Draft Environmental Impact Assessment (EIA) Report

(Baseline period-March to May 2021)

Development of 6-lane access controlled spur to Haridwar from Delhi-Saharanpur-Dehradun Economic Corridor in the States of Uttar Pradesh & Uttarakhand

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

Environmental Consultant : Feedback Infra Private Limited, Gurugram

August 2021

For National Highway Authority of India
Feedback Infra Private Limited

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It is however, to be noted that this report has been prepared with assumptions and estimates considered to be appropriate and reasonable, which though cannot be guaranteed. There might be inadvertent omissions / errors / aberrations owing to situations and conditions that are out of the control of NHAI and its consultants. Further, the report has been prepared on a best-effort basis, based on inputs considered appropriate for the report.

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ABBREVIATIONS

°C	:	Degree Celsius	DFO	:	Divisional Forest Officer
°F	:	Degree Fahrenheit	DM	:	District Magistrate
µmhos/cm	:	micromhos per centimetre	DM	:	Disaster Management
ADT	:	Average Daily Traffic	DM&R	:	Disaster Management & Relief
AAQ	:	Ambient Air Quality	DO	:	Dissolved Oxygen
			DOR	:	Department of Revenue
AE	:	Authority Engineer	DoT	:	Department of Telecommunications
AM	:	Anti Meridiem	E	:	East
ANL	:	Ambient Noise Level	E. coli	:	Escherichia coli
APHA	:	American Public Health Association	EAC	:	Expert Appraisal Committee
AQ	:	Air Quality	EC	:	Environmental Clearance
			EIA	:	Environmental Impact Assessment
Avg.	:	Average	EMP	:	Environmental Management Plan
AWWA	:	American Water Works Association	EOC	:	Emergency Operation Centre
BC	:	Bituminous Concrete	EP	:	Environmental (Protection)
BOD	:	Biological Oxygen Demand	ETC	:	Electronic Toll Collection
CaCO3	:	Calcium Carbonate	FCI	:	Food Corporation of India
CAGR	:	Cumulative Annual Growth Rate	FY	:	Fiscal Year
CALINE	:	California Line Source Dispersion Model	GoI	:	Government of India
CBRN	:	Chemical, Biological, Radiological, and Nuclear	GSB	:	Granular Sub-Base
CD	:	Cross Drainage	DLC	:	District Level Committee
CER	:	Corporate Environmental Responsibility	GSDP	:	Gross State Domestic Product
CGWB	:	Central Ground Water Board	GSVA	:	Gross State Value Added
Cm	:	Centimetre	GW	:	Ground Water
CO	:	Carbon Monoxide	Ha.	:	Hectare
COD	:	Chemical Oxygen Demand	HDPE	:	High-density Polyethylene
CoRTN	:	Calculation of Road Traffic Noise	HMA	:	Hot Mix Asphalt
CPCB	:	Central Pollution Control Board	HMAC	:	Hot Mix Asphalt Concrete
CPR	:	Community Property Resource	HMP	:	Hot Mix Plant
Cr.	:	Crore	SPCB	:	State Pollution Control Board
CRRI	:	Central Road Research Institute	IA	:	Impact Assessment
CSIR	:	Council of Scientific and Industrial Research	I-BAT	:	Integrated Biodiversity Assessment Tool
CTE	:	Consent to Establish	IMD	:	India Meteorological Department
CTO	:	Consent to Operate	INR	:	Indian Rupee
CTSB	:	Cement Treated Sub-base	IPCC	:	Inter-Governmental Panel on Climate Change
cum	:	Cubic Meter	IRC	:	Indian Roads Congress
dB	:	Decibels	IS	:	Indian Standard
DBC	:	Dense Bituminous Concrete	ITI	:	Industrial Training Institute
DBM	:	Dense Bituminous Macadam	IVI	:	Importance Value Index
Dept.	:	Department	IUCN	:	International Union for Conservation of Nature and Natural Resources
Km/hr	:	Kilometre per Hour	PH	:	Public Hearing

KM2	:	Square kilometre	PHED	:	Public Health Engineering Department
LARR	:	Land Acquisition, Rehabilitation and Resettlement	PMC	:	Project Monitoring Consultant
			PPP	:	Public Private Partnership
LCV	:	Light Commercial Vehicles	PQC	:	Pavement Quality Concrete
LED	:	Light Emitting Diode	PRI	:	Primary Rate Interface
Leq	:	Equivalent Continuous Noise Level	PROW	:	Proposed Right of Way
LHS	:	Left Hand Side	PUC	:	Pollution Under Control
LMV	:	Light Motor Vehicle	PVC	:	Poly Vinyl Chloride
LS	:	Lateral Section	PWD	:	Public Works Department
LULC	:	Land Use and Land Cover	R&R	:	Rehabilitation and Resettlement
LVUP	:	Light Vehicular Under pass	RAP	:	Resettlement Action Plan
m	:	Meter	RCC	:	Reinforced Concrete Cement
MAV	:	Multi Axle Vehicles	RDD	:	Rural Development Department
MC	:	Monitoring Consultant	RHS	:	Right Hand Side
mm	:	Millimetre	ROB	:	Road Over Bridge
MoEF&CC	:	Ministry of Environment, Forest and Climate Change	ROW	:	Right of Way
			SBWL	:	State Board of Wildlife
MSL	:	Mean Sea Level	SC	:	Supervision Consultant
MSME	:	Micro, Small and Medium Enterprises	SDM	:	Sub Divisional Magistrate
MT	:	Metric Tonne	SDMA	:	State Disaster Management Authority
N	:	North	SDRF	:	State Disaster Response Force
NAAQS	:	National Ambient Air Quality Standards	SEIAA	:	State Environment Impact Assessment Authority
NBWL	:	National Board of Wildlife	SH	:	State Highways
NCR	:	National Capital Region	SIA	:	Social Impact Assessment
NGO	:	Non-Governmental Organisation	SL	:	Sound Level
NH	:	National Highway	SMA	:	Stone Matrix Asphalt
NHAI	:	National Highways Authority of India	SO_2	:	Sulphur Dioxide
NOC	:	No-objection Certificate	SOP	:	Standard Operating Procedures
NOX	:	Oxides of Nitrogen	SOx	:	Oxides of Sulphur Dioxide
NP	:	National Parks	SPL	:	Sound Pressure Level
NSDP	:	Net State Domestic Product	Spp.	:	Species
OHT	:	Over Head Tanks	sq. km.	:	Square kilometre
OPD	:	Outpatient Department	SVUP	:	Small Vehicular Underpass
PAF	:	Project Affected Family	SW	:	Surface Water
PAP	:	Project Affected Person	TCS	:	Typical Cross Section
PCU	:	Passenger Car Unit	TDS	:	Total Dissolved Solids
PDS	:	Public Distribution System	wt./ wt.	:	Weight/Weight
PM	:	Particulate Matter			

1 INTRODUCTION

1.1 The Project

The Government of India has decided to develop a Spur to Haridwar. This will be a new connection to Haridwar from Delhi-Saharanpur-Dehradun Economic Corridor. The project stretch lies in Saharanpur and Haridwar districts in the states of Uttar Pradesh and Uttarakhand respectively. Delhi-Saharanpur-Dehradun expressway starts from Akshradham, Delhi to Dehradun covering a length of 212 km. The proposed corridor is 6-lane access-controlled highway. The route of the corridor is Akshradham/Delhi-EPE at Latifpur village-Saharanpur Bypass-Ganeshpur-Dehradun. This corridor is spread across the states of Delhi, Uttar Pradesh and Uttarakhand and passes through cities such as Baghpat, Shamli and Saharanpur.

At present, the traffic from Delhi to Haridwar follows NH 334 (Old NH No.58) passing through Ghaziabad, Modi Nagar, Meerut, Muzaffarnagar and Roorkee. NH 334 (Old NH No.58) is 4-lane in most of the length and passing through Built-up/Semi Built-up areas at some sections. NH 334 is partially access controlled highway with at-grade junctions and median openings. Traffic on NH 334 (Old NH No.58) nearer to Roorkee is 36176 PCU.

The distance between Akshradham/Delhi to Haridwar/Har Ki Pauri through DME and existing NH 334 (Old NH No.58) is 210 Km and it takes around 5 hrs travel time. Haridwar/Rishikesh are an important religious pilgrim centres. Haridwar is a gateway to other hill cities and temples of Uttarakhand, the traffic bound to the most important pilgrimage circuit in Uttarakhand, Chardham comprising Yamunotri, Gangotri, Kedarnath temple and Badrinath temple also passes through Haridwar. The number of pilgrims visiting the Chardham tour has been continuously increasing. The pilgrims visit Haridwar and Rishikesh in throughout the year predominantly during the winter.

The existing NH-334 (Old NH No. 58), is getting congested during pilgrimage season or during important festivals. Tens of millions of pilgrims attending the Kumbh Mela in January to March at Haridwar will use this highway extensively.

More than 50 million devotees attended the last Kumbh Mela. The existing NH 334 beyond Haridwar, will also connect the border with Tibet passing through Chamoli, Joshimath, Badrinath and finally to Mana Pass near the border with the Tibet.

Hence, the proposed 6 lane access-controlled spur to Haridwar is very much important for the country and region. Salient features of the project are as follows.

Table 1-1: Project Salient Features

Sl. No.	Particular	Details
1	Project Name	Development of 6-lane access controlled spur to Haridwar from Delhi-Saharanpur-Dehradun Economic Corridor in the States of Uttar Pradesh & Uttarakhand.
2	Project Length	43.900 km
3	Configuration	6 lanes access controlled
4	Location of project stretch	The proposed project highway originates from Ch. 108+450 of Delhi-Dehradun economic corridor near Halgoya village in Saharanpur district of Uttar Pradesh and ends at existing Ch. 182+070 of NH-334 near Badheri Rajputan village in Haridwar

Sl. No.	Particular	Details
		district of Uttarakhand. The important places through which the proposed alignment traverses are Halgoya, Baseda, Manakpur Adampur, Harchandpur Mazra, Madhopur Hazratpur, Saliyar, Mehwar Kalan, Rahmatpur and Badheri Rajputan.
5	Geographical Coordinates	From: 29°47'32.83"N 77°33'33.91"E; To: 29°54'4.47"N 77°58'7.33"E
6	Land details	Proposed highway follows plain terrain
7	Water demand	About 21,58,442 KL shall be required during construction phase
8	Sources of water	Tanker Supply & Surface water after permission from authority
9	Nearest railway station	Iqbalpur Railway Station, ~ 1.5 km from Ch: 27+200
10	Nearest State highway / National highway	Intersections with SH-59, SH28, NH-344 & NH-334
11	Nearest airport	Dehradun Airport
12	Seismic Zone	Proposed alignment falls under Seismic Zone IV (High Damage Risk Zone)

1.2 Project Proponent

The 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 proposed project highway originates from Ch. 108+450 (29°47'32.83"N 77°33'33.91"E) of Delhi-Dehradun economic corridor near Halgoya village in Saharanpur district of Uttar Pradesh and ends at existing Ch. 182+070 (29°54'4.47"N 77°58'7.33"E) of NH-334 near Badheri Rajputan village in Haridwar district of Uttarakhand. The proposed alignment generally passes through agricultural fields. The terrain along proposed alignment is plain. The important places through which the proposed alignment traverses are Halgoya, Baseda, Manakpur Adampur, Harchandpur Mazra, Madhopur Hazratpur, Saliyar, Mehwar Kalan, Rahmatpur and Badheri Rajputan. Location of the Project stretch is shown in Figure 1.1.

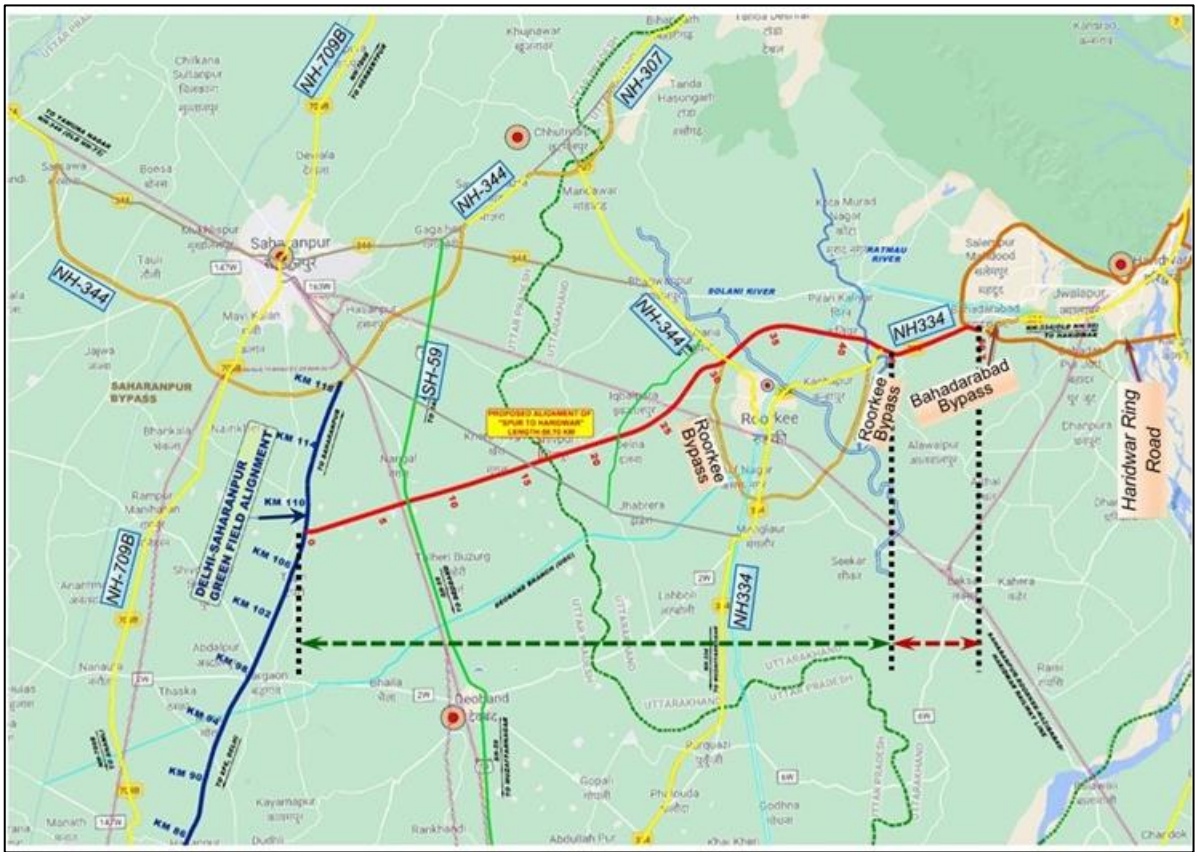


Figure 1-1: Location Map of Proposed Alignment for Spur to Haridwar

Project alignment duly imposed on Survey of India toposheet is attached as **Annexure 1.1**.

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.10/25/2021-IA.III dated 17th June, 2021. ToR compliance is presented as Annexure 1.3 of this report.

1.5 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 EIA study was carried out simultaneously with design of the project road and methodology is shown in 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. The sections below detail out the methodology adopted for the assessment of environment for the project.

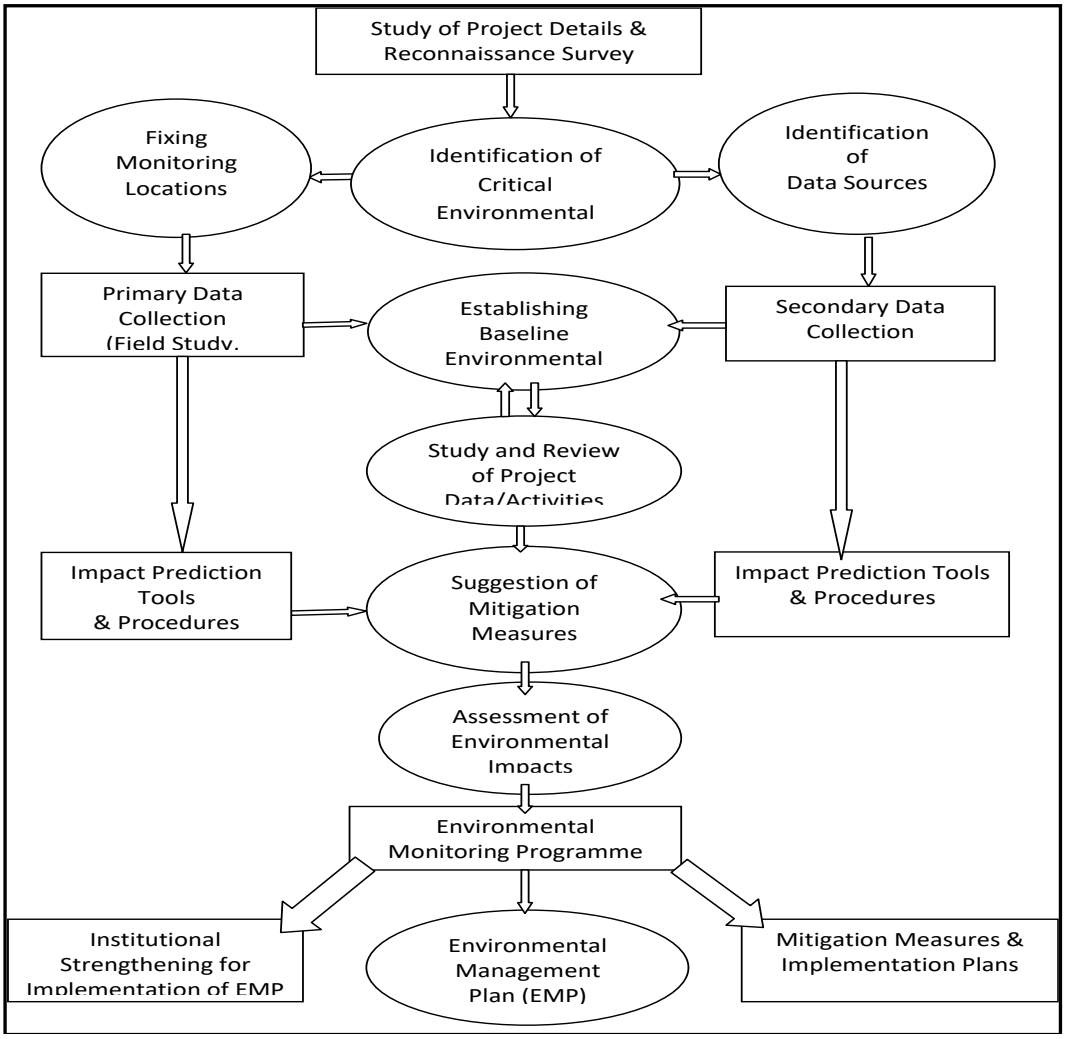


Figure 1-2: Methodology of EIA

1.5.1 Reconnaissance Survey

A reconnaissance survey has been undertaken for identification of Valued Environment Components (VECs) falling within the RoW of proposed for the project. 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.

1.5.2 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.

1.5.3 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.

1.5.4 Assessment of Alternatives

With and without project scenarios have been assessed. The assessment of alternatives and technologies (pavement, cross-sections, wet/dry mix etc.), sources of materials from an environmental management perspective, selection of alignment, etc were studied.

1.5.5 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 summarised 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 March 2021 to May 2021 for the proposed project. 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 Review of the Regulatory Environment Framework

Sl. No.	Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
1	The Environmental (Protection) Act. 1986, and the Environmental (Protection) Rules, 1987-2002 (various amendments)	Umbrella Act for protection and improvement of the environment.	Yes	All environmental Notifications, Rules and Schedules are issued under the EP Act	MoEF&CC, State Dept. of Environment & Forest, CPCB and SPCB
2	The EIA Notification, 14th September 2006 & amended thereof	Identifies all new national highways, expansion of national highways projects greater than 100 km involving additional ROW or land acquisition greater than 40m on existing alignments and 60m on re-alignments or by-passes (item 7 (f) of schedule) as one of the projects requiring prior clearance.	Yes	Project Highway is a new national highway project. Hence, Environment Clearance is required from MoEF&CC.	MoEF&CC & SEIAA
		Opening of new Quarry Area (including excavation of Riverbed)	Yes	Prior EC to be taken by Contractor if there is any need of mining activity	
3	Notification for use of Fly ash, 3rd November 2009 and its amendment on 25th January 2016	"No agency, person or organization shall, within a radius of 300 Kilometres of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments with top soils; the guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP:58 of 2001 as amended from time to time regarding use of fly ash shall be followed and any deviation from this direction can only be agreed to on technical reasons if the same is approved by Chief Engineer (Design) or Engineer-in-Chief of the concerned agency or organization or on production of a certificate of "fly ash not available" from the Thermal Power Plant(s)	Yes	Deen Bandhu Chotu Ram TPP, Panipat TPS etc. are located within 300km from the proposed highway alignment	MoEF&CC, SPCB

Sl. No.	Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
4	The Water (Prevention and Control of Pollution) Act, 1974	Central and State Pollution Control Boards to establish / enforce water quality and effluent standards, monitor water quality, prosecute offenders, and issue licenses for construction / operation of certain facilities.	Yes	Consent required for not polluting ground and surface water during construction	State Pollution Control Board
5	The Air (Prevention and Control of Pollution) Act. 1981	Empowers SPCBs to set and monitor air quality standards and to prosecute offenders, excluding vehicular air and noise emission.	Yes	Consent required for establishing and operation of crushers, hot mix and batching plants etc.	State Pollution Control Board
6	Noise Pollution (Regulation And Control) Act, 1990, 2010 and its subsequent amendments	Standards for noise emission for various land uses	Yes	Construction machineries and vehicles to conform to the standards for construction	State Pollution Control Board
7	Forest (Conservation) Act, 1980 its subsequent amendments.	Conservation and definition of forest areas. Diversion of forest land follows the process as laid by the Forest conservation Act.	Yes	Proposed alignment is passing through the strip forests declared as protected forests alongside roads, canals and railway lines	State Forest Department, MoEF&CC
9	Wildlife Protection Act, 1972 and amended thereof,	Protection of Wildlife Sanctuaries and National Park	No	The proposed alignments is neither passing through nor falling within 10.0 km radius of any areas protected under Wildlife (Protection) Act, 1972.	NBWL, SBWL & Chief Wildlife Warden
10	Ancient Monuments and Archaeological sites & Remains Act 1958 and amended thereof,	To protect and conserve cultural and historical remains found.	No	No ASI Notified monument is located within proximity of proposed alignment. Applicable for any "chance find" would be Notified / surrendered to the competent authority.	Archaeological Survey of India, State Dept. of Archaeology
11	The Motor Vehicle Act. 1988 its subsequent amendments.	Empowers State Transport Authority to enforce standards for vehicular pollution. From August 1997 the "Pollution Under Control Certificate" is issued to reduce vehicular emissions	Yes	All vehicles used for construction will need to comply with the provisions of this act.	State Motor Vehicles Department
12	The Explosives Act (& Rules)	Sets out the regulations as to regards the use of	Yes	Use of blasting materials (if	Chief Controller of

Sl. No.	Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
	1884 (1983) its subsequent amendments.	explosives and precautionary measures while blasting & quarrying		required) for new quarrying operation and storing of Diesel / Petrol in the camp site	Explosives
13	Public Liability and Insurance Act, 1991	Protection to the general public from accidents due to hazardous materials	Yes	Hazardous materials like Bitumen shall be used for road construction	Labour Commissioner / District Magistrate
14	Hazardous and Other Wastes (Management, & Trans-boundary Movement) Rules, 2016 and amended thereof	Protection to the general public against improper handling and disposal of hazardous wastes	Yes	Hazardous wastes shall be generated due to activities like of maintenance and repair work on vehicles	State Pollution Control Board
15	Construction and Demolition Waste Management Rules, 2016 and Solid Waste Management Rules 2016	Safe disposal of construction waste and municipal solid waste	Yes	Construction and demolition waste due to demolition of existing structures & construction activities and municipal waste shall be generated from the construction worker camp	State Pollution Control Board
16	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Protection against chemical accident while handling any hazardous chemicals resulting	Yes	Handling of hazardous (flammable, toxic and explosive) chemicals during road construction	District & Local Crisis Group headed by the DM and SDM
17	Mines & Minerals (Regulation & Development) Act, 1957 & amended thereof,	Permission of Mining of aggregates and sand from riverbed & aggregates	Yes	Mining of sand, soil or aggregates shall require permission from mining dept.	State Department of Mining
18	The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) BOCW Act, 1996	Employing Labour / workers	Yes	Employment of labours	District labour Commissioner

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 DFOs / wildlife officers and Research journals
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

1.5.6 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 chapter-5, to reduce potentially adverse environmental impacts to acceptable levels.

1.5.7 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 to a possible extent as per policy guidelines. 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 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 str*etc*h, 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 Project Profile

The proposed project highway originates at Ch. 108+450 of Delhi-Dehradun economic corridor near Halgoya village in Saharanpur district of Uttar Pradesh and ends at existing Ch. 182+070 of NH-334 near Badheri Rajputan village in Haridwar district of Uttarakhand. The proposed alignment generally passes through agricultural fields. The terrain along proposed alignment is plain. The important places through which the proposed alignment traverses are Halgoya, Baseda, Manakpur Adampur, Harchandpur Mazra, Madhopur Hazratpur, Saliyar, Mehwar Kalan, Rahmatpur and Badheri Rajputan. The coordinates are given in Table 2-1.

Table 2-1: Project Coordinates

Description	Coordinates
Starting point	29°47'32.83"N 77°33'33.91"E
Terminating point	29°54'4.47"N 77°58'7.33"E

The proposed RoW of the project highway is 60m. Location of the Project stretch is shown in Figure 1.1. Alignment duly marked on google satellite imagery is shown as Figure 2.1.

2.2 Project Features

The Project highway is a green-field access controlled is configured to 6 lane as per IRC SP 99-2013 standards. The various aspects viz geometrics of expressway, interchange design, junction design, cross sections, drainage design, pavement design, structure design for culverts, bridges, flyover, VUP's, LVUP's, SVUP's, and interchanges that have been considered in the development of design for the proposed highway are brought out in this section.

2.2.1 Design Speed

The project corridor passes through plain terrain. Design speed adopted for main carriageway 100 km/h; for loops at interchanges – 50 km/h; for ramps at interchanges – 70 km/h and for service road – 40 km/h.

2.2.2 Right of Way

The recommended minimum Right of Way is 60m throughout the project stretch. Additional land at interchanges, toll booth, highway amenities, truck lay byes shall be acquired.

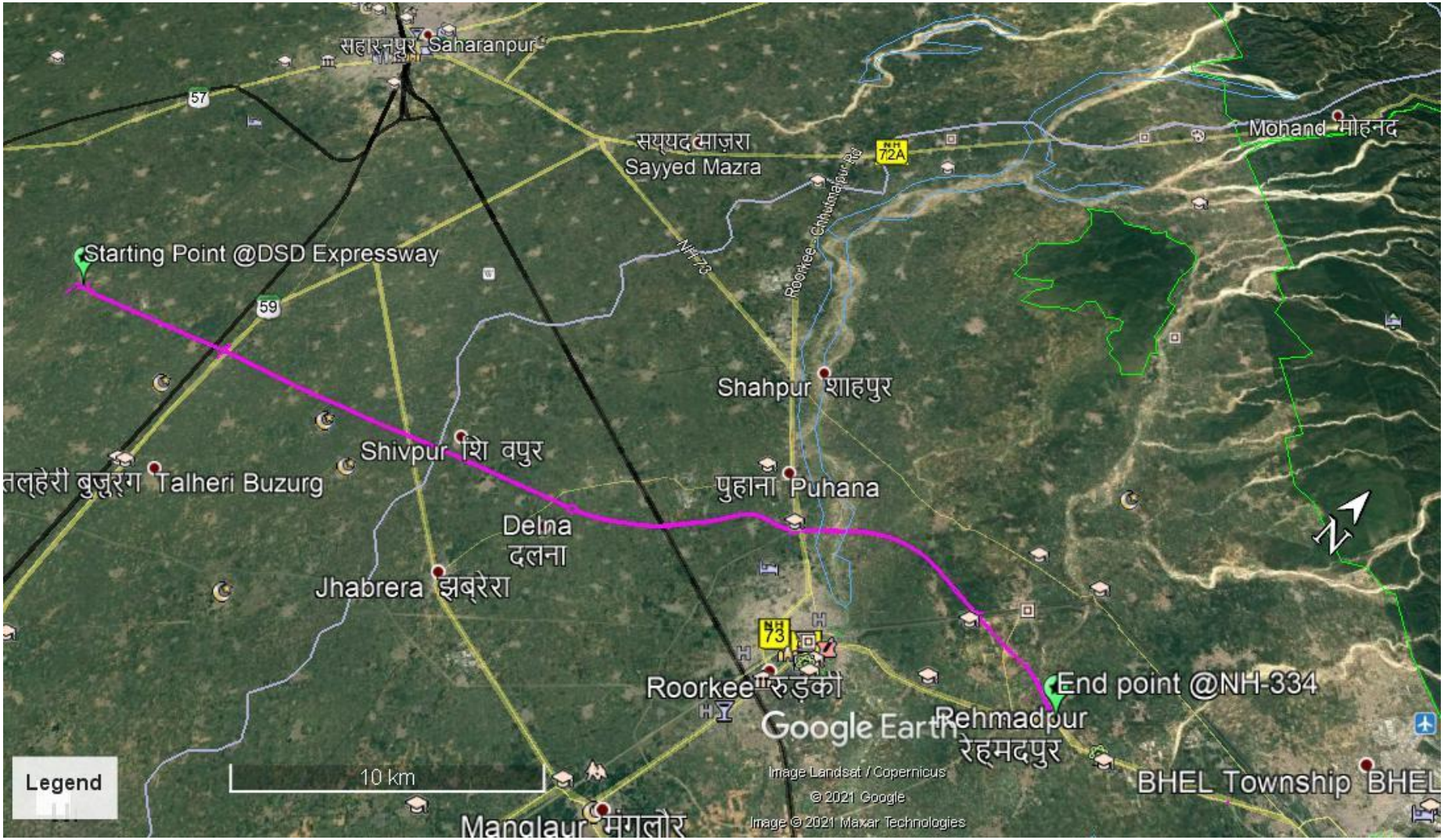


Figure 2-1: Proposed Alignment Marked on Satellite Imagery (Google Earth)

2.2.3 Camber /Cross-fall

The values of camber proposed to be applied on straight (i.e., without super-elevation) sections of Main Carriageway, Paved Shoulder & Service Road would be 2.5% and 2.0% for bituminous and cement concrete surfaces respectively, and 3.0% for Earthen Shoulders.

