Road Kill

Annexure 8.1: Format for Reporting of Road Kill

Date				**Time**	
Chainage (Km)-		**Village-**		**Distance from Road (m)**	
Local/ Common Name of Species		**Scientific Name (if known)**		**Sighting / Kill**	
Photographs of Road Kill					
Top View		**View from LHS**		**View from RHS**	
Signature (Contractor)		**Signature (Concessionaire)**		**Signature (AE/MC)**	

Annexure 9.1: Environmental Management Plan

Annexure 9.1: Environmental Management Plan

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
A. Pre-construction and Design Stage									
1. Alignment									
1.1 Pavement damage and inadequate drainage provisions in habitation areas	• Pavement Construction in habitation areas considering alignment level and drainage • Raise road level above the nearby areas with provision of adequate side drains to evacuate the rain water and domestic discharges (drained by inhabitants occasionally) to prevent damage to road and rain water entry to habitation area as per IRC SP:42-1994 and 50-1999. • Unlined drains are proposed along the road in either side Line drains are proposed at some of the locations.	Design requirement	All habitation areas, throughout the alignment	Design of both cross & side drains	Design of both sides drain in urban area should be incorporated in design	Review of detail design documents & drawings	Included in construction cost	Design Consultant	NHAI / AE
1.2 Safety along the proposed alignment	• Provision of Road signage and pavement marking as per IRC:67-2012. • Provision of speed regulator at intersections to regulate vehicle speed • Provision of signage and other safety measure for pedestrian crossing near habitat areas, school, hospital, religious places • Compliance with norms specified in IRC codes for major district road for curvature	Design requirement	Accident prone areas, habitat areas and bridge area, Wild Life Movement area	No. of accident & Vehicle collision, Accidental Kill of Wild life	Provision of cautionary sign board, Speed regulator and signage in habitat and sensitive areas	Field observation, interview of locals	Included in construction cost	Design Consultant	NHAI / AE
2. Natural Hazards									
2.1 Protection for damage from Earthquake	• Design considering relevant IRC specifications No 6-2010 for earthquakes in bridges		• Throughout the stretch	Incorporation of IRC guidelines for earthquake in bridge design	Incorporation of IRC guidelines	Review of bridge design	Project preparation Cost	Design Consultant	NHAI / AE
2.2 Protection of Road embankment in Flood prone / water	• Providing the adequate number of culverts to maintain the carrying capacity. • Provision of adequate drainage and cross drainage structures	IRC:34 Recommendations for road construction in waterlogged	All the existing culverts / bridges	Design of both cross & side drains	Design after consideration of flood hazard	Review of design	Included in construction cost	Design Consultant	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring Indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
logged areas		area and IRC: 75 and MORT&H guidelines for Design of High Embankment							
3. Shifting of utility structures									
3.1 Disruption of utility services to local community	• Electric poles, transformers, Hand Pump, HT Line and OFC poles are likely to be shifted before start of construction. Necessary permission and payments should be made to relevant utility service agencies to allow quick shifting and restoration of utility services • Local people must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any	Project requirement	Throughout the corridor	Utility shifting plan Complaints from local people Status of local utility services	Necessary approval from regulatory body with proper safety provisions	Interaction with concerned utility authorities and local public	Included in construction	Concessionaire /Contractor	NHAI / AE
B. Construction Stage									
1. Air Quality									
1.1 Dust Generation due to construction activities and transport, storage and handling of construction materials	• Transport of construction materials in covered vehicles. • Storage areas to be located downwind of the habitation area • Water spraying on earthworks, unpaved haulage roads and other dust prone area. • Provision of PPEs to workers.	MORT&H Specifications for Road and Bridge works (Clause No 111) Air Act, 1981 and Central Motor and Vehicle Act, 1988	Throughout project corridor	Particulate matter concentration measurement Dust pollution or complaint of locals	Zero complaint from locals Level of pollution should not exceed the NAAQ standards	Standards CPCB methods Observations Public consultation	Included in project cost	Concessionaire /Contractor	NHAI / AE
1.2 Emission of air pollutants (SO_2, NO_x, CO etc.) from vehicles due to traffic congestion and use of equipment and machinery	• Regular maintenance of machinery and equipment. • Batching plant, Asphalt mixing plants and crushers at downwind (1 km) direction from the nearest settlement. • Only crushers licensed by the PCB shall be used • Use of low Sulphur diesel as fuel in DG sets. • Ambient air quality monitoring • Use of PUC certified vehicles	The Air Act, 1981 and Rules 1982	Asphalt mixing plants, crushers, DG sets locations	Monitoring of ambient air quality & checking PUC certificates	Zero complaint from locals Level of pollution should not exceed the NAAQ standards	Standards CPCB methods	Included in project cost	Concessionaire /Contractor	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
2. Noise									
2.1 Noise from construction vehicle, equipment and machinery.	• All equipment to be timely serviced and properly maintained. • Construction equipment and machinery to be-fitted with silencers and maintained properly. • Only IS approved equipment shall be used for construction activities. • Timing of noisy construction activities shall be done during night time and weekends near schools and selected suitable times near temples when there are no visitors, • Time regulation near residential, built up and construction shall be restricted to daylight hours. • Initiation of multi layered plantation in open areas (if any) • Honking restrictions near sensitive areas • PPEs to workers • Noise monitoring as per EMP • Provision of Noise Barrier at sensitive receptors likely to experience high noise.	Noise Pollution (Regulation and Control) Rules, 2000	Throughout project section especially at construction sites, residential and identified sensitive locations	Noise levels Measurements Complaints from local people	Zero Complaints from locals Leq should not exceed as per prescribed limit	As per Noise rule, 2000 Consultation with local people	Included in Project Cost	Concessionaire/ Contractor	NHAI / AE
3. Land and Soil									
3.1 Land use Change and Loss of productive / top soil	• Non-agricultural areas to be used as borrow areas to the extent possible (if required).	Project requirement	Throughout the project section and borrow areas	Borrow pit locations Top soil storage area	Productive land should be avoided for borrowing / construction purpose	Review borrow area plan, site visits	Included in construction cost	Concessionaire /Contractor	NHAI / AE
3.2 Slope failure and Soil erosion due to Construction activities, earthwork, and cut and fill, stockpiles etc.	• Care should be taken that the slope gradient shall not be greater than 2:1. • The earth stockpiles to be provided with gentle slopes to prevent soil erosion.	IRC:56 - 1974 recommended practice for treatment of embankment slopes for erosion control	Throughout the entire project road	Occurrence of slope failure or erosion issues	Necessary provisions as per column 2 should be implemented	Review of design documents and site observation	Included in Constructio n cost	Design consultant and Contractor/Con cessionaire	NHAI / AE
3.3 Borrow	• Non-productive, barren lands, upland	IRC	Borrow sites	Existence of	Productive land	Review of	Included in	Design	NHAI / AE

Environmental issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
area management	shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Transportation of earth materials through covered vehicles. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. Else, it shall be converted into fishpond in consultation with fishery department. • Garland drain all along the Borrow area • Detailed borrow area management plan is given as Annexure 7.3.	specifications No 10-1961 on borrow areas (Environmental Protection Act and Rules, 1986; Water Act, Air Act)	location	borrow areas in inappropriate unauthorized locations. Poor borrow area management practices. Incidents of accidents. Complaints from local people.	should be avoided for borrowing purpose Borrow area should be selected as per MoRTH and IRC-10, 1961 specifications	design documents and site observation	Construction cost	consultant and Contractor/ Concessionaire	
3.4 Quarry Operations	• Aggregates will be sourced from existing licensed quarries • In case Contractor/Concessionaire decides in opening new stone quarries he shall follow the stipulated GoI norms	Clause No. 111.3 MORT&H Specifications for Road and Bridge works Guidelines	Quarry area locations	Existence of licenses for all quarry areas from which materials are being sourced	Only licensed quarry should be used	Review of design documents, contractor documents and site observation	Included in Construction cost	Contractor/Concessionaire	NHAI / AE
3.5 Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment	• Construction vehicles, machinery, and equipment to be stationed in the designated RoW to avoid compaction. • Approach roads / haulage roads shall be designed along barren and hard soil area to reduce the compaction. • Transportation of quarry material to the dumping site through heavy vehicles shall be done through existing major roads to the extent possible to restrict wear and tear to the village/minor roads. • Land taken for construction camp and other temporary facility shall be restored to its original conditions.	Design requirement	Parking areas, Haulage roads and construction yards.	Location of approach and haulage roads Presence of destroyed / compacted agricultural land or land which has not be restored to its original condition	Ensure 3times water sprinkling on all haul roads	Site observation	Included in construction cost	Contractor/Concessionaire	NHAI / AE
3.6 Contamination of soil due to leakage /	• Construction vehicles and equipment will be maintained and refueled in such a fashion that oil / diesel spillage does not contaminate the soil.	Design requirement	Fueling station, construction sites, and	Quality of soil near storage area Presence of	Should ensure proper storage to achieve zero contamination	Site observation	Included in construction cost.	Contractor/Concessionaire	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
spillage of oil, bituminous and non - bituminous debris generated from demolition and road construction	• Fuel storage and refueling sites to be kept away from drainage channels. • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • To avoid soil contamination 2 nos of Oil-interceptors shall be provided at wash down and refueling areas. • Waste oil and oil-soaked cotton/ cloth shall be stored in containers labeled 'Waste Oil' and 'Hazardous' sold off to MoEF&CC/SPCB authorized vendors only • Unusable and non-bituminous debris materials should be suitably disposed of in an environmentally acceptable manner at pre-designated disposal locations as directed by AE, with approval of the concerned authority. • The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal MoRTH guidelines should be followed		construction camps and disposal location.	spilled oil or bitumen in project area					
4. Water Resources									
4.1 Sourcing of water during Construction	• Requisite permission shall be obtained for abstraction of groundwater from Central Groundwater Authority and Surface Water from Irrigation Department and/or CWC or other concerned authorities. Extraction of Groundwater should be avoided since the project area is located in water scarce zone • Arrangements shall be made by contractor/concessionaire that the water availability and supply to nearby communities remain unaffected.	-	Throughout the project construction	Approval from competent authority Complaints from local people on water availability	No complaints from downstream users	Checking of documentation Discussion with local people	Included in construction cost	Contractor/Concessionaire	NHAI / AE
4.2 Disposal of waste water	• Waste water will be disposed at suitable location. • No-runoff water will be discharged to	Environment Protection Act, 1986 and Water	Throughout the Project construction	Existence of proper drainage system for	Reutilization for water sprinkling and horticulture	Standards methods Site observation	Included in construction cost	Contractor/Concessionaire	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
	existing pond being used for domestic and recreational purposes.	Act, 1974		disposal of waste water	purpose	and review of documents			
4.3 Alteration in surface water hydrology due to embankment	• Existing drainage system to be maintained and further enhanced.	Design requirement, Clause No 501.8.6. MORT&H Specifications	Near all drainage channels, river, cross drainages structures, etc.	Design of road side drains	No alteration	Review of design documents Site observation	Included in construction cost	Contractor/Concessionaire	NHAI / AE
4.4 Siltation in water bodies due to construction activities / earthwork	• Provision of 2420m of Silt fencing shall be made for water bodies • Earthworks and stone work to be prevented from impeding natural flow of streams and water canals or existing drainage system. • Periodic monitoring of water quality as per Environmental Monitoring Plan.	MoRT&H Specifications for Road and Bridge works and worldwide best practices	Near all water bodies, river embankment slopes.	Siltation of rivers, streams, ponds and other water bodies in project area	Ensure provision of silt fencing near water bodies to ensure zero siltation due to construction activities	Field observation	Included in construction cost	Contractor/Concessionaire	NHAI / AE
4.5 Deterioration in Surface water quality due to leakage from vehicles and equipment and waste from construction camps.	• No vehicles or equipment should be parked or refueled near water-bodies, so as to avoid contamination from fuel and lubricants. • 2 Nos of Oil-Interceptors shall be provided at wash down and refueling areas. • All chemicals and oil shall be stored away from water and concreted platform with catchment pit for spills collection. • Construction camp to be sited away from water bodies. • Wastes must be collected, stored and taken to approve disposal site only. • Water quality shall be monitored periodically	The Water Act, 1974 and amendments thereof.	Water bodies, refueling stations, construction camps.	Water quality of ponds, streams, rivers and other water bodies in project Presence of oil floating in water bodies in project area	Construction camp should be 500 m away from nearest water body Zero Contamination	Conduction of water quality tests as per the monitoring plan Field observation	Included in project cost	Contractor/Concessionaire	NHAI / AE
4.6 Sewage discharge from the construction camp	• Septic tank with soak pit will be provided in construction camp	The Water Act, 1974 and amendments thereof.	Construction Camp	Discharge practice of sewage	Provision of septic tank with soak pit in construction camp	Visual observation	Construction Cost	Contractor/Concessionaire	NHAI / AE
5. Flora and Fauna									
5.1 Vegetation	• Minimize tree cutting to the extent possible.	Forest Conservation	Throughout project	ROW width Number of	Proposer permission and	Review of relevant	Road side &	Contractor/Concessionaire,	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring Indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
loss due to site preparation and construction activities	• Approx. 7966 roadside trees to be removed with prior approval of competent authority. • Compensatory plantation shall be done at 1:10 ratio or as per the legal requirement • Avenue plantation & maintenance of 201586 trees • Regular maintenance of all trees planted. • Provision of LPG in construction camp as fuel source to avoid tree cutting, wherever possible. • Plantation of trees on both sides of the road to the extent possible. • Speed control & provision of signage for wildlife movement areas must be taken • Accidental road kill record must be documented and maintained as per the format of Annexure – 8.1 • In the event of design changes during the construction stages additional assessments including the possibility to save trees shall be made by the Environment Expert of AE. • Road side Plantation Strategy as per IRC SP21:2009 specifications including manuring	Act, 1980	corridor	trees for felling Compensatory plantation plan-Number of trees replanted	compensatory afforestation as per legislation	documents, tree cutting permit, compensatory plantation plan Field observations	Compensatory plantation cost is included in project costs.	Relevant agency specialized in afforestation	
6. Construction Camps									
6.1 Impact associated with location	• All camps should maintain minimum distance from following: ➢ 500m from habitation ➢ 500m from water bodies where possible ➢ 500m from through traffic route where possible • The average distance between two camps should be 50 km	Design Requirement	All construction camps	Location of campsites and distance from habitation, forest areas, water bodies, through traffic route and other construction camps	Guidelines as mentioned in column 2 should be followed	On site observation	Included in construction cost	Contractor/Concessionaire and AE	NHAI / AE
6.2 Worker's Health in construction	• The location, layout and basic facility provision of each labor camp will be submitted to AE prior to their	The Building and Other Construction	All construction camps	Camp health records	One qualified doctor supported by	Camp records	Part of the Contractors costs	Contractor/Concessionaire	NHAI / AE

Environmental issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
camp	construction. • The contractor, no later than 30 days after the issuance of the Notice to proceed will prepare and submit a Health and Safety Plan to the Engineer (AE) for review and approval. • The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner as approved by AE. • Adequate water and sanitary latrines with septic tanks attached to soak pits shall be provided. • Preventive medical care to be provided to workers including a First-Aid kit that must be available in the camp. • Waste disposal facilities such as dust bins must be provided in the camps and regular disposal of waste must be carried out. • No alcoholic liquor or prohibited drugs will be imported to, sell, give and barter to the workers of host community. • Awareness raising to immigrant workers / local community on communicable and sexually transmitted diseases.	workers (Regulation of Employment and Conditions of Service) Act 1996 and The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof		Existence of proper first aid kit in camp site Complaints from local people	one compounder in each camp	Site observation			
7. Management of Construction Waste / Debris									
7.1 Selection of Dumping Sites	• Unproductive / waste lands shall be selected for dumping sites. • Away from residential areas and water bodies • Public perception and consent / approval from the village Panchayats and other concerned authorities has to be obtained before finalizing the location.	Design Requirement and MORT&H guidelines	At all Dumping Sites	Location of dumping sites Public complaints	No dumping without permission from Gram Sabha / Municipal Corporation	Field survey and interaction with local people	Included in construction cost.	Contractor/Concessionaire	NHAI / AE
7.2 Reuse and Disposal of construction and dismantled waste	• The existing bitumen surface shall be utilized for paving of access roads and paving works in construction sites and camps temporary traffic diversions, and haulage routes. • Unusable and non-bituminous debris materials should be suitably disposed of	MORT&H guidelines	Throughout the project corridor	Percentage of reuse of existing surface material Method and location of disposal site	Ensure Zero contamination to land, soil and water bodies	Contractor records Field observation Interaction	Included in construction cost.	Contractor/Concessionaire	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
	in an environmentally acceptable manner at pre-designated disposal locations, with approval of the concerned authority. • The bituminous wastes shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal MoRTH guidelines should be followed			of construction debris		with local people			
8. Traffic Management and Safety									
8.1 Management of existing traffic and safety	• Temporary traffic diversion shall be planned by the contractor and approved by the AE. • The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for night time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC's SP 55 document'. • The Contractor/Concessionaire will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary paved diversions will be constructed. • Restriction of construction activity to only one side of the existing road. • The Contractor/Concessionaire shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from AE • Use of adequate signages to ensure traffic management and safety. Conduct of regular safety audit on safety measures.	Design requirement and IRC SP:55, 2001	Throughout the project corridor especially at intersections.	Traffic management plan Safety signs on site Number of traffic accidents	Approved Traffic Management Plan should be in place before start of construction activities Zero complaints from locals	Review traffic management plan Field observation of traffic management and safety system Interaction with people in vehicles using the road	Included in construction cost.	Contractor/Concessionaire	NHAI / AE
8.2 Pedestrians,	• Access to the schools, temples and other public places will be maintained when	Design requirement	Near habitation on	Road signage as per IRC	Ensure Road signage is in	Field observation	Included in construction	Contractor/Concessionaire	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
Cattle movement	construction takes place in nearby locations.	and IRC: SP: 27-1984 IRC: SP: 32 - 1988 Road Safety for Children (5-12 Years Old) IRC: SP:44-1994 Highway Safety Code	both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	guideline Complaints from local people	place as per IRC guideline	Interaction with local people	cost.		
8.3 Safety of Workers and accident risk from construction activities	• The contractor/concessionaire, no later than 30 days after the issuance of the Notice to proceed will prepare and submit a Health and Safety Plan to the Engineer (AE) for review and approval. • Contractor/Concessionaire to adopt and maintain safe working practices. • Usage of fluorescent and retro-reflectors signage, in local language at the construction sites • Training to workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor will not employ any person below the age of 18 years for any work • Use of hazardous material should be minimized and/or restricted. If used, hazardous material shall be handled as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 • Emergency plan (to be approved by	Child Labour Act, 1986 Indian Labour Laws	Construction sites	Availability of Safety PPEs to workers Safety signage Training records on safety Number of safety related accidents	Ensures Zero accident due to construction activities	Site observation Review records on safety training and accidents Interact with construction workers	Included in construction cost	Obligation of Contractor/Concessionaire	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
	engineer) shall be prepared to respond to any accidents or emergencies.								
8.4 Accident risk to local community	• Restrict access to construction sites to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • Adequate signage must be provided for safe traffic movement		Construction sites	Safety signs end their location Incidents of accidents Complaints from local people	Ensures Zero accident due to construction activities	Site inspection Consultation with local people	Included in construction cost	Contractor/Concessionaire	NHAI / AE
9. Site restoration and rehabilitation									
9.1 Clean-up Operations, Restoration and Rehabilitation	• Contractor/Concessionaire will prepare site restoration plans, which will be approved by the AE • The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. • All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used / affected by the project will be left clean and tidy, at the contractor's expense, to the satisfaction of the Environmental officer of AE. • All the opened borrow areas will be rehabilitated and CSC will certify in this regard.	Project requirement	Throughout the project corridor, construction camp sites and borrow areas	Clean and restored camp sites Presence / absence of construction material / debris after completion of construction works on construction site	NOC from respective authority / land owners	Site observation Interaction with locals Issue of completion certificate after restoration of all sites	Included in construction cost.	Contractor/Concessionaire	NHAI / AE
C. Operation stage									
1. Air quality									
1.1 Air pollution due to vehicular movement	• Roadside tree plantations shall be maintained. • Regular maintenance of the road will be done to ensure good surface condition • Vehicular air pollution will be monitored on regular basis. • Ambient air quality monitoring as per Environmental Monitoring Plan. If monitored parameters are above the prescribed limit, suitable control	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Throughout the Corridor	Ambient air quality (PM 2.5, PM10, CO, NOx, SO2) Survival rate of trees planted	No traffic congestion	As per CPCB requirements Site inspection	Included in Operation / Maintenance cost	PIU NHAI through monitoring agency	NHAI / AE

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
	measures must be taken. • Road signs shall be provided reminding the motorist to properly maintain their vehicles to economize on fuel consumption and protect the environment.								
2. Noise									
2.1 Noise due to movement of traffic	• Effective traffic management and good riding conditions shall be maintained to reduce the noise level throughout the stretch and speed limitation and honking restrictions may be enforced near sensitive locations. • The effectiveness of the multilayered plantation should be monitored and if needed, solid noise barrier shall be placed. • Create awareness amongst the residents about likely noise levels from road operation at different distances, the safe ambient noise limits and easy to implement noise reduction measures while constructing a building close to the road • Noise monitoring as per as per Environmental Monitoring plan • Provision of Noise Barrier at sensitive receptors likely to experience high noise	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Sensitive receptors	Noise levels	No horn key zone near sensitive receptor	Noise monitoring as per noise rules, 2000 Discussion with people in sensitive receptor sites	Included in Operation / Maintenance cost	PIU NHAI through monitoring agency	NHAI / AE
3. Land and Soil									
3.1 Soil erosion at embankment during heavy rain fall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching near water bodies, slope management, etc. • Necessary measures to be followed wherever there are failures	Project requirement	At slopes and other probable soil erosion areas.	Existence of soil erosion sites Number of soil erosion sites	No soil erosion	On site observation	Included in Operation / Maintenance cost	PIU NHAI through monitoring agency	PIU NHAI
4. Water resources/Flooding and Inundation									
4.1 Siltation	• Regular checks shall be made for soil erosion and turfing conditions of river • Provision of side drain on both side of the	Project requirement	Near surface Water bodies	Water quality	No siltation	Site observation	Included in Operation / Maintenance cost	PIU NHAI through monitoring agency	NHAI

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility: Implementation	Institutional Responsibility: Supervision
	road • Regular water quality monitoring								
4.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning of drains shall be done along the alignment to ensure that flow of water is maintained through cross drains and other channels / streams • Monitoring of water borne diseases due to stagnant water bodies	Project requirement	Near surface Water bodies	Areas with water stagnation	No water logging or blockage of side drains / CD structures	Site observation	Included in Operation / Maintenance cost	PIU NHAI through monitoring agency	NHAI
5. Flora									
5.1 Vegetation	• Planted trees, shrubs and grasses to be properly maintained • The tree survival audit to be conducted at least once in a year to assess the effectiveness	Forest Conservation Act, 1980	Project tree plantation sites	Minimum of 70% of tree survival	70% survival	Records and fields observations	Operation and Maintenance Cost	NHAI throug monitoring agency	NHAI
6. Fauna									
6.1 Wildlife	• Speed control & Condition of signage for wildlife movement areas must be monitored, checked and maintained properly • Accidental road kill record must be documented and maintained as per the format of Annexure – 8.1 • Ponds are slightly affected. bridge proposed at these locations.	Wildlife Conservation Act, 1972	Throughout project corridor & Specific stretches	Number of accidental road Kill of wildlife	Zero (0) accidental road kill of any Schedule I species	Audit/Review of efficacy of EMP, Condition of mitigation measures taken	Considered in EMP	Contractor/Concessionaire,	NHAI/ AE
7. Maintenance of Right of Way and Safety									
6.1 Accident Risk due to uncontrolled growth of vegetation	• Efforts shall be made to make shoulder completely clear of vegetation • Regular maintenance of plantation along the roadside	Project requirement	Throughout the project route	Presence of and extent of vegetation growth on either side of road Accident data	Necessary pruning	Visual inspection Accident records	Included in operation / Maintenance cost	NHAI	NHAI
6.2 Accident risks associated with traffic movement.	• Traffic control measures, including speed limits, will be enforced strictly. • Further encroachment of squatters within the ROW will be prevented. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained	IRC: SP:55	Throughout the Project route	Police records on accident Condition and existence of safety signs, rumble strips	Zero Accident	Review accident records Site observations	Included in Operation / Maintenance cost	NHAI	NHAI

Environmental Issue / Component	Remedial Measure	Reference to laws / guidelines	Location	Monitoring indicators	Target	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
								Implementation	Supervision
	• Tow-away facility for the break down vehicles if possible			etc. on the road					

Annexure 9.2: Environmental Standards & Environmental Monitoring Plan

Annexure 9.2: Environmental Standards & Environmental Monitoring Plan

Monitoring Parameters and Standards

The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

1.1 Ambient Air Quality Monitoring (AAQM)

The air quality parameters as per CPCB standard procedure and further recommendation of the World Bank as per direction of Environment Specialist of IE shall be regularly monitored at identified locations from the initiation of the project just after award of job to concessionaire. Ambient air quality shall be monitored in accordance with the National Ambient Air Quality Standards as given in Table 1.