2.2.4 Typical Cross Sections

Total 20 types cross-sections have been proposed as per IRC-99-2013 of each Lane having 3.75 m width. Typical cross-sectional drawings are shown Annexure 2.1.

2.2.5 Grade Separators

At grade junctions are safety hazard in view of high speed and thus no at-grade junctions have been provided in the project highway. The details of proposed grade separated structures is given below:

Table 2-2: Details of Grade-Separated Structures

Sl. No.	Chainage (Km)	Intersecting road	Category of road	Span (m)	Vertical clearance	Width of Structure (m)	Type of structure
1	0+644	Halgoa	Village Road	1x12	4.0	2x12.25	LVUP
2	0+801	Delhi - Dehradun Road	Access controlled Highway	2x37.6	5.5	2x12.25	Flyover
3	2+896	Nainsobe - Sitlakhera	Village Road	1x12	4.0	2x12.25	LVUP
4	3+745	Gangnauli - Sitlakhera	Village Road	1x12	4.0	2x12.25	LVUP
5	5+476	Dagrauli - Aamki	Village Road	6x30	4.0	2 x 14.5	LVUP
6	6+286	Dagraquli - Pahadpur	Village Road	1x12	5.5	2 x 14.5	VUP
7	8+034	Muzaffarnagar - Sharanpur Road	SH-59	1x20	5.5	2 x 14.5	Flyover
8	11+288	Nangal - Tejpur	Village Road	2x30	4.0	2 x 14.5	LVUP
9	12+511	Khera - Tejpur	Village Road	1x12	4.0	2 x 14.5	LVUP
10	14+266	Khera - Salempur	Village Road	1x12	5.5	2 x 14.5	VUP
11	16+683	Sharanpur - Jhabrera	MDR	1x20	5.5	2 x 14.5	VUP
12	17+743	Shivpur - Bachitt	Village Road	1x20	4.0	2 x 14.5	LVUP
13	19+250	Shivpur - Manakpur	MDR	1x12	5.5	2 x 14.5	VUP
14	21+310	Harchandpur - Manakpur	MDR	1x20	5.5	2 x 14.5	VUP
15	22+988	Puhana - Jhabrera	SH-28	1x20	5.5	2 x 14.5	VUP
16	24+434	Saidabad - Heerahedi	Village Road	1x20	4.0	2 x 14.5	LVUP
17	25+439	Iqbalpura - Roorkee	ODR	1x12	5.5	2 x 14.5	VUP
18	27+660	Iqbalpura - Roorkee	ODR	1x20	5.5	2 x 14.5	VUP
19	29+883	Anantpur - Sunhera	Village Road	1x20	4.0	2 x 14.5	LVUP
20	31+017	Madopur - Sunhera	Village Road	1x12	4.0	2 x 14.5	LVUP
21	32+095	Roorkee Bypass	NH-344	1x12	5.5	2 x 14.5	Flyover
22	32+665	Madopur -STP	Village Road	12x30	4.0	2 x 25	LVUP
23	37+484	Imlikhera – Mehwar Kalan	Village Road	1x12	4.0	2 x 14.5	LVUP
24	40+946	Piran Kaliyar - Rehmadpur	ODR	1x20	5.5	2 x 14.5	VUP

2.2.6 Major & Minor Bridge

Total 15 nos. of bridges are required along the project road consisting 5 major bridge and 10nos of minor bridges. The span arrangement and total length of bridges are proposed based on hydrology

and geotechnical investigations. Overall deck width of 14.5 m has been proposed consisting of 0.5+13.5+0.5 m for carriageway including shyness, 0.50 m for the concrete crash barrier on either side. Detailed of the structures are listed from Table 2-3 to Table 2-4.

Table 2-3: Major Bridge

Sl. No.	Chainage (Km)	Name of the bridge/Nala	Span (m)	Width of Structure (m)
1	1+530	Hindan River	4x30	2 x 14.5
2	33+450	Solani River	20x30	2 x 14.5
3	35+860	Sipia Nala	3x30	2 x 14.5
4	39+563	Upper Ganga Canal	5x35 + 1x105 + 1x35	2 x 14.5
5	42+530	Ratmau	6x30	2 x 14.5

Source: Design Report

Table 2-4: Minor Bridge

Sl. No.	Chainage (Km)	Name of the bridge/Nala	Span (m)	Width of Structure (m)
1	2+373	Nala	1x13	2 x 14.5
2	12+048	Kali Nadi	3x11	2 x 14.5
3	18+210	Nala	4x12	2 x 14.5
4	21+814	Nala	1x15 + 1x8	2 x 14.5
5	27+877	IOCL pipeline	1x27	2 x 14.5
6	29+260	Sila Khala	2x10	2 x 14.5
7	37+356	Nala	1x14	2 x 14.5
8	38+013	Nala	1x12	2 x 14.5
9	39+038	Nala	1x12	2 x 14.5 + 2 x 11
10	42+219	Nala	1x8	2 x 14.5

Source: Design Report

2.2.7 Access Control

The proposed highway is completely access controlled and access has been provided at interchanges only.

2.2.8 Interchange

Interchanges have been proposed at 5 locations as per details given in Table 2-5.

Table 2-5: Interchange Details

Sl. No.	Design Chainage (Km)	Connecting Road	Type of Interchange
1	0+800	Delhi-Dehradun access controlled Highway	Trumpet
2	8+034	Muzaffarnagar - Saharanpur Road (SH-59)	Dumbell with Toll Booths
3	32+095	Roorkee - Chhutmalpur Road (NH-344)	Dumbell without Toll Booths
4	39+500	Upper Ganga Canal Road	Dumbell without Toll Booths
5	43+820	Roorkee - Haridwar Road (NH- 334)	Dumbell without Toll Booths

Source: Design Report

2.2.9 **RoB**

Table 2-6: Details of RoB

Sl. No.	Chainage (Km)	Location of crossing	Location of crossing	Span (m)	width of structure (m)
1	7+550	Between LC-77 (Baseda) and SPL-78 T-2 (Nagal)	Muzaffarnagar-Saharanpur BG Line (North Railway, Delhi Division)	1x54	2 x 21.5
2	27+134	Between LC-518 (Padli ganda) and LC-519 (Khata Khedi)	Roorkee- Saharanpur BG Line (North Railway, Moradabad (Division)	1x60	2 x 14.5

Source: Design Report

2.2.10 Culvert

Culverts along the proposed alignment have been proposed as per locations of streams. RCC Box culverts of varying sizes have been proposed as per the prevailing site condition. The overall width of culverts between outer most faces of parapets shall be equal to the roadway width of approaches (Paved carriageway + Earthen Shoulders). In case of high banks, the length of culvert shall be increased to avoid high face walls.

Table 2-7: Summary of Culverts

Sl. No.	Culverts for cross drainage		Culverts for Connecting road/ Road cum Drain		Span	Total
	MCW	Ramps	MCW	Ramps		
1	7	9	-	-	1x 1.2	16
2	21	9	-	-	1 x 2	30
3	28	2	-	-	1 x 3	30
4	3	-	37	-	1 x 4	40
5	2	-	10	-	1 x 5	12
6	3	-	9	--	1 x 6	12
Total						**140**

Source: Design Report

2.2.11 Connecting / Service / Slip Roads

Connecting / service / slip roads shall be provided outside the RoW and width of connecting road shall be same as standard of crossing road to maintain proper circulation of local traffic, continuity of travel and to facilitate crossing over to the other side of the project highway through an under/overpass. The construction and maintenance of connecting roads shall be part of the Project Corridor. The detail of location where connecting / service / slip roads is provided is given in the below Table 2-8.

Table 2-8: List of Proposed Connecting / Service / Slip Roads

S. No.	Chainage (Km)		Width (m)	Length (m)	Chainage (Km)		Width (m)	Length (m)
	From	To			From	To		
1	23+410	24+110	700	8.00	23+410	24+110	700	8.00
2	43+870	44+540	670	11.50	43+870	44+540	670	11.50

Source: Design Report

2.2.12 Boundary Wall at ROW

Road Boundary wall to be constructed as specified in Ministry Circular No.RW/NH-24036/27/2010-PPP dated 25.04.2018.

2.2.13 Pavement Design

Perpetual pavement with design life of 50 years is recommended in the main carriageway, while the design life of rigid pavement is 30 years. The crust detail is in Table 2-9.

Table 2-9: Proposed Pavement Design for Main Carriageway

Pavement Composition	Pavement Type	Recommended Crust Thickness (mm)
BC	Flexible	50
Dense Bituminous Concrete (DBM) VG-40		70
Wet Mix Macadam (WMM)		175
Granular Sub-Base (GSB)		200
Total		**495**

Source: Design Report

2.2.14 Drainage

Earthen drains are provided through-out the project corridor to ensure efficient drainage from carriageway to drain. All drains are connected to cross drainage structure. Median drains are provided with rain water harvesting structure. Proper drainage arrangements are provided for grade separated structures. If required, CD work is also provided for loops and ramps.

2.2.15 Highway Amenities

- Wayside amenities to be provided at two locations

Start (Ch.)	End (Ch.)	Area	Side
23+660	23+860	2 ha	LHS
23+660	23+860	2 ha	RHS

- All amenities provided like drinking water kiosk, toilet facilities, parking, restaurants, petrol station, garage, generator set / solar system area, ATMs, Ambulance area, medical room etc. to be provided

2.2.16 Lighting

Lighting shall be provided at all interchanges, toll booths, bridges, overpasses/ underpasses etc. as specified in IRC:SP:99-2013

2.2.17 Traffic Management Systems

Advance Traffic Management Systems (ATMS) shall be provided as per Clause-816 of MORT&H Specifications for road and bridge works.

2.2.18 Crash Barriers

Metal Beam Crash Barriers are proposed at high embankment locations and at major bridge approaches

2.2.19 Traffic Control Devices, Road Safety Devices and Road Side Furniture

Traffic control devices, road safety devices and road side furniture shall comprise of road signs, road markings, object markers, hazard markers, studs, delineators, attenuators, safety barriers, boundary fences, boundary stones, kilometre stones, etc. as per Relevant IRC Guidelines (IRC 2,

IRC:8, IRC:35, IRC:67, IRC SP 99 etc.), MoRT&H Guidelines for Expressways manual and Section 800 of MoRT&H Specifications shall be followed.

2.3 Cost

The total project cost is INR 1908.89 crores.

2.4 Traffic Studies & Forecast

The survey locations summarized below have been selected following careful assessment of the traffic characteristics including entry and exit points along the project influence area. Currently, the traffic bound to Haridwar from Delhi side are using exiting NH-334 and the traffic from Saharanpur side are using SH-68. Hence the traffic surveys have been conducted along both NH-334 & SH-68 and in addition to that 7-day CVC has been conducted at NH-334 after Bahadarabad to observe the traffic that are travelling between Roorkee and Haridwar.

Table 2-10: Traffic Survey Locations

S. No.	Locations
1	Muzaffarnagar-Roorkee section of NH334, Km 160+300, Mundyaki Village
2	Bhagwanpur - Bahadarabad Section of SH-68, Km 7+500, Near Imlikheda village
3	Badheri-Haridwar Section of NH-334, Km 192+500, Near Bahadarabad

Table 2-11: Average Daily Traffic

S. No.	Vehicle Type	Roorkee - Muzaffarnagar section of NH-334		Bhagwanpur - Bahadarabad section of SH-68		Bahadarabad - Haridwar of NH-334	
		Nos.	PUC	Nos.	PUC	Nos.	PUC
1	Car	11918	11918	4990	4990	19007	19007
2	Mini-Bus	172	258	46	69	201	302
3	Pvt. Bus	350	1050	45	135	534	1602
4	Govt. Bus	667	2001	42	126	784	2352
5	LCV	1578	2367	789	1184	1363	2045
6	2 Axle	522	1566	381	1143	1303	3909
7	3 Axle	652	1956	321	963	841	2523
8	4-6 Axle	1025	4613	371	1670	562	2529
9	>=7 Axle	1	5	0	0	1	5

Source: Design Report

2.4.1 Projected traffic on Greenfield Haridwar Spur

Table 2-12: Projected Traffic (Ch. 0+000 to 43+900)

Financial Year	Numbers	PCUs
2020-21	12878	24925
2021-22	13522	26310
2022-23	14198	28487
2023-24	14908	30041
2024-25	15798	31451
2025-26	16741	33900
2026-27	17740	35456
2027-28	18800	37091

Financial Year	Numbers	PCUs
2028-29	19923	38810
2029-30	21114	41070
2030-31	22170	42687
2031-32	23278	44375
2032-33	24442	46137
2033-34	25664	47977
2034-35	26947	49615
2035-36	28295	51316
2036-37	29709	53082
2037-38	31195	54915
2038-39	32755	56820
2039-40	34392	58473
2040-41	36112	60183
2041-42	37918	61950
2042-43	39813	63776
2043-44	41804	65664
2044-45	43894	67358
2045-46	46089	69102
2046-47	48393	70899
2047-48	50813	72749
2048-49	53354	74656
2049-50	56021	76621
2050-51	58823	78645
2051-52	61764	80731
2052-53	64852	82882
2053-54	68094	85097

Source: Design Report

3 ANALYSIS OF ALTERNATIVES

This chapter is an attempt to compare feasible alternatives to the proposed development in respect to site, technology, design, etc. The criteria adopted for the evaluation of the alternate route for construction of proposed expressway comprise of engineering, economic, environmental and social considerations. The chapter discusses how environmental and social parameters were assigned due importance and were carefully considered in the analysis of alternatives.

3.1 With & Without Project Alternatives

3.1.1 Without Project Scenario

The existing connectivity with the proposed section is mostly with varying pavement width. The existing scenario of the traffic volumes along with higher estimated future traffic volumes coupled with the aim of improving the efficiency of freight movement, the capacity of the existing highways is insufficient for handling the high volume of traffic and freight movement. This is further compounded by the various land use conflicts, in terms of uncontrolled development along the highway. There are dense settlements / habitations along the existing highway which causes disruptions to the traffic flow and further vehicular-pedestrian conflicts creates higher probability for accident occurrence. These conflicts lead to reduced efficiency and mobility of the existing infrastructure. The population growth increase in traffic volumes and the economic development along the corridor would continue to occur and will worsen the already critical situation. In the absence of proposed development, the existing unsafe conditions and the adverse environmental consequences in terms of the environmental quality along the existing roads would continue to worsen. Moreover, if it is decided not to proceed with the project, then the regional beneficiaries (sub-urban and rural population) of the proposed project will be deprived of the socio-economic development of project region. 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. The inability of the existing infrastructure to meet future demands calls for development of a greenfield access-controlled expressway.

3.1.2 With Project Scenario

The 'with project scenario' is found to have a positive impact in the long run on social, environmental, economic and financial issues. This scenario includes the development of greenfield access-controlled expressway. The scenario is economically viable and will improve the existing socio-economic conditions of the project area. It would thereby, contribute to the developmental goals envisaged by NHAI, MoRTH, GoI and enhance the growth potential of the area.

In-spite of the various development benefits likely to accrue due to the project, as is the case of every road development project, the project would be accompanied by certain impacts on the natural, social and environmental components. The potential impacts on the various environmental components can be avoided through good environmental practices. Wherever avoidance of negative impact has not been possible, appropriate mitigation and enhancement actions are worked out to effectively offset the environmental damages inflicted due to the project. Comparative assessments of the "with and without" project scenarios are presented in the Table 3-1.

Table 3-1: Comparative Assessment of "With and Without" Project Scenarios

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometrics	Acces controlled expressway	Existing highways of four / six lanes carriageway with poor geometrics
Design Speed	100 Kmph	50-60 kmph with traffic jam incidences
Congestion in Settlements	Free flow of traffic due to access controlled movement	Congestion in urban areas
Felling of trees	Felling of both old and young trees, 10 times of the number of trees felled to be planted as compensatory plantation.	No felling of trees. The old trees may become a safety hazard to the existing highways with passage of time
Road Safety Measures	Access controlled expressway, provision of proper road markings and design geometry to reduce accidents	Accident incidents shall rise with an increased traffic volume
Environmental Quality	Provision of drain on both side of the highway to improves environmental quality An aggressive tree plantation as per IRC SP-21:2009 and compensatory plantation shall not only improve aesthetics but also improve the quality of air Lesser distance and free flow traffic condition will reduce carbon emission as expected from similar traffic volumes on existing highway	Poor due to congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to Increase in traffic volumes and further congestion
Drainage	Drainage along side the proposed highway shall be imporved due to both side drainage facility	These issues shall remain unaddressed on existing highways
Road Side Amenities	Appropriate road side amenities to be provided at various locations along the corridor.	Not adequate
Development	Higher potential for development due to improvement in access and connectivity	Development activities will be greatly hampered by the gross inadequacy of infrastructure
Improvement in tourism and pilgrimage	Fast and safe connectivity resulting in saving fuel, travel time and cost to reach the different tourist places	Slow movement of traffic on existing highways. Situation will further be worsened as the traffic nos. shall be increased with time

3.2 Criteria for Fixing Alignment for Greenfield Highway

- 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.
- 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 two terminal stations.
- The project initial cost, maintenance cost, and operating cost should be optimum so as to be considered economical with respect to its options.
- The Greenfield alignment should be finalised giving due consideration to siting/location of major structures including Major Bridges, Interchanges and ROBs. The space requirement of interchanges to be kept into consideration to avoid major resettlement.

- Tunnel / Box cutting of Hills should be considered as the last option and should be provided only when it is absolutely necessary.
- The location of spurs for connecting the important towns to be decided while fixing the alignment Options.
- The alignment should follow the unused / barren land to the extent possible to reduce the cost of land acquisition.
- Proposed alignment shall be fixed in such a way that traverses at a minimum distance of 150m from built up areas avoiding important buildings and structures. However, few isolated buildings falling along the alignment cannot be avoided due to Geometric requirements.
- Existing water bodies shall be avoided as far as feasible.
- Utmost care shall be taken while fixing the alignment near wildlife sanctuaries, national parks, Reserve Forest and other Eco Sensitive Zones. The MOEF&CC guidelines shall be adhered to while fixing the alignment.

Considering the above criteria, various options were prepared and following salient techno-economic parameters were evaluated and the Options were compared against each individual parameter.

- Total Proposed Length between Start and End Nodes,
- Total Length of New Alignment / Bypasses (km),
- Road Geometry,
- Requirement of ROB / VUP / Flyover/Tunnel,
- Connectivity to important towns,
- Wildlife Clearance, Forest Area Affected, Eco-Sensitive Area,
- Total Approx. Area of Land to be acquired (Ha.),
- Approx. Civil Cost, estimated based on per km cost and
- Other Constraints, if any.

3.3 Project Influence Area

Three options have been studied for the alignment of proposed road. The proposed alignment of all the options, traverses through Saharanpur district of Uttar Pradesh and Haridwar district of Uttarakhand

3.4 Alignment Options

Possible alignment options were prepared based on various site visits and surveys. Besides, each option was also cross-checked through detailed reconnaissance survey at site. The possible alignment options are described below, with comparative statements. Key map showing all the alignment options is presented on next page.

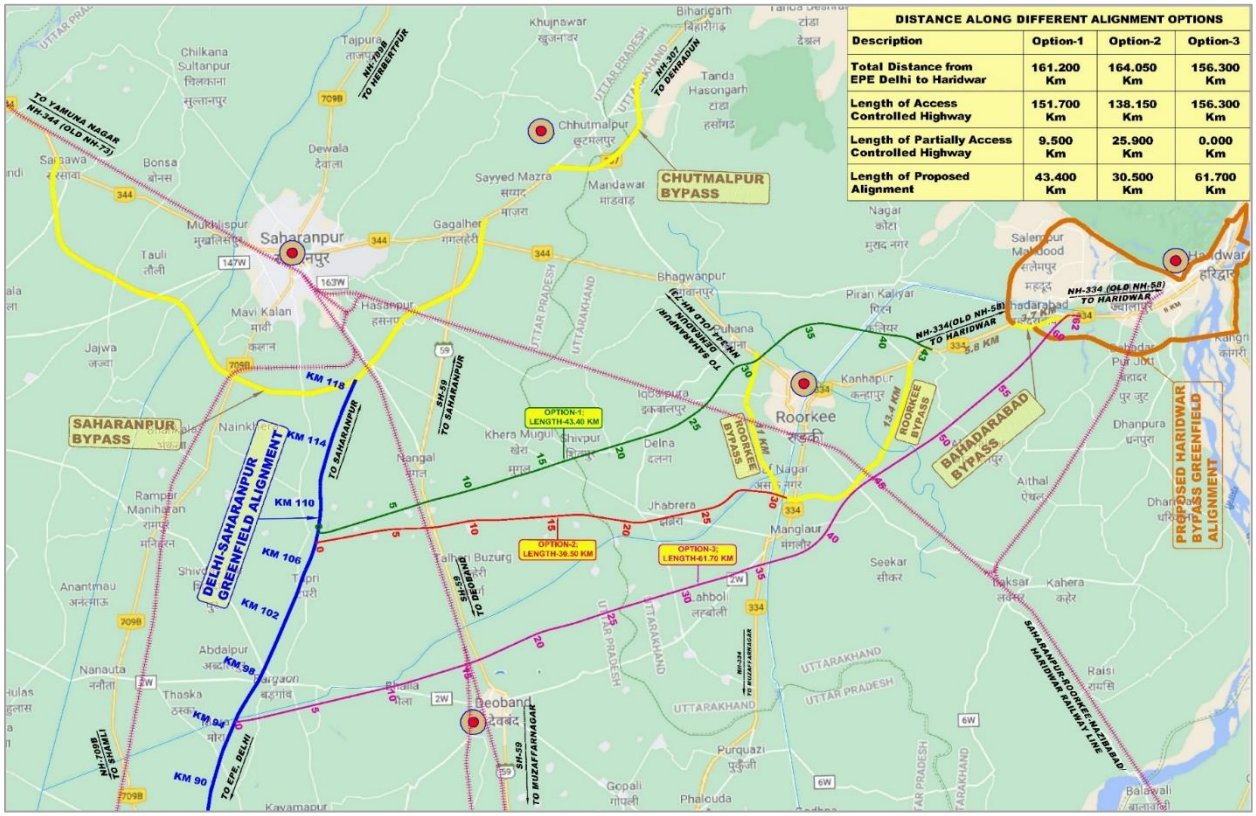


Figure 3-1: Alignment Options Map

The comparative statement for proposed alignment of Spur to Haridwar is given in Table 3-2.

Table 3-2: Comparative Analysis for Proposed Alignment

S. No.	Parameter	Option 1	Option 2	Option 3
1	Total Length (Km)	43.900	30.500	61.700
2	Length of Greenfield Alignment (Km)	43.900	30.50	61.70
3	Length of Brownfield Alignment (Km)	0.000	0.000	0.000
4	Start	At Ch. 108+450 of Delhi-Saharanpur Greenfield alignment near Halgoya Village	At Ch. 107+650 of Delhi-Saharanpur Greenfield alignment near Halgoya Village	At Ch. 94+600 of Delhi-Saharanpur Green field alignment near Mora Village
5	End	At Existing Ch. 182+000 of NH-334 (Old NH No. 58) near Badheri Rajputan Village	At Existing Ch. 1+100 of Roorkee bypass section of NH-344 (Old NH No. 73)	At Ch. 2+400 of Proposed Haridwar Ring Road/ Eastern end of Bahadarabad Bypass on NH-334 (Old NH No. 58)
6	Total Distance from EPE	162.15	163.80	156.30

S. No.	Parameter	Option 1	Option 2	Option 3
	Delhi to Haridwar			
7	Lane Configuration	6-lane Access Controlled	6-lane Access Controlled	6-lane Access Controlled
8	Districts	Saharanpur in Uttar Pradesh and Haridwar in Uttarakhand	Saharanpur in Uttar Pradesh and Haridwar in Uttarakhand	Saharanpur in Uttar Pradesh and Haridwar in Uttarakhand
9	Connecting Highways	Delhi-Dehradun Economic Corridor, SH-59, NH-344/73, NH-334/58	Delhi-Dehradun Economic Corridor, SH-59, NH-344/73, NH-334/58	Delhi-Dehradun Economic Corridor, SH-59, NH-344/73, NH-334/58
10	No. of NH Crossings	3	3	3
11	No. oh SH Crossings	1	1	1
12	Major Built-up areas Connected	Roorkee and Haridwar	Roorkee and Haridwar	Roorkee and Haridwar
13	No. of settlements along prop. alignment	48	60	59
14	Existing land use	Agricultural	Agricultural	Agricultural
15	Affected Forest Area	0.156		
16	Eco-sensitive/ Protected Area	Nil	Nil	Rajajii National Park within 10 Km Radius
17	Forest Clearance	Yes	Yes	NA
18	Environmental Clearance	Yes	Yes	Yes
19	Description of Alignment	a) Greenfield alignment in a length 43.90 km and then follows existing road (NH-334) in a length of 9.80 Km up to Haridwar; b) This alignment runs on northern side of Roorkee; a. Existing 4-lane highway beyond greenfield alignment in a length of 9.80 Km passes through built-up areas with no access control	a) Greenfield alignment for 30.50 km and then follows the existing Roorkee Bypass road for a length of 16.90 km and further follows the existing road (NH-334) up to Haridwar; b) Existing 4-lane Highway in a length of 9.800 km passes through built-up areas with no access control; c) At the junction with Roorkee Bypass Road, Ch 30.60, approx. 1km length of bypass road needs to reconstructed to match with the FRL of proposed trumpet	a) Green field alignment with full access control up to Haridwar; Joins with proposed Haridwar Bypass Road; a. This alignment runs on southern side of Roorkee parallel existing bypass on NH-334 (Old NH No. 58)

S. No.	Parameter	Option 1	Option 2	Option 3
			interchange; a. After crossing the canal at 30.60 joins with NH-334 (Old NH No. 58) at grade, needs to use slip road to access the eastern part of Roorkee Bypass	
20	Merits	a) Part of this alignment runs on northern side of Roorkee connecting existing western and eastern bypasses, thus completes the total ring around Roorkee; b) Beneficial for both Delhi and Saharanpur bound traffic; c) Provide better connectivity to Roorkee and Haridwar	Length of new construction is less compared to other options	a) Shortest Route from Delhi to Haridwar; Access Control in entire length
21	Demerits	a) Length of new construction is more compared to Option 2; Existing 4-lane highway in a length of 9.80 km passes through built-up areas with no access control;	a) As this option connects to southern side of Roorkee Bypass, not beneficial to Saharanpur bound traffic; Traffic bound to Haridwar will have to follow existing highway in a length of 15.8 km with partially access control and 9.80 km with no access control, which is more than the other options	a) Length of New construction is more than the other options Construction cost is more than other options; Runs parallel to Roorkee Bypass on NH-334/58; As this runs on southern side of Roorkee, not beneficial to Saharanpur bound traffic
22	Number of Structures	Flyover/Interchanges-4; VUP-9; LVUP-11; SVUP-29; MJB-5; MNB-10; ROB-2	Flyover/Interchanges-3; VUP-3; LVUP-8; SVUP-20; MJB-2; MNB-10; ROB-2	Flyover/Interchanges-4; VUP-8; LVUP-15; SVUP-41; MJB-3; MNB-23; ROB-3
23	Proposed ROW (m)	60.00	60.00	60.00
24	Total Additional land required (Ha.)	289.184	264.993	444.190
25	Cost of Civil	1088.80	614.50	1437.18

S. No.	Parameter	Option 1	Option 2	Option 3
	Works (in Cr.)			
26	Centages (in Cr.)	207.05	116.87	273.33
27	Cost Non-Civil Works (in Cr.)	711.53	606.35	1070.36
28	Total Project Cost (in Cr.)	2007.38	1337.73	2780.87

From the above table it is evident that Option 1 is the preferred option due to following reasons and hence the same was selected by the NHAI:

- Better connectivity to major towns Roorkee and Haridwar
- Beneficial to both Delhi bound and Saharanpur bound Traffic
- Minimum forest area diversion
- Acts as Ring Road to Roorkee and
- Minimum number of settlements affected.

3.5 Alternative Technologies

It is undeniable that the road construction industry every day is looking for a greater effectiveness and efficiency in its techniques and methods. However, change in the construction environment is not willingly embraced by the construction industry and this conflict to change compromises innovation performance, and unenthusiastically impacts customer and industry goals. In other words, with rising globalization, roads have become a very vital infrastructure in enabling the transfer of freight as well as people, making the better and sustainable development of roads very important. Innovation in road construction offers important industry and community benefits. This refers to the use of better materials for the purpose of road construction, such as solar roads, eco-friendly roads, recycled materials, foamed bitumen etc. It can be technology innovation that includes the usage of better technologies for the integration of successful innovation in this sector. Advanced technology includes the automated computerized systems of traffic indicators, having better databases, use of solar or process innovation that can be implemented in this sector, including the use of better engineering practices, more harmony between the private and the public sectors and employing better quality control in processes.

Moreover, there is high government spending in road construction as well as maintenance, so there is also a need for the use of innovation to find methods that will be cost effective. Also, environmental concerns around reduction in the emission of greenhouse gases and reduction in pollution encourage the use of innovation for the adoption of greener methods of road construction as well as maintenance.

Discussed below are some the best innovations across the world regarding road construction technologies:

3.5.1 Cold Mix & Hot Mix Technology Analysis

Cold Mix Technology involves cold asphalt, which is a high-quality, polymer-modified cold mix asphalt available in batch orders. Hot Mix Technology involves Hot Mix Asphalt (HMA) which is a

combination of approximately 95% stone, sand, or gravel bound together by asphalt cement, a product of crude oil. Asphalt cement is heated aggregate, combined, and mixed with the aggregate at an HMA facility. The comparison between the two construction technologies are given in Table 3-4.