The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 5.

Table 1: National Ambient Air Quality Standards

Sl. No.	Pollutants	Time-weighted average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Areas (notified by Central Government)	
1	Sulphur Dioxide (SO_2) µg/m³	Annual*	50	20	- Improved West & Gaeke - Ultraviolet fluorescence
		24 hours**	80	80	
2	Nitrogen Dioxide (NO_2) µg/m³	Annual*	40	30	- Modified Jacob and Hochheiser (Na-Arsenite) - Chemiluminiscence
		24 hours**	80	80	
3	Particulate Matter (size less than 10 µm) or PM_{10} µg/m³	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24 hours**	100	100	
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ µg/m³	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
		24 hours**	60	60	
5	Ozone (O_3)µg/m³	8 hours**	100	100	- UV photometric - Chemiluminiscence - Chemical Method
		1 hours**	180	180	
6	Lead (Pb) µg/m³	Annual*	0.50	0.50	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
		24 hours**	1.0	1.0	
7	Carbon Monoxide (CO) mg/m³)	8 hours**	02	02	- Non-Dispersive Infra-Red (NDIR) spectroscopy
		1 hours**	04	04	
8	Ammonia (NH_3) µg/m³	Annual*	100	100	- Chemiluminiscence - Indophenol Blue Method
		24 hours**	400	400	
9	Benzene (C_6H_6) µg/m³	Annual*	05	05	- Gas chromatography based continuous analyser - Adsorption and Desorption followed by GC analysis

Sl. No.	Pollutants	Time-weighted average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Areas (notified by Central Government)	
10	Benzo(a) Pyrene Particulate Phase only ng/m³	Annual*	01	01	- Solvent Extraction followed by HPLC/GC analysis
11	As ng/m³	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Ni ng/m³	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

** Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.*

*** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or monitoring and further investigation.

Source: MoEF Notification dated 16th November, 2009

1.2 Noise Quality Monitoring

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in Table 2. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 5.

Table 2: National Ambient Noise Quality Standards

Category of Area / Zone	Limits in dB(A) Leq	
	Day Time	Night Time
Industrial area	75	70
Commercial area	65	55
Residential area	55	45
Silence Zone	50	40

Note: (1) Day time shall mean from 6.00 a.m. to 10.00 p.m. (2) Night time shall mean from 10.00 p.m. to 6.00 a.m. (3) Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority (4) Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

1.3 Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO, coliform count, total suspended solids, total dissolved solids, Iron, Fluorides etc. shall be monitored at all identified locations from initiation of the project just after award of job to concessionaire as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500:2012, presented in Table 3 & 4 respectively. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan 5.

Table 3: Primary Water Quality Standards

S. No.	Designated Best Use	Class of Water	Criteria
1	Drinking Water source (with conventional treatment)	A	Total Coliform MPN/100 ml shall be 50 or less pH between 6.5 to 8.5 Dissolved Oxygen 6 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 2 mg/l or less
2	Outdoor bathing (organised)	B	Total Coliform MPN/100 ml shall be 500 or less pH between 6.5 to 8.5 Dissolved Oxygen 5 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 3 mg/1 or less
3	Drinking Water source (without conventional treatment)	C	Total Coliform MPN/100 ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4 mg / l or more Biochemical Oxygen demand (BOD) 5 days 20°C 3 mg/1 or less
4	Propagation of Wildlife	D	pH between 6.5 to 8.5 for fisheries Dissolved Oxygen 4 mg / l or more Free Ammonia (as N) 1.2 mg/l or less
5	Irrigation, Industrial Cooling, Controlled Waste	E	pH between 6.0 to 8.5 Electrical Conductivity at 25°C µmhos/cm Max. 2250 Sodium absorption rations Max. 26 Boron, Max.2 mg/l

Ref: CPCB (1999). Bio mapping of rivers, Parivesh New Letter, 5 (iv), Central Pollution Control Board, Delhi, PP.20.

Table 4: Indian Standard Drinking Water Specifications: IS 10500:2012

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
Essential Characteristics						
1	Colour, Hazen Units, Max.	5	Above 5, consumer acceptance decreases	15	IS 3025 (Part 4)	Extended to 15 only if toxic substances, in absence of alternate sources.
2	Odour	Agreeable	-	Agreeable	IS 3025 (Part 5)	A test cold and when heated. Test at several dilution
3	Taste	Agreeable	-	Agreeable	IS 3025 (Part 7 & 8)	Test to be conducted only after safety has been established
4	Turbidity NTU, Max.	1	Above 5, consumer acceptance decreases	5	3025 (Part 10): 1984	
5	PH value	6.5 to 8.5	Beyond this range the water will not affect the mucous membrane and /or water supply system	No relaxation	IS 3025 (Part 11)	

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
6	Total hardness (as $CaCO_3$) mg/1, Max.	300	Encrustation in water supply structures an adverse effect on domestic use	600	IS 3025 (Part 21)	
7	Iron (as Fe) mg /l Max.	0.3	Beyond this limit taste/appearance are affected has adverse effect on domestic uses and water supply structures and promotes iron bacteria	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
8	Chlorides (as Cl) mg/1 Max.	250	Beyond this limit, taste corrosion and palatability are affected	1000	IS 3025 (Part 32)	
9	Residual, free chloride, mg/1 Min.	0.2		1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be Min. 0.5 mg/1
Desirable characteristics						
1	Dissolved solids mg/1 Max.	500	Beyond the palatability decreases and may cause gastro intestinal irritation	2000	IS 3025 (Part 16)	
2	Calcium (as Ca) mg/1 Max.	75	Encrustation in water supply structure and adverse effects on domestic use	200	IS 3025 (Part 40)	
3	Magnesium (as Mg) mg/1, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	100	IS 3025 (Part 46)	
4	Copper (as Cu) mg/1 Max.	0.05	Beyond taste, discoloration of pipes, fitting and utensils will be caused beyond this	1.5	IS 3025 (Part 42)	
5	Manganese (as Mn) mg/1, Max.	0.1	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures.	0.3	IS 3025 (Part 59)	

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
6	Sulphate (as 200 So2), mg/1, Max.	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	IS 3025 (Part 24)	May be extended up to 400 provided (as Mg) does not exceed 30
7	Nitrate (as No2) mg/l, Max.	45	Beyond this methaemoglobinemia take place	No relaxation	IS 3025 (Part 34)	To be tested when pollution is suspected
8	Fluoride (as F) mg/1, Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	IS 3025 (Part 60)	To be tested when pollution is suspected
9	Phenolic compounds (as C6H5OH) mg/1, Max.	0.001	Beyond this it may cause objectionable taste and odour	0.002	IS 3025 (Part 43)	To be tested when pollution is suspected
10	Mercury (as Hg) mg/1, Max.	0.001	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 48)	To be tested when pollution is suspected
11	Cadmium (as cd), mg/1, Max.	0.003	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 41)	To be tested when pollution is suspected
12	Selenium, (as Se), mg/l, Max.	0.01	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 56)	To be tested when pollution is suspected
13	Arsenic (As) mg/1, Max.	0.01	Beyond this the water becomes toxic	0.05	IS 3025 (Part 37)	To be tested when pollution is suspected
14	Cyanide (as CN) mg/1, Max.	0.05	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 27)	To be tested when pollution is suspected
15	Lead (as Pb), mg/1, Max.	0.01	Beyond this the water becomes toxic	No relaxation	IS 3025 (Part 47)	To be tested when pollution is suspected
16	Zinc (as Zn) mg/1, Max.	5	Beyond this limit it can cause astringent taste and an opalescence taste and an opalescence in water	15	IS 3025 (Part 49)	To be tested when pollution is suspected
17	Anionic detergents (as MBAS) mg/1, Max.	0.2	Beyond this it can cause a light froth in water	1	Annex K of IS 13428	To be tested when pollution is suspected
18	Chromium (as Cr6+) mg/1, Max.	0.05	May be carcinogenic above this limit	No relaxation	IS 3025 (Part 52)	To be tested when pollution is suspected
19	Poly nuclear aromatic hydra carbons (as PAH) mg/1, Max.	0.0001	May be carcinogenic above this limit	No relaxation	APHA 6440	-

S. No.	Substance / Characteristics	Requirement (acceptable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of Test (ref. To IS)	Remarks
20	Mineral oil mg/1, Max.	0.5	Beyond this limit undesirable taste and odour after chlorination take place.	0.03	IS 3025 (Part 39)	-
21	Pesticides mg/1, Max.	-	Toxic	-	-	-
22	Radioactive material	-	-	-	IS 14194	-
23	Alpha emitters bq/1, Max.	0.1	-	No Relaxation	-	-
24	Beta emitter pci/1, Max.	1.0	-	No Relaxation	-	-
25	Total alkalinity (as $CaCO_3$), mg/l, max	200	Beyond this limit taste becomes unpleasant	600	IS 3025 (Part 23)	-
26	Aluminium (as Al) mg/1, Max.	0.03	Cumulate effect is reported to cause dementia	0.2	IS 3025 (Part 55)	-
27	Boron mg/1, Max.	0.5	-	1.0	IS 3025 (Part 57)	-

Source: Indian Standard Drinking Water Specification – IS 10500:2012

Environmental Monitoring Plan

The environmental monitoring plan is given below in table 5.

Table 1: Environmental Monitoring Plan

Environmental Components	Monitoring			Location	Frequency	Institutional Responsibility	
	Parameters	Special Guidance	Standards			Implementation	Supervision
Air	PM2.5, PM10, SO_2, NO_x, CO	As per CPCB guidelines	The Air (Prevention and Control of Pollution) Rules, CPCB, 1982	At hot mix plant, batching plant, sensitive areas and chainage as directed by Environment Specialist of Monitoring Consultant	10 locations twice in season for three seasons in a year for 2 years for construction period and 6 locations once in a month for three seasons in a year for 5 years during operation period	Contractor/Concessionaire through NABL/MOEF&CC approved monitoring agency	NHAI, AE
Water	pH, BOD, COD, TDS, TSS, DO, Total coliform, Conductivity, Oil & Grease other Baseline Parameters	Grab sample collected from source and analyze as per standard methods for examination of water and wastewater	Water quality standards by CPCB	River tributaries, roadside ponds and ground water at construction camp sites and chainages as directed by Environment Specialist of Monitoring Consultant	8 locations twice in a year (pre & post monsoon) for 2 years for construction period and 6 locations twice in a year (pre & post monsoon) for 5 years for operation period	Contractor/Concessionaire through NABL/MOEF & CC approved monitoring agency	NHAI, AE
Noise Levels	Noise level for day and night on dB(A) scale	In free field at 1m distance from the equipment to be monitored	Noise standard by CPCB	At equipment yards, camp and villages along the alignment and chainages as directed by Environment Specialist of Monitoring Consultant	10 locations three times in a year for 2 years for construction period and 6 locations once in a season for three seasons for 10 years	Contractor/Concessionaire through NABL/MOEF&CC approved monitoring agency	NHAI, AE
Soil quality	Monitoring of NPK & heavy metals, grease and		ICAR Criteria of Soil Quality	Sensitive Landuse and chainages as directed by Environment	6 locations twice in a year for 2 years for construction period and 6 locations once in a year for 5 years for operation	Contractor/Concessionaire through NABL/MOEF&CC approved monitoring agency	NHAI, AE

Environmental Components	Monitoring			Location	Frequency	Institutional Responsibility	
	Parameters	Special Guidance	Standards			Implementation	Supervision
	other Baseline Parameters			Specialist of Monitoring Consultant	period		
Road side plantation	Monitoring of felling of trees	It should be ensured That the marked trees are felled only	As given in the IEE report	All along the corridor	During the felling of trees	Forest department	NHAI, AE
	Survival rate of trees, success of re-vegetation	The number of trees surviving during each visit should be compared with the number of saplings planted	The survival rate should be at- least 75% below which re-plantation should be done	At locations of compensatory afforestation	For 2 years after completion of construction period	NHAI	NHAI
Wildlife	Accidental Road Kill	Format attached as Annexure 8.1	Zero accidental kill of Schedule – I species	Entire Project Stretch	As and when required	Contractor/Concessionaire	NHAI, AE
	Condition of Roadside Signage	Visual observation	as per IRC code	Roadside Signage Locations	At least twice in a year		
	Plying Vehicular speed	Random Speed checking	-	Speed Limit Sections	At least twice in a year		

ENGLISH SUMMARY

Development of 6 lane Access Controlled Greenfield Highway of Shamli-Ambala Sec. from Ch. 0+000 to Ch. 120+970 (Total length: 120.970 km) under Bharatmala Pariyojana Phase II (Lot-9/Package-I)in the States of Uttar Pradesh, Haryana and Punjab

Project Proponent :	National Highway Authority of India Ministry of Road, Transport & Highways, Govt. of India
Environmental Consultant:	Mantras Green Resources Ltd.

December 2021

For National Highway Authority of India
Mantras Green Resources Limited

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1.1 Introduction

National Highway Authority of India (NHAI) is responsible for management of national highways and is the nodal agency of Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI aims at provision and maintenance of national highways network to meet user expectations in the most time-bound and cost-effective manner within the strategic policy framework. NHAI is the nodal authority/proponent for the Development of Economic Corridors, Inter Corridors and Feeder Routes to improve the efficiency of freight movement in India under Bharatmala Pariyojana (Lot-9/Package-1).

The proposed highway with new alignment has been envisaged through an area which shall have the advantage of simultaneous development as well as shall result in a shorter distance to travel. Proposed highwayfollows the greenfield alignment with 6 lanes carriageway configurations. The proposed project starts near Gogwan Jalalpur (Ch: 0+000) village in Shamli (district of Uttar Pradesh and ends at Sadopur village (Ch:120+970) in Ambala district of Haryana State. The RoW for the project is 60m. The proposed project is falling in the state of Uttar Pradesh, Haryana & Punjab.

1.2 Need of the Project

The proposed highway is essential as it connects the three major agriculture producing states of Northern India. This project is being developed as economic corridor to boost the industrial development and freight movement in the project area by National Highways Authority of India under Bharatmala Pariyojna. The key highlights of the scheme are:

- Improving the quality of existing roads
- Construction of direct new roads to complete 34000 km
- Better connectivity to ports, coastal regions, etc.
- The main stress will be given on the construction and development of Greenfield highway for better management of traffic and freight.

Further, the proposed project will have multi-fold benefits for the local and regional economies as follows:

- Connectivity to the important towns
- Lower transport costs for freight and passengers of motorized and non-motorised vehicles;
- Improved Road network connectivity to the villages in the vicinity of the road;
- Enhanced traffic facilities and volume in the project road;
- Enhancement in economic opportunities/activities of the local people;
- Enhanced basic amenities to the villages along the proposed road;
- Rural prosperity of the project influence area;
- Elevate tourism
- Improve the economy of the area like agriculture, commerce, education, health, social welfare and public safety

1.3 Project Area

Project section covers 120.970 Km of length distributed across Shamli & Saharanpur district of Uttar Pradesh State, Karnal, Yamunanagar, Kurukshetra & Ambala districts of Haryana & SAS Nagar district of Punjab State.

Table 1: Location of the Proposed Project

S. No.	Name of the District	State	Design Chainage (km)		Length (km)
			Start	End	
1	Shamli	Uttar Pradesh	0+000	14+422	14.422
2	Saharanpur		14+422	47+668	33.246
3	Karnal	Haryana	47+668	55+037	7.369
4	Yamunanagar		55+037	71+168	16.131
5	Kurukshetra		71+168	75+533	4.365
6	Ambala		75+533	108+450	32.917
7	SAS Nagar	Punjab	108+450	111+800	3.35
8	Ambala	Haryana	111+800	120+970	9.17

1.4 Project Proponent

National Highways Authority of India (NHAI), an autonomous agency of the Government of India, is responsible for management of the network of national highways across the country. It is a nodal agency of the Ministry of Road Transport and Highways (MoRTH), Government of India. NHAI vision is to meet the nation's need for the provision and maintenance of national highways network to global standards and to meet user expectations in time-bound and cost-effective manner, within the strategic policy framework set by the Government of India and thus promoting economic well-being and quality of life of the people.

NHAI is the nodal authority / project proponent for the development of the highway project under present study.

1.5 Environmental Impact Assessment (EIA) Study

The study methodology for the EIA employs a simplistic approach in which the important environmental issues have been identified before initiation of the baseline study. Based on the identification baseline data for proposed project was collected during the study period from January to March 2021. This data has analyzed to predict and quantify the impacts and suggest best suited mitigation measure to mitigate the identified impacts.

1.6 Policy, Legal and Administrative Framework

As part of the project execution, the following clearances and NOCs has to be obtained by NHAI & the contractors:

- Prior Environmental Clearance from MoEF&CC under the purview of EIA Notification 2006 & its subsequent amendments, as the proposed project is a development of new national highway
- Prior permission for felling of trees from Forest dept. / District Authorities
- Compensate the affected households as per entitlement matrix based on Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act 2013

- Prior Environmental Clearance from MoEF&CC / SEIAA by the Contractors for sand and aggregate quarries, wherever and if required
- NOC and Consents under Air & Water Acts for establishing and operating the construction plants including but not limited to hot mix plants, WMM, crushers etc. from State Pollution Control Board
- NOC under the Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 from SPCB
- PUC certificate for use of vehicles for construction from Transport department
- NOC for water extraction for construction and allied works from Irrigation department
- Conversion of land use from the revenue department for setting camps and plants
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for location and layout of Camps & plants before start of Construction
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for Traffic Management Plan before start of Construction
- Approval of Monitoring Consultant / Supervision Consultant / Authority Engineer for the Emergency Action Plan for accidents responding to involving fuel & lubricants before the construction starts

1.7 Baseline Environmental Profile

1.7.1 Physical Environment

Climatology

The climate of the project area is generally hot. As per climatic conditions, the year may be divided into four seasons. The hot season is from March to May. From March onwards it is a period of continuous rise in the temperature and May is generally the hottest month of the year. Hot winds blow during summer, occasionally accompanied by dust storms. The temperature may touch 45°C or more on some days. Generally, pre-monsoon showers are experienced in the middle or end of June which may bring down temperature considerably. From early October, the weather becomes very pleasant as the winter season sets in. November and December are pleasant but nights are cold

Topography

The proposed alignment follows the 'plain' terrain. The elevation varies from ~240m to ~288m above msl at different locations. Average elevation of the project stretch is ~250m above msl.

Soil

The region slopes towards south-west. It is a plain area with relatively richer loamy soils. Khadar lies along Yamuna river, it is formed by deposition of alluvium sediments, clay and sand. Silty loam is easily workable and productive. The soil along the bank of river beds is usually light and sandy, while elsewhere it is mainly a productive loam stiffened by the action of water into clay in the lower levels. All along the old high bank of the Yamuna lies a belt of stiff-swampy clay of varying width producing excellent vice but elsewhere the Yamuna Khadar consists of light loam and in places includes patches of sand and reh. The light rich loam or sandy loam soil covers nearly three fourth of the area of the district. It is called by the local name of rausli and ranges from a light friable soil with a considerable admixture of sand to the softer kinds of clay in which

all crops can be grown with equal facility. Soil samples were collected from 9 representative locations for assessment of soil characteristics for the proposed highway.

Ambient Air Quality (AAQ)

Ambient air quality monitoring has been done at evenly distributed ten (10) locations along the proposed alignment. The results indicate that all air quality parameters are within the standards specified in the NAAQS in absence of any major pollution generation activities near study area.

Ambient Noise Level (ANL)

Noise monitoring has been carried out once during the entire study period at ten (10) locations along the proposed alignment for a period of 24 hours. Day & Night-time Leq has been computed from the hourly Leq values as per standards. The Noise quality result shows that Leq Day time varies from 48.4 to 51.0 dB(A) and Leq Nighttime varies from 38.4 to 40.9 dB(A). Noise level was found within the standards.

Surface Water

Surface water quality along the project stretch was monitored at four (4) representative locations along the proposed alignment as per the parameters laid down by Central Pollution Control Board for surface water quality criteria. The surface water in the project was found alkaline with pH varying from 7.25 to 7.54.

Ground Water

Keeping in view the importance of ground water to the local population, four (4) representative ground water sampling locations along the proposed alignment were identified and samples were analysed for assessment of ground water quality.

1.7.2 Biological Environment

Protected Areas

The proposed alignment is neither passing through nor falling within 10.0km radius of any National Park or Wildlife Sanctuary. Therefore, Wildlife clearance is not required under Wildlife (Protection) Act, 1972.

Forest Area

About 7.5 ha of protected forest land shall be diverted for the development of proposed project. The proposed alignment is passing through the strip plantation notified as protected forest along the roads & canals. Hence, diversion of forest land shall be applicable under Forest Conservation Act 1980.

1.7.3 Social Environment

Census Profile

The demographic features of Shamli& Saharanpur districts in the state of Uttar Pradesh, Yamuna Nagar, Karnal, Kurukshetra and Ambala districts in the state of Haryana and SAS Nagar district of Punjab State forming an immediate influence. As per Census 2011, the total population of Haryana is 2,53,51,462 with the density as 573 /km^2, Uttar Pradesh is 15,53,17,278 with a density of 829/km^2 and Punjab is 2,77,43,338 with a density of 551/km^2.

Table 2: Demographics of Project District

Sl. No	State	District	Population 2011		
			Persons	Male	Female
1.	Uttar Pradesh	Saharanpur	34,66,382	18,34,106	16,32,276
		Shamli	12,73,578	6,87,732	5,85,846
2.	Haryana	Yamuna Nagar	12,14,205	6,46,718	5,67,487
		Karnal	15,05,324	7,97,712	7,07,612
		Kurukshetra	9,64,655	5,10,976	4,53,679
		Ambala	11,28,350	5,98,703	5,29,647
3.	Punjab	SAS Nagar	9,94,628	5,29,253	4,65,375

1.8 Public Interactions & Consultation

Public Interactions & consultations were conducted during the project preparations. The main purpose of these consultations was to know the community's reaction to the perceived impact of proposed project on the people at individual and settlement level.

1.9 Potential Environmental Impacts

The environmental components are mainly impacted during the construction and operational stages of the project and must be mitigated for and incorporated in the engineering design. Environmental mitigation measures represent the project's endeavour to reduce its environmental footprint to the minimum possible. These are conscious efforts from the project to reduce undesirable environmental impacts of the proposed activities and offset these to the degree practicable. Enhancement measures are project's efforts to gain acceptability in its area of influence. They reflect the pro-active approach of the project towards environmental management. Slight change in the micro-climate of the area is expected due to heat island effect as unpaved area will be converted into the paved road. However, Impact on the climate conditions from the proposed road project will not be significant in long run as removal of vegetation will be compensated by compensatory plantation.

1.9.1 Impact on Air Quality

There will be rise in PM levels during the construction activities, which shall again be within prescribed limit after the construction activities are over. The level of CO is likely to be increased, however, level shall remain within prescribed standards.