Table 3-3: Analysis of Cold & Hot Mix Technology

Sl. No.	Parameter	Cold Mix	Hot Mix
1	Description	Street Cold Asphalt is a relatively new product developed in 1995 through the introduction of new polymer technology and research into the manipulation of viscosity and material design, of the various components of an asphalt mix - Street Cold Asphalt is soft and sticky out of the bag, but it quickly hardens after application and the end result is a pavement patch with better strength but similar properties to hot asphalt.	Hot mix asphalt is used primarily as paving material and consists of a mixture of aggregate and liquid asphalt cement, which are heated and mixed in measured quantities. Hot mix asphalt facilities can be broadly classified as either drum mix plants or batch mix plants, according to the process by which the raw materials are mixed. In a batch mix plant, the aggregate is dried first, then transferred to a mixer where it is mixed with the liquid asphalt. In a drum mix plant, a rotary dryer serves to dry the aggregate and mix it with the liquid asphalt cement.
2	Requirements	Cold patch, also known as cold mix or cold asphalt, was first recognized as a way to make road repairs quickly because it can be applied right from the container without heating. Cold asphalt also doesn't require any special heavy rolling machines or special applicators as it can be shovelled or poured into a pothole or utility cut and tamped down with a hand tool.	Hot mix asphalt concrete (commonly abbreviated as HMAC or HMA) is produced by heating the asphalt binder to decrease its viscosity, and drying the aggregate to remove moisture from it prior to mixing. Mixing is generally performed with the aggregate at about 300°F (roughly 150°C) for virgin asphalt and 330°F (166°C) for polymer modified asphalt, and the asphalt cement at 302°F (150°C). Paving and compaction must be performed while the asphalt is sufficiently hot
3	Use	Cold mix asphalt concrete is produced by emulsifying the asphalt in water with (essentially) soap prior to mixing with the aggregate. While in its emulsified state the asphalt is less viscous and the mixture is easy to work and compact The emulsion will break after enough water evaporates and the cold mix will, ideally, take on the properties of cold HMAC Cold mix is commonly used as a patching material and on lesser trafficked service roads	HMAC is the form of asphalt concrete most commonly used on high traffic pavements such as those on major highways, racetracks and airfields Asphalt concrete has different performance characteristics in terms of surface durability, tire wear, braking efficiency and roadway noise.
4	Merits	Actually less expensive to use over the life of a road repair Completely seals and patches potholes, utility cuts, edge repairs,	Less expensive for new road construction

Sl. No.	Parameter	Cold Mix	Hot Mix
		and even overlays.	
5	Demerits	Less resilient and more vulnerable to cracking	Expensive

Cold Mix technology is more suitable for repair of potholes and cracks on roads, bridges, overlays, parking lots, other asphalt and concrete surfaces. However, for constructing new roads hot mix technology is better suited. Contractor / Concessionaire shall utilise the same wherever suitable.

3.5.2 Noise-reducing Asphalt

Quiet asphalt pavement options fall into four general categories. These are fine-graded surfaces, open-graded friction courses, rubberized asphalt, and stone-matrix asphalt.

- *Fine-graded surfaces* are conventional asphalt mixes that are mostly composed of fine-grained particles; reducing the apparent road noise generated by the expelled air by altering its frequencies.
- *Open-graded friction courses (OGFC)* are a porous mix; with more connected voids through which air and water can escape.
- *Rubberized asphalt* contains crumbs of recycled tires that provide some flexing in the road surface as tires pass over it, allowing the air a bit more time to be forced out at lower pressure.
- *Stone-matrix asphalt* mainly uses coarse aggregate to create a stone skeleton, tied together by asphalt binders and fibers.

After careful assessment, stone matrix asphalt has been proposed to be used in the project road.

3.5.3 Dust suppression

Dust can be suppressed before it becomes airborne. A series of nozzles discharge a chemical compound in a fine spray to materially reduce the amount of water or other liquids necessary to saturate fly ash and eliminate dust. An unpaved road stabilized with calcium chloride retains a smooth dustless surface serves as a viable cost-effective alternative to an asphalt surface treatment, controls dust, reinforces stabilization and helps improve roads when used over time. Dust Suppression uses a blend of polymers for erosion control and dust suppression for road developments.

3.5.4 Porous Pavement

Porous pavement or pervious pavement is the newest development in green technology for road construction. It contains more rock and less oil than traditional asphalt. This combination provides a higher amount of air voids in the paved surface, causing it to be much more permeable than regular asphalt. Instead of rainwater stopping when it hits traditional asphalt and becoming runoff, porous pavement allows the rainwater to flow through its voids into a rock bed underneath. Once the rainwater passes through this filtering rock bed it is returned to the groundwater system.

3.5.5 Plastic Roads

Plastic Road project proposes the development of a road surface made up of recycled plastic. The surface would be a dramatically greener alternative to asphalt (which is responsible for 1.6 million tons of CO2 emissions/year globally) and would also significantly improve the amount of time spent on road construction.

3.5.6 Dynamic paint

Drivers on a road can be guided by glow-in-the-dark road markings. Glowing Lines is aimed at increasing visibility and safety. The project should aim at using different technologies to create the "interactive and sustainable roads of tomorrow". Glowing Lines uses luminescent paint that is charged by solar energy during the day and then glows for up when it gets dark. This means that the road markings have higher visibility than those using standard paint, whilst still not requiring electricity. Dynamic Paint envisages the use of temperature sensitive paint on the roads to provide contextual information. For example, if it were to be very cold, then the usually transparent paint would become visible and display warning messages.

An insight in choosing alternate technologies will not only mitigate impacts on environment, further, reduces expenditure.

3.6 Environmental Considerations

The various mitigation measures for minimising the extent of environmental impacts and avoiding of sensitive environmental features have been worked out. Table 3-5 provides the measures that have been adopted for offsetting the impacts. A description of the measures has been presented in the following sections.

Table 3-4: Minimization of Environmental Impacts

Criteria	Means
Maintenance of Design Speed through traffic	Geometrics as per standard IRC codes
Improvement of Road Safety	Intersection as per IRC safety codes; Access controlled expressway
Adequate drainage	Provision of drains
Reduction of Air and Noise Pollution	Aggressive tree plantations; good EMP implementation practices
Displacement of Local Population	Limiting of development within PRoW, SIA & RAP
Minimisation of Direct Impact on Sensitive Receptors, cultural and religious properties	Alignment option analysis, Public consultations, Good EMP measures
Minimisation of Property acquisition	Alignment selection, SIA & RAP
Loss of Water body	Wise design
Avoidance of contamination due to Siltation / spillage	Silt Fencing, Oil Interceptor
Displacement of Commercial Properties	Alignment Selection, SIA & RAP
Minimisation of Loss of Utility Lines	Utility shifting after concurrence of regulatory authority and stakeholders
Minimisation of Tree Loss	Maximum effort shall be given to avoid avoidable tree felling
Stabilisation of Slope	Turfing / Pitching
Accidental Road Kill of Fauna	Proper Signage, Speed Control

3.6.1 Improvement of air and noise quality

- Siting of greenfield highway beyond the settlement reach;

- Lesser the distance (in comparison to existing route options) will result in lesser carbon footprint;
- Free flow traffic conditions will reduce the jam related air and noise pollutions;
- Provision of Noise barrier

3.6.2 Avoidance of Impact of Sensitive, Cultural and Community Properties

- Siting of greenfield highway beyond the reach of such areas;
- By providing underpass for smooth and safe travel of local populace;
- Providing noise attenuation measures mainly along schools and hospitals;
- Avoiding direct impact on sensitive receptors

4 DESCRIPTION OF ENVIRONMENT

4.1 General

As a precursor for the prediction of various types of environmental impacts likely to arise due to implementation of the project, it is essential to establish the baseline environmental status in project study area. Details of baseline environment parameters are required for decision making for the project.

4.2 Study Area & Period

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 for the Proposed Road was carried out for one season from March to May 2021.

The Proposed Road passes through Haridwar and Saharanpur district of the state of Uttarakhand and Uttar Pradesh respectively.

4.3 Physical Environment

Physical environmental components along the project road are described below.

4.3.1 Physiography and Terrain

Haridwar district can broadly be divided in to physiographic units viz. the structural hills, the upper piedmont plain or the Bhabar and the Tarai or the lower piedmont plain.
The complete northern and northeastern part of the Haridwar district is covered by the structural hills called the Siwaliks. The second unit lying just below the foothills of Siwaliks locally called as Bhabar. This unit is characterized by Boulders, cobbles, pebbles sands and clays etc. with relatively dry terrains fringing the Siwalik foothill belt and lying at higher elevation as compared to plains having a steeper gradient around 10 to 20 meters/kms.

Just below the Bhabar zone lies the Tarai or plains or the lower piedmont plain. This shows almost a plain surface sloping towards south with very low gradient around 1.2 meter/kms.

Saharanpur district can be divided into three physiographic divisions, the structural hills,the upper physiographic divisions, the structural hills, the upper piedmont plains or the Bhabar,and the Terai or the lower piedmont plains. The entire northern part of the district is formed structural hills named Siwaliks. In this area the relief is high with steep and sharp hill slopes. The rugged topography of the area affords well for high run off. The second units lying just below the foothills of Siwalik locally called as Bhabhar, is characterized by boulders, pebbles, cobbles etc. with relatively dry terrains fringing. The Siwalik foot hills with gradient around 5 m/km. which is much higher than the southern plains.Just south of Bhabar zone lies the 'Tarai' or the plains of piedmont plain. The plains sloping gradually by southward have around 1.5m/km. gradient. Lithologically, the area is characterized by coarse sand & gravel.

The proposed alignment mostly follows plain terrain. The elevation varies from ~256 m above MSL to ~276 m above MSL at different locations. Average elevation of the project stretch is ~265 m above MSL. Elevation profile are depicted in Figure 4.1.

Source: Google Earth

Figure 4-1: Elevation Profile of Proposed Alignment

4.3.2 Climatology

The climate of region is moderate subtropical to humid climate with three distinct seasons viz. summer followed by rainy and winter seasons. The climate of project region can be divided into three major conventional seasons as follows:

- Hot Weather Season (mid-March to end of June)
- Monsoon Season (End of June to September)
- Cold Weather Season (October to February)

The climate conditions prevalent in project influence districts are

The climate of the Haridwar district is characterized by general dryness, bracing cold season and a hot summer. The year may be divided into four seasons cold, hot, monsoon and post monsoon. May and June are the hottest months, with the mean daily maximum temperature around 41.90 ºC in the year 2009. January is generally the coldest month and the mean daily minimum at 3.70 ºC. During the cold season, cold waves affect the district, the minimum temperature dropping down below the freezing point. Winds are generally light with some increase in force during the later summer and monsoon season. Being situated at the foothills of Himalayas and having extensive forest cover, the district experiences heavy rainfall. Average rainfall in the district is 2315.4 mm during 2009.

The climate of the Saharanpur district is characterized by general dryness, a bracing cold season and a hot summer. The cold season from around the middle of November to February is followed by the hot season lasting till the end of June. The monsoon season starts from July to mid of September. May and June are the hottest months with maximum temperature around 39ºC and the daily minimum around 25ºC. The heat in summer is intense and the maximum temperature on individual days goes up to 45ºC and over. January is generally the coldest month with mean daily maximum at 20.1º C and the mean daily minimum at 6.6ºC.

The Indian Meteorological Department's (IMD) observatories in vicinity of project alignment is located at Roorkee Uttarakhand. Long-Term climatological data has been analysed for assessment of prevailing meteorological scenario in the project region and is shown in shown in the Table 4-1.

Table 4-1: Long-Term Climatologically Conditions at IMD Observatories (1981-2010)

Month	Temp Monthly (°C)		Humidity (%)		Avg. Wind Speed (kmph)	Dominant Direction (from)	Avg. Rainfall (mm)
	Max	Min	Mor.	Eve.			
January	25	3.3	88	62	2.5	NW	31

Month	Temp Monthly (°C)		Humidity (%)		Avg. Wind Speed	Dominant Direction	Avg. Rainfall
February	28.4	4.7	81	53	3.2	NW	39.8
March	33.5	8.3	70	44	4.1	NW	34.7
April	39.9	13.6	52	35	4.6	NW	10.7
May	42.3	18.3	50	37	5.4	SE	31.8
June	42.2	20.5	60	47	4.9	SE	79.8
July	38.3	21.5	81	69	4.7	SE	225.8
August	36.2	21.9	85	74	3.7	SE	265.7
September	35.3	19.9	84	68	3.4	SE	183.3
October	34.5	12.6	75	57	2.3	NW, SE	18.9
November	30.8	7.4	79	59	1.7	NW	3.9
December	26.9	4	85	60	2.2	NW	18.1
Total / Avg.	**41.5**	**3.1**	**74**	**56**	**3.6**	NW	**973.5**

Source: Climatological Normals, 1981-2010, India Meteorological Dept., Govt. of India

Ombrothermic Analysis: Water balance is one of the main environmental conditions that influence the vulnerability of a region to climate change. Ombrothermic analysis uses two indicators – precipitation (ombro) and temperature (thermic) – to assess the spatial extent of vulnerability of a region to climate change. Ombrothermic analysis uses humidity/aridity indices and graphics to integrate temperature and precipitation data over time. Using readily available temperature and precipitation data, the method produces graphics and maps that can identify vulnerable areas that may be prone to humidity (excessive rainfall) or aridity (drought). Also this analysis helps to identify the wet and dry months at a region. The ombrothermic graph for Haridwar and Saharanpur district is given below:

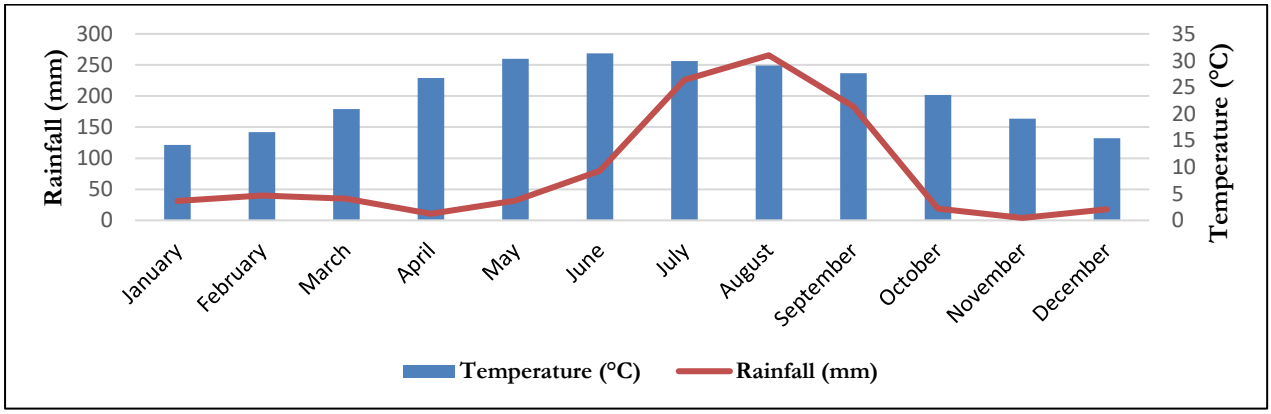


Figure 4-2: Ombrothermic Analysis for the Haridwar District

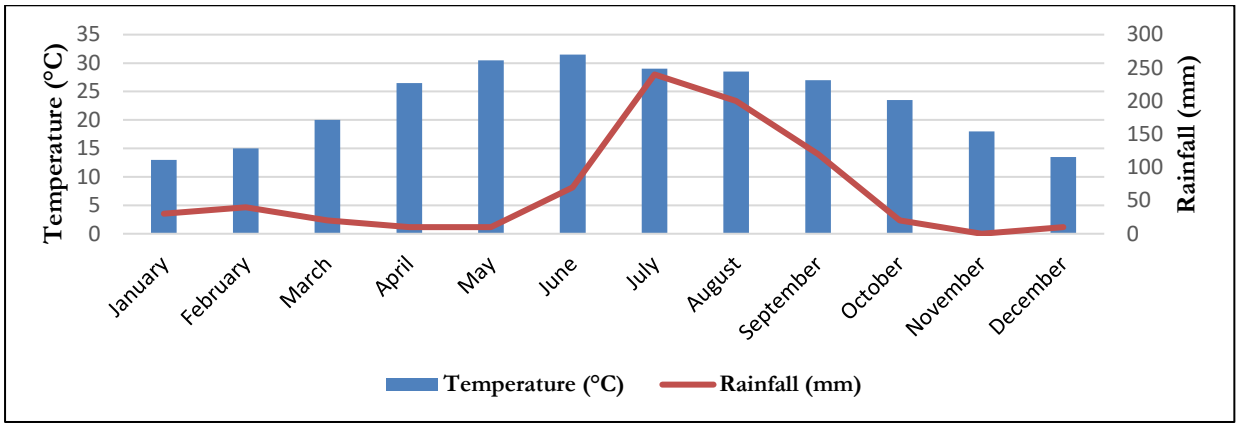


Figure 4-3: Ombrothermic Analysis for the Saharanpur District

4.3.3 Micro-Meteorology

To assess the primary meteorological scenario of the area, primary meteorological data for one season (March 2021 to May 2021) were collected at Roorkee. The data collected are presented in Table 4-2.

Table 4-2: Onsite Micro-meteorological Conditions

Months	Temperature (°C)		Relative Humidity (%)		Total Rainfall (mm)
	Max	Min	Max	Min	
March 2021	35	23	50	21	0.5
April 2021	38	17	86	18	0.0
May 2021	37	24	92	23	0.7

Source: Primary Survey by ITC labs

4.3.4 Geology

The district Haridwar is covered by high steep hills of Himalayas called Siwalik Range. The most rage lying just north to the district the upper Siwaliks followed by middle Siwaliks are exposed.

The upper Siwaliks are mostly redaceous consisting of sand stone, boulders, pebbles, conglomerates, shale, slit and clay. The maximum thickness of upper Siwaliks is around 1000 meters.The middle Siwaliks in this area is largely consists of lower alterations of clay and sand stone sequence and an upper sequence of massive sand stones. The upper part is frequently split up by clays in to a more argillaceous sequence. The thickness of middle Siwaliks is around 2000 meters.

In Haridwar district, colour and fertility of soil varies in different regions. In the upper Siwalik, soil is the conglomerates of sand and clay. In the sub-montane tract soil is light and shallow, resting on a deep stratum of stone and boulders. The soils of this region are mostly coarse loamy to sandy. The soil of the tarai is everywhere a moist alluvial deposit. Roorkee region is entirely plain which is composed of recent alluvium. In the khadar region nature of soil varies ranging from almost pure sand to the stiff clay.

In Saharanpur district, 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.

The surface soil found in the Shiwalik region is generally a thin vegetable deposit, bearing a crop of sal, sain and other trees, with chir on the higher attitudes and northern slopes. In the upland tract the soil along the bank of riverbeds 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.

No mineral occurrences have been reported from the districts. However, some gravels and pebbles are locally used for construction purposes. Stones are crushed after collecting them from the banks of rivers. There are many stone crushers in Saharanpur and Haridwar districts of Uttar Pradesh & Uttarakhand respectively

4.3.5 Soil

The soil quality was monitored at four locations at Project Road to assess the soil quality in and around the project alignment, which were truly representing the soil conditions of project area. Soil sampling locations are given in Table 4-3 & Figure 4-4.

Table 4-3: Soil Sampling Locations

Sl. No.	Location Code	Village Name	Land use	Geo-Coordinates	Distance from the road centreline (m)
1	S1	Chandena Colimast	Agriculture	29°48'15.33"N 77°35'26.31"E	20
2	S2	Village Bilaspur	Agriculture	29°49'25.15"N 77°40'25.90"E	500
3	S3	Puhana Jhabrere Mankpur	Agriculture	29°51'11.23"N 77°46'55.24"E	10
4	S4	NH 334,Badheri	Barren	29°55'1.31"N 77°54'20.13"E	250

Figure 4-4: Soil Sampling Location Map

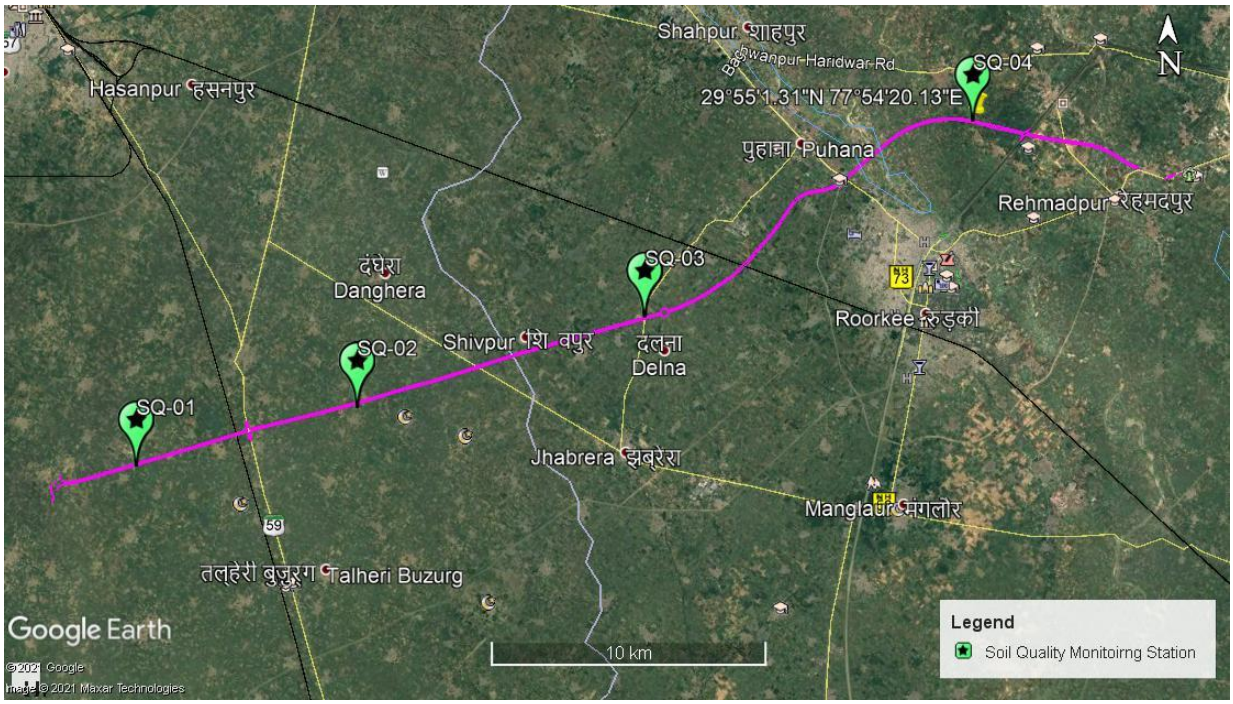


Table 4-4: Soil Test Result

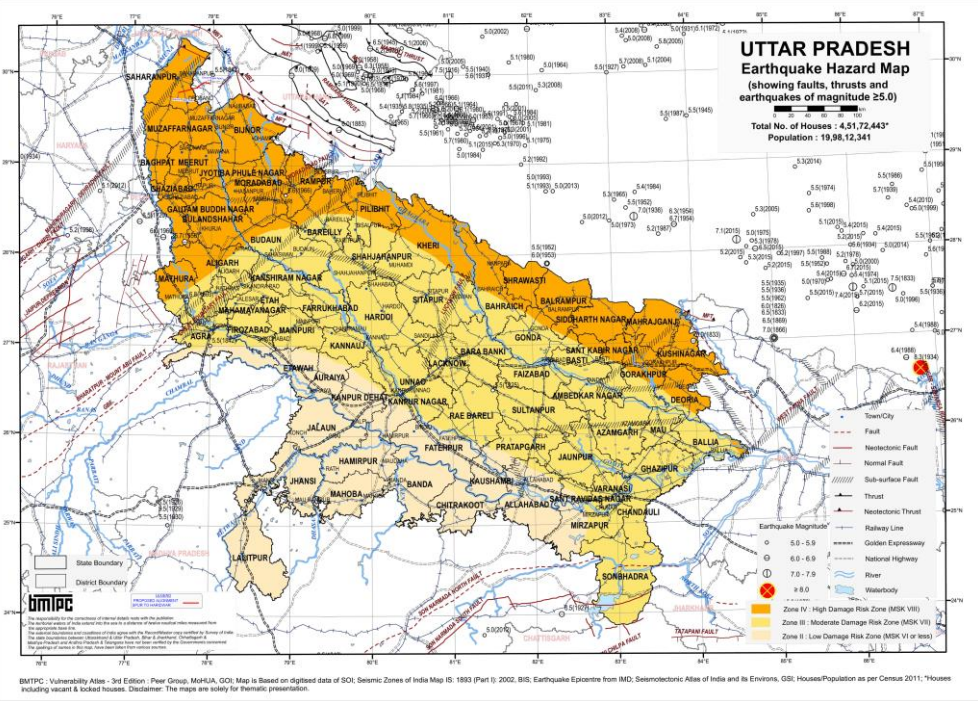
S. No.	Parameter	Unit	Method	S-1	S-2	S-3	S-4
1	Texture	--	STP/ITC/EW-19	Silt	Sandy Loam	Sandy	Silt
2	Organic Carbon	(% by mass)	STP/ITC/EW-21	0.021	0.018	0.016	0.024
3	Nitrogen as N	(% by mass)	APHA 23rd Edition	0.008	0.011	0.009	0.012
4	Phosphorous as P	(% by mass)	EPA 3050 B	0.010	0.014	0.012	0.013
5	Potassium as K	(% by mass)	STP/ITC/EW-16	0.016	0.017	0.015	0.012
6	Iron as Fe	(mg/kg)	STP/ITC/EW-11	2.31	2.36	3.17	4.09
7	Zinc as Zn	(mg/kg)	STP/ITC/EW-7	24.06	22.07	23.19	24.20
8	Manganese as Mn	(mg/kg)	STP/ITC/EW-7	198.21	197.19	196.03	195.09
9	Copper as Cu	(mg/kg)	STP/ITC/EW-7	15.33	17.18	18.23	17.12
10	Boron as B	(mg/kg)	STP/ITC/EW-7	8.95	9.35	8.17	9.21
11	Molybdenum as Mo	(mg/kg)	STP/ITC/EW-7	BLQ	BLQ	BLQ	BLQ
12	Chlorine as Cl	(mg/kg)	APHA 23rdEdition	0.006	0.004	0.008	0.007

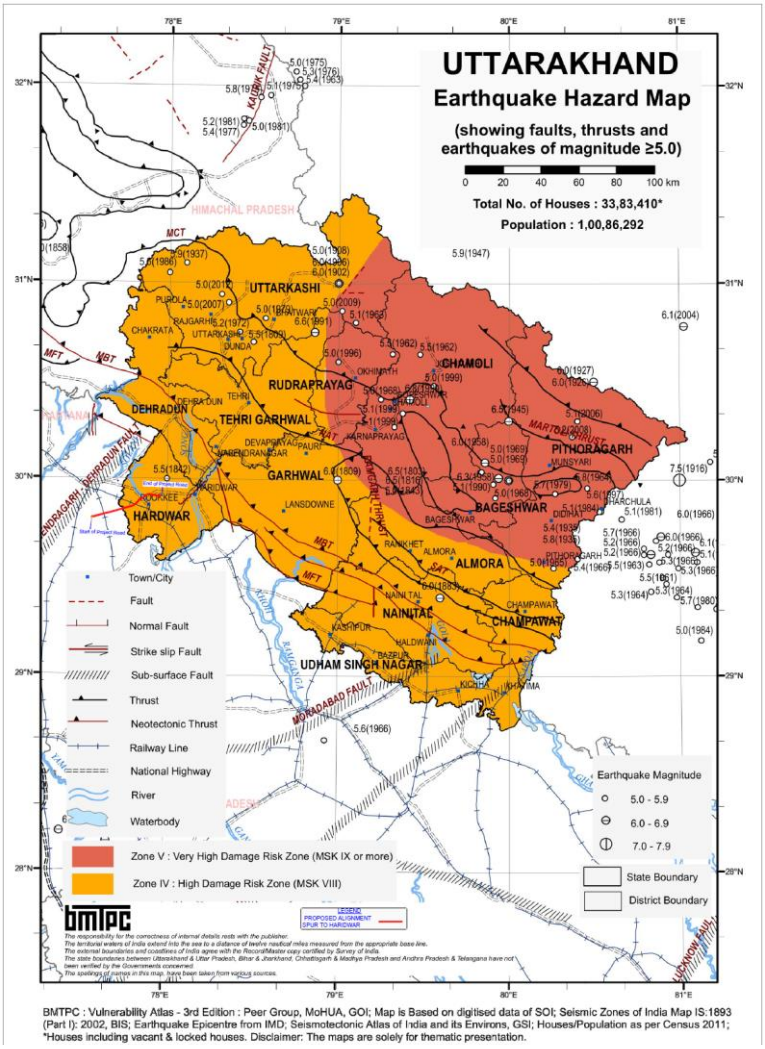
Source: Primary Survey by ITC labs

4.3.6 Seismicity

Bureau of Indian Standards [IS-1893 Part 1:2002] categorises 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 project highway is found in Seismic Zone IV (High Damage Risk Zone). Structures of the highway need to be planned as per seismic zoning guidelines.