1.9.2 Impact on Noise Levels

The area is likely to experience an increment in noise level due to increase in vehicle density after road strengthening. Construction camp shall be established at least 1000m away from nearest habitation and forest area. Temporary noise barriers should be provided surrounding the high noise generating construction equipment during work near to settlement area. Avenue plantation have been proposed on either side of the highway to control the associated air and noise pollution.

1.9.3 Impact on Water Resources and Quality

The construction and operation of the proposed project roads will not have any major impacts on the surface water and the ground water quality in the area. Design made to avoid physical loss to the water bodies to the extent possible. Contamination to water bodies may result due to spilling of construction materials, oil, grease, fuel and paint in the construction camp. This will be

more prominent in case of locations where the project road crosses drains, ponds, etc. Silt fencing shall be provided along the major canals and pond. Oil interceptors are proposed near fuel handling areas.

1.9.4 Impact on Ecological Resources

Trees within ROW are likely to be affected due to the proposed development leading temporally loss of micro ecosystem. However, on the long run the impacts will be compensated in terms of compensatory and avenue plantation.

1.9.5 Impact on Land

During the construction of the proposed project, the topography will change due to cuts & fills for project road and construction of project related structures etc. Provision of construction yard for material handling will also alter the existing topography. The change in topography will also be due to the probable induced developments of the project.

1.9.6 Social Impacts

About 824.285 ha of land shall be required for proposed highway

1.10 Analysis of Alternatives

Detailed analyses of the alternatives have been conducted taking into account both with and without project. The proposed development of greenfield highway is likely to have a positive impact on the economic value of the region. However, there are certain environment and social issue, these needs to be mitigated for sustainable development.

1.11 Mitigation Avoidance & Enhancement Measures

Mitigation and enhancement measures have been planned for identified adverse environmental impacts. The construction workers camp will be located at least 1000 m away from nearby habitations. Hot mix plants, batching plants, etc. will also be located more than 1000 m away from habitations and in downwind directions. Existing cross drainage structures have been planned to maintain for proper cross drainage. In order to compensate negative impacts on flora due to cutting of trees the project plans compensatory plantation in the ratio of 1:10 i.e. for every tree to be cut, ten trees will be planted. The project shall also witness the plantation of trees for providing aesthetic beauty and shade. As the space for compensatory plantation might not be adequate along the project road, this plantation shall be taken up by the forest department, after payment of the cost for raising and maintaining the saplings for five years. The project will take an opportunity to provide environmental enhancement measures to improve aesthetics in the project area. The planned environmental enhancement measures include plantation in available clear space in ROW, enhancement of water bodies etc. In order to avoid contamination of water bodies during construction Silt fencing, oil interceptors at storage areas and at construction yard have been proposed. The affected households shall be compensated as per the entitlement matrix based on Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation & Resettlement Act 2013.

1.12 Institutional Requirements & Environmental Monitoring Plan

The responsibility of implementing the mitigation measures lies with environment team duly appointed by the Contractor/Concessionaire. The overall supervision of Environmental

monitoring works during construction and operation stage shall be carried out by NHAI with the help of the Monitoring Consultant / Supervision Consultant / Authority Engineer. To mitigate the potential negative impacts of proposed development and measurement the performance of mitigation measures, an Environmental Monitoring and Management Plan is developed. The formulation of an appropriate environmental monitoring plan and its diligent implementation are keys to overall success for the project.

1.13 Environmental Management Plan

Project specific environmental management plan have been prepared for ensuring the implementation of the proposed measures during construction phase of the project, implementation and supervision responsibilities. The cost for environmental management during construction has been indicated in EMP. The project impacts and management plan suggested thereof are summarized in next section.

1.14 Environment Impact & Management Matrix

Table 3: Environment Impact & Management Matrix

Particulars	Stages	Potential Impacts	Mitigation Measures
Physiographic Environment			
Topography	Preconstruction & Construction	• Slight changes are expected due to development of the road • Impacts are marginal, but permanent.	• Proper planning to keep the land reformation upto bare minimum • No new quarry for the project
Geology	Preconstruction & Construction	• Impacts are moderate because of extraction of sand	-
Climate			
Temperature / Rain fall / Humidity	Preconstruction & Construction	• Tree felling will have an impact of micro-climate of the area • Heat island effect due to increase in paved roads • Low spatially restricted short-term impact	• Compensatory plantation in 1:10 ration of the trees to be cut • With the proposed avenue plantation scheme, the micro climate of the project corridor will be smoothened
Land			
Loss of Other Land	Design, Preconstruction & Construction	• Loss of Property & Livelihood	• Compensation as per LARR, 2013
Induced Development	Preconstruction & Construction	• Insignificant change in the land use pattern	• Civil authorities to plan and guide any induced development under regulatory framework
Soil			
Soil Erosion	Preconstruction,	• In Road slopes and	• Embankment protection

Particulars	Stages	Potential Impacts	Mitigation Measures
	Construction & Operation	spoils • Erosion in excavated areas	through pitching & turfing • Regular water sprinkling in excavated areas
Contamination of Soil	Preconstruction, Construction & Operation	• Scarified bitumen wastes • Oil and diesel spills • Emulsion sprayer and laying of hot mix • Production of hot mix and rejected materials • Residential facilities for the labour and officers	• Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 • Oil Interceptor will be provided in storage areas for accidental spill of oil and diesel • Rejected material to be laid as directed by monitoring consultant. • Septic tank to be constructed for waste disposal.
Water			
Impact on Water Resource	Design, Preconstruction, Construction & Operation	• Depletion of ground water recharge • Contamination from fuel and lubricants & waste disposal in camp area • Contamination of surface water system due to run-off from road construction area	• Provision of Storage/harvesting structure of water, wherever feasible • Oil Interceptor and Septic tank in construction camp • Enforcement of Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 • Both side drain facility to suitably divert the run-off from roads
Air			
Dust generation	Preconstruction& Construction	• Shifting of utilities, removal of trees & vegetation, transportation of material	• Regular Sprinkling of Water • Fine materials to be completely covered, during transport and stocking. • Hot mix plant to be installed in down wind direction with at least 1000m distance from nearby settlement. • Regular monitoring of particulate matter in Ambient Air
Gaseous pollutants	Preconstruction, Construction & Operation	• Operation of Hot mix plant and vehicle operation for material	• Air pollution Norms will be enforced. • Only PUC certified vehicle

Particulars	Stages	Potential Impacts	Mitigation Measures
		transportation	shall be deployed • Labourers will be provided with mask. • Regular gaseous pollution monitoring in ambient air
Ambient air quality	Operation	• Air pollution from traffic • CO level is likely to increase	• Compliance with statuary regulatory requirements
Noise			
Pre-Construction Activity	Pre-Construction	• Man, material and machinery movements • Establishment of labour camps, onsite offices, stock yards and construction plants	• No Horn Zone sign, Speed Barriers near sensitive receptors • Camps will be setup more than 1000m away from settlements.
Construction Activity	Construction	• Operation of high noise equipment like hot mix plant, diesel generators etc. • Community residing near to the work zones.	• Camp will be setup more than 1000m away from the settlements, in down wind direction. • Noise pollution regulation to be monitored and enforced.
Operation Stage	Operation	• Indiscriminate blowing of horn near sensitive area	• Restriction on use of horns • No Horn Zone sign.
Ecology			
Flora	Preconstruction, Construction	• Loss of vegetation cover • Felling of appprox. 7966 of trees	• Felling of only unavoidable trees • Compensatory Plantation in the ratio of 1:10
Fauna	Preconstruction, Construction & Operation	• Loss of insect, avian and small mammalian species due to felling of trees • Accidental run over	• Compensatory Plantation • Speed breaker, Signage and limit in sensitive areas
Social			
Socio Environment	Design, Preconstruction & Construction	• Loss of Property & Livelihood • Loss of CPRs, Religious Structures	• Compensation as per LARR, 2013 • Relocation of CPRs, Religious Structures to suitable place
Public Health and Road Safety			
Health and safety	• Preconstruction, Construction & Operation	• Psychological impacts on project affected people	• Continued consultation with PAPs and the competent authority for speedier

Particulars	Stages	Potential Impacts	Mitigation Measures
		• Migration of worker may lead to sanitation problem creating congenial condition for disease vectors • Discomfort arising of air and noise pollution • Hazards of accident	settlements of appropriate compensation package and resettlement. • Ensuring sanitary measures at construction camp to prevent water borne disease and vector borne disease. • Provision for appropriate personal protective equipment like earplugs, gloves gumboot, and mask to the work force. • Safe traffic management at construction area. • Drive slow sign and speed barriers near community facilities like school, hospital, etc.

1.15 Conclusions

Based on the EIA study and surveys conducted for the Project, it can be safely concluded that associated potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the measures as stated in the EIA 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. The proposed project shall improve trade efficiency and bring economic growth. In terms of air and noise quality, the project shall bring considerable improvement to possible exposure levels to population.

AMBIENT ENVIROTECH

AMBIENT ENVIROTECH PRIVATE LIMITED

Reviving Timeless Treasures

To
Sh. Dharamvir Tolikar
Team Leader
K & J Projects Pvt. Ltd.
Plot No. 59, Block A, Bagdola,
Sector 8, Dwarka, New Delhi - 110077

Sub: - Submission of Draft EIA Report for the development of 6 lane access controlled greenfield highway of Shamli-Ambala Sec. from Ch. 0+000 to Ch. 120+970 in the States of Uttar Pradesh, Haryana and Punjab under Bharatmala Pariyojana Phase II (Lot-9/Package-I)
Ref.: - Terms of Reference (TOR) Issued by MOEF&CC, vide File No.10-33/2021-IA.III on dated 22nd Sept, 2021 and amended 6th Dec 2021.

Respected Sir,

With reference to the above subject matter, we are submitting herewith the draft EIA/EMP report along with English and Hindi Summary in accordance with the terms of reference prescribed by MOEF&CC. This is for your reference and onwards submission to the Authority for conducting the public hearing.

1. Hardcopy of draft EIA /EMP report
2. Hardcopy of executive summary in Hindi & English
3. Soft copies of above documents in CD

We requesting to your good office that acknowledge the above-mentioned documents.

Assuring you of our best professional services at all time and thanking you.

Yours faithfully,

For Ambient Envirotech Pvt Ltd.

AMBIENT ENVIROTECH PVT. LTD.

Authorized Signatory

Encl: As above

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हिन्दी सारांश

भारतमाला परियोजना के तहत चरण II (लॉट-9/पैकेज-I) शामली-अंबाला खंड चेनेज 0+000 से चेनेज 120+970 (कुल लंबाई: 120.970 किमी) उत्तर प्रदेश, हरियाणा और पंजाब राज्यों में 6 लेन एक्सेस कंट्रोल्ड ग्रीनफील्ड हाईवे का विकास

परियोजना प्रस्तावक: भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
सड़क, परिवहन और राजमार्ग मंत्रालय, भारत सरकार

पर्यावरण सलाहकार: मंत्रास ग्रीन रिसोर्सेज लिमिटेड

दिसंबर 2021

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
मंत्रास ग्रीन रिसोर्सेज लिमिटेड

विषयसूची

तालिकाओं की सूची

1.1 परिचय

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण (NHAI) राष्ट्रीय राजमार्गों के प्रबंधन के लिए जिम्मेदार है और भारत सरकार के सड़क परिवहन और राजमार्ग मंत्रालय (MoRTH) की नोडल एजेंसी है। NHAI का उद्देश्य रणनीतिक नीति ढांचे के भीतर सबसे अधिक समयबद्ध और कम लागत से उपयोगकर्ता की अपेक्षाओं को पूरा करने के लिए राष्ट्रीय राजमार्ग नेटवर्क का प्रावधान और रखरखाव करना है। भारतमाला परियोजना (लॉट-9/पैकेज-1) के तहत भारत में माल ढुलाई की दक्षता में सुधार के लिए आर्थिक गलियारों, अंतर गलियारों और फीडर मार्गों के विकास के लिए एन.एच.ए.आई. नोडल प्राधिकरण प्रस्तावक है। नए संरेखण के साथ प्रस्तावित राजमार्ग की परिकल्पना एक ऐसे क्षेत्र के माध्यम से की गई है जिसमें एक साथ विकास का लाभ होगा और साथ ही यात्रा के लिए कम दूरी तय करनी पड़ेगी। प्रस्तावित राजमार्ग संरेखण 6 लेन (ग्रीनफील्ड) का होगा। प्रस्तावित राजमार्ग गोगवान जलालपुर गांव (Ch: 0+000) जिला शामली उत्तर प्रदेश से शुरू-होकर सदोपुर गांव (Ch:120+970) जिला अंबाला हरियाना में समाप्त हो जाती है। प्रस्तावित प्रोजेक्ट की कुल लंबाई लगभग 120.970 किमी है। परियोजना के लिए ROW 60 मीटर है। प्रस्तावित परियोजना उत्तर प्रदेश, हरियाणा और पंजाब राज्यों से होकर गुजरेगी।