Figure 4-5: Superimposing of proposed alignment on Seismic Zone Map of UP &UK





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

4.3.7 Land Use and 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 4-5 & and LULC map is provided in Annexure 4.1.

Table 4-5: Land Use Land Cover of the 500 m Buffer of Project Road

Sl. No.	Category	Area (ha)	Percentage %
1	Agricultural Land	3907.05	81.25
2	Brick kiln & mining Area	82.93	1.72
3	Built up	183.98	3.83
4	Industry	26.03	0.54
5	Natural Vegetation	36.04	0.75
6	Open scrub	26.57	0.55
7	Plantation	367.06	7.63
9	Rail	4.49	0.09
10	Road	83.39	1.73
11	Vacent Land/Private Vacent	41.66	0.87

Sl. No.	Category	Area (ha)	Percentage %
12	Waste Land	10.09	0.21
13	Water Bodies	39.13	0.81
Total Area		**4808.42**	**100**

4.4 Air Environment

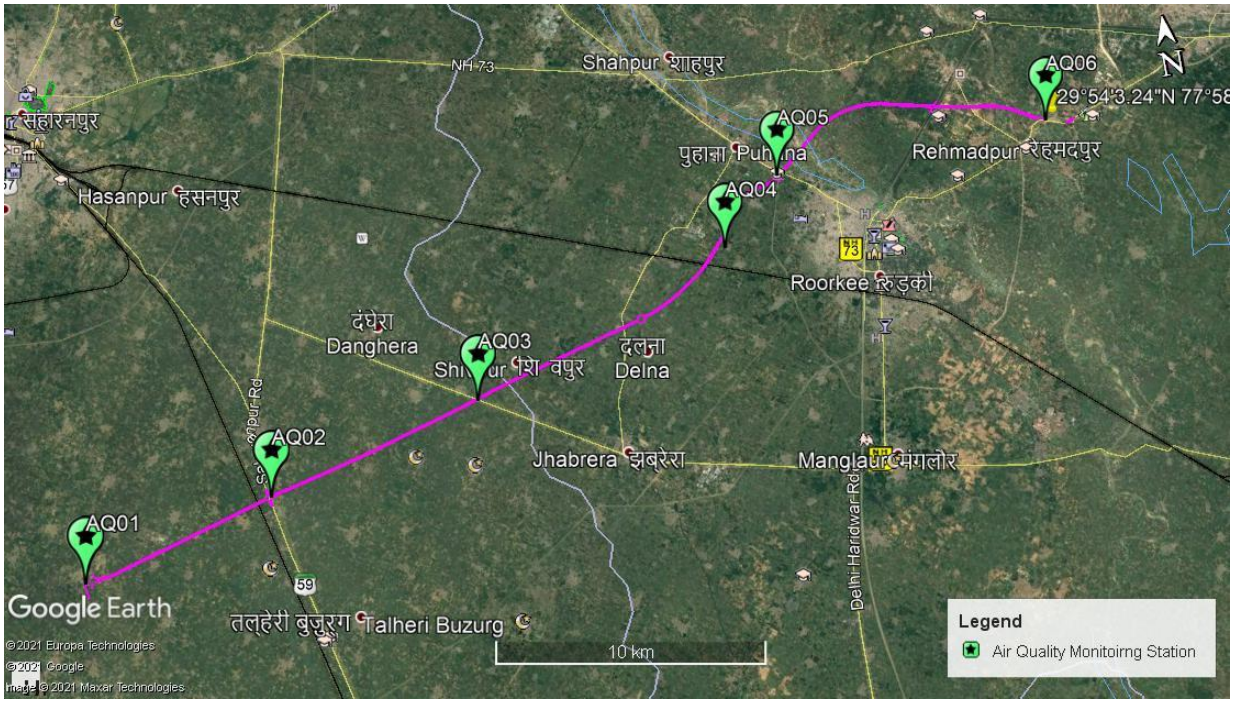
A network of six ambient air quality sampling locations are selected along Project road. These location has been chosen for assessment of the existing status of air environment within the study zone. The selection of monitoring locations has been distributed throughout the study area to get representative baseline of any variation in land use as well as road geometrics and traffic conditions across the proposed alignment including the baseline at sensitive receptors along the project. The selected locations of ambient air monitoring stations are presented in Table 4-6 & Figure 4.6.

Table 4-6: Ambient Air Quality (AAQ) Monitoring Stations/Location

Station Code	Location	Distance from PCL (m)	Height from Ground Level (m)	GPS Coordinates
AQ1	Halgoa village	70	3.5	29°47'53.35"N 77°33'31.38"E
AQ2	Bricklin @ village Basera	5	4.0	29°48'58.15"N 77°37'59.52"E
AQ3	Jhabrera Road @ Bilaspur village	30	3.5	29°50'11.19"N 77°43'10.55"E
AQ4	Salempur village	225	2.5	29°52'29.17"N77°49'42.08"E
AQ5	STIBAS Collage	90	2.5	29°53'52.00"N 77°51'19.37"E
AQ6	NH 334, Badheri	20.0	3.5	29°54'03.24"N 77°58'12.74"E

Source: Primary Survey by ITC labs

Figure 4-6 : Ambient Air Quality (AAQ) Monitoring Location Map



The summary of ambient air quality results for the project stretch is presented in Table 4-7. The results indicate that all air quality parameters are within the standards specified in the NAAQS.

Table 4-7: Results of Ambient Air Quality Monitoring

Sl. No	Sample Code	PM10 (µg/m³)		PM 2.5 (µg/m³)		SOx (µg/m³)		NOx (µg/m³)		CO (mg/m³)	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	AQ1	67	87	26	40	5	10	7	16	BLQ	1.3
2	AQ2	78	108	35	53	9	15	13	22	1.3	1.4
3	AQ3	75	97	30	48	7	13	10	24	1.1	1.4
4	AQ4	70	94	30	50	7	15	9	23	1.1	1.4
5	AQ5	90	98	46	58	11	16	17	22	1.3	1.5
6	AQ6	93	133	40	75	10	16	15	24	1.3	1.5
NAAQS Limit		**100**		**60**		**80**		**80**		**02**	

Source: Primary Survey by ITC labs

PM10: The Concentration of PM10 was found within the CPCB limits at all monitoring locations except Bricklin @ village Basera (AAQ2) & NH 334, @ Badheri village.

PM2.5: Concentration of PM2.5 was found below the limits prescribed by CPCB except NH 334, @ Badheri village. Concentration for PM2.5 ranged between 26 µg/m^3 to 75 µg/m^3.

SO_2: The Concentration ranged between 5 µg/m^3 to 16 µg/m^3 and is well below the CPCB prescribed limits**.**

NO_x: The Concentration ranged between 7 µg/m^3 to 24 µg/m^3 and is well below the CPCB prescribed limits.

CO: The concentration of CO was found within the permissible limit.

Jhabrera Road Bilaspur

Halgoa village

STIBAS College

NH-334 @ Badheri village

Mandarsa @ village Salempur

Brick klin @ Basera village

Figure 4-7: Photographs of Air Quality Monitoring Surveys

4.5 Ambient Noise Quality

Noise is an important environmental attribute in all road projects because vehicular traffic is a major source of noise pollution. Two ambient noise-sampling locations along the project road were identified to characterize the baseline noise levels in the project area. Locations for noise monitoring along the corridor are identified to cover the various land use present along the corridor. Noise monitoring stations are detailed in Table 4.8 and shown in Figure 4.9.

Table 4-8: Noise Monitoring Locations

Sl. No.	Station Code	Location	GPS Coordinates
1	N1	Village Halgoa	29°47'53.35"N 77°33'31.38"E
2	N2	Village Basera Bricklin	29°48'58.15"N 77°37'59.52"E
3	N3	Jhabrera Road Bilaspur	29°50'11.19"N 77°43'10.55"E
4	N4	Salempur, Iqbalpur,Kalelpur	29°52'29.17"N 77°49'42.08"E
5	N5	STIBAS Collage	29°53'52.00"N 77°51'19.37"E
6	N6	NH 334,Badheri	29°54'3.24"N 77°58'12.74"E

Source: Primary Survey by ITC Labs

Noise Monitoring has been conducted to assess the background noise levels in different zones viz., residential, industrial, commercial and silence zones. The main objective of noise monitoring was to establish the baseline noise levels and assess the impact of the total noise that is expected to be generated in the surrounding areas by implementing the proposed project.

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.

Figure 4-8: Photographs of Noise Monitoring Surveys

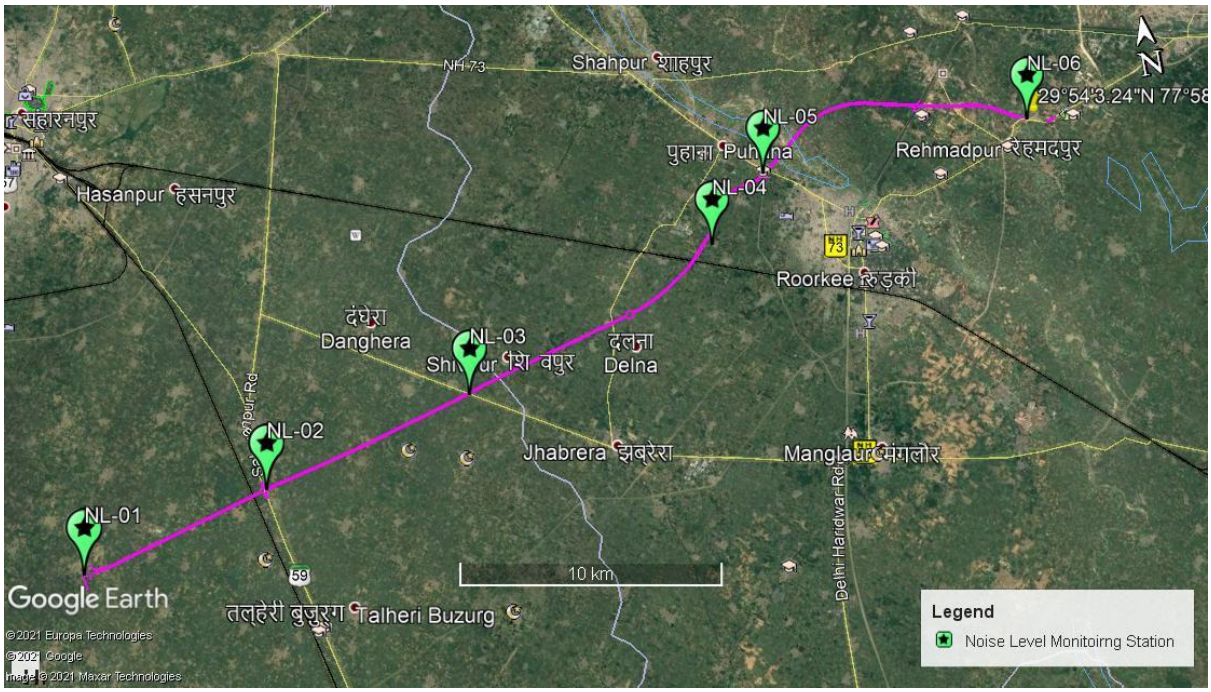
Village Halgoa

Village Basera Bricklin

Jhabrera Road Bilaspur

Salempur village

Figure 4-9: Ambient Noise Level Sampling Location Map



The Noise quality result presented in below table shows that Leq Day time varies from 51.3 to 63.3 dB(A) and Leq Night-time varies from 40.6 to 54.1 dB(A).

Table 4-9: Results of Primary Noise Monitoring

Sl. No.	Sample Code	Leq Day	Leq Night	Noise Quality Standards in dB (A)	
				Daytime	Night time
1	AN-1	53.1	42.8	55	45
2	AN-2	52.1	42.3	55	45
3	AN-3	54.6	43.3	55	45
4	AN-4	51.3	40.6	65	55
5	AN-5	52.3	43.4	55	45
6	AN-6	63.3	54.1	65	55

Source: Primary Survey by ITC labs

4.6 Water Resources

River Ganga enters in the Haridwar district at the boundary of Haridwar and flows southwardly draining the eastern part of the district. One stream emerges from river Ganga at near Shahpur Sheetlakhera and passes through Bhogpur, Sultanpur Patti and Raisi called Ban Ganga River. River KotwaliRoa, Rasawan Nadi and Pili Nadi emerging from Siwalik Hills in the eastern part of the district are the tributary of River Ganga River Ganges and Solani are the perennial rivers.

The other prominent river in the area is Solani, which drains the central part of the district. The Solani River originates from Saharanpur. SiplaNadi joins Solani river between Bhagwanpur and Roorkee. MohandRoa, ChillawalRoa, the seasonal tributaries meets Solani River at the northern part of the district. These rivers originate from Siwaliks at the northern end and passes through the Bhabar belt lying below the foothills of Siwaliks. The other major tributaries of Solani River are Ratmau Rao and GholnaRao, Apart from these rivers other seasonal river/nalas also contributes the river Solani. The drainage pattern in the district is sub dendetric to dendetric and trills. The drainage courses of most of the nalas out falling in the various tributaries are broad, flat and occupied with cobbles, boulders and gravels. Most of these nalas are torrential, carried surface run off which fluctuate gently and are losing springs.

The main drainage system in Saharanpur district is river Yamuna which flows overall north to south, forming the western part (boundary) of the district. Hindon, Kali and Khairanwala river are the main tributaries of the river Yamuna on its western bank within the Bhabar belt. The north eastern part of district drains by river Solani which is a tributary of Ganga river. The drainage covers most of the nalas falling in various tributaries is broad, flat and occupied with cobbles, boulders and gravels. Most of the nalas are torrential and carry runoff with gentle fluctuation. A large amount of influent seepage from such streams during the monsoon period whereas during non-monsoon period the streams and nalas are generally dry. The proposed alignment is crossing 1 ponds, 4 river, 2 irrigation canals & 3 nala.

4.6.1 Groundwater Status & Quality

Samples for ground water quality assessment were collected from four locations of project road and analysed for assessment of water quality. Locations of ground water sampling are provided in Table 4.10 & Figure 4.11.

Table 4-10: Ground Water Sampling Locations

Sl. No.	Location Code	Location Name	Source / Description of Location	Distance from Centre line (m)	Geo-Coordinates
1	GW1	Chandeana Colimast	Hand pump	10.0	29°48'6.64"N 77°35'9.31"E
2	GW2	Bilaspur TBM-2	Hand pump	5.0	29°50'19.64"N 77°42'55.10"E
3	GW3	STIBAS Collage Madhopur	Hand pump	50.0	29°53'58.28"N 77°51'16.34"E
4	GW4	NH 334 Village Badheri	Hand pump	20.0	29°54'2.66"N 77°58'14.17"E

Source: Primary Survey by ITC labs

Table 4-11: Ground Water Monitoring Results

Sl. No	Parameters	Unit	Procedure	GW 1	GW 2	GW 3	GW4	Standard as per IS 10500:2012	
								Acceptable Limit	Permissible Limit
1	Colour	Hazen	IS 3025 (P-4): 1983	**5**	**5**	**5**	**4**	5 max.	15 max.
2	Odour	--	IS 3025 (P-5): 1983	Agreeable				Agreeable	Agreeable
3	pH	--	IS 3025 (P-11): 1983	**7.56**	7.92	7.92	7.5	6.5 – 8.5	No Relaxation
4	Taste	--		Agreeable				Not Specified	Not Specified
5	Turbidity	NTU	IS 3025 (P-10)-1984	<0.5	<0.6	<0.8	<0.6	1 max.	5 max.
6	Total Dissolved Solids	mg/l	IS 3025 (P-16) :1984	470	478	486	534	500 max.	2000 max.
7	Total Hardness (as $CaCO_3$)	mg/l	IS 3025 (P-21) :1983	329	333	356	383	200 max.	600 max.
8	Total Alkalinity (as HCO_3)	mg/l	IS 3025 (P-23): 1986	371	387	312.4	503	200 max.	600 max.
9	Chloride (as Cl)	mg/l	IS 3025 (P-32): 1988	126	38	16	36	250 max.	1000 max.
10	Fluoride (as F)	mg/l	IS 3025 (P-60): 2008	BLQ (LOQ:0.01)	0.4	0.3	0.2	1.0 max.	1.5 max.
11	Sulphate (as SO_4)	mg/l	IS 3025 (P-24): 1986	42	34	28	82	200 max.	400 max.
12	Nitrate (as NO_3)	mg/l	IS 3025 (P-34): 1988	8	15	12	10	45 max.	No Relaxation
13	Iron (as Fe)	mg/l	IS 3025 (P-53): 2003	BLQ (LOQ:0.01)				0.3 max.	No Relaxation
14	Lead (as Pb)	mg/l	IS 3025 (P-47): 1994	BLQ (LOQ:0.002)				0.01 max.	No Relaxation
15	Zinc (as Zn)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				5 max.	15 max.
16	Total Chromium (as Cr)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				0.05 max.	No Relaxation
17	Copper (as Cu)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				0.05 max.	1.5 max.
18	Calcium (as Ca)	mg/l	IS 3025 (P-40): 1991	93.3	63.3	76.6	98.3	75 max.	200 max.
19	Magnesium (as Mg)	mg/l	IS 3025 (P-46): 1994	23.3	42.5	40	33.4	30 max.	100 max.
20	Manganese (as Mn)	mg/l	IS 3025 (P-59): 2006	BLQ (LOQ:0.1)				0.1 max.	0.3 max.
21	Total Arsenic (as As)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				0.01 max.	0.05 max.

Source: Primary Survey by ITC labs

The water samples as collected were analysed in laboratory and the result was compared against IS 10500: 2012 for drinking water standards.

The results for Project road shows that pH was found ranging from 7.5 to 7.9 in ground water samples taken along the proposed alignment. The chloride content varied between 16 to 126 mg/l. The Fluoride content was found within the maximum permissible limit (1.0 mg/l) in drinking water as prescribed by BIS. The concentration of Nitrate ranges between 8 to 15 mg/l.

Figure 4-10: Photographs of Collection of Water Quality Samples

STIBAS College

Bilaspur TBM-2

Pond at village Sohalpur Gada

Hindon River Halgoa

4.6.2 Surface Water Quality

Surface water quality of the entire project stretch has been monitored as per the parameters laid down by Central Pollution Control Board for surface water quality criteria at four locations along the Project Road.

Figure 4-11: Surface & Ground Water Sampling Location Map

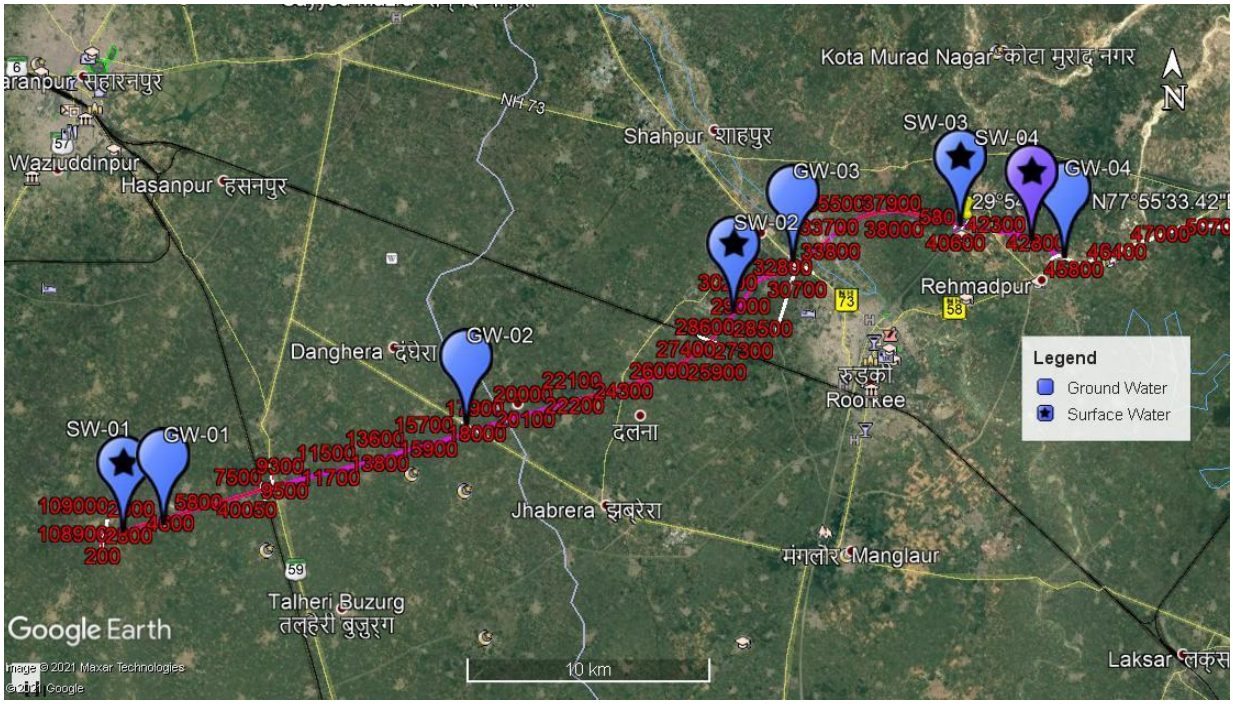


Table 4-12: Surface Water Sampling Locations

Sl. No.	Location Code	Chainage (Km)	Location Name	Geo-Coordinates
1	SW1	1+550	Hinden River Halgoa	29°47'56.46"N 77°34'7.56"E
2	SW2	28+700	Pond at village Sohalpur Gada	29°52'49.66"N 77°49'45.06"E
3	SW3	39+500	Upper Ganga Canal	29°54'44.72"N 77°55'33.42"E
4	SW4	42+550	NH 334 Village Badheri	29°54'26.27"N 77°57'23.70"E

The results of surface water quality is mentioned in the Table 4-13.

Table 4-13: Surface Water Test Result

Sl. No.	Parameters	Unit	Procedure	SW1	SW2	SW3	SW4	Standard as per IS 10500:2012	
								Acceptable Limit	Permissible Limit
1	Colour	Hazen	IS 3025 (P-4): 1983	15	20	10	10	5 max.	15 max.
2	pH	--	IS 3025 (P-11): 1983	7.44	7.56	8.13	8.17	6.5 – 8.5	No Relaxation
3	Total Dissolved Solids	mg/l	IS 3025 (P-16) :1984	685	660	147	217	500 max.	2000 max.
4	Chloride (as Cl)	mg/l	IS 3025 (P-32): 1988	150	100	12	22	250 max.	1000 max.
5	Fluoride (as F)	mg/l	IS 3025 (P-60): 2008	0.4	0.3	0.1	0.2	1.0 max.	1.5 max.
6	Sulphate (as	mg/l	IS 3025 (P-	38	43	79	13	200 max.	400 max.

Sl. No.	Parameters	Unit	Procedure	SW1	SW2	SW3	SW4	Standard as per IS 10500:2012	
	SO_4)		24): 1986						
7	Nitrate (as NO_3)	mg/l	IS 3025 (P-34): 1988	BLQ (LOQ:1.0)				45 max.	No Relaxation
8	Iron (as Fe)	mg/l	IS 3025 (P-53): 2003	BLQ (LOQ:0.01)				0.3 max.	No Relaxation
9	Lead (as Pb)	mg/l	IS 3025 (P-47): 1994	BLQ (LOQ:0.002)				0.01 max.	No Relaxation
10	Zinc (as Zn)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				5 max.	15 max.
11	Copper (as Cu)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				0.05 max.	1.5 max.
12	Total Arsenic (as As)	mg/l	IS 3025 (P-2): 2004	BLQ (LOQ:0.002)				0.01 max.	0.05 max.
13	Dissolved Oxygen	mg/l	IS 3025 (P-38): 1989	4.8	5.2	6	5.8	Not Specified	Not Specified
14	BOD at 27°C for 3 days	mg/l	IS 3025 (P-44): 1993	2	2	BLQ (LOQ:1.0)		Not Specified	Not Specified
15	Total Coliforms	MPN/ 100ml	IS 1622: 1981	Absent				Absent/ 100 ml	Absent/ 100ml

Source: Primary Survey by ITC labs

The surface water results for Project Road showed that the pH of the collected Surface water in the study area was found to be in the range of 7.44 to 8.17. The chloride and Sulphate values of the samples were observed from 12 to 150mg/L and from 13 to 79 mg/L respectively. Dissolved oxygen found from 4.8 to 6 mg/L.

4.7 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. The details of construction material source as identified for the project are described under Section 5.2.2.2 and 5.2.2.3 of this EIA Report.

- Borrow areas for locating suitable soils for use in embankment and sub-grade.
- Quarries for locating hard stone / granular materials for use in subbases, bases, bituminous mixes and concrete works
- Source of fine aggregate for use in DBM/BC layers and cement concrete works.

4.8 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 an 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.

4.8.1 Forest

The Forest Survey of India (FSI) estimated nearly 71.2 million hectares of forest cover in India— a

number that includes tree cover in plantations and other non-forest areas. Project Road transverse through both Uttarakhand and Uttar Pradesh States. As per the India State of Forest Report, 2019, the Forest Cover in the State of Uttarakhand and Uttar Pradesh is 24,303.04 sq km and 14,805.65 respectively.

Uttarakhand is rich in forest resources and the state has nine forest type groups, which are further divided into 43 forest types. Physiographically, the State can be divided into three zones namely, the Himalayas, the Shiwalikand the Terai region. The human and livestock population is largely dependent on forests due to agrarian economy and pastoralism. In the context of the Haridwar District the overall percentage of the total forest cover is less than the state i.e., 25.80%.

Uttar Pradesh belong to five forest type groups, which are further divided into 28 forest types. Major part of the State is agrarian. In the context of the Saharanpur District the overall percentage of the total forest cover is more than the state i.e., 12.02%.

The forest cover in the project districts of different forest density classes is presented in the Table 4-14.

Table 4-14 : Forest cover of under Proposed Project (km^2)

District/State	Geographical Area (km^2)	Very Dense Forest (km^2)	Mod. Dense Forest (km^2)	Open Forest (km^2)	Total (km^2)	% of GA
Haridwar	2,360	74.74	276.42	234.09	585.25	24.80
Saharanpur	3,689	0.00	174.00	269.26	443.26	12.02
Uttarakhand	**53,483**	**5,046.76**	**12,805.24**	**6,451.04**	**24,303.04**	**45.44**
Uttar Pradesh	**2,40,928**	**2,616.43**	**4,080.04**	**8,109.18**	**14,805.65**	**6.15**

Source: India State of Forest Report, 2019

Project alignment is crossing protected forest certain the locations. The linear plantation developed along the existing road & canals are notified by forest dept. as protected forest in the states of Uttarakhand & Uttar Pradesh. The exact length of affected forest area along the project alignment will be measured during joint inspection with forest department at later stage. Approximately 8300 nos. of trees to be felled for the project execution.

4.8.2 Protected Area

The project alignment is neither passing through nor falling with 10.0 km radius of ecological sensitive or protected area. However, Raja Ji National Park is falling within 15 km radius of the proposed alignment.

4.8.3 Bio-diversity Study

The present description of biodiversity assessment mainly involves the compilation of secondary data from published authentic literature with respect to the study area. For all the species of Flora and Fauna, lists from 'IUCN' and 'Indian Wildlife Protection Act' have been consulted to assess the status of the endangered species in the study area.

4.8.3.1 Flora species in the Study area

An inventory on the flora recorded in the reported in the secondary resources has been enlisted in the table 4-15.