1.2 परियोजना आवश्यकता

प्रस्तावित राजमार्ग आवश्यक है क्योंकि यह उत्तरी भारत के तीन प्रमुख कृषि उत्पादक राज्यों को जोड़ता है। भारतमाला परियोजना के तहत भारतीय राष्ट्रीय राजमार्ग प्राधिकरण द्वारा परियोजना क्षेत्र में औद्योगिक विकास और माल ढुलाई को बढ़ावा देने के लिए इस परियोजना को आर्थिक गलियारे के रूप में विकसित किया जा रहा है।

योजना की मुख्य विशेषताएं हैं:

- मौजूदा सड़कों की गुणवत्ता में सुधार।
- 34000 किमी. को पूरा करने के लिए सीधी नई सड़कों का निर्माण।
- बंदरगाहों, तटीय क्षेत्रों आदि से बेहतर संपर्क।
- यातायात और माल ढुलाई के बेहतर प्रबंधन के लिए ग्रीनफील्ड हाईवे के निर्माण और विकास पर मुख्य जोर दिया जाएगा।

इसके अलावा, प्रस्तावित परियोजना से स्थानीय और क्षेत्रीय अर्थव्यवस्थाओं को कई गुना लाभ होंगे जोकि निम्नानुसार हैं:

- महत्वपूर्ण शहरों से संपर्क।

- मोटरचालित और गैर-मोटर चालित वाहनों के माल ढुलाई और यात्रियों के लिए कम परिवहन लागत।
- सड़क के आसपास के गांवों के लिए बेहतर सड़क नेटवर्क कनेक्टिविटी।
- परियोजना सड़क में यातायात सुविधाओं और मात्रा में वृद्धि।
- स्थानीय लोगों के आर्थिक अवसरों/गतिविधियों में वृद्धि।
- प्रस्तावित सड़क के किनारे के गांवों के लिए बुनियादी सुविधाओं में वृद्धि।
- परियोजना प्रभाव क्षेत्र की ग्रामीण समृद्धि।
- पर्यटन को बढ़ावा देना।
- कृषि, वाणिज्य, शिक्षा, स्वास्थ्य, सामाजिक कल्याण और सार्वजनिक सुरक्षा जैसे क्षेत्र की अर्थव्यवस्था में सुधार करना।

1.3 परियोजना क्षेत्र

प्रस्तावित परियोजना खंड की कुल लम्बाई 120.970 किमी है जो उत्तर प्रदेश के शामली और सहारनपुर जिलों, हरयाना के करनाल, यमुनानगर, कुरुक्षेत्र और अंबाला जिलों तथा पंजाब के एस.ए.एस. नगर जिला से होकर गुजरता है।

तालिका 1 : प्रस्तावित परियोजना का स्थान

क्रमिक संख्या	जिले का नाम	राज्य	डिजाइन श्रृंखला (किमी)		लंबाई (किमी)
			शुरू	समाप्त	
1	शामली	उत्तर प्रदेश	0+000	14+422	14.422
2	सहारनपुर		14+422	47+668	33.246
3	करनाल	हरयाना	47+668	55+037	7.369
4	यमुनानगर		55+037	71+168	16.131
5	कुरुक्षेत्र		71+168	75+533	4.365
6	अंबाला		75+533	108+450	32.917
7	एस.ए.एस. नगर	पंजाब	108+450	111+800	3.35
8	अंबाला	हरयाना	111+800	120+970	9.17

1.4 परियोजना प्रस्तावक

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण (NHAI), भारत सरकार की एक स्वायत्त एजेंसी, देश भर में राष्ट्रीय राजमार्गों के नेटवर्क के प्रबंधन के लिए जिम्मेदार है। यह सड़क परिवहन और राजमार्ग मंत्रालय (MoRTH), भारत सरकार की एक नोडल एजेंसी है। NHAI की दृष्टि वैश्विक मानकों के लिए राष्ट्रीय

राजमार्ग नेटवर्क के प्रावधान और रखरखाव के लिए देश की आवश्यकता को पूरा करना है और रणनीतिक नीति के भीतर समयबद्ध और कम लागत में उपयोगकर्ता की अपेक्षाओं को पूरा करना है। वर्तमान अध्ययन के तहत राजमार्ग परियोजना के विकास के लिए एन.एच.ए.आई नोडल प्राधिकरण परियोजना प्रस्तावक है।

1.5 परियोजना में पर्यावरणीय प्रभाव आकलन (ई.आई.ए.) अध्ययन

ई.आई.ए. अध्ययन के लिए एक सरल दृष्टिकोण पद्धति की पहचान की गई है जिसमें आधारभूत अध्ययन शुरू करने से पहले महत्वपूर्ण पर्यावरणीय मुद्दों की पहचान की गई है। पहचान के आधार पर प्रस्तावित परियोजना के लिए आधारभूत पर्यावरणीय आकड़े जनवरी से मार्च 2021 की अवधि के दौरान एकत्र किये गए। इन आकड़ो का प्रभावों की भविष्यवाणी और परिमाणित करने के लिए विश्लेषण किया है। और पहचाने गए प्रभावों को कम करने के लिए सबसे उपयुक्त शमन उपाय सुझाया है।

1.6 नीति, कानूनी और प्रशासनिक ढांचे

परियोजना निष्पादन के हिस्से के रूप में, एन.एच.ए.आई और डेवलपर को निम्नलिखित मंजूरी और एन.ओ.सी. लेना होगा:

- ई.आई.ए. अधिसूचना 2006 और उसके बाद के संशोधनों के दायरे में एम.ओ.ई.एफ और सी.सी से पूर्व पर्यावरण मंजूरी, क्योंकि प्रस्तावित परियोजना नए राष्ट्रीय राजमार्ग का विकास है।
- वन विभाग जिला प्राधिकारियों से पेड़ों की कटाई की पूर्व अनुमति।
- प्रभावित परिवारों को उचित मुआवजे और पारदर्शिता का अधिकार भूमि अधिग्रहण, पुनर्वास और पुनर्स्थापन अधिनियम 2013 मेंपात्रता मैट्रिक्स के अनुसार मुआवजा दिया जाएगा।
- रेत और कुलखदानों के लिए, जहां भी और यदि आवश्यक हो, ठेकेदारों द्वारा पर्यावरण एवं एम.ओ.ई.एफ और सी.सी/ एस.ई.आ.ई.ए.ए से पूर्व पर्यावरणीय मंजूरी।
- राज्य प्रदूषण नियंत्रण बोर्ड से हॉट मिक्स प्लांट, डब्ल्यू.एम.एम, क्रशर आदि सहित निर्माण संयंत्रों की स्थापना और संचालन के लिए वायु और जल अधिनियमों के तहत एन.ओ.सी और सहमति प्राप्त करनी होगी।
- एस. पी.सी.बी से खतरनाक और अन्य अपशिष्ट (प्रबंधन और सीमा पार आंदोलन) नियम, 2016 के तहत एन.ओ.सी।
- परिवहन विभाग से निर्माण के लिए वाहनों के उपयोग के लिए पीयूसी प्रमा णपत्र।
- निर्माण एवं सम्बद्ध कार्यों के लिए सिंचाई विभाग से जल निकासी हेतु अनापत्ति प्रमाण पत्र।
- राजस्व विभाग से कैंप वप्लांट लगाने के लिए भूमि उपयोग में परिवर्तन।
- निर्माण शुरू होने से पहले शिविरों और पौधों के स्थान और लेआउट के लिए निगरानी सलाहकार / पर्यवेक्षण सलाहकार / प्राधिकरण अभियंता की स्वीकृति।

- निर्माण शुरू होने से पहले यातायात प्रबंधन योजना के लिए निगरानी सलाहकार / पर्यवेक्षण सलाहकार / प्राधिकरण अभियंता की स्वीकृति।
- ईंधन शामिल होने पर होने वाली दुर्घटनाओं के लिए आपातकालीन कार्य योजना के लिए निगरानी सलाहकार/पर्यवेक्षण सलाहकार/प्राधिकरण अभियंता का अनुमोदन।

1.7 आधारभूत पर्यावरण प्रोफाइल

1.7.1 भौतिक वातावरण

जलवायु विज्ञानशास्त्र

परियोजना क्षेत्र की जलवायु सामान्यतः गर्म होती है। जलवायु परिस्थितियों के अनुसार वर्ष को चार ऋतुओं में विभाजित किया जा सकता है। गर्मी का मौसम मार्च से मई तक होता है। मार्च के बाद से यह तापमान में निरंतर वृद्धि की अवधि है और मई आमतौर पर वर्ष का सबसे गर्म महीना होता है। गर्मियों के दौरान गर्म हवाएं चलती हैं, कभी-कभी धूल भरी आंधी के साथ। कुछ दिनों में तापमान 45°C या अधिक को छू सकता है। आमतौर पर, प्री-मानसून वर्षा जून के मध्य या अंत में होती है जो तापमान में काफी कमी ला सकती है। अक्टूबर की शुरुआत से, सर्दियों का मौसम शुरू होते ही मौसम बहुत सुहावना हो जाता है। नवंबर और दिसंबर सुखद होते हैं लेकिन रातें ठंडी होती हैं।

तलरूप

प्रस्तावित संरेखण 'मैदान' इलाके का अनुसरण करता है। विभिन्न स्थानों पर ऊंचाई एम.एस.एल ~240 मीटर से ~288 मीटर तक है। परियोजना खंड की औसत ऊंचाई एम.एस.एल से ~250 मीटर ऊपर है।

मिट्टी

इस क्षेत्र का ढलान दक्षिण-पश्चिम की ओर है। यह अपेक्षाकृत समृद्ध दोमट मिट्टी वाला एक मैदानी क्षेत्र है। खादर यमुना नदी के किनारे स्थित है, यह जलोढ़ तलछट, मिट्टी और रेत के जमाव से बनता है।सिल्टी लोम आसानी से काम करने योग्य और उत्पादक है। नदी के किनारे की मिट्टी आमतौर पर हल्की और रेतीली होती है, जबकि अन्य जगहों पर यह मुख्य रूप से निचले स्तरों में मिट्टी में पानी की क्रिया से कठोर उत्पादक दोमट होती है। यमुना के पुराने ऊंचे किनारे के साथ-साथ अलग-अलग चौड़ाई की कड़ी-दलदल मिट्टी की एक बेल्ट है जो उत्कृष्ट उपाध्यक्ष पैदा करती है, लेकिन कहीं और यमुना खादर में हल्की दोमट होती है और जगहों पर रेत और रेह के पैच शामिल होते हैं। हल्की समृद्ध दोमट या बलुई दोमट मिट्टी जिले के लगभग तीन चौथाई क्षेत्र को कवर करती है। इसे रौसली के स्थानीय नाम से पुकारा जाता है और हल्की भुरभुरी मिट्टी से लेकर रेत के काफी मिश्रण के साथ नरम प्रकार की मिट्टी तक होती है जिसमें सभी फसलों को समान सुविधा के साथ उगाया जा सकता है।प्रस्तावित

राजमार्ग के लिए मिट्टी की विशेषताओं के आकलन के लिए 9 प्रतिनिधि स्थानों से मिट्टी के नमूने एकत्र किए गए थे।

परिवेश वायु गुणवत्ता (ए.ए.क्यू.)

प्रस्तावित संरेखण के साथ समान रूप से वितरित 10 स्थानों पर परिवेशी वायु गुणवत्ता निगरानी की गई है। परिणाम दर्शाते हैं कि अध्ययन क्षेत्र के निकट किसी भी प्रमुख प्रदूषण उत्पादन गतिविधियों के अभाव में सभी वायु गुणवत्ता मानदंड NAAQS में निर्दिष्ट मानकों के अनरूप पायी गयी है।

परिवेश शोर स्तर(ए.एन.एल)

प्रस्तावित संरेखण के साथ 10 स्थानों पर पूरे अध्ययन अवधि के दौरान एक बार शोर निरीक्षण किया जाता है (24 घण्टा की अवधि मै हर घंटे के समय अंतराल पर) प्रत्येक स्थान पर, प्रति घंटे की leq दर से दिन और रात के समय की Leq दर का निर्धारण किया गया है ताकि राष्ट्रीयपरिवेश शोर स्तर से तुलना की जा सके। शोर की गुणवत्ता के परिणाम से पता चलता है कि Leq दिन के समय 48.4 से 51.0 dB (A) और Leq रात के समय 38.4 से 40.9 dB (A) तक होता है। शोर का स्तर मानकों के भीतर पाया गया।

सतही जल

सतही जल गुणवत्ता मानदंड के लिए केंद्रीय प्रदूषण नियंत्रण बोर्ड द्वारा निर्धारित मापदंडों के अनुसार प्रस्तावित संरेखण के साथ 4 स्थानों पर परियोजना खंड के साथ सतही जल की गुणवत्ता परीक्षण कियागया। परियोजना में सतही जल क्षारीय पाया गया जिसका पीएच 7.25 से 7.54 के बीच था।

भूजल

स्थानीय आबादी के लिये भूजल के महत्व को ध्यान में रखते हुए, भूजल नमूनो के लिये ४ स्थानों की पहचान की गई और भूजल की गुणवत्ता के आकलन के लिए विश्लेषण किया गया। पानी का विश्लेषण प्रयोगशाला में किया।

1.7.2 जैविक पर्यावरण

संरक्षित क्षेत्र

कोई वन्य जीव अभयारण्य या राष्ट्रीय उद्यान प्रस्तावित संरेखण के 10.0 किमी त्रिज्या के भीतर स्थित नहीं है। इसलिए, वन्यजीव (संरक्षण) अधिनियम, 1972 के तहत वन्यजीव मंजूरी की आवश्यकता नहीं है।

वनस्पति पशुवर्ग

प्रस्तावित परियोजना के विकास के लिए लगभग 7.5 हेक्टेयर संरक्षित वन भूमि को परिवर्तित किया जाएगा। प्रस्तावित संरेखण सड़कों और नहर के किनारे संरक्षित वन के रूप में अधिसूचित पट्टी वृक्षारोपण से गुजर रहा है। अतः वन भूमि का परिवर्तन के लिए वन संरक्षण अधिनियम 1980 लागू होगा।

1.7.3 सामाजिक वातावरण

जनगणना प्रोफाइल

यह परियोजना के उत्तर प्रदेश शामली और सहारनपुर जिलों, हरयाना के करनाल, यमुनानगर, कुरुक्षेत्र और अंबाला जिलों और पंजाब के एस.ए.एस नगर जिले से होकर गुजरती है।

2011 की जनगणना के अनुसार, हरियाना की कुल जनसंख्या 2,53,51,462 है जिसका घनत्व 573/किमी है, उत्तर प्रदेश की कुल जनसंख्या 15,53,17,278 है, और घनत्व 829/किमी^{2} है और पंजाब की कुल जनसंख्या 2,77,43,338 है और घनत्व 551/किमी^{2} है।

तालिका 2: परियोजना जिले की जनसांख्यिकी

क्रमांक	राज्य	ज़िला	जनसंख्या 2011		
			व्यक्ति	पुरुष	महिला
1.	उत्तर प्रदेश	सहारनपुर	34,66,382	18,34,106	16,32,276
		शामली	12,73,578	6,87,732	5,85,846
2.	हरयाना	यमुना नगर	12,14,205	6,46,718	5,67,487
		करनाल	15,05,324	7,97,712	7,07,612
		कुरुक्षेत्र	9,64,655	5,10,976	4,53,679
		अंबाला	11,28,350	5,98,703	5,29,647
3.	पंजाब	एस.ए.एस. नगर	9,94,628	5,29,253	4,65,375

1.8 सार्वजनिक इंटरैक्शन और परामर्श

परियोजना की तैयारी के दौरान सार्वजनिक इंटरैक्शन और परामर्श आयोजित किए गए। इन परामर्शों का मुख्य उद्देश्य प्रस्तावित परियोजना के अनुमानित प्रभावों पर समुदाय की प्रतिक्रिया को जानना और गाव के स्तर पर निपटारा करना था ।

1.9 संभावित पर्यावरण प्रभाव

पर्यावरण के घटक मुख्य रूप से परियोजना के निर्माण और परिचालन चरणों के दौरान प्रभावित होगे। इन प्रभावों को कम करने का प्रावधान अभियांत्रि की योजना मे सम्मिलित होगा। पर्यावरणीय समन उपाय परियोजना से होने वाले पर्यावरणीय प्रभाव को कम करने की कोशिश को प्रस्तुत करते है। पर्यावरणीय समन उपाय परियोजना के आवंधित पर्यावरणीय प्रभाव को कम करने की कोशिश है। पर्यावरणीय समन उपाय परियोजना प्रभावित क्षेत्रमें परियोजनाके लिए सकारात्मकता की कोशिश को उजागर करते है। वे पर्यावरण प्रबंधन के लिए परियोजना के समर्थक सक्रिय दृष्टिकोण को प्रतिबिंबित करतेहैं।गर्मी द्वीप प्रभाव के कारण क्षेत्र के सूक्ष्म जलवायु में मामूली बदलाव की उम्मीद है क्योंकि कच्चा क्षेत्र पक्की सड़क में परिवर्तित हो जाएगा। हालांकि, प्रस्तावित सड़क परियोजना से जलवायु की स्थिति पर प्रभाव लंबे समय में महत्वपूर्ण नहीं होगा क्योंकि वनस्पति को हटाने की भरपाई प्रतिपूरक वृक्षारोपण द्वारा की जाएगी।

1.9.1 वायु गुणवत्ता पर प्रभाव

प्रस्तावित सड़क की निर्माण गतिविधियों के दौरान पी.एम स्तर में वृद्धि होगी, जो निर्माण गतिविधियों के खत्म होने के बाद फिर से निर्धारित सीमा के भीतर होगी। CO का स्तर बढ़ने की संभावना है। हालांकि स्तर निर्धारित मान कों के भीतर ही रहेगा।

1.9.2 ध्वनि प्रदूषण स्तर पर प्रभाव

निर्माण स्थलनिकटतम आवास एवं वन क्षेत्र से कम से कम 1000 मीटर की दूरी पर स्थापित किया जाना चाहिए। बंदोबस्त क्षेत्र के निकट कार्य के दौरान उच्च ध्वनि उत्पन्न करने वाले निर्माण उपकरणों के आस-पास अस्थायी शोर अवरोधक उपलब्ध कराए जाने चाहिए। संबंधित वायु और ध्वनि प्रदूषण को नियंत्रित करने के लिए राजमार्ग के दोनों ओर एवेन्यू वृक्षारोपण का प्रस्ताव किया गया है।

1.9.3 जल संसाधन और गुणवत्ता पर प्रभाव

प्रस्तावित परियोजना सड़कों के निर्माण और संचालन से सतह के पानी और क्षेत्र में भूजल की गुणवत्ता पर कोई बड़ा प्रभाव नहीं पड़ेगा। अभियांत्रिकी योजना जल निकायो को संभावित हद तक नुकसान से बचाने के लिये बनायी गयी है ।

निर्माण सामग्री, तेल, ईंधन और पेंट के फैलाव के कारण जल निकाय का प्रदूषण होसकताहै। यह उन जगहों के मामले में अधिक प्रमुख होगा जहां परियोजना सड़क नदियों, नालियों आदि को पार करती है ।इन जल निकायों का प्रदूषण से बचने के लिए समय सीमा योजना बनाई गई है। ईंधन से निपटने वाले क्षेत्रों के पास तेल इंटरसेप्टर प्रस्तावित हैं ।

1.9.4 पारिस्थितिक संसाधनों पर प्रभाव

R.O.W. के भीतर पेड़ प्रभावित होने की संभावना है। जिसके कारण सुक्षम पारिस्थतकी तंत्र के अस्थायी रूप से नुकसान की संभाबना है। क्षतिपूर्ति वनीकरण और मार्ग के दौनों ओर पौधे लगाने से पारिस्थतकी प्रभाव को लंबे समय मे क्षतिपूर्ण किया जा सकता है। हालांकि, लंबे समय तक क्षतिपूर्ति वनीकरण और एवेन्यू बागान के मामले में प्रभावों का मुआवजा दिया जाएगा।

1.9.5 भूमि पर प्रभाव

प्रस्तावित परियोजना के निर्माण के दौरान, प्रोजेक्ट रोड के लिए कटौती और भरने के कारण स्थलाकृति बदल जाएगी और परियोजना से संबंधित संरचनाओं का निर्माण इत्यादि। भौतिक हैंडलिंग के लिए निर्माण यार्ड का प्रावधान मौजूदा स्थलाकृति को भी बदल देगा। स्थलाकृति में परिवर्तन परियोजना के संभावित प्रेरित विकास के कारण भी होगा।

1.9.6 सामाजिक प्रभाव

प्रस्तावित राजमार्ग के लिए लगभग 824.285 हेक्टेयर भूमि की आवश्यकता होगी।

1.10 विकल्पों का विश्लेषण

परियोजना के लिए दोनों विकल्पों का विस्तृत विस्लेशण किया गया है।प्रस्तावित सड़क को मजबूती प्रदान करने से इस क्षेत्र के आर्थिक मूल्य पर सकारात्मक प्रभाव पड़ सकता है। हालांकि, कुछ पर्यावरण और सामाजिक मुद्दे हैं, इन्हें सतत विकास के लिए कम किया जाना चाहिए।

1.11 शमन परिहार एक और संवर्धन के उपाय

प्रतिकूल पर्यावरणीय प्रभावों के लिए कमी और वृद्धि उपायों की योजना बनाई गई है। कर्मचारियों के लिए शिविर का निर्माण पास के निवास स्थान से कम से कम 1000 मीटर दूर स्थित होगा। निर्माण यार्ड, HMP संयंत्र इत्यादि हवा की दिशा के आपेक्ष और निवास स्थान से 1000 मीटर से अधिक दूर स्थित होंगे। उचित क्रॉस ड्रेनेज को बनाये रखने के लिए मौजूदा क्रॉस ड्रेनेज की योजना बनाई गयी है। वृक्षों के काटने के कारण फ्लोरा पर नकारात्मक प्रभावों की भर पाई करने के लिए परियोजना 1:10 के अनुपात में क्षतिपूर्ति वृक्षारोपण की योजना बनाई गई है। इस परियोजना में सौंदर्य और छाया प्रदान करने के लिए पेड़ों के वृक्षारोपण को भी देखा जाएगा। चूंकि क्षतिपूर्ति वनीकरण के लिए जगह परियोजना सड़क के साथ पर्याप्त नहीं हो सकती है, इसलिए यह वृक्षारोपण जंगल विभाग द्वारा 5 साल तक पौधों

को बढ़ाने और बनाए रखने के लिए भुगतान किया जाएगा। परियोजना क्षेत्र के सौंदर्य में सुधार के लिए पर्यावरणीय वृद्धि उपायों को प्रदान करने का अवसर लेगी। नियोजित पर्यावरणीय वृद्धि उपायों में ROW में उपलब्ध स्पष्ट स्थान, जल निकायों के संवर्द्धन आदि में वृक्षारोपण शामिल है। भंडारण क्षेत्रों और निर्माण यार्ड में सिल्ट फेंसिंग, ऑयल इंटरसेप्टर प्रस्तावित किए गए हैं। प्रभावित परिवारों कोउचित मुआवजे और पारदर्शिता का अधिकारभूमि अधिग्रहण, पुनर्वास और पुनर्स्थापन अधिनियम 2013 में पात्रता मैट्रिक्स के अनुसार मुआवजा दिया जाएगा।