Table 4-15: List of flora found along the project road

Sl. No.	Scientific Name	Common Name	Family	IUCN Status
Trees				
1	*Adina cordifolia*	Haldu	Rubiaceae	
2	*Aegle marmelos*	Bael	Rutaceae	NT
3	*Albizia lebbeck*	Black Siris	Fabaceae	LC
4	*Anogeissus latifolia*	Axlewood	Combretaceae	
5	*Artocarpus integrifolia*	Jack fruit	Moraceae	
6	*Bauhinia acuminata*	Dwarf White Orchid Tree	Fabaceae	LC
7	*Bauhinia variegata*	Orchid tree	Fabaceae	LC
8	*Bombax ceiba*	Cotton tree	Malvaceae	
9	*Callistemon citrinus*	Crimson bottlebrush	Myrtaceae	
10	*Celtis australis*	European nettle tree	Cannabaceae	LC
11	*Dalbergia sissoo*	Indian rosewood	Fabaceae	LC
11	*Desmodium oojeinensis*	Ujjain Desmodium Tree	Fabaceae	
12	*Delonix regia*	Gulmohar	Fabaceae	LC
13	*Emblica officinalis*	Indian gooseberry	Phyllanthaceae	LC
14	*Ficus religiosa*	Sacred fig	Moraceae	
15	*Ficus tomentosa*	Ficus mollis	Moraceae	
16	*Grewia optiva*	Bhimal	Malvaceae	
17	*Holoptalia integrifolia*	Indian elm	Ulmaceae	
18	*Leucaena leucocephala*	River tamarind	Fabaceae	
19	*Litchi chinensis*	Lychee	Sapindaceae	VU
20	*Mangifera indica*	Mango	Anacardiaceae	DD
21	*Melia azedaracha*	Chinaberry	Meliaceae	
22	*Morus alba*	White mulberry	Moraceae	LC
23	*Ricinus communis*	Castor bean	Euphorbiaceae	
24	*Shorea robusta*	Sal tree	Dipterocarpaceae	LC
25	*Tectona grandis*	Teak	Lamiaceae	
26	*Terminalia belerica*	Baheda	Combretaceae	
27	*Terminalia chebula*	Myrobalan	Combretaceae	
Shrubs				
1	*Alstonia scholaris*	Blackboard tree	Apocynaceae	LC
2	*Anisomeles indica*	Gopoli	Lamiaceae	
3	*Calotropis procera*	Aak	Asclepiadaceae	
4	*Cannabis sativa*	Cannabis	Cannabaceae	
5	*Carissa carandas*	Karonda	Apocynaceae	
6	*Cassia occidentalis*	Peeli Kaner	Apocynaceae	
7	*Cassia tora*	Senna tora	Fabaceae	
8	*Cichorium intybus*	Kasunda	Caesalpiniaceae	
9	*Cleome viscosa*	Kasni	Asteraceae	
10	*Datura metel*	Bagra	Cleomaceae	
11	*Datura stramonium*	Jimsonweed	Solanaceae	
12	*Lantana camara*	Lantana	Verbenaceae	
13	*Morus alba*	Raimuniya	Verbenaceae	
14	*Rauwolfia serpentina*	Indian snakeroot	Apocynaceae	
15	*Ricinus communis*	Shahtut	Moraceae	
16	*Senna tora*	Arandi	Euphorbiaceae	
17	*Sesbania sesban*	Chakunda, Java bean	Caesalpiniaceae	
18	*Solanum nigrum*	Black nightshade	Solanaceae	
19	*Tabernaemontana divaricata*	Jayanti	Fabaceae	
20	*Tecoma stans*	Chandni, Crape Jasmine	Apocynaceae	
21	*Thevetia peruviana*	Piliya, Yellow Trumpet	Bignoniaceae	
22	*Triumfetta rhomboidea*	Chikti	Tiliaceae	

Sl. No.	Scientific Name	Common Name	Family	IUCN Status
23	*Urena lobata*	Caesarweed	Malvaceae	
24	*Vicia sativa*	Akra	Fabaceae	
25	*Xanthium strumarium*	Ghaghara	Asteraceae	
26	*Ziziphus mauritiana*	Ber	Rhamnaceae	
27	*Ziziphus oenoplia*	Jackal jujube	Rhamnaceae	
28	*Zizyphus nummularia*	Jharberi	Rhamnaceae	
Climbers				
1	*Basella alba*	Poi	Basellaceae	
2	*Bougainvillea spectabilis*	Booganbel	Nyctaginaceae	
3	*Cissampelos pareira*	Akanadi, Velvet Leaf	Menispermaceae	
4	*Coccinia grandis*	Kundru	Cucurbitaceae	
5	*Convolvulus arvensis*	Hiranpug, Field Bindweed	Convolvulaceae	
6	*Cucumis melo*	Wild Melon	Cucurbitaceae	
7	*Cucumis maderaspatanus*	Kachari	Cucurbitaceae	
8	*Dioscorea bulbifera*	Bitter Yam	Dioscoreaceae	
9	*Ipomoea carnea*	Behaya	Convolvulaceae	
10	*Ipomoea pes-tigridis*	Panchpatia	Convolvulaceae	
11	*Tribulus terrestris*	Gokhuru, Puncture Vine	Zygophyllaceae	
12	*Trichosanthes cucumerina*	Chachinda	Cucurbitaceae	
Herbs				
1	*Abutilon indicum*	Kanghi, Pathaka	Malvaceae	
2	*Achyranthes aspera*	Devil's horsewhip	Amaranthaceae	
3	*Achyranthes aspera*	Chirchita, Phutkanda	Amaranthaceae	
4	*Adhatoda vasica*	Arusa, Bansa, Basuti	Acanthaceae	
5	*Ageratum conyzoides*		Asteraceae	
6	*Ageratum conyzoides*	Jangli Pudina, Bhakumbar	Asteraceae	
7	*Amaranthus spinosus*	Spiny amaranth	Amaranthaceae	
8	*Amaranthus spp.*	Chaulai	Amaranthaceae	
9	*Amaranthus viridis*	Jungali Chaulai	Amaranthaceae	
10	*Anagallis arvensis*	Krishna Neel	Primulaceae	
11	*Argemone mexicana*	Mexican prickly poppy	Papaveraceae	
12	*Argemone mexicana*	Satyanashi	Papaveraceae	
13	*Artemisia scoparia*	Seeta Bani	Asteraceae	
14	*Artemisia vulgaris*	Mugwort	Asteraceae	
15	*Boerhavia diffusa*	Punarnava, Red hogweed	Nyctaginaceae	
16	*Caesulia axillaris*	Maka	Asteraceae	
17	*Canna indica*	Sarvajjaya	Cannaceae	
18	*Cannabis sativa*	Bhang	Cannabaceae	
19	*Chenopodium album*	White goosefoot	Amaranthaceae	
20	*Chenopodium album*	Bathua	Amaranthaceae	
21	*Chenopodium ambrosioides*	Sugandha Vastuka	Chenopodiaceae	
22	*Cirsium arvense*	Creeping Thistle	Asteraceae	
23	*Colocasia esculenta*	Taro	Araceae	LC
24	*Commelina benghalensis*	Kankawa	Commelinaceae	
25	*Commelina diffusa*	Kanshura	Commelinaceae	
26	*Conyza stricta*	Horseweed	Asteraceae	
27	*Croton bonplandianus*	Kala Bhangra	Euphorbiaceae	
28	*Eclipta alba*	Bhringaraj	Asteraceae	
29	*Eichhornia crassipes*	Jalkumbhi	Pontederiaceae	
30	*Erigeron bonariensis*	Ragweed	Asteraceae	
31	*Euphorbia helioscopia*	Dudhya	Euphorbiaceae	

Sl. No.	Scientific Name	Common Name	Family	IUCN Status
32	*Euphorbia hirta*	Bada Dudhi	Euphorbiaceae	
33	*Euphorbia prostrata*	Prostrate Spurge	Euphorbiaceae	
34	*Euphorbia thymifolia*	Chhota Dudhi	Euphorbiaceae	
35	*Fimbristylis complanata*	Puerto Rico fimbry	Cyperaceae	LC
36	*Fumaria indica*	Papada	Fumariaceae	
37	*Galium aparine*	Kuri	Rubiaceae	
38	*Gnaphalium indicum*	Indian Cudweed	Asteraceae	
39	*Grangea maderaspatana*	Madras carpet	Asteraceae	LC
40	*Ipomoea nil*	Neelkalmi	Convolvulaceae	
41	*Lathyrus aphaca*	Jangli Mattar	Fabaceae	
42	*Lepidium didymum*	Pitpapra	Brassicaceae	
43	*Malva rotundifolia*	Small Mallow	Malvaceae	
44	*Malvastrum coromandelianum*	Kharenti	Malvaceae	
45	*Mazus rugosus*	Asian mazus	Mazaceae	
46	*Medicago polymorpha*	Chandansi	Fabaceae	
47	*Melilotus alba*	Safed Ban Methi	Fabaceae	
48	*Melilotus indicus*	Ban Methi	Fabaceae	
49	*Opuntia dillenii*	Nagphani	Cactaceae	
50	*Oxalis corniculata*	Amrul	Oxalidaceae	
51	*Parthenium hysterophorus*	Santa Maria feverfew	Amaranthaceae	
52	*Parthenium hysterophorus*	Gajar ghas	Asteraceae	
53	*Peristrophe paniculata*	Atrilal	Acanthaceae	
54	*Phyla nodiflora*	Chhota Okra	Verbenaceae	
55	*Physalis angulata*	Cutleaf Ground Cherry	Solanaceae	
56	*Physalis minima*	Native gooseberry	Solanaceae	
57	*Polygonum plebeium*	Lal Buti	Polygonaceae	
58	*Portulaca spp.*	All Aglow	Portulacaceae	
59	*Ranunculus sceleratus*	Jaldhaniya	Ranunculaceae	
60	*Rhynchosia minima*	Kulata	Fabaceae	
61	*Rumex dentatus*	Ambavati	Polygonaceae	
62	*Sida acuta*	Baraira	Malvaceae	
63	*Silene conoidea*	Cone Campion	Caryophyllaceae	
64	*Sisymbrium irio*	Khubkaln, London Rocket	Brassicaceae	
65	*Solanum nigrum*	Makoi	Solanaceae	
66	*Solanum virginianum*	Kateli	Solanaceae	
67	*Sonchus oleraceus*	Dudhi	Asteraceae	
68	*Stellaria media*	Buch-Bucha	Caryophyllaceae	
69	*Trianthema portulacastrum*	Sabuni	Aizoaceae	
70	*Trifolium pratense*	Tripatra	Fabaceae	
71	*Verbesina encelioides*	Junglee surajmukhi	Asteraceae	
72	*Withania somnifera*	Ashwagandha	Solanaceae	
Grasses				
1	*Acrachne racemosa*		Poaceae	
2	*Alopecurus borii*	Foxtail grass	Poaceae	
3	*Apluda mutica*	Apluda	Poaceae	
4	*Apluda mutica*	Tachula	Poaceae	
5	*Arundo donax*	Giant reed	Poaceae	
6	*Arundo donax*	Baranal	Poaceae	
7	*Bothriochloa pertusa*	Indian couch grass	Poaceae	
8	*Brachiaria ramosa*	Signalgrass	Poaceae	
9	*Brachiaria ramosa*	Makra	Poaceae	
10	*Cenchrus ciliaris*	Dhaman	Poaceae	

Sl. No.	Scientific Name	Common Name	Family	IUCN Status
11	*Chloris dolichostachya*	Poaceae		
12	*Cymbopogon citratus*	Lemon grass	Poaceae	
13	*Cymbopogon martini*	Indian geranium	Poaceae	
14	*Cynodon dactylon*	Scutch grass	Poaceae	
15	*Cynodon dactylon*	Doob	Poaceae	
16	*Dactyloctenium aegyptium*	Crowfoot Grass	Poaceae	
17	*Desmostachya bipinnata*	Halfa grass	Poaceae	LC
18	*Digitaria cilliaris*	False Couch Grass	Poaceae	
19	*Echinochloa colona*	Jangli jhangora	Poaceae	
20	*Eleusine indica*	Indian goosegrass	Poaceae	
21	*Eleusine indica*	Malankuri	Poaceae	
22	*Eragrostis tenella*	Japanese lovegrass	Poaceae	
23	*Heteropogon contortus*	Black Spear Grass	Poaceae	
24	*Imperata cylindrica*	Cogon grass	Poaceae	
25	*Oplismenus burmannii*	Wavy-Leaf Basket Grass	Poaceae	
26	*Oplismenus compositus*	Running Mountain Grass	Poaceae	
27	*Panicum virgatum*	Switch Grass	Poaceae	
28	*Paspalum paspaloides*	Knot Grass	Poaceae	
29	*Phalaris minor*	Dwarf Canary Grass	Poaceae	
30	*Poa annua*	Annual Meadow Grass	Poaceae	
31	*Poa pratensis*	Smooth Meadow Grass	Poaceae	
32	*Polypogon monspeliensis*	Annual Beard Grass	Poaceae	
33	*Saccharum spontaneum*	Grass native	Poaceae	
34	*Saccharum spontaneum*	Kaans	Poaceae	
35	*Setaria sphacelata*	Bandra	Poaceae	
36	*Setaria viridis*	Green Foxtail	Poaceae	
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, En= endangered				

Source: Navneet, Akash, Bhandari BS (2018c). Tree diversity, stand structure and community composition in tropical forest of Rajaji Tiger Reserve, Northern India. J. of App. and Nat. Sci., 10(3): 945-953

4.8.3.2 Fauna species in the Study area

An inventory on the fauna recorded in the reported in the secondary resources has been enlisted in the Table 4-16. A total of 34 mammalian, 43 avian, 11 amphibian, 18 reptilian, 17 butterflies and 4 other insects are mentioned in the list along with their common names and conservation status.

Table 4-16: Faunal Species found in the Study Area

S. No.	Scientific Name	Common name	WPA & IUCN Status
Mammals			
1	*Aonyx cinerea*	Asian small-clawed otter	II/VU
2	*Asis procinus*	Indian hog deer	EN
3	*Axis axis*	Spotted deer	III/LC
4	*Canis aureus*	Golden jackal	II/LC
5	*Canis auries*	Jackal	II
6	*Cervus unicolor*	Sambar deer	III/VU
7	*Cynopterus brachyotis*	Short-Nosed Fruit Bat	IV/LC
8	*Elephas maximus*	Asian elephant	I/EN
9	*Felis bengalensis*	Leopard cat	I
10	*Felis chaus*	Jungle cat	II/LC
11	*Felis lynx*	Lynx	
12	*Funambulus palmarum*	Indian Palm Squirrel	IV/LC

S. No.	Scientific Name	Common name	WPA & IUCN Status
13	*Golunda ellioti*	Indian Bush Rat	IV/LC
14	*Herpestes edwardsii*	Indian Grey Mongoose	II/LC
15	*Herpestes edwardsii*	Indian grey mongoose	II/LC
16	*Hyaena hyaena*	Striped Hyaena	III
17	*Hystrix indica*	Indian porcupine	IV/LC
18	*Lepus nigricollis*	Indian Hare	IV/LC
19	*Manis crassicaudata*	Indian pangolin	I/EN
20	*Mellivora capensis*	Honey badger	I/LC
21	*Melursus ursinus*	Sloth Bear	I/VU
22	*Muntiacus muntjak*	Indian muntjac	III/LC
23	*Mus booduga*	Little Indian Field Mouse	IV/LC
24	*Nemorhaedus goral*	Grey goral	III/NT
25	*Nemorhaedus goral*	Goral	III/VU
26	*Panthera pardus*	Leopard	I/VU
27	*Panthera tigris*	Tiger	I/EN
28	*Peramelemorphia*	Bandicoot	-
29	*Prionailurus rubiginosus*	Rusty Spotted Cat	I/NT
30	*Pteropus giganteus*	Indian Flying Fox	IV/LC
31	*Rattus rattus*	Black Rat	IV/LC
32	*Selenarctos thibetanus*	Asian black bear	
33	*Sus scrofa*	Wild boar	III/LC
34	*Vulpes vulpes*	Red fox	II/LC
Aves			
1	*Acridotheres tristis*	Common Myna	IV/LC
2	*Alcedo atthis*	Common Kingfisher	IV
3	*Amaurornis phoenicurus*	White Breasted Waterhen	IV/LC
4	*Anas acuta*	Common Teal	IV
5	*Ardea purpurea manilensis*	Eastern Purple Heron	IV/LC
6	*Ardeola grayii*	Paddy Bird	LC
7	*Astur badius*	Shikra	IV
8	*Aythya ferina*	Common Pochard	IV/VU
9	*Bubulcus ibis*	Cattle Egret	IV/LC
10	*Burhinus indicus*	Satone Curlew	IV
11	*Centropus sinensis*	Southern Coucal	IV/LC
12	*Cinnyris asiaticus*	Purple Sunbird	IV
13	*Coracias benghalensis indica*	Southern Indian Roller	IV/LC
14	*Corvus spelndens*	Ceylon House Crow	V/LC
15	*Cuculus varius*	Common Hawk Cuckoo	LC
16	*Cypsiurus parvus*	Palm Swift	LC
17	*Dicrurus macrocercus*	Black Drongo	IV/LC
18	*Egretta garzetta*	Little Egret	IV/LC
19	*Eudynamys scolopacea*	Koel	IV/LC
20	*Gallus gallus*	Red Jungle Fowl	IV/LC
21	*Glaucidium radiatum*	Jungle Owlet	IV/LC
22	*Halcyon smyrnensis*	WhiteThroated Kingfisher	IV/LC
23	*Haliastur Indus*	Brahmy Kite	IV/LC
24	*Ictinaetus malayensis*	Black Eagle	LC
25	*Lanius meridionalis*	Southerm Grey Shrike	IV/VU
26	*Milvus migrans*	Black Kite	I/LC
27	*Motacilla maderaspatensis*	White Browed Wagtail	IV/LC
28	*Muscicapa dauurica*	Asian Brown Flycatcher	LC
29	*Nycticorax nycticorax*	Night Heron	IV

S. No.	Scientific Name	Common name	WPA & IUCN Status
30	*Orthotomus sutorius*	Tailor Bird	IV
31	*Passer domesticus indicus*	Indian House Sparrow	IV/LC
32	*Pavo cristatus*	Indian Peafowl	I/LC
33	*Perdicula asiatica*	Jungle Bush Quail	IV
34	*Phalacrocorax niger*	Little Cormorant	IV/LC
35	*Poster roseus*	Rosy Starling	IV/LC
36	*Psittacula cyanocephala*	Parakeet	IV/LC
37	*Psittacula krameri*	Rose Ringed Parakeet	IV/LC
38	*Pycnonotus cafer*	Red Vanted Bulbul	IV/LC
39	*Saxicoloides fulicata*	Indian Robin	IV
40	*Strentopelia chinensis*	Spotted Dove	IV
41	*Streptopelia decaocto*	Indian Ring Dove	IV
42	*Turdoides caudatus*	Common Babbler	IV
43	*Vanellus indicus*	Red Wattled Lapwing	IV/LC
Amphibians			
1	*Duttaphrynus brevirostris*	Short-Nose Toad	DD
2	*Duttaphrynus melanostictus*	Common Indian Toad	IV
3	*Euphlyctis cyanophlyctis*	Indian Skipper Frog	LC
4	*Euphlyctis ghosi*	Manipur Frog	DD
5	*Euphlyctis hexadactylus*	Indian Pond Frog	LC
6	*Hoplobatrachus tigerinus*	Indian Bull Frog	IV/LC
7	*Kaloula taprobanica*	Painted Frog	LC
8	*Microhyla rubra*	Red Small-Mouthed Frog	LC
9	*Polypedates maculatus*	Common Tree Frog	LC
10	*Ramanella variegata*	Marbled Small-Mouthed Frog	LC
11	*Rana tiger*	Common Frog	IV
Reptiles			
1	*Bronchocela cristatella*	Green Crested Lizard	-
2	*Calotes sp.*	Garden Calotes	-
3	*Calotes versicolor*	Garden Lizard	IV/LC
4	*Eutropis carinata*	Keeled Grass Skink	IV/LC
5	*Eutropis carinata*	Common Brahminy Skink	LC
6	*Geckoella collegalensis*	Kollegal Ground	LC
7	*Geochelone elegans*	Indian Starred Tortoise	IV/VU
8	*Hemidactylus brookii*	Brook;s Gecko	-
9	*Hemidactylus macalatus*	Spotted House Gecko	IV/LC
10	*Lygosoma punctata*	Spotted Snake Skink	-
11	*Melanochelys trijuga*	Indian Black Turtel	NT
12	*Ophisops leschenaultii*	Leschenault's Lacertid Lizard	-
13	*Pieris canidae*	Indian Cabbage White	-
14	*Psammophilus dorsalis*	Peninsular Rock Agama	-
15	*Ptyas mucosa*	Indian Rat Snake	II/Not yet been assessed
16	*Ptyas mucosa*	Dhaman /Rat Snake	II
17	*Sauria lacertidae*	Lizard	IV
18	*Ophiphagus hunnah*	King cobra	II/VU
Butterflies			
1	*Catopsilia pomona*	Common Emigrant	-
2	*Danaus chiysippus*	Common Tiger	-
3	*Danaus chiysippus*	Plain Tiger	IV
4	*Diplacodes trivialis*	Ground Skimmer	LC
5	*Eurema hecabe*	Common Grass Yellow	-
6	*Ictinogomphus rapax*	Common Club Tail	LC

S. No.	Scientific Name	Common name	WPA & IUCN Status
7	*Junonia hierta*	Yellow Pansy	-
8	*Junonia lemonias*	Lemon Pansy	-
9	*Neptis hylas*	Common Sailor	-
10	*Orthetrum sabina*	Green Marsh Hawk	-
11	*Papilio demoleus*	Lime Butterfly	-
12	*Papilio polytes*	Common Mormon	-
13	*Parantica aglea*	Glassy Tiger	IV
14	*Peacock pansey*	Junonia Almanac	-
15	*Taractrocera maevius*	Common Grass Dart	-
16	Tirumala limniacae	Blue Tiger	-
17	*Zizeeria knysna*	Dark Crass Blue	-
Insects			
1	*Apisindica sp.*	Honey Bee	IV
2	*Hierodula membranacea*	Mentis Green	-
3	*Lasius niger*	Black Ant	-
4	*Scolopendra sp.*	Centipede	IV
Abbreviations: LC= Least Concerned, CR= Critically Endangered, VU= Vulnerable, DD= Data Deficient, NT= Near Threatened, En= endangered			

Source: Joshi, R. (2016). Mammalian fauna of Rajaji National Park, India: a review on ecological observations and checklist. Check List, 12, 1.

4.9 Socio-Economic Profile

Socio-economic analysis has been conducted for the state and project influence states along the proposed project road. 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.

4.9.1 Demographic Profile

4.8.3.3 Population

The population of Uttarakhand as per Census 2011, is of 1.01 Crores, an increase from figure of 84.89 Lakh in 2001 census. Total population of Uttarakhand as per 2011 census is 10,086,292 of which male and female are 5,137,773 and 4,948,519 respectively.

As per details from Census 2011, Uttar Pradesh has population of 19.98 Crores, an increase from figure of 16.62 Crore in 2001 census. Total population of Uttar Pradesh as per 2011 census is 199,812,341 of which male and female are 104,480,510 and 95,331,831 respectively.

The details of the decadal growth rate and population of the affected districts and states are given in Table 4-17.

Table 4-17: Decadal Growth Rate

Districts/State	Decadal Growth Rate (%)
Haridwar	30.62
Saharanpur	19.66
Uttarakhand	24.74
Uttar Pradesh	20.2
India	**17.64**

Source: Census 2011

4.8.3.4 Population Density

Total area of Uttarakhand is 53,483 sq. km. Density of Uttarakhand is 189 per sq km which is lower than national average 382 per sq. km. In 2001, density of Uttarakhand was 159 per sq km, while nation average in 2001 was 324 per sq. km.

Total area of Uttar Pradesh is 240,928 sq. km. Density of Uttar Pradesh is 829 per sq km which is higher than national average 382 per sq. km. In 2001, density of Uttar Pradesh was 690 per sq km, while nation average in 2001 was 324 per sq. km. The details of the sex ratio for the state and districts are given in **Table 4-18**.

Table 4-18: Population Density

Districts/State	Population Density (persons per sq. km.)
Haridwar	801
Saharanpur	940
Uttarakhand	189
Uttar Pradesh	829
India	**382**

Source: Census 2011

4.8.3.5 Sex Ratio

The Sex Ratio in Uttar Pradesh is 912 i.e. for each 1000 male, which is below national average of 943 as per census 2011. In 2001, the sex ratio of female was 898 per 1000 males in Uttar Pradesh.

Sex Ratio in Uttarakhand is 963 i.e. for each 1000 male, which is below national average of 943 as per census 2011. In 2001, the sex ratio of female was 962 per 1000 males in Uttarakhand. The details of the sex ratio for the state and districts are given in Table 4-19.

Table 4-19: Sex Ratio

District/State	2001	2011
Haridwar	865	880
Saharanpur	865	890
Uttarakhand	962	963
Uttar Pradesh	898	912
India	**933**	**943**

Source: Census 2011

4.8.3.6 Literacy Rate

As per Census 2011, Uttarakhand has slight increase in the literacy rate of 78.82 % compare to that of Census 2001. Male literacy rate is 87.40 % and that of Female is 70.01 %.

Literacy rate in Uttar Pradesh has seen an upward trend and is 67.68% as per Census 2011 out of which, male literacy rate stands at 77.28% while female literacy rate is 57.18%. The literacy details of the state and districts are given in Table 4-20:

Table 4-20: Number of Literates and Literacy Rate for State and Districts

Districts/State	Number of Literates			Literacy Rate (%)		
	Persons	Male	Female	Persons	Male	Female
Haridwar	11,78,354	6,91,411	4,86,943	73.43	81.04	64.79

Districts/State	Number of Literates			Literacy Rate (%)		
	Persons	Male	Female	Persons	Male	Female
Saharanpur	20,77,108	12,20,114	8,56,994	70.5	78.3	61.7
Uttarakhand	**6,880,953**	**3,863,708**	**3,017,245**	**78.82**	**87.4**	**70.01**
Uttar Pradesh	**11,43,97,555**	**6,82,34,964**	**4,61,62,591**	**67.7**	**77.3**	**57.2**
India	**76,36,38,812**	**43,47,63,622**	**32,88,75,190**	**72.98**	**80.88**	**64.63**

Source: Census 2011

Among the project influence districts, both Haridwar district has the Slightly higher literacy rate of 73.43% than that of Saharanpur district accounts for 70.5%. Both district has significantly lower female literacy rate compare to male literacy rate.

4.8.3.7 Work Participation Rate

The work participation rate in Uttarakhand is higher than Uttar Pradesh. The WPR of males are stagnantly higher than women in both states and district. The details of the work participation rate are given in Table 4-21.

Table 4-21: Work Participation Rate

District/State	Work Participation Rate		
	Total	Males	Females
Haridwar	30.58	49.52	9.07
Saharanpur	29.9	49.7	7.7
Uttarakhand	38.39	49.67	26.68
Uttar Pradesh	32.9	47.7	16.7

Source: Census 2011

4.8.3.8 Employment Pattern

The Census 2011 further classifies the workers (both main and marginal) into four categories namely cultivators, agricultural labourers, household industries and other workers. The categorisation of the workers revealed that there was a declining share of the cultivators and agricultural labour but increasing share of other type of worker. The employment pattern is given in Table 4-22.

Table 4-22: Employment Pattern of Main and Marginal Workers

State/District	Uttarakhand		Haridwar		Uttar Pradesh		Saharanpur	
Category of Workers (Main & Marginal)	**Nos.**	**%**	**Nos.**	**%**	**Nos.**	**%**	**Nos.**	**%**
Cultivators	15,80,423	40.81	93,660	16.2	1,90,57,888	28.96	2,21,567	21.36
Agricultural Labourers	4,03,301	10.42	1,03,115	17.84	1,99,39,223	30.3	2,73,050	26.32
Household Workers	1,14,312	2.95	19,955	3.45	38,98,590	5.92	34,032	3.28
Other Workers	17,74,239	45.82	3,61,391	62.51	2,29,19,014	34.82	5,08,695	49.04
Total Workers	**38,72,275**	**100**	**5,78,121**	**100**	6,58,14,715	100	10,37,344	100

Source: Census 2011

4.9.2 Agriculture Profile

Haridwar District

Haridwar District has 3 three types of agro-climatic zones *i.e* Upper, Gangetic and Plain Region.

Majority of the population is dependent on agriculture and animal husbandry for their livelihood. The district has a total cultivated area of 118.4 ha, out of which area sown more than once is 43 ha. Major crops of the district are Rice, wheat, sugarcane, Pulses and oil seeds. Rainfed agriculture is prevalent in some parts of the district. Agriculture suffers from frequent droughts caused by low and erratic rainfall leading to wide variation in production and productivity. Table 4-23 provides a brief profile of agriculture in the district and area cultivated under major crops.

Table 4-23: Agricultural Base of Haridwar (2011)

Description	Area ('000 ha)
Net Cultivable area	118.4
Area Sown more than once	43
Gross cropped area	160.9
Major Field Crops	
Rice	17.1
Sugarcane	
Wheat	48.3
Lentil	0.6
Groundnut	1.1
Mustard	0.8

Source: https://agricoop.nic.in/sites/default/files/haridwar.pdf

Saharanpur District

Saharanpur is primarily and agricultural district. Roughly 70% of the land is under agricultural use still the region is of little importance from the point of view of pastures. Agriculture plays an important role in the economy of the district. One significant feature is that even though the agricultural land for food crops has reduced in recent years the food production has increased considerably. The significance of commercial crops have increased manifold as a consequence of sugarcane production. The important food crops of the region are Wheat, Rice, Maize, Jawar, Bajara, sugarcane; oilseeds, cotton and jute are the main commercial crops. Table 4-24 provides a brief profile of agriculture in the district and area cultivated under major crops.

Table 4-24: Agricultural Base of Saharanpur (2011)

Description	Area ('000 ha) *
Total Cultivated Area	1838.00
Major Field Crops	
Maize	12,606
Wheat	126,433
Rice	66,246
Gram	601
Other Pulses	13,831
Oil Seeds Ground Nut	5,270

Source: Statistical Abstract of Uttar Pradesh, 1992, Economic & Planning Division, U.P., Lucknow.

4.9.3 Mineral Resource

Mineral resources found of Uttarakhand State is limestone, magnesite, steatite, tungsten, asbestos, copper, dolomite, graphite, gypsum, lead-zinc, silver and rock phosphate. In Haridwar district major minerals available are Sand, Stone and Gypsum.

Uttar Pradesh has many resources like limestone, Magnesite, Copper, Gypsum. This state has only 2% of the total value of the resources found the country. Minerals in this state are found mainly in the southern plateau parts of the state.

Saharanpur district is very poor in mineral resources. Limestone stone boulders are the only main minerals. Limestone is found in the Shivalik hills. Stone, hard enough to be used for building purposes is scarce and is found in Shivaliks while stone for road metal is found in the beds of Solani, Hindon and Sukhrao streams. Excellent lime is also procured from the boulders covering the beds of the hilly torrents. The saline efflorescence which is known by the name of Rah is found in the low lying tracts and in the canal irrigated areas.

4.9.4 Tourism

Uttarakhand is situated in the foothills of Himalayas. The presence of several hill stations, wildlife parks, pilgrimage places & trekking routes make Uttarakhand an attractive tourist destination.

The state is popularly known as Devbhumi (land of Gods) due to the presence of numerous Hindu pilgrimage sites. As a result, religious tourism forms a major portion of the tourism in the state. In 2017, domestic tourist inflow in the state were 34.36 million and foreign tourist visits had crossed over 0.13 million.

Haridwar is an important city in the religious architecture of the country. The large number of people gathering on the bathing ghats on the holy Ganges River give the place a chaotic feel. Apart from these, there is the mammoth Kumbh Mela which takes place once in every twelve years. There are a number of Hindu temples, ashrams and dharamshalas (pilgrims rest houses) in the city. The city also serves as the entry point to the nearby Rajaji National Park

Uttar Pradesh is one of the most popular and an established tourist destination for both Indians and foreigners alike in India. Uttar Pradesh contains many historical monuments and places of religious significance. Uttar Pradesh is one of the states that aesthetically defines India and its rich history that's as ancient as the time known. The total tourists in Uttar Pradesh for the year 2019 are 54,06,00,343, out of which 53,58,55,162 are domestic tourists and 47,45,181 are foreign tourists.

Tourist places in Saharanpur district are Baba bhuradev temple, Shakambhari Devi temple, Bala Sundari Devi Temple, Naugaja Peer and Darul Uloom Deoband

4.9.5 Industrial Profile

Uttarakhand is a state in the northern part of India. It is often referred to as the "Land of the gods" due to the many holy Hindu temples and pilgrimage centres found throughout the state. Uttarakhand has emerged as a significant destination for investments in manufacturing industry, tourism and infrastructure. Emphasis is on stimulating all three sectors of its economy (agriculture, industry and services),to their fullest potential in tandem with the geographic profile of the state.

Uttar Pradesh is the most populous and dominating state on socio-political scenario of our country. But it economically remains, by and large, far behind many states in the country and,

therefore, it deserves greater thrust for accelerating the pace of economic growth in general and specific emphasis on industrial development in particular.

The industrial profile of the project influence districts is discussed in the following sections.

Haridwar District

The district has 496 registered industrial units, out of which 159 are registered industrial under medium and large units. The major industrial units in the district are Textiles, Automobiles, Pharmaceuticals, Food processing and Eco- Tourism etc The summary of industrial scenario of the district is shown in the Table 4-25.

Table 4-25: Industrial Profile of Haridwar

Sl. No.	Head	Units (in no.)
1	Registered Industrial Units	496
2	Registered Medium and large Units	159
3	Total Industrial Areas	38
4	Employment in large and medium Industries	55768

Source: Brief Industrial Profile of District, Haridwar MSME, (2011-12)

Saharanpur District

Saharanpur district has 9557 registered industrial units, out of which 14 are registered industrial medium and large units. The major industries in the district are Agro based, Beverages, Textiles, Wood/wooden based furniture and Paper & Paper products etc. The summary of industrial scenario of the district is shown in the Table 4-26.

Table 4-26: Industrial Profile of Saharanpur

S. No.	Head	Units (in no.)
1	Registered Industrial Units	9557
2	Registered Medium and large Units	14
3	Total Industrial Areas	03
4	Employment in large and medium Industries	2972

Source: Brief Industrial Profile of District Shahjahanpur (U.P.), MSME, (2013-14)

5 ENVIRONMENTAL IMPACT & MITIGATION PLAN

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

Project Highway is located in moderate subtropical to humid climate with high variation between summer and winter temperatures. 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 45°C during summer season.

This increase in the daytime temperature assumes significant especially in close vicinity of proposed expressway, as the project area experiences temperatures as high as 45°C during summer season.

Mitigation

Although the impact is significant but reversible in nature and shall be compensate by avenue tree plantation 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 expressway, no slow moving traffic or pedestrians are likely on proposed expressway.

5.2.2 Land

5.2.2.1 Physiography

Project highway mostly 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.

Total 15 nos. of bridges are required along the project road consisting of 5 major bridges and 10 nos. minor bridges along with 140 culverts.

5.2.2.2 Geology and Seismology

The entire stretch of the project traverses through Seismic Zone IV (High Damage 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	Quantity
1	Embankment fill	Cum	57,68,928.34
2	Selected fill on RE wall	Cum	4,35,130.90
3	Sub grade fill	Cum	14,21,608.90
4	Fly ash fill	Cum	45,18,057.33
5	Median fill	Cum	61,078.44
6	Bitumen	MT	19,478.00
7	Emulsion	MT	1,575.00
8	Cement	MT	1,25,304.00
9	Steel reinforcement	MT	28,047.00
10	strand wire	MT	6,858.00
11	Aggregates	cum	12,07,362.00
12	sand	cum	4,24,430.00
13	Stone	cum	11,281.00
14	Water	KL	21,58,442.17

Source: Design report

The summary of identified stone and sand quarries and fly ash sources are given in Table 5-2.

Table 5-2: Location of Identified Quarries

Stone Quarries				
S. No.	**Location ID**	**Quarry Location**	**Dist. From Project Road (Km)**	**Availability**
1	AG 01	Daulatpur, Tehsil- Bhagwanpur, Dist.- Haridwar, Uttarakhand	32	Abundance
2	AG 02	Sunderpur, Tehsil- Behat, Dist.- Saharanpur, Uttar Pradesh	35	Abundance
3	AG-03	Raipur, Tehsil- Behat, Dist.- Saharanpur, Uttar Pradesh	56	Abundance
4	AG-04	Khizrabad, Tehsil- Chhachhrauli, Dist.- Yamuna Nagar, Haryana	80	Abundance
5	AG-05	Bhogpur, Tehsil- Laskar, Dist.- Haridwar, Uttarakhand	50	Abundance
Sand Quarries				
Sl. No.	**Location ID**	**Quarry Location**	**Dist. From Project Road (Km)**	**Availability**
1	SA 01	Daulatpur, Tehsil- Bhagwanpur, Dist.- Haridwar, Uttarakhand	32	Abundance
2	SA 02	Sunderpur, Tehsil- Behat, Dist.- Saharanpur, Uttar Pradesh	35	Abundance
3	SA-03	Raipur, Tehsil- Behat, Dist.- Saharanpur, Uttar Pradesh	56	Abundance
4	SA-04	Khizrabad, Tehsil- Chhachhrauli, Dist.- Yamuna Nagar, Haryana	80	Abundance
5	SA-05	Bhogpur, Tehsil- Laskar, Dist.- Haridwar, Uttarakhand	50	Abundance

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. Tentative location for probable borrow areas as identified along the project has been presented in Table 5-3.

Table 5-3: Summary of Identified Borrow Area Locations

SL No.	Location ID	Chainage (km)	Left/Right	Location/Name Of Village	Lead (Km)	Remarks
1	BA-01	5+500	Both Side	Dagrauli Village	1.0	Private Land
2	BA-02	8+600	Both Side	Baseda Village	1.5	PrivateLand
3	BA-03	12+400	Left	Tajpur Village	2.0	PrivateLand
4	BA-04	22+700	Both Side	Khajuri Village	0.8	PrivateLand
5	BA-05	26+800	Both Side	Padli Ganda Village	0.5	PrivateLand
6	BA-06	34+500	Right	Mohammadpur Panda	2.5	PrivateLand
7	BA-07	40+000	Both Side	Bajuhedi Village	0.5	PrivateLand
8	BA-08	41+500	Left	Rahmatpur Village	1.6	PrivateLand

Source: Design report

The lead chart showcasing the lead distance of quarries and borrow area in reference to project alignment is presented in Figure 5-1.

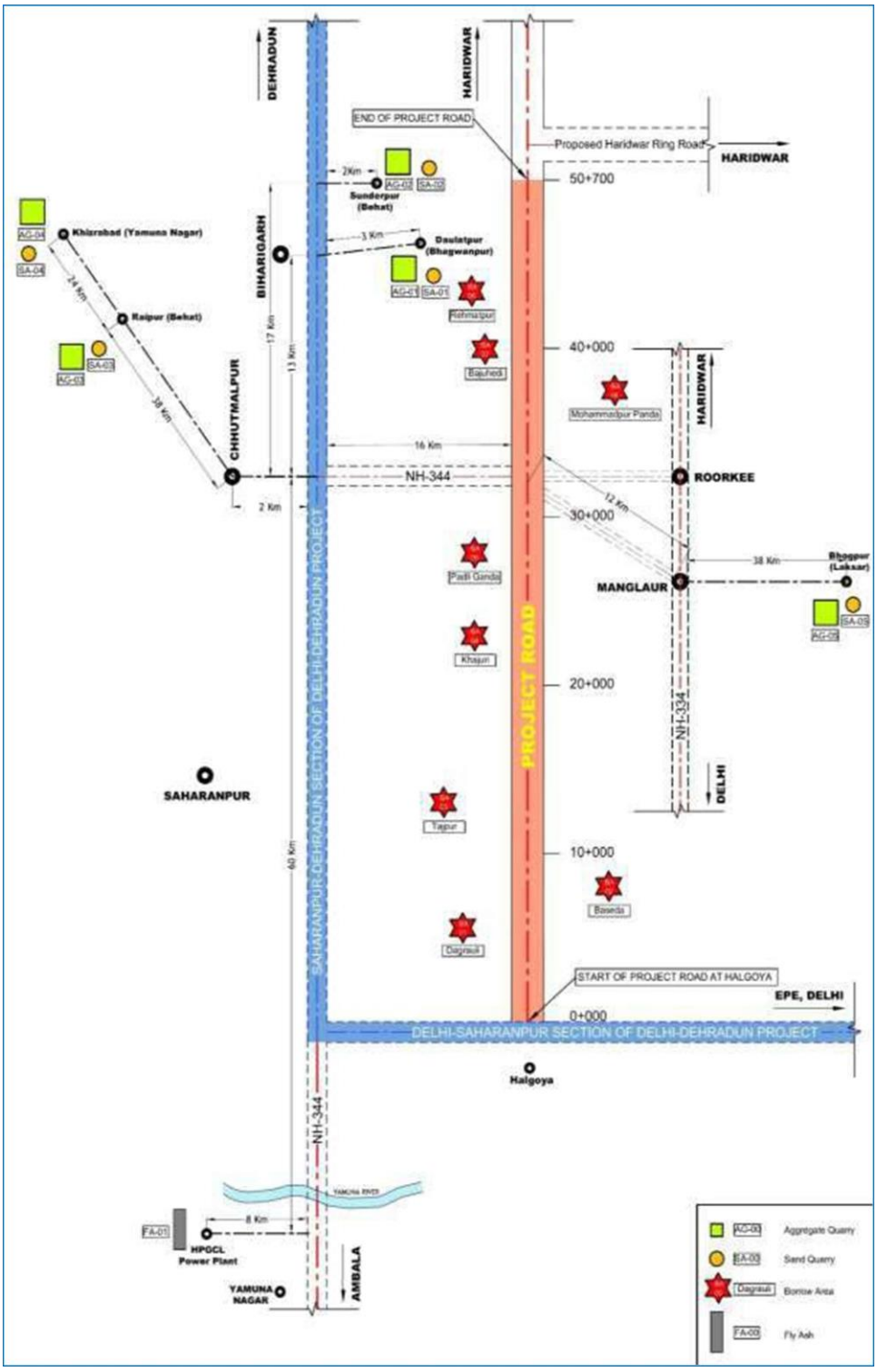


Figure 5-1: Lead Chart for Quarry and Borrow Area

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 1:2, 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.

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 stabilised 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. SO2, NO2 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), *Ficus bengalensis* (Banyan), *Tamarindus indica* (Imli) and *Azadirachta indica* (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 the part of one traffic sections viz. 0+000 to 43+900(Green field) for Spur to Haridwar from Delhi Dehradun Economic corridor. Traffic load and emission factors were estimated for all the traffic sections for the projection year 2053-54 to assess the worst case scenario analysis. Table 5-4 presents the Traffic and emission factor considered for the modelling.

Table 5-4: Traffic and Emission Factors for Traffic Sections

Year	Traffic volume per day	Emission Factor (gm/mile) for CO
Section 1		

Year	Traffic volume per day	Emission Factor (gm/mile) for CO
2053-54	65579	2.31

Results

Dispersion model software was run by using data as discussed in previous sections. The output results at various distances along the project expressway for projected year 2059-60 are presented in Table 5-5.

Table 5-5: Predicted Pollutant Concentration

Location	Resultant CO Concentration (mg/m³) at various distance from RoW Edge					
	10m	20m	40m	60m	80m	100m
Section 1	0.15	0.11	0.07	0.06	0.05	0.04

Conclusion

Considering that CO concentration in study area was found below 1.15 mg/m^3 and predicted incremental concentration of 0.51 mg/m^3 from row edge (nearest possible receptor), the maximum resultant CO concentration shall be in the tune of 1.3mg/m3 in respect to 2 mg/m^3 of Ambient Air Quality Standards. Hence, predicted CO concentration including ambient level shall remain well within the National Ambient Air Quality Standards for the projected years 2059-60.

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 expressway construction
- Surface water bodies along the project road might be subject to adverse impacts due to the various construction activities
- Project section is crossing 1 ponds, 4 rivers, 3 nala & 2 irrigation canals

Table 5-6: Ponds along the project road

S. No	Chainage (Km)	Side	Total Area of the Pond (m²)	Affected area within RoW		Measures Adopted
				(m²)	(%)	
1.	28+700	LHS	5628	0.0	0.0	Silt fencing

Source: Primary Survey

Mitigation

- 15 nos. of bridges are required along the project road consisting of 5 major bridges and 10 nos. minor bridges along with 140 culverts 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 21,58,442 KL. 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.

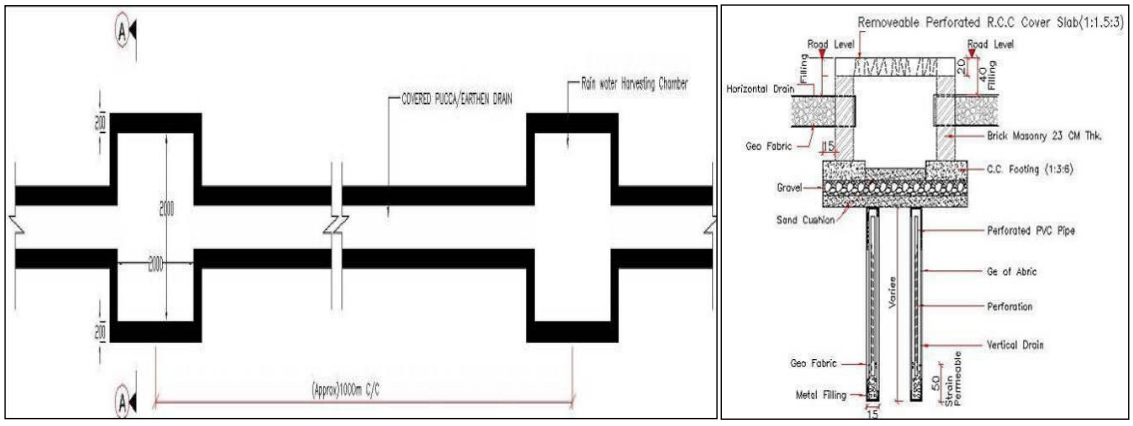


Figure 5-2: Rainwater Harvesting Structure

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. About 52 nos. of hand-pump shall be relocated 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 5-7.

Table 5-7: Silt Fencing Locations

Sl. No.	Design Chainage	Name of Village	Name of River/ Nala	Crossing Length / Perimeter	Approx. Silt Fencing Length (m)
1	1+530	Halgoya Ahatmaal	Hindan River	60	150
2	12+048	Tajpur	Kali Nadi	85	250
3	21+814	Khajoori	Nala	-	-
4	29+260	Sohalpur Gada	Sila Khala Nala	-	-
5	33+450	Saliyar Salhapur	Solani River	65	230

6	35+860	Mohammadpur Panda	Sipia Nala	60	160
7	39+563	Mehwad Kalan/ Bajuhedi	Upper Ganga Canal	-	-
8	42+530	Rahmatpur Ahatmaal	Ratmau River	70	360
				Total	**1150**

Silt fencing of about 1150m 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.

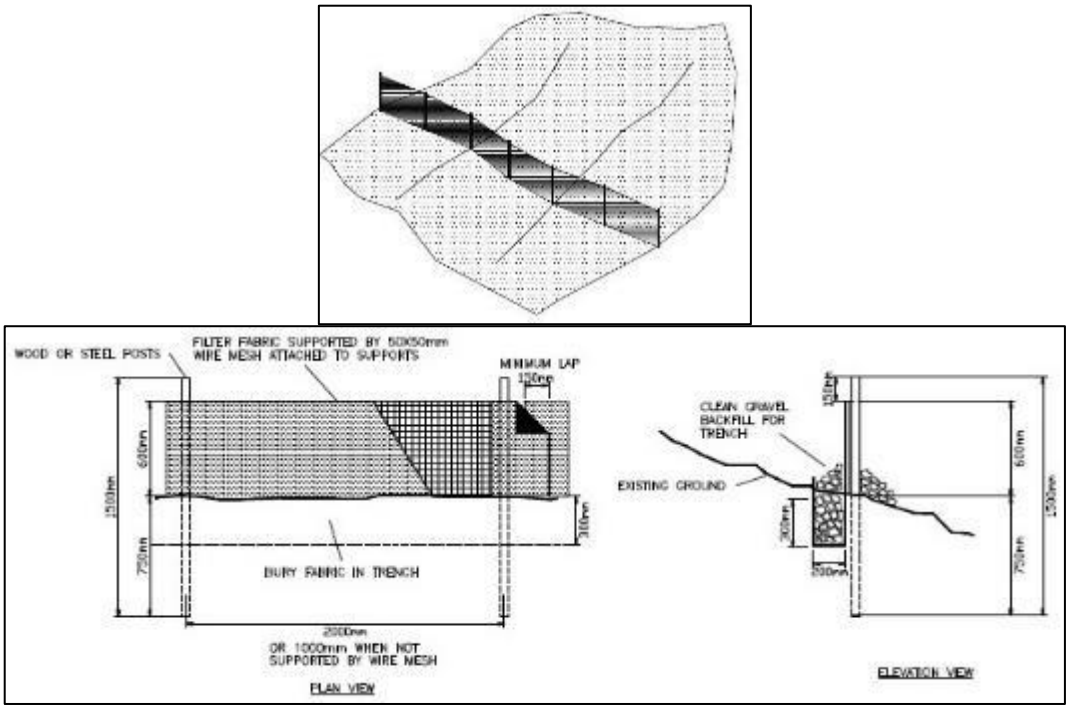


Figure 5-3: Schematic diagram of Silt Fencing

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. 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.

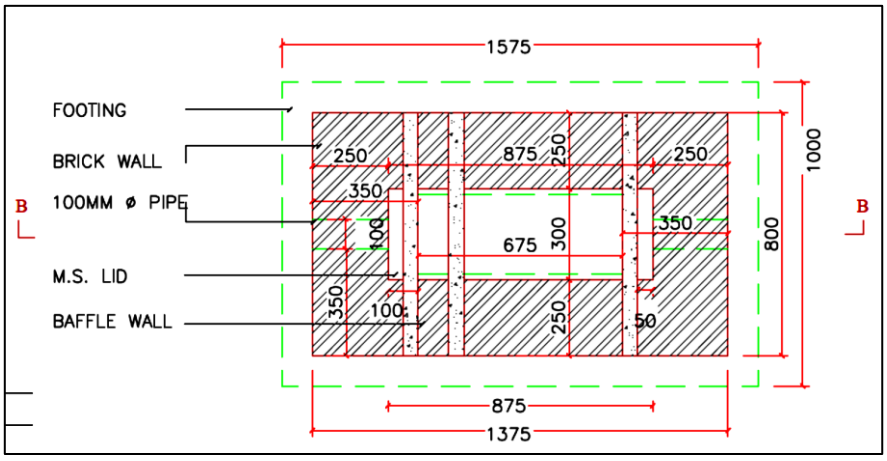


Figure 5-4: Schematic diagram of Oil Interceptor

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 time and night time are shown in Figure 5-4 & Figure 5-5 respectively.

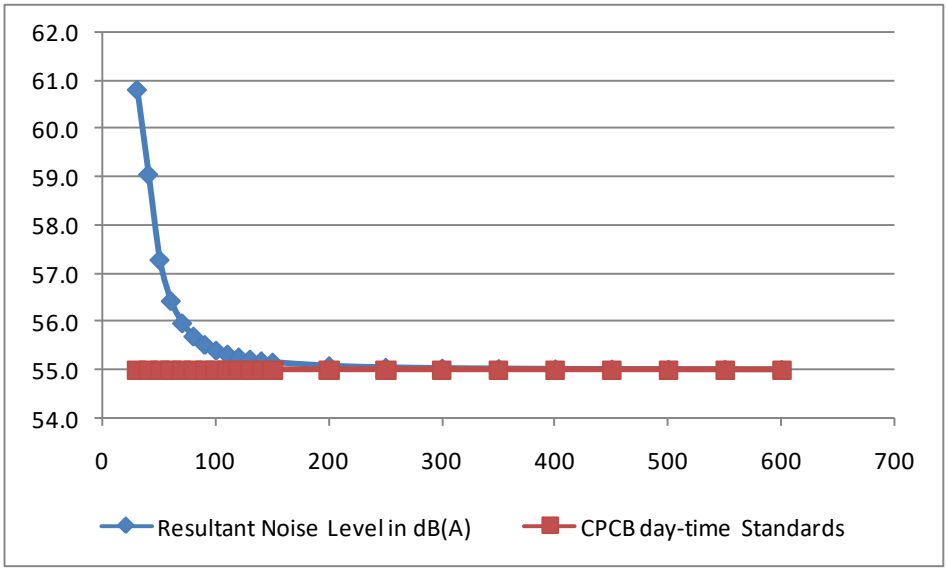


Figure 5-5: Day-time Construction Noise Intensity vs Distance from the Source

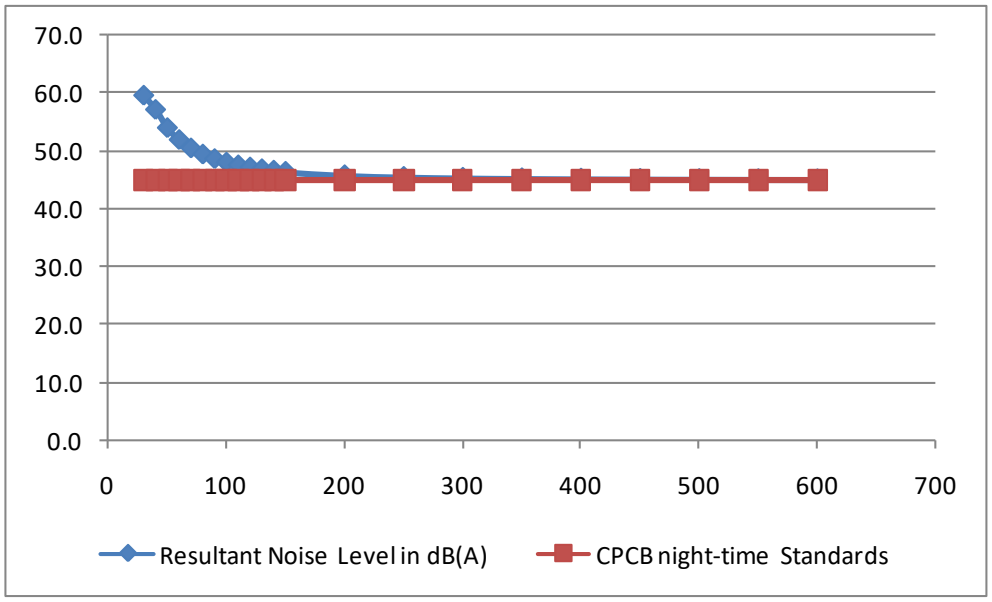


Figure 5-6: Night-time Construction Noise Intensity vs Distance from the Source

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 5-8 need to be worked out for the noise impacts associated with the various construction activities.

Table 5-8: Summary of Mitigation Measures for Construction Stage

Source of Noise Pollution	Impacts	Generic Mitigation Measures
• Utilization of heavy construction machinery; • Construction of structures and facilities; • Crushing plants, asphalt production plants; and • Loading, transportation and unloading of construction materials	Increased Noise Levels causing discomfort to local 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 dB (A). If required, machinery producing high noise as concrete mixers, generators etc. must be provided with noise shields; • At construction sites within 500 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

Source of Noise Pollution	Impacts	Generic Mitigation Measures
		diversified activities to prevent prolonged exposure to noise levels of more than 90 dB (A) per 8 hour shift; • Hot mix plant, batching or aggregate plants shall not be located within 1000 m of sensitive land use and settlements; • Project is an expressway 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: Meteorological 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 2054, which has the maximum generated traffic for assessment of worst case scenario. The Table below lists the class of vehicles for the projected year.

Table 5-9: Traffic distribution across the Project Sections

Projected Year	Light Vehicle		Heavy Vehicles					Total Nos.
	Car	Mini Bus	Bus	LCV	2A Truck	3A Truck	MA Truck	
2054	51953	413	2335	5474	1956	2367	3597	68094

Traffic flow for different hours of the day has been estimated based on percentage of traffic in different hours on existing NH-334. The percentage of traffic considered under different hours is tabulated below.

Table 5-10: Traffic percentage in different Hours on existing NH-58

Time (Hrs)			PCU (nos.)	PCU (%)
7	-	8	1154	3.42
8	-	9	1481	4.39

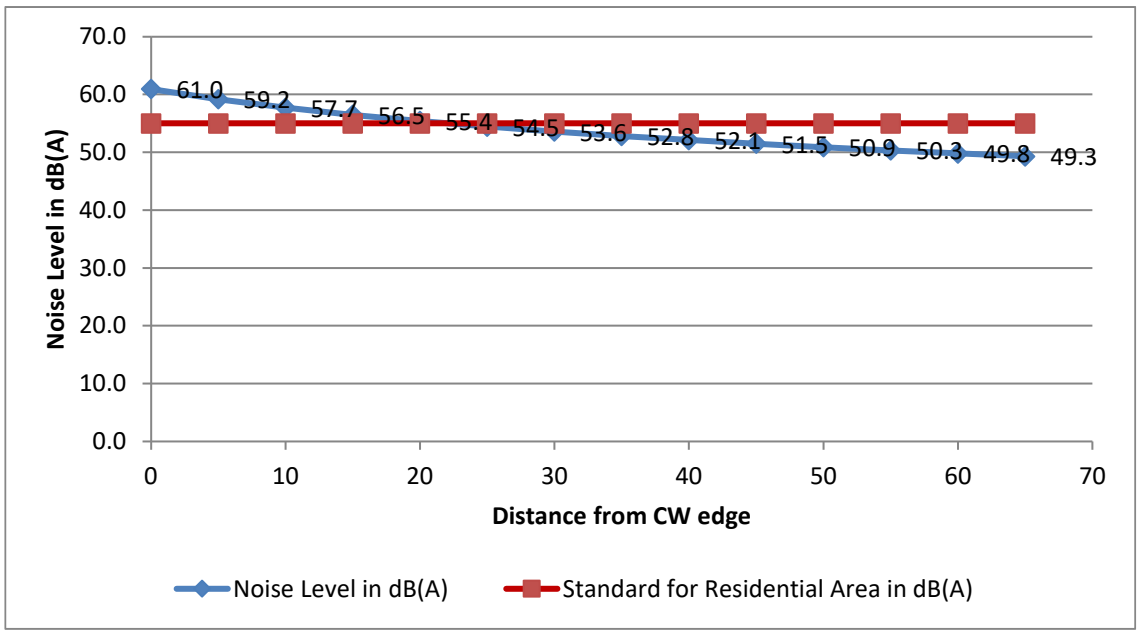
Time (Hrs)			PCU (nos.)	PCU (%)
9	-	10	1657	4.91
10	-	11	1892	5.61
11	-	12	1779	5.27
12	-	13	1774	5.26
13	-	14	1751	5.19
14	-	15	1763	5.22
15	-	16	1813	5.37
16	-	17	1952	5.78
17	-	18	1995	5.91
18	-	19	1963	5.82
19	-	20	1748	5.18
20	-	21	1499	4.44
21	-	22	1377	4.08
22	-	23	1326	3.93
23	-	00	1123	3.33
00	-	1	1022	3.03
1	-	2	931	2.76
2	-	3	729	2.16
3	-	4	747	2.21
4	-	5	713	2.11
5	-	6	742	2.20
6	-	7	822	2.44

The increment noise level will attain to the standards of residential i.e. 55 dB(A) at 25m from the RoW edge. Table and figure below shown the Noise level due to traffic activities at various distances along the project highway.

Table 5-11: Noise Level due to Vehicular Traffic (Year 2054)

Dist. from RoW edge (m)	Projected Noise Level in dB(A)	Noise Standards for day time in dB(A)
0	61.0	55
5	59.2	55
10	57.7	55
15	56.5	55
20	55.4	55
25	54.5	55
30	53.6	55
35	52.8	55
40	52.1	55
45	51.5	55
50	50.9	55
55	50.3	55
60	49.8	55
65	49.3	55

Figure 5-7: Noise Intensity due to Vehicular Operation vs Noise Standards (2054)



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. Noise barrier is proposed to the location where alignment may pass through within 30m (considering 5m as safe distance from project level) from the settlement or sensitive (Educational, Medical, etc.) areas.

5.3 Biological Environment

5.3.1 Protected Areas

The proposed alignment is not passing through any National Park or Wildlife Sanctuary.

Forest Areas

Project alignment is crossing protected forest certain the locations. The linear plantation developed along the existing road & canals are notified by forest dept. as protected forest in the states of Uttarakhand & Uttar Pradesh. The exact length of affected forest area along the project alignment will be measured during joint inspection with forest department at later stage. The project involves diversion of about 0.156 ha forest area for the development of proposed alignment.

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, urbanised, 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

About 8300 nos. of tree shall be affected due to the proposed development.. The tree enumeration list is presented in Annexure 5.12.

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.

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

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

- Clearing of the 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 increases.
- 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 PD & the TL of the 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 5-12: Species Recommended

Scientific name	Common Name	Reason
Azadirachta indica	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
Ficus bengalensis	Banyan	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Ficus religiosa	Peepal	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Magnifera indica	Mango	Noise barrier, Pollution sink, Economic Value (fruit bearing), Shade
Morus alba	Shahtut	economic value, shade
Millettia pinnata	Karanj	Economic Value
Syzygium cumini	Jamun	Pollution sink, Economic Value (fruit bearing)
Tamarindus indica	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 expressway. Entry and exit at the expressway at the highway shall only be allowed through interchanges. Also, the project doesn't pass through any natural forest. LVUP / SVUP shall be provided & maintained for crossings of domesticated animals. Therefore, no roadkill is likely due to the proposed improvement. Roadkill data of the expressway 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

Approx. 296.618 ha land shall be required for the proposed project. The land acquisition shall be done as per NH Act, 1956 and LARR Act, 2013. The R&R issues shall be resolved as per LARR Act, 2013.

5.4.2 Project Affected Families

Total number of PAHs are affected are 67, and they are owned by 59 titleholders (TH) and 8 tenants. Total 67 PAFs comprises 270 PAPs. There are BPL-9, WHH- 1, and SC-3 households among the affected households. 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. Utilities like bore wells, transmission lines, electric lines, O.F.C., petroleum pipeline, STP discharge pipeline etc. have been encountered along and across the Project Highway.

5.4.4 Cultural and Community Properties

Few structures having religious / cultural importance (mosque, graveyard and temple) are likely to be affected. Detailed impacts on Cultural & Religious properties are elaborated in SIA & RAP.

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 expressway.