1.12 संस्थागत आवश्यकताओं और पर्यावरण निगरानी योजना

शमन उपायों को लागू करने की ज़िम्मेदारी पर्यावरण टीम की होगी जो की ठेकेदार के द्वारा नियुक्त की गयी है। निर्माण और संचालन चरण के दौरान पर्यावरण कार्यों की समग्र निगरानी सलाहकार की मदद से NHAI द्वारा की जाएगी। प्रस्तावित विकास और माप के संभावित नकारात्मक प्रभावों को कम करने के लिए शमन उपायों के प्रदर्शन, पर्यावरण निगरानी और प्रबंधन के लिए योजना विकसित की गई है। उचित पर्यावरण निगरानी योजना ,निर्माण और इसका कार्यान्वयन परियोजना के लिए समग्र सफलता की कुंजी है।

1.13 पर्यावरण प्रबंधन योजना

परियोजना, कार्यान्वयन और पर्यवेक्षण जिम्मेदारियों के निर्माण चरण के दौरान प्रस्तावित उपायों के कार्यान्वयन को सुनिश्चित करने के लिए परियोजना विशिष्ट पर्यावरणीय प्रबंधन योजना तैयार की गई है। निर्माण के दौरान पर्यावरणीय प्रबंधन के लिए आने वाली लागत को ई.एम.पी में सांकेतिक किया गया है। प्रस्तावित परियोजना प्रभाव और प्रबंधन योजना का सारांश अगले खंड में किया गया है।

1.14 पर्यावरण प्रभाव और प्रबंधन मैट्रिक्स

तालिका 3 : पर्यावरण प्रभाव और प्रबंधन मैट्रिक्स

विवरण	चरणों	संभावित प्रभाव	शमन के उपाय
भौतिकविज्ञानपर्यावरण			
तलरूप	पूर्व निर्माण और निर्माण	• सड़क के विस्तार और सुधार के कारण थोड़ा बदलाव अपेक्षित हैं • प्रभाव मामूली, लेकिन स्थायी हैं।	• जितना हो सके भूमि सुधार करने की उचित योजना बनाना। • परियोजना के लिए कोई नई खदान का उपयोग नहीं करना।
भूगर्भशास्त्र	पूर्व-निर्माण और निर्माण	• रेत के निष्कर्षण की वजह से मामूली प्रभाव होगा।	-

विवरण	चरणों	संभावित प्रभाव	शमन के उपाय
जलवायु			
तापमान / बारिश/ आर्द्रता	पूर्व-निर्माण और निर्माण	• वृक्ष गिरने से क्षेत्र के सूक्ष्म-जलवायु पर असर पड़ेगा • पक्की सड़कों में वृद्धि के कारण हीट द्वीप प्रभाव बढ़ेगा • प्रभाव काम समय और कुछ छेत्र तक ही सिमित रहेगा	• काटे जाने वाले पेड़ों के 1:10 के अनुपात में प्रतिपूरक वृक्षारोपण होगा। • प्रस्तावित एवेन्यू बागान योजना के कारण, परियोजना गलियारे का सूक्ष्म वातावरण अच्छा हो जाएगा।
भूमि			
वन और पेड़ का नुकसान	पूर्व-निर्माण औरनिर्माण	• संपत्ति और आजीविका का नुकसान	• एल.ए.आर.आर, 2013 के अनुसार मुआवजा
अनुमानित विकास	पूर्व-निर्माण और निर्माण	• भूमि उपयोग पैटर्न में महत्वहीन परिवर्तन	• नागरिक विनियामक मौजूदा ढांचे का उपयोग कर के किसी भी अनुमानित विकास की योजना बनाने के लिए मार्गदर्शन करना।
मिट्टी			
मृदा अपरदन	पूर्व निर्माण, निर्माण और संचालन	• सड़क ढलानों में और नुकसान के कारण • उत्खनन क्षेत्रों में क्षरण	• पिचिंग और टर्फिंग के माध्यम से तटबंध संरक्षण • उत्खनन क्षेत्रों में नियमित पानी छिड़कावसे
मृदाकाप्रदूषण	पूर्व-निर्माण, निर्माण औरसंचालन	• कंटियाचारकोलकचरे • तेल और डीजल का बिखरना • इमल्शन स्प्रेयर और गर्म मिश्रण डालना • गर्म मिश्रण का उत्पादन और अस्वीकृत सामग्री • मजदूरों और अधिकारियों के लिए आवासीय सुविधाएं	• खतरनाक वेस्ट प्रबंधन और हैंडलिंगनियम, 2016 लागू किया जाएगा। • तेल और डीजल के आकस्मिक फैलाव के लिए भंडारण क्षेत्रों में तेल इंटर सेप्टर प्रदान किया जाएगा • परामर्शदाता के निर्देश के अनुसार ही अस्वीकृत सामग्री को दूसरे स्थान पर डाला जाना चाहिए। • अपशिष्ट निपटान के लिए सेप्टिक

विवरण	चरणों	संभावित प्रभाव	शमन के उपाय
			टैंक का निर्माण किया जाएगा।
पानी			
जल संसाधन पर प्रभाव	डिजाइन, पूर्व निर्माण, निर्माण औरसंचालन	• भूजल रिचार्ज की कमी • शिविर क्षेत्र में ईंधन और स्नेहक और अपशिष्ट निपटान से प्रदूषण • सड़क निर्माण क्षेत्र से बारिश म बहने वाला सतही जल प्रणाली का प्रदूषण	• जहां भी हो सके, पानी की संग्रहण /कटाई संरचना का प्रावधान • निर्माण शिविर में तेल इंटर सेप्टर और सेप्टिक टैंक • खतरनाक अपशिष्टों का प्रबंधन और हैंडलिंगनियम, 2016 • सड़कों से बारिश में बहने वाला जल को उचित रूप से दोनों तर फनाली बनाकर निकलना
वायु			
धूल उत्पादन	पूर्व-निर्माण और निर्माण	• उपयोगिताओं का स्थानांतरण, पेड़ों और वनस्पतियों कोहं टाने, सामग्री का परिवहन	• पानी का नियमित छिड़काव • परिवहन और भंडारण के दौरान, सड़क बनाने की सामग्री को पूरी तरह से कवर किया जायेगा। • HMP को नीचे की ओर से कम से कम 1000 मीटर की दूरी के साथ नीचे हवा की दिशा में स्थापित किया जाना चाहिए। • परिवेश वायु में कण पदार्थ की नियमित निगरानी
गैसीय प्रदूषक	पूर्व निर्माण, निर्माण और संचालन	• सामग्री परिवहन वाहन के संचालन और HMP का संचालन	• वायु प्रदूषण मानदंड लागू किए जाएंगे। • केवल PUC प्रमाणित वाहन तैनात किया जाएगा • मजदूरों को मुखौटा प्रदान किया जाएगा। • परिवेश हवा में नियमित गैसीय प्रदूषण जांच की जाएगी
परिवेश वायु गुणवत्ता	ऑपरेशन	• यातायात से वायु प्रदूषण • CO स्तर में वृद्धि होने की संभावना है	• Statuary नियामक आवश्यकताओं के साथ अनुपालन

विवरण	चरणों	संभावित प्रभाव	शमन के उपाय
शोर			
पूर्वनिर्माणगतिविधि	पूर्वनिर्माण	• मनुष्य, सामग्री और मशीनों का संचालन • श्रम शिविरों, ऑनसाइट कार्यालयों, गोदाम और निर्माण संयंत्रों की स्थापना	• हॉर्नजोनव स्पीड बाधाओं के सूचक संवेधनशील रिसेप्टर्स के पास नहीं लगाए जाएंगे • नो हॉर्न जोन साइन, संवेदनशील रिसेप्टर्स के पास स्पीड बाधाएं • शिविरवास उपनिवेश स्थान /से 1000 मीटरसेअधिकदूरस्थापितकियाजाएगा ।
निर्माण गतिविधि	निर्माण	• HMP, डीजल जेनरेटर आदि जैसे उच्च शोर उपकरणों का संचालन • कार्यक्षेत्र के पास रहने वाले लोग।	• शिविर हवाओं की दिशा में, वास स्थान से 1000 मीटर से अधिक दूर स्थापित किया जाएगा। • शोर प्रदूषण विनिय मन की निगरानी और उन्हें लागू किया जाना चाहिए।
ऑपरेशनचरण	ऑपरेशन	• संवेदनशील क्षेत्र के पास हॉर्न का अंधाधुंध बजाना	• हॉर्न के अनावस्यक उपयोग पर प्रतिबंध • हॉर्न नहीं संकेत सूचक
• परिस्थितिकी			
फ्लोरा	पूर्वनिर्माण, निर्माण	• वनस्पति कवर का नुकसान • 7699 पेड़ो का कटाव	• केवल अपरिहार्य पेड़ों की फेलिंग • 1:10 केअनुपात में पेड़ो का वनीकरण
पशुवर्ग	पूर्वनिर्माण, निर्माण और संचालन	• पेड़ों के गिरने के कारण कीट, पक्षी और छोटी स्तनधारी प्रजातियोंका नुकसान • दुर्घटनाग्रस्तरन	• नए पेड़ लगाना • संवेदनशील क्षेत्रों में धीमी गति से संबन्धित संकेत सूचक।
• सामाजिक			
सामाजिक पर्यावरण	डिजाइन, पूर्व निर्माण और निर्माण	• संपत्ति और आजीविका का नुकसान • सीपीआर का नुकसान, धार्मिक संरचनाएं	• एल.ए.आर.आर, 2013 के मुताबिक मुआवजा • सी.पी.आर, धार्मिक संरचनाओं का स्थानांतरण उपयुक्त जगह पर

विवरण	चरणों	संभावित प्रभाव	शमन के उपाय
• सार्वजनिक स्वास्थ्य और सड़क सुरक्षा			
स्वास्थ्य औरसुरक्षा	• पूर्वनिर्माण, निर्माण और संचालन	• परियोजना से प्रभावित लोगों पर मनोवैज्ञानिक प्रभाव • कामगारोंमजदूरों के प्रवास/ से स्वच्छता से संबन्धित समस्या उत्पन्न होने से बीमारी कारको के लिए अनुकूल स्थिति उत्पन्न हो सकती है। • हवा और शोर प्रदूषण से उत्पन्न असुविधा • दुर्घटना के खतरे	• उचित मुआवजे और पुनर्वास के त्वरित निपटान के लिए परियोजना से प्रभावित व्यक्तियों और सक्षम प्राधिकारी के साथ सतत परामर्श। • पानी और वेक्टरों से उत्पन्न होने वाली बीमारी को रोकने के लिए निर्माण शिविर में स्वच्छता उपायों को सुनिश्चित किया जाएगा। • कान के प्लग, दस्ताने,गमबूट औरमुखोटा जैसे उचित व्यक्तिगत सुरक्षात्मक उपकरणो केलिएप्रावधान। • निर्माण क्षेत्र में सुरक्षित यातायात प्रबंधन। • विद्यालय, अस्पताल इत्यादि जैसी सामुदायिक सुविधाओं के पास धीमी गति और गतिवाधाओं के संकेतसूचक की व्यवस्था ।

1.15 निष्कर्ष

ई.आइ.ए अध्ययन और परियोजना के लिए किए गए सर्वेक्षणों के आधार पर यह निष्कर्ष निकाला जा सकता है कि ई.आई.ए. रिपोर्ट में बताए गए उपायों के पर्याप्त कार्यान्वयन से संबंधित संभावित प्रतिकूल पर्यावरणीय प्रभावों को स्वीकार्य स्तर पर कम किया जा सकता है। पर्यावरणीय बजट में सुझाए गए पर्यावरणीय शमन और निरीक्षण आवश्यकताओं और उनसे संबंधित लागत को पूर्ण करने के लिए परियोजना में पर्याप्त प्रावधान किए जाएंगे। प्रस्तावित परियोजना सड़को में सुधार के साथ साथ आर्थिक विकास भी लाएगी। परियोजना वायु और शोर गुणवत्ता से संबन्धित संभावित जोखिम स्तर में काफी सुधार लाएगी।