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 expressway 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 expressway. 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 to 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 kilometre 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 expressway except interchange locations. Further, smooth geometry of the project expressway 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:

- Approx. 296.618 ha land shall be required for the proposed project. The land acquisition shall be done as per NH Act, 1956 and LARR Act, 2013. The R&R issues shall be resolved as per LARR Act, 2013.
- Total number of PAHs are affected are 67, and they are owned by 59 titleholders (TH) and 8 tenants. Total 67 PAFs comprises 270 PAPs. There are BPL-9, WHH- 1, and SC-3 households among the affected households.
- The proposed alignment is crossing 1 pond, 4 river, 3 nala and 2 irrigation canals. Flyover/Interchanges-6; VUP-9; LVUP-11; MJB-5; MNB-10; ROB-2 are proposed along the project stretch for free passage to villagers & domesticated animals and to avoid any impact on local hydrology.
- About 8300 nos. of tree shall be affected due to the proposed development. 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 IRC SP-21:2009.
- The project involves diversion of about 0.156 ha forest area for the development of proposed alignment. The forest area is in form of Protected Forest notified by Forest Departments / Concerned State Government Departments along Roads and Canals. Compensatory afforestation according to Forest Conservation Act, 1980 shall be undertaken to mitigate the loss of plantation cum forest area.

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 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. Consultations at new proposed Green Field Project locations were undertaken at 8 locations. Peoples' representatives, affected people and common public participated in the consultations. Meetings were held in 8 locations Rahamatpur Km 41+200 Harchandpur Majra Km 22+800 Badheri Rajputana Km 44+800 Bangla Manopharpur Km. 49.440 Ikbalpur Kamelpur Km 28+500 Padali Km 26+500 Saliyar Km 32+500 Baseda Km. 8+100 villages along the Project corridor to obtain their views and suggestions regarding the proposed project interventions.

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 expressway. 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 Forest 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. Photographs of the consultation are presented in Figure 7-1.

7.1.7 Project Disclosure: Awareness about the Project

Public consultations meetings were conducted in Project corridor villages. All the people expressed their full support in favour of the proposed road Project as they are aware that proposed Project will improve the connectivity of the villages and there is an opportunity to generate direct and indirect employment. During public consultation it has been recorded that proposed Project can impact residential, commercial, community and religious structures.

7.1.8 Consultation with Different Group of Persons

Public Consultation meetings were held with the randomly selected villagers, Sarpanch, influential persons and affected persons. These groups encompass a wide age range, as well as both genders, and people from the entire communal spectrum. Natural group discussions were also conducted wherever possible. Natural group discussions are interviews conducted with 'naturally' occurring groups. The method has the advantage of being interviewed at a time and place of their convenience and is suitable from the point of view of the interviewee. The result is honest and open discussion in a more relaxed and informal manner.

7.1.9 Consultation with Project Affected Families

The team has consulted the Project affected families and discussed about their socio-economic conditions (their source of income, total income by agriculture and other sources, their expenditure, household size, literacy, socio-economic status of women etc). During public consultation it was recorded that affected families don't want to resettle from their native house. Their suggestion is to avoid their residential and commercial structures along the Project road.

7.1.10 Consultation with the Daily wage personal

After consultation with the labours, it is observed that most of the persons are employed as labourers in agricultural fields. They felt, construction of road will generate direct and indirect employment opportunities to the local people.

7.1.11 Consultation with Youth

During general consultations with youth of the study area it is found that they are much more aware with their need for better education and career, and are seeking employment opportunities in metropolitan cities. Several youth were involved in preparation for Govt. Jobs, like army, police and SSC. They are very much ambitious about their careers.

7.1.12 Consultation with Women

Women in the study area consistently lag behind the men in terms of education, health care, jobs, etc. Some basic measures need to be taken on a priority basis to improve female literacy, improvement of skills and capability among women for enabling them to earn to survive in family.

During public consultations, some issues were discussed, like safety of their children and animals, resettlement of their residential, as well as commercial structures, gender-based violence, human trafficking, as well as the benefits and constraints of the Project.

Spur – Haridwar Project corridor is basically influenced by a male dominated society during consultations, it was observed that major decisions are taken by men in the family. They are involved in agriculture or agricultural labour and cattle rearing. Now days, most of the family members are busy in daily agricultural labour activities and employment opportunities are very low. Agricultural is one of the main sources of livelihood in these regions. And allied agricultural activities have prominence in this region as source of employment. Beside these opportunities, they feel that the proposed Project will bring employment opportunities and development of the region. They welcomed the Project and said that it will reduce the travel time and can easily fulfil their daily requirements. Proposed Project will also help the villagers to easily avail the medical facilities nearest towns like Baheda Rajputana, Baseda, Manoharpur, Piraan Kaliyar etc. It has been recorded that some village women are running self-help groups. They are investing the money earned from SHG group on cattle rearing, but they have more expectations from the government for economic/financial support. Mostly, the girls drop their education after 10th and 12th classes due to unavailability of colleges near the village/town. Also, it has been recorded that women are aware of HIV/AIDS.

Figure 7-1: Public Consultation Photographs

Consultation at Village Ikbalpur Kamelpur (Km. 28+500)

Village Harchandpur (Km. 22+800)

Village Rahamatpur (Km. 41+200)

Village Bangla Manoharpur (Km. 49.440)

Village Badheri Rajputana (Km. 44+800)

Village Padali (Km. 26+500)

Village Saliyar (Km. 32+500)

Village Baseda (Km 8+100)

At the start of the consultation sessions, the Project objectives, proposed improvements expected from the Project were informed to the participants. It was informed to the participants that there was a conscious effort to minimize land acquisition and impacts on private lands and assets. Only at

very constricted locations, where the safety and design standards shall warrant, the acquisition of land has been proposed in the Project. Further, it was clarified that the consultations will provide inputs to further refine the Project designs to minimize acquisition of lands, private and community structures, and other assets. The detailed consultations along with issues, views an suggestions is given in Table 7.1.

Table 7-1: Detailed Consultations along with issues, views & suggestions

Sr. No.	Date	District	Village/ Chainage	Location	No. of participants	Issues/Concerns	Views & Suggestions
1	25.07.2021	Haridwar	Rahamatpur at Km 41+200	Community Office	11	Compensation, Service Road, Link road, Drainage Facilities, Employment	Compensation according to LA Act, 2013 Local people should be consulted for Employment opportunity to the affected families or local people during construction phase measures near. CPR/Religious structures Proper drainage should be provided Employment opportunity should be provided to the affected families or local people during construction phase
2	25.07.2021	Haridwar	Harchandpur Majra at Km 22+800	At Village Head Representative Place	12	Service lanes for village commuters, RUB for village roads at appropriate location. Drainage facilities.	Compensation according to LA Act, 2013 Provision of street lights Good quality material should be used in construction Provision of drainage and Culverts Job should be provided to one member of the family
3	26.07.2021	Haridwar	Badheri	At	12	Service lanes for	Compensation

Sr. No.	Date	District	Village/ Chainage	Location	No. of participants	Issues/Concerns	Views & Suggestions
			Rajputana at Km 44+800	commercial location		village commuters, RUB for village roads at appropriate location.	according to LA Act, 2013
							Provision of street lights
							Good quality material should be used in construction
							Provision of drainage and Culverts
							Job should be provided to one member of the family
4	26.07.2021	Haridwar	Bangla Manopharpur at Km. 49.440	At commercial location	10	Compensation for crop &	Compensation according to LA Act, 2013
						Irrigation Facilities	Provision of streetlights
						Service Roads,	Provision of water storage facilities for irrigation purpose
						Bore well Compensation	Local people should be consulted for
							Employment opportunity to the affected families or local people during construction phase measures near.
5	26.07.2021	Haridwar	Ikbalpur Kamelpur at Km 28+500	Community center	12	Compensation for land loss and crop,	
						Service Road	Local people should be consulted
						Link road	Air & Noise Pollution measures near CPR/Religious structures
						Irrigation Facilities not to be disturbed.	Compensation according to LA Act, 2013
							Excavated material shouldn't be dumped at private land, it

Sr. No.	Date	District	Village/ Chainage	Location	No. of participants	Issues/Concerns	Views & Suggestions
							should be dumped at dumping sites.
							Speed breakers should be provided at desirable locations
6	26.07.2021	Haridwar	Padali at Km 26+500	Village Head Representative Place	12	Compensation	Compensation according to LA Act, 2013
						Service Road	Provision of street lights
						Link road, RUB for village roads at appropriate location.	Good quality material should be used in construction
							Provision of drainage and Culverts
							Job should be provided to one member of the family
7	26.07.2021	Haridwar	Saliyar at Km 32+500	BhandarPara	11	Compensation	Compensation according to LA Act, 2013
						Service Road	Provision of street lights
						Link roads not to be disturbed.	Provision of water storage facilities for irrigation puRAPose
						Irrigation Facilities	Air & Noise Pollution measures near CPR/Religious structures
8	26.07.2021	Saharanpur	Baseda at Km. 8+100	Commercial location	12	Compensation	Compensation according to LA Act, 2013
						Service Road	Provision of street lights. Local people should be consulted for
						Link road	Employment opportunity to the affected families or local people during construction phase

Sr. No.	Date	District	Village/ Chainage	Location	No. of participants	Issues/Concerns	Views & Suggestions
							measures near.
						Irrigation Facilities	Good quality material should be used in construction
							Provision of drainage and Culverts
							Job should be provided to one member of the family

Key Issues/Concerns and Suggestions

Though the road Project stretch passes through two different Districts of Saharanpur, Haridwar and four tehsils of Rampur Maniharan, Deoband, Roorkee, Haridwar, the socio-economic profile along the Project road has a lot of uniformity. The green fields along the corridor are agricultural fields intercepted with brick kiln fields and semi builds up area. The PAP's have two seasons of crop with good irrigation facilities, the important food crops of the region are Wheat, Rice, Maize, Jawar, Bajara, sugarcane; oilseeds, cotton and jute are the main commercial crops. Even the issues that have emerged as a result of this consultative process are also quite common, with minor variations. The key Issues raised during Consultations are as follows:

- Impacts on land and livelihood, compensation were the main issue of the affected, local and influential persons of the Project corridor.
- Participants also suggested in detail at every meeting on replacement value for any immovable property acquired. Participants also suggested that compensation be paid in time bound and single installment so that the amount can be used in a fruitful manner.
- Services lane and commute to the inter-villages have to be provided with RUB's and without any disturbance to the village's roads / commuters.
- Safety issue (Children/Local persons/Cattle) is another main concern along the Project corridor. Participants were informed that road safety provisions, extra wide road, footpath and drains will be provided in the settlement areas.
- Required drainage system along the Project road.
- Due to proposed Green Filed Project, some plots were divided into two parts and it may affect their access, therefore agricultural farmers suggested provision of Pedestrian under Pass (PUP).
- Employment opportunity to be given to the affected families and local people during the construction period.

7.1.13 Outcome of the Consultation

The outcomes of consultation are discussed below:

Local Community

- Save or avoid the structures as it is a major concern.

- Due to the proposed Green Filed Project, some plots will be divided into two parts and it may affect their access to field.
- The landowners expected good compensation for likely affected land.
- PAFs suggested consult with the farmers on deciding the compensation rate.
- Farmers who are losing their livelihood due to the acquisition asked for government jobs.
- Expectation of employment opportunities from the Project.
- Trauma centre is not available near the proposed Green Field Project. Therefore, they requested to establish a trauma centre.
- Involvement of the local people during road construction.
- The people expressed concerns over movement of heavy traffic, as they fear safety of children and livestock that roam around freely in the area.

Village Panchayat/ Head of Village

- The Gram Panchayat was observed to be supportive of the Project. They felt that the proposed Project can bring more opportunities in the area.
- They demanded engagement of local community and provide employment opportunities to local people.
- They asked to save the structures wherever possible.
- Village Panchayats expect local benefits like enhancement of the local infrastructure, targeted social investment programme through government initiatives.
- The Panchayat also expressed concerns over movement of heavy traffic, as they fear for the safety of children and livestock that roam around freely in the area.
- The Village Panchayat hinted at the contribution towards developmental activities of the area.

Thus, on the basis of above consultations /discussions with local community / villagers / village Sarpanch / village Panchayat members / influential persons of the region / Government Officials and various other stake holders, we may conclude that the proposed Project will prove beneficial not only to the local region, but also up to State and National levels for a long term.

7.2 Social Impact Assessment

The proposed project is likely to have positive as well as negative impacts on the local people and community. To identify these impacts, a Social Impact Assessment (SIA) survey has been conducted for each affected household/structure. The purpose of this exercise was to assess the losses and social impacts due to the proposed project and to gather information on the affected persons. During the SIA, the profiling of the project area has been done for better planning and implementation of the project. Based on the findings of SIA, a Resettlement Action Plan (RAP) will also be prepared to deal and mitigate the negative impacts on the people due to project implementation.

The proposed project involves acquisition of private (agricultural, non-agricultural including homestead land) as well as the government land. The acquisition of land may lead to socio-economic changes in the project area. The development of proposed section can be viewed as boosting economic growth and poverty reduction which will bring substantial social and economic development in the region. The social benefits arising due to the project will be triggered off by the improved accessibility to various services such as easy access to markets, health facilities, schools, workplace etc. It will in turn increase the income of the local people and elevate their standard of living. The possible direct and indirect positive impacts are listed below:

7.2.1 Generation of Employment Opportunity

The construction phase of the project will generate both skilled and unskilled employment. The opportunity will be given to the project affected persons as well as other people of the affected villages especially to those who work as daily wage laborers etc.

7.2.2 Economic Growth

The employment generation in the village will generate income as well as the expenditure capacity of the people which will enhance the economic growth of the region.

7.2.3 Improvement of Road Network

The improved road network will provide better links between villages and communities. It shall provide wider access to market facilities, health centres, education etc. Improved roads not only help people building strong institutional network with outside agencies but also allow people to link with better markets and new work opportunities at distant places. People can shuttle to distant places for work such as engage in construction, factories, business as well as domestic works.

7.2.4 Impact on Land

Approx. 296.618 ha land shall be required for the proposed project. Which includes Government, Gram Panchayat land and private land. Land majorly belongs to the private ownership.

7.2.5 Categories of Impact:

The proposed road improvement will impact 56 are private structures, 76 small structures/ sheds, Hand pumps, compound walls 9 common property resources along the corridor. All structures that are likely to be fully impacted belong to titleholders and 8 non-title holder tenants.

Impact on Community and government properties: (1) temples (2) schools (3) graveyards (1) mosque, (1) community hall (1) small religious idol in the agricultural field.

7.2.6 Socio-Economic Profile

Total number of PAHs are affected are 67, and they are owned by 59 titleholders (TH) and 8 tenants. Total 67 PAFs comprises 270 PAPs. There are BPL-9, WHH- 1, and SC-3 households among the affected households.

7.2.7 Ownership of the Properties likely to be affected

Out of 65 properties that are likely to be affected, 56 (86.15%) are private properties (properties that are owned by individuals and do not have govt. or community ownership), while 9 (13.85%) are Community properties such as religious temple, mosque, community hall, graveyard, school are (1) temples (2) schools (3) graveyards (1) mosque, (1) community hall (1) small religious idol in the agricultural field. Details of properties with level of impacts have been presented in Table 7.2.

Table 7-2: Type of affected properties

Sl. No	States	Districts	Private Structure	CPR	Total
1	Uttar Pradesh	Saharanpur	17	2	19
2	Uttarakhand	Haridwar	39	7	46
Total			**56**	**9**	**65**
%			**86.15**	**13.85**	**100.00**

Source: Census Survey, 2021

7.2.8 Common Property resources (CPRs)

Table given below, shows Districts wise breakup of CPRs.

Table 7-3: Common Property Resources

Sl. No	States	Districts	Temple		Total
			RHS	LHS	
1	Uttar Pradesh	Saharanpur	1	1	2
2	Uttarakhand	Haridwar	4	3	7
Total			**5**	**4**	**9**
%			**55.56**	**44.44**	**100.00**

Source: Census Survey, 2021

7.2.9 Other Affected Assets attached to Structures and Land

A total of 76 small structures/ sheds, Hand pumps, compound walls are going to be affected due to the proposed Project. Details of other assets are given in the following table:

Table 7-4: Other affected assets on affected structures & land

Sl. No	Details	Haridwar	Saharanpur	Total
1	Tube well	9	2	11
2	Hand Pumps	16	2	18
3	Water Tank	15	2	17
4	Toilets	14	3	17
5	CW	7	3	10
6	Cattle /Sheds	3	0	3
Total				**76**

Source: Census Survey, 2021

7.2.10 Type of Construction of the structure

Out of the 56 affected structures, 15 are semi-pucca, 22 are temporary and 19 permanent structures are to be impacted within the RoW. The details of type of constructions of the structures are summarized in Table 7.5.

Table 7-5: Typology of Affected Structures

Sl. No	States	Districts	Permanent	Semi-permanent	Temporary	Total
1	Uttar Pradesh	Saharanpur	3	1	13	17
2	Uttarakhand	Haridwar	16	14	9	39
Total			**19**	**15**	**22**	**56**
%			**33.93**	**26.79**	**39.29**	**100.00**

Source: Census Survey, 2021

7.2.11 Impact on Private Properties by Usage

There are 56 private structures that are going to be impacted in the Districts of Saharanpur and Haridwar of Uttar Pradesh and Uttarakhand states. We have categorised private structures into three categories, i.e. residential, commercial, and residential cum commercial. Category wise no. of structures is given in Table 7.6.

Table 7-6: Type of Affected Structure

Sl. No	Impact	Private Structure			Total
		Residential	Commercial	Residential cum Commercial	

1	Fully Impacted	12	24	4	40
2	Partially Impacted	6	10	0	16
	Total	**18**	**34**	**4**	**56**
	%	**32.14**	**60.71**	**7.14**	**100.00**

Source: Census Survey, 2021

7.2.12 Status of the Ownership of the Properties/Structures

The proposed Green Field Project will impact 56 private properties, of which 34 have responded to the social survey and remaining 22 households did not respond to the survey team who are presumed to be title holders. Apart from total 56 tittle holders, 8 Households are tenants involved in commercial activities in the Haridwar. Details of properties with levels of impact are presented in Table &.7

Table 7-7: Details of Impacted Private Properties

Sl. No	States	Districts	Title Holder	Non- Title Holder / tenant	Total
1	Uttar Pradesh	Saharanpur	17	0	17
2	Uttarakhand	Haridwar	39	8	47
Total			56	8	64
%			**87.50**	**12.50**	**100.00**

Source: Census Survey, 2021

7.2.13 Affected Area of Structures

During the Census Survey, the affected areas of the structures were calculated by taking measurements from the centreline to design ROW. Area of the affected structures is given in Table 7.8.

Table 7-8: Affected Area of Structures

Sl. No.	Type of structure	Affected Area (Sq. M.)
1	Permanent	1310.13
2	Semi-Permanent	3905.73
Total		**5215.86**

Source: Census Survey, 2021

7.2.14 Socio-economic Profile of the PAPs along the Project Road

The Socio-economic Survey of affected households was conducted along with Census Survey. A questionnaire was used for both Census and Socio-economic Surveys which is attached in Annexure-5-1. Different questionnaires were used for census and social survey. The socio-economic details of the people include their educational status, social stratification, income level, occupational pattern etc. have been provided in the following sub sections.

7.2.15 Impact on Affected Family

The data reveals for the 34 households responded to the social surveys. As many as total 59 numbers of affected families among the categories of titleholders (land and structures losers), squatters, and 8 tenants (Non-titleholders) are likely to be affected due to the Project. The details for the same are shown in Table 7.9.

Table 7-9: Affected Households and PAPs

Sl. No	Districts	Category	Nos. of Affected Family	Share Percentage

Sl. No	Districts	Category	Nos. of Affected Family	Share Percentage
1	**Saharanpur**	Title Holders	**59**	**88.05%**
2	**Haridwar**	Non – Title Holders (Tenant)	**8**	**11.94%**
Total			**67**	**100.00%**

Source: Census Survey, 2021

7.2.16 Total Number of affected populations

At this stage of study, only those households are included whose structures are losing in the survey. There is a total of 270 PAPs being affected which includes 140 (51.85%) males and 130 (46.29%) females. The average household size is 4.5 and the sex ratio among PAPs is 928.

This figure does not include the affected persons of those households who were not available for survey, and the family members of the wage earners. At few locations, people were even reluctant in giving the details of their families. The detail of number of PAPs enumerated has been mentioned in Table 7-10.

Table 7-10: Number of Affected Persons

Sl. No.	Age Group (Years)	Total PAPs	Percentage	Gender Disaggregated Population			
				Male	%	Female	%
1	<=6 Years	21	7.77	11	4.07	12	3.37
2	>06-<=14 Years	47	17.40	28	10.37	19	7.03
3	>14-<=59 Years	174	64.44	91	33.70	85	31.48
4	Above 59 Years	22	8.14	09	3.33	14	5.18
Total		**270**	100.00	**140**	**100.00**	**130**	**100.00**
%				**51.85**		**48.14**	

Source: Census Survey, 2021

7.2.17 District wise affected households and PAPs:

Districts and gender wise Project affected population is given in Table 7-11, shows that out of 270 of total PAPs, male comprises of 140 (51.85%) and females are 125 (46.29).

Table 7-11: District wise Project affected Population

Sl. No.	States	Districts	Total Affected PAHs	%	PAPs (Gender wise)				Total Affected PAPs	%
					Male	%	Female	%		
1	Uttar Pradesh	Saharanpur	4	11.76	25	17.85	23	18.4	48	17.77
2	Uttarakhand	Haridwar	30	88.23	120	85.71	102	81.06	222	82.22
Total			**34**	**100.00**	**145**	**100.00**	**125**	**100.00**	**270**	**100.00**
%					**53.70**		**46.29**			

Source: Census Survey, 2021

7.2.18 Religious Category

Majority of the families belong to Hindu religion (61.76%) followed by 38.24% who are Muslims. The trend shows that Hindu communities dominate the project road. Table 7.12 delineates the religious break-up of the affected families.

Table 7-12: Religious Categories of the affected families

Sl. No	Districts	Hindu	Muslim	Total
1	Saharanpur	3	1	4
2	Haridwar	18	12	30
Total		**21**	**13**	34
Percentage (%)		**61.76%**	**38.24%**	0

Source: Census Survey, 2021

7.2.19 Social Categorization

Out of the total 34 PAFs, 17 (50.00%) belong to General caste, 15 (44.11%) are OBC, 2 (5.88%) are SCs. There is no ST population likely to be impacted. Table 7.13, shows social categories of PAFs along the proposed road.

Table 7-13: Social Stratification of Affected Families

Sl. No.	Districts	General	OBC	SC	Total
1	Saharanpur	3	1	-	4
2	Haridwar	14	14	2	30
Total		**17**	**15**	**2**	**34**
%		**50.00**	**44.11**	**5.88**	**100**

Source: Census Survey, 2021

7.2.20 Family Types

The Socio-economic Survey revealed that out of the total 34 affected families, 64.70% are nuclear families and 32.35% are joint families. The nuclear family in the project affected area is low comparatively with the district census etc. Table 7.14, shows total percentage of Joint and nuclear families affected along the road.

Table 7-14 Family Types of PAHs

Sl. No.	Districts	Nuclear	Joint	Total
1	Saharanpur	2	2	4
2	Haridwar	21	9	30
Total		**22**	**11**	**34**
%		**64.70**	**32.35**	**100.00**

Source: Census Survey, 2021

7.2.21 Occupational Pattern of the Affected Persons

Out of 270 PAPs, 179 constitute the working population and 91 represent the non-working population. Occupation-wise analysis of working and non-working group population is shown in Table 7.15. As far as occupation of the affected population is concerned, majority of PAPs are engaged in agricultural activities.

Table 7-15: Occupational Pattern of Working Population

Sl. No.	Occupation	Distribution of PAPs in working population	%	Distribution of PAPs by Gender			
				Male	%	Female	%
1	Govt. Service	03	1.11%	02	1.42%	1	.76%
2	Pvt. Service	08	2.96%	5	3.57%	3	2.30%
3	Business	25	9.25%	25	17.85%	0	0
4	Agriculture	11	4.07%	11	7.85%	0	0
5	Agri. Labour	3	1.11%	3	2.14%	0	0

Sl. No.	Occupation	Distribution of PAPs in working population	%	Distribution of PAPs by Gender			
				Male	%	Female	%
6	Non Agri. Labour	06	2.22%	06	4.28%	00	0
7	Non-working	95	35.18%	28	20.00%	67	51.53%
8	Student	80	29.62	49	35.00%	31	23.84%
Total		**270**	**100.00**	**140**	**100.00**	**130**	**100.00**

Source: Census Survey, 2021

7.2.22 Income Pattern of the Affected Households

Annual Income as revealed by the PAFs has been analysed. This information helps in assessing family's financial condition. During the Census cum Socio-economic Surveys incomes of the households were recorded. As per available information collected during survey, the income level of the affected households is mostly (73.52%) are earning above Rs. 2,40,000 per annum. About 11.76% families earn below Rs. 60,000 per annum.

Table 7-16: Annual Income of the affected households

Sl. No.	Annual Income	Number of PAH	Percentage
1	Below 60,000	04	11.76%
2	Between 60,001 to 1,20,000	00	00
3	Between 1,20,001 to 1,80,000	02	5.88%
4	Between 1,80,001 to 2,40,000	03	8.82%
5	Above 2,40,000	25	73.52%
Total		**34**	**100.00**

Source: Census Survey, 2021

7.2.23 Education and Literacy

Table 7.17, presents the educational level of households, wherein majority of them were found to be literate. As per Census cum Socio-Economic data literacy rate is highest in Secondary level i.e. 40% followed by Primary (26%) and (23.33%) Higher education. Table shows the gender-disaggregated information on the educational level and literacy rate of the affected people in the Project area.

Table 7-17: Education and Literacy among PAPs

Sl. No.	Indicators (Literacy Rate / Educational Level)	Total Persons	%	Gender Disaggregated Information			
				Male	%	Female	%
1	Illiterate	03	1.11%	00	0	03	2.72%
2	literate (Read & Write)	25	9.25%	05	3.12%	20	18.18%
3	Primary (class 1-5)	71	26.29%	41	25.62%	30	27.275
4	Secondary (Class 6-12)	108	40.00%	73	45.62%	35	31.81%
5	Higher (graduate)	63	23.33%	41	25.62%	22	20%
Total		**270**	100	**160**	100	**110**	100

Source: Census Survey, 2021

7.3 Disaster Management, 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 and NHAI has introduced road safety provisions during the design of highway with the help of Road Safety Manual. Some of these are listed below:

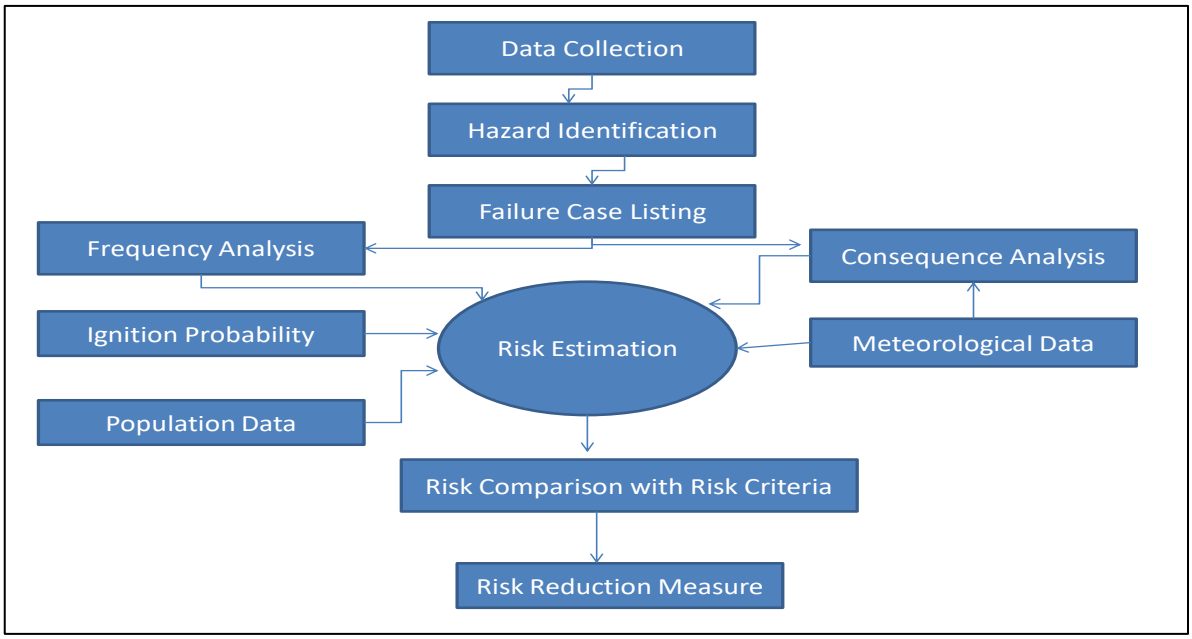
- Safety barriers/delineators hard shoulders on main roads
- Traffic signs and pavement markings
- Underpasses and other grade separators at junctions
- Removal of junctions and direct access points on main roads
- Improved median openings with stacking lanes
- Separate provisions and direct access point
- Service roads in towns and villages for segregating local and highways traffic.

The contractors 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 7-2: Risk Assessment Process



7.3.2 Person(s) at Risk

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

7.3.3 Emergency Response Plan

Concessionaire / Contractor shall 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 include 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:

7.3.3.1 Fire and Explosion

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

7.3.3.2 Road Accident

In case of road accidents, the following contact no should be contacted.

Table 7-18: 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
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

7.3.3.3 Traffic Management

Hazards due to external traffic are as follows:

- Construction workers hit by external vehicles while working
- Injury to Pedestrians

- Due to fall in excavated trenches
- 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

7.3.3.4 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. The variables 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.

7.3.3.5 Traffic Control Devices

Traffic control devices used to regulate the traffic in Road Construction Zones includes:

- Road Signs
- Delineators
- Barricades
- Cones
- Pylons
- Pavement markings
- Flashing lights

Table 7-19: Minimum Sightline Distance and the Minimum Size of the Signs

Average Speed (Km/h)	Distance of first sign in advance of the first channelizing device (m)	Size of Warning Sign (mm)	Minimum no of signs in advance of the hazard
Under 50	100	600	3
51 – 60	100 – 300	750	3
61 – 80	120 – 300	900	3 or 4
81 – 100	300 – 500	1200	4
Over 100	1000	1200 to 1500	4

Cautionary / Warning Signs

In case of divided carriageways, the signs should be provided both adjacent to the shoulder and on the central median so as to be visible from all lanes.

Delineators

Delineators are devices or treatment which outlines the roadway or portion thereof. They include Safety Cones, Traffic Cylinders, Tapes, Drums, Painted lines, Raised Pavement Markers, Guide Posts, and Post-mounted Reflectors etc. They are used in or adjacent to the roadway to control the flow of traffic. Delineators are basically driving aids and should not be regarded as a substitute for warning signs or barriers for out-of-control vehicles.

Drums

Drums of height 800 mm to 1000 mm high and 300 mm in diameter can be used as either channelizing on warning devices. Both plastic and metallic drums (e.g. Bitumen drums) can be used for this purpose. Drums need to be filled up with earth or sand to increase its stability. Drums should be reflective and painted as shown in the Figure 7-3.

Figure 7-3: Road Traffic Signals

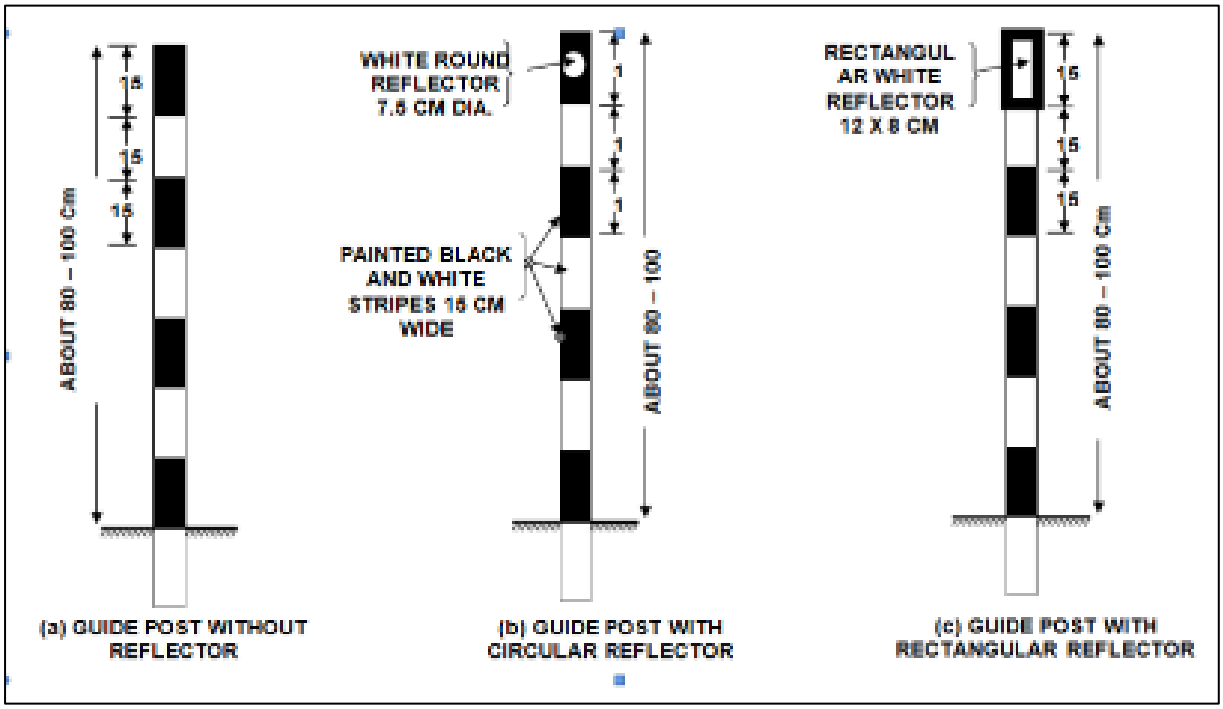
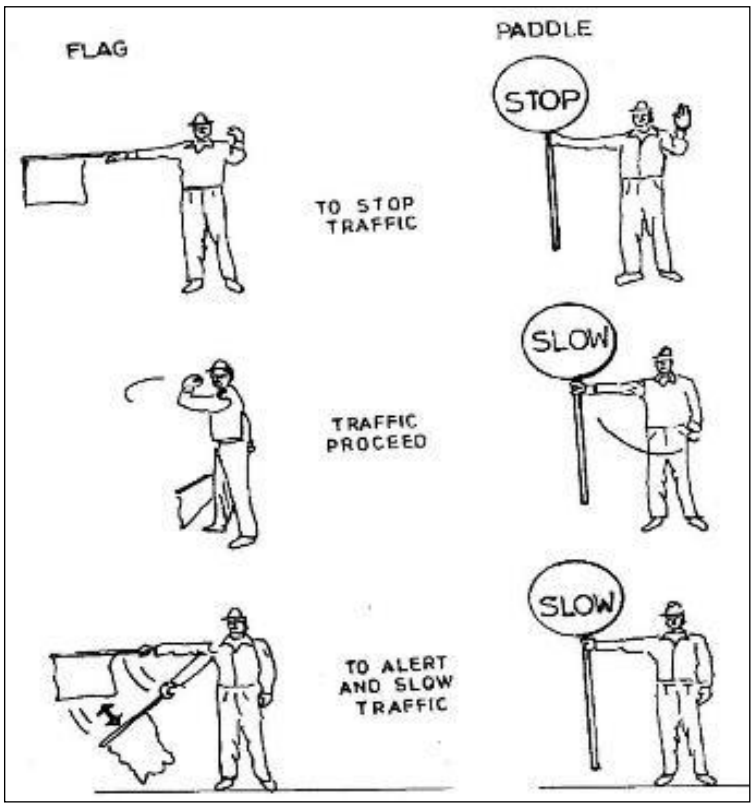


Figure 7-4: Drum Reflections



Flagmen

- An authorised personnel at least average intelligence, be mentally alert and good in physical condition be selected, since flagmen are responsible for public and workmen safety
- 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
- 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

Guide Post

They are intended to delineate the edges of the midway so as to guide driven about the alignment ahead, particularly where it might be confusing. Guideposts can be of metal, concrete, cut stone, amber or plastic. The posts can be made of Circular, Rectangular or Triangular Cross-section but the side facing traffic should be at least 10 cm wide.

Barricades

Standard barricades shall be used.

Safety Cones

Safety cones are 500 mm, 750 mm and 1000 mm high and 300 mm to 500 mm in diameter. They are usually made of plastic, rubber, HDPE, PVC and have retro refectories red and white bands. Safety cones would be displaced or blown unless their bases are anchored or loaded with ballast. This can be avoided by, using sandbag rings to provide increased stability, heavier weighted cones, cones with special weighted bases & or doubling the cones to provide added weight.

7.3.4 Traffic Management Practices

7.3.4.1 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.

7.3.4.2 Working zone

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

7.3.4.3 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 other road sign.

7.3.4.4 Safety zone

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

7.3.4.5 Approach Transition Zone

This will vary with the speed limit and the width of the works.

7.3.4.6 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.

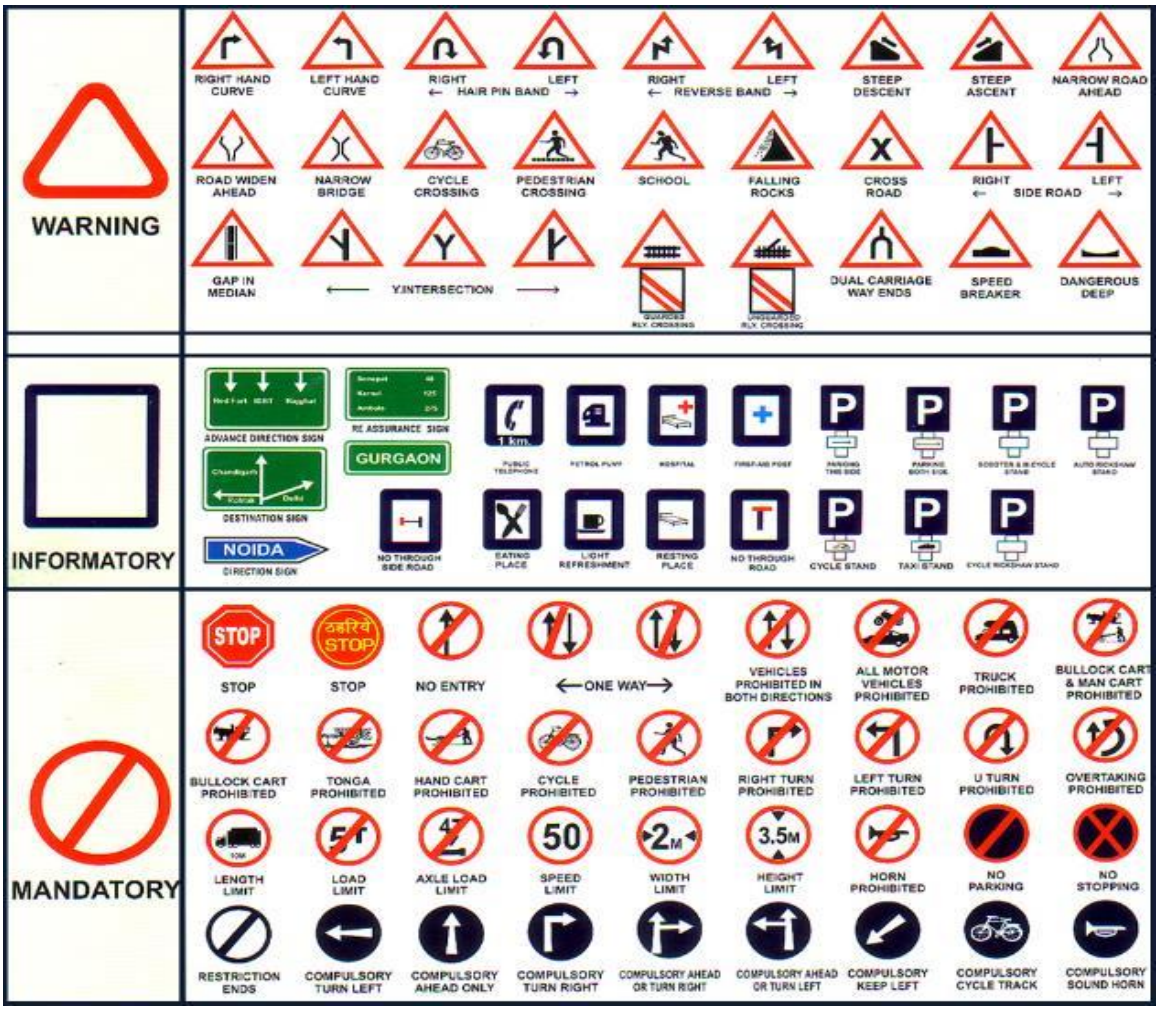
7.3.4.7 Lateral buffer zone

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.

7.3.4.8 Works on Strengthening of Existing Carriageway

- The construction zone shall be barricaded with barricade.
- Approached diversion would be taken out of the works zone for the movement of construction supervision vehicles.
- The 'works traffic" shall be governed by the location of base camp where workmanship less than 20, a flagman shall be kept for controlling traffic, public and workmen safety or more than 20 in addition to that a safety steward shall be kept for continuous monitoring to identify and removal of unsafe acts and conditions.

Figure 7-5: Traffic Signages



7.3.5 Traffic Management on Road Junction

7.3.5.1 Construction Traffic meets Live Traffic from Quarry/Plant/Borrow Pit

- Where vehicles are more to the approach junction from the side road, permission shall be seek for providing speed breaker at junction from local traffic police and road-authority
- Flag man shall be kept in the peak time provided with the traffic circle painted with red and white at the corner at a height of 500 mm, clearly visible to approaching traffic for a distance provided with while gloves and STOP, GO Paddle and night time flagman should use LED Batons
- Spillage of earth / Gravel / Aggregates / Bituminous mix from the tipper shall be cleaned on regular basis, if required 2 labourers to be permanently posted for booming
- All Construction vehicles must follow lane discipline and road signs

7.3.5.2 Activities inside Median / Island

- The traffic would discontinue from plying temporarily on the carriageway; for two min for reversing & dumping earth / stones / etc. under the direction of helper and the flagman
- The construction zone shall be barricaded
- One Flagman shall be appointed at traffic coming side of the transition zone.
- No personnel shall be allowed to come out of the safety zone, unless under flagman guidance.

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 7-20. 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 7-20: 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

Sl. No.	Family	Main Event	Short Description/ Secondary Disaster
			ground shaking triggered by earthquakes.
		Tsunami	A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides. Tsunami waves travel at very high speed across the ocean but as they begin to reach shallow water, they slow down and the wave grows steeper.
2	Hydrological	Flood, Landslides and Wave Action	• **Coastal Erosion-** The temporary or permanent loss of sediments or landmass in coastal margins due to the action of waves, winds, tides, or anthropogenic activities • **Coastal flood-** Higher-than-normal water levels along the coast caused by tidal changes or thunderstorms that result in flooding, which can last from days to weeks Flash Flood Hydrological - Heavy or excessive rainfall in a short period of time that produce immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall • **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) • **Wave Action-** Wind-generated surface waves that can occur on the surface of any open body of water such as oceans, rivers and lakes, etc. The size of the wave depends on the strength of the wind and the travelled distance (fetch).
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, Tornado, 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 Defence
- 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 7.21

Table 7-21: 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
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 7-22: 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.

Sl. No.	Department	Disaster Specific Action Plan
		• 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. • 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 paramedical, • Set up health centres in relief camps and assure hygiene and sanitation.

Sl. No.	Department	Disaster Specific Action Plan
		• 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 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.

Sl. No.	Department	Disaster Specific Action Plan
		• 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 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

Sl. No.	Department	Disaster Specific Action Plan
		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 • 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

Sl. No.	Department	Disaster Specific Action Plan
		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.

7.5 Traffic Report

The EAC while recommending the ToR had also mandated that "*The proponent, with the help of an independent institute/expert of national repute, shall carry out a detailed traffic study to assess inflow of traffic from adjoining areas like airport/urban cities.*" The traffic report is attached with the EIA report.

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 expressway. This will avoid traffic congestion and speed-up the freight movement. It is expected that overall, the proposed Spur to Haridwar 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 Efficient and Safe Connectivity Option

The Project is a part of the proposed access-controlled greenfield Delhi-Saharanpur-Dehradun expressway corridor (~212 km) interlinking different State & National highways while connecting Delhi to Dehradun. The greenfield connectivity to Haridwar will connect Haridwar to Delhi. The project is planned as high-speed corridor which provides high speed connectivity between states of North India, more importantly giving a reliable access to the economic and tourism destination located alongside the project expressway. The development of proposed Expressway will improve the connectivity between districts of Uttar Pradesh, Uttarakhand the National Capital Territory of Delhi. The highway will be access-controlled and ensure high speed traffic movement from Delhi to Haridwar and Dehradun.

At present the traffic from Delhi to Haridwar follows NH 334 (Old NH No.58) passing through Ghaziabad, Modi Nagar, Meerut, Muzaffarnagar and Roorkee. NH 334 (Old NH No.58) is 4-lane in most of the length and passing through Built-up/Semi Built-up areas at some sections. NH 334 is partially access controlled highway with at-grade junctions and median openings. Traffic on NH 334 (Old NH No.58) nearer to Roorkee is 36176 PCU.

The distance between Akshradham/Delhi to Haridwar/Har Ki Pauri through DME and existing NH 334 (Old NH No.58) is 210 Km and it takes around 5 hrs travel time. Haridwar/Rishikesh are

an important religious pilgrim centres. Haridwar is a gateway to other hill cities and temples of Uttarakhand, the traffic bound to the most important pilgrimage circuit in Uttarakhand, Chardham comprising Yamunotri, Gangotri, Kedarnath temple and Badrinath temple also passes through Haridwar. The number of pilgrims who visited the Chardham tour has been continuously increasing. The pilgrims visit Haridwar and Rishikesh in the entire year but more so during the winter.

The existing NH-334 (Old NH No. 58), is packed with pilgrims and tourists during pilgrimage season or during important festivals. Tens of millions of pilgrims attending the Kumbh Mela in January to March at Haridwar will use this highway extensively.

More than 50 million devotees attended the last Kumbh Mela. The existing NH 334 beyond Haridwar, will also connect the border with Tibet passing through Chamoli, Joshimath, Badriath and finally to Mana Pass near the border with the Tibet.

8.3 Traffic Decongestion

A traffic study was conducted across various locations of the existing NHs and SHs. It was found that the traffic movement capacity of NH-334 will get exhausted by another few years in most of sections even after widening to 4/6 lanes. Hence, requirement of widening of existing road / new highway arises. The existing alignments are congested requiring more travel time. Average travel time presently is 55 km/hr for this section. Hence, as an alternate, the alignment is proposed to provide direct access from Delhi to Dehradun and Haridwar. This proposed expressway will act as feeder to many districts.

Following major types of traffic load are expected to accrue the maximum benefit from the project:

- **Commercial and Industrial:** Traffic on the existing roads is driven by local, tourism, commercial and industrial traffic. The expressway will support the local businesses and economy along the proposed corridor. The proposed expressway will act as a significant axis of entry to Delhi from major industrial hubs like Roorkee, Bhagwanpur & Bahadrabad etc. It will facilitate rapid growth of the small, medium and large-scale industries mentioned above, by streamlining transport of raw materials and finished goods. Apart from this, the project corridor would help in quicker movement of agricultural commodities to the consumption centres and provide enhanced accessibility to tourists, helping in the overall development of the region.
- **Tourist:** Passenger traffic will be generated due to the major pilgrimage centre - 'Haridwar and other part of Uttarakhand'
- **Health and Education:** Faster connectivity and accessibility to Delhi NCR will help in higher flow of traffic from Uttrakhand, especially for higher education, tertiary healthcare and specialized treatments. Reduction in travel time will allow patients to avail OPD / other medical services from the national or state capital region.

8.4 Savings in Travel Time and Cost

The proposed section is expected to reduce the travel time between Delhi to Haridwar by at least 2-hour w.r.t. NH-344. This further leads to the following cost savings for users:

- Vehicle Operation Cost;
- Travel Time and
- Toll costs

8.5 Benefit to Local Trade and Economy

The proposed project plans to link Delhi NCR to Western UP & Uttarakhand State. The strong regional connectivity proposed through the Project will further increase regional tourism, trade and economic growth. The regions to be connected through the project have their distinct economic profiles.

8.6 Employment Generation (Direct and Indirect)

Proposed development is expected to generate employment during construction phase. It is estimated that ~300 direct employees will be required per day during construction of the highway. Further, due to ecosystem which will be created during construction and operations phase of the project, the highway will also create considerable indirect employment opportunities in form of transportation of construction materials, greenbelt development, ancillary facilities like canteens, dhabas, etc.

During operations phase, the project will largely have indirect employment benefits in form of highway amenities and through economic & social hubs developed around the highway. Efficient reach and connectivity to distant markets will further enhance economy of the districts and create employment opportunities.

9 ENVIRONMENTAL 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 1 ponds, 4 rivers, 2 canal & 3 nala. 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 Corporate Environmental Responsibility (CER)

As per the OM file No. 22-65/2017-IA.III dated 1st May 2018, CER cost has been calculated on slab basis as defined in the circular. Hence, CER cost for the project will be ~ INR 1908.89 Crore. Break-up of the estimated budget is given in Table 9-1.

Table 9-1: Slab wise CER Budget

Sl. No.	Slab in respect to Project Cost (INR Crores)	Percentage of CER	Project Cost Break-up (INR Crores)	CER Cost (INR Crores)
1	≤ 100 Crores	2.0%	100	2.0
2	> 100 Crores to ≤ 500 Crores	1.5%	400	6.0
3	> 500 Crores to ≤ 1000 Crores	1.0%	500	5.0
4	> 1000 Crores to ≤ 10000 Crores	0.5%	908.89	4.54
Total Cost			**1908.89**	**17.54**

Activities to be undertaken under CER area drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers, rain water harvesting, soil moisture conservation, avenue plantation and plantation in community areas, etc.

9.8 EMP Budget

The EMP cost has been presented in Table 9-2. The estimated budget of EMP is INR 17.064 Cr.

Table 9-2: Project Environmental Budget

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Cr.
1	**MITIGATION / ENHANCEMENT COST**						
1.1	**Pre-construction Stage**						
1.1.1	Land acquisition		Covered in LA 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		Avenue plantation with flowering, shade, medicinal, ornamental & fruit bearing trees @ 988 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	No.	43373	1,500.00	6,50,59,800.00	6.506
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	No.	29237	1,500.00	4,38,56,100.00	4.386
1.2.3		Circular tree guard for protection of plantation	No.	43373	1,000.00	4,33,73,200.00	4.337
1.2.4		Landscaping and aesthetics of junctions and at other locations as per design, drawings and direction of the Environmental Specialist of the PPMC / SC / AE	LS	-	5,00,000.00	5,00,000.00	0.050
1.2.5	Slope / Embankment	Turfing of embankment with grasses and herbs / other engineering measures	Covered in Engineering Cost			0.00	0.000

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Cr.
	protection						
1.2.6	Soil & Ground Water	Providing Oil Interceptors as per design and drawing at vehicle parking areas	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	Ground Water	Rainwater Harvesting Structures complete in all respect and confirming to the relevant specifications	No.	24	20,000.00	4,80,000.00	0.048
1.2.9	Flora	Cost of transport & distribution of cooking fuel to construction workers	Months	43.900	30,000.00	13,17,000.00	0.132
1.2.10	Air	Dust Management with sprinkling of water, covers for vehicles transporting construction material	Km	0	8,000.00	-	0.000
1.2.11	Noise	Noise Barrier / Boundary Wall near sensitive receptors	Running m	24	15,000.00	360000.00	0.036
1.2.12	Solid Waste Disposal	Disposal of Sewage and other wastes in the construction yard and labour camps as per directions of the Environmental Specialist of the PMC/ SC/AE	Month	2	30,000.00	60,000.00	0.006
TOTAL MITIGATION COST						**15,76,68,100.00**	**15.767**
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 5 locations including approved hot mix plant locations, sensitive area and chainages as per direction by Environmental Specialist of the PMC / SC / AE for three seasons (except during monsoon season) a year for 2 years as per the Monitoring Plan given in EMP	No. of Samples	60	2,000.00	1,20,000.00	0.012

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Cr.
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	60	4,000.00	2,40,000.00	0.024
2.1.3	Water Quality	Collection of grab samples of water quality at 6 locations at chainages identified by the engineer for 2 years (twice a year) in pre & post monsoon seasons as per the Monitoring Plan given in EMP & Environmental Specialist of the PMC / SC / AE	No. of Samples	24	400.00	9,600.00	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	No. of Samples	24	6,000.00	1,44,000.00	0.014
2.1.5	Noise	Monitoring Noise level at Equipment Yards, Sensitive area and Settlements using automatic noise meters at 5 locations at chainages identified by the Environmental Specialist PMC / SC / AE for three seasons in a year for 2 years as per the Monitoring Plan given in EMP	Nos.	30	1,500.00	45,000.00	0.005
2.1.6	Soil	Sampling Soil at 3 locations at chainages identified by the Engineer as per directions of Environmental Specialist of the PMC / SC / AE for twice a year for 2 years as per the Monitoring Plan given in EMP	Nos.	12	2,000.00	24,000.00	0.002

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Cr.
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 chainages as per direction by Environmental Specialist of the PMC / SC / AE for three seasons in a year for 5 years of operational period of 5 years	No. of Samples	45	2,000.00	90,000.00	0.009
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 NHAI as per MoEF&CC charges.	No. of Samples	45	4,000.00	1,80,000.00	0.018
2.2.3	Water Quality	Collection of grab samples of water quality at 3 locations at chainages for twice a year in pre & post monsoon seasons for 5 years as per direction of Environmental Specialist of the PMC / SC / AE	No. of Samples	30	400.00	12,000.00	0.001
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 PMC / SC / AE and as per MoEF&CC rate	No. of Samples	30	6,000.00	1,80,000.00	0.018

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Cr.
		list.					
2.2.5	Noise	Monitoring Noise level at Sensitive area and Settlements using hand-held noise meters at 3 locations for once in a year for 5 years as per directions of Environmental Specialist of the PMC / SC / AE	Nos.	45	1,500.00	2,25,000.00	0.023
2.2.6	Soil	Soil sampling at 2 locations at chainages identified by Environmental Specialist of the PMC / SC / AE for once a year for 5 year as per the Monitoring Plan given in EMP	Nos.	10	2,000.00	20,000.00	0.002
2.2.7	Transportation Cost	Transportation cost for monitoring of noise, air and water during operation period for 5 years considering every alternate year.	L.S.	10	2,50,000.00	25,00,000.00	0.250
TOTAL MONITORING COST						**39,39,600.00**	**0.394**
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	13	15,000.00	1,95,000.00	0.020
3.3	Administrative Charges including logistics	Maintenance of vehicle with the Environment Cell, Data processing, administrative support, stationery etc.	Months	13	35,000.00	4,55,000.00	0.046
3.4	Miscellaneous Items	Digital Camera for the Environment Cell	No.	1	5,000.00	5,000.00	0.001
TOTAL MISCELLANEOUS COST						**9,05,000.00**	**0.091**
TOTAL COST						**16,25,12,700.00**	**16.251**
Contingency @ 5% on Total Environmental Cost						**8125635.00**	**0.813**
GRAND TOTAL						**170638335.00**	**17.064**

10 SUMMARY & CONCLUSION

10.1 Introduction

Government of India has decided to develop Delhi – Saharanpur - Dehradun Expressway to improve the efficiency of freight & transport movement in the region. The project proponent for the Project is National Highways Authority of India (NHAI).

The project being discussed under this report concerns the development of spur to Haridwar from Delhi – Saharanpur- Dehradun economic corridor near Halgoya village in Saharanpur district of Uttar Pradesh and ends at existing Ch. 182+070 of NH-334 near Badheri Rajputan village in Haridwar district of Uttarakhand. The Project is planned as 6 lanes with provision of service road at some locations.

10.2 Need of the Project

The proposed Expressway will improve connectivity from Delhi to Haridwar. At present the traffic from Delhi to Haridwar follows NH 334 (Old NH No.58) passing through Ghaziabad, Modi Nagar, Meerut, Muzaffarnagar and Roorkee. NH 334 (Old NH No.58) is 4-lane in most of the length and passing through Built-up/Semi Built-up areas at some sections. NH 334 is partially access controlled highway with at-grade junctions and median openings. Traffic on NH 334 (Old NH No.58) nearer to Roorkee is 36176 PCU.

The distance between Akshradham/Delhi to Haridwar/Har Ki Pauri through DME and existing NH 334 (Old NH No.58) is 210 Km and it takes around 5 hrs travel time. Haridwar/Rishikesh are an important religious pilgrim centres. Haridwar is a gateway to other hill cities and temples of Uttarakhand, the traffic bound to the most important pilgrimage circuit in Uttarakhand, Chardham comprising Yamunotri, Gangotri, Kedarnath temple and Badrinath temple also passes through Haridwar. The number of pilgrims who visited the Chardham tour has been continuously increasing. The pilgrims visit Haridwar and Rishikesh in the entire year but more so during the winter.

The existing NH-334 (Old NH No. 58), is packed with pilgrims and tourists during pilgrimage season or during important festivals. Tens of millions of pilgrims attending the Kumbh Mela in January to March at Haridwar will use this highway extensively.

More than 50 million devotees attended the last Kumbh Mela. The existing NH 334 beyond Haridwar, will also connect the border with Tibet passing through Chamoli, Joshimath, Badriath and finally to Mana Pass near the border with the Tibet

10.3 Project Area

Project section covers 43.9 Km of length distributed in Saharanpur & Haridwar districts of Uttar Pradesh & Uttarakhand states respectively.

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 Spur to Haridwar was collected during the study period from March 2021 to May 2021. This data has analysed 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
- Forest clearance as the proposed alignment is passing through strip forests declared as protected forests alongside roads, canals and railway lines
- 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

10.7 Baseline Environmental Profile

10.7.1 Physical Environment

Climatology

The climate of region is moderate subtropical to humid climate with three distinct seasons viz. summer followed by rainy and winter seasons. The climate of the project district is characterized by general dryness, bracing cold season and a hot summer.

Topography

The proposed alignment mostly follows plain terrain. The elevation varies from ~256 m above MSL to ~276 m above MSL at different locations. Average elevation of the project stretch is ~265 m above MSL.

Geology

The district Haridwar is covered by high steep hills of Himalayas called Siwalik Range. The most rage lying just north to the district the upper Siwaliks followed by middle Siwaliks are exposed. Saharanpur district 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.

Soil

Soil samples were collected from 4 representative locations for assessment of soil characteristics. The texture of soil is found to be Silty, Sandy, Sandy loam in nature.

Ambient Air Quality (AAQ)

Ambient air quality monitoring has been done at evenly distributed 6 locations along the proposed alignment. The results indicate that all air quality parameters are within the standards specified in the NAAQS except except Bricklin @ village Basera (AAQ2) & NH 334, @ Badheri village.

Ambient Noise Level (ANL)

Noise monitoring has been carried out once during the entire study period at 6 locations along the 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 51.3 to 63.3 dB(A) and Leq Nighttime varies from 4.6 to 54.1 dB(A). At NH 334, @ Badheri village noise level was found crossing the standards due to day to day activities in nearby villages and vehicular operation on existing roads.

Surface Water

Surface water quality along the project stretch was monitored at 4 representative locations along the 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 slightly alkaline with pH varying from 7.244 to 8.17 locations along the alignment. The reason for alkalinity may be the excessive use of fertilizer in agricultural fields.

Ground Water

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

The results shows that pH was found ranging from 7.5 to 7.92 in ground water samples taken along the proposed alignment. The chloride content varied between 16 to 126 mg/l. The Fluoride content was found within the maximum permissible limit (1.0 mg/l) in drinking water as prescribed by BIS. The concentration of Nitrate ranges between 8 to 15 mg/l. The concentration of iron in ground water was found within the permissible limits.

10.7.2 Biological Environment

Protected Areas

The proposed alignment is neither passing through nor falling within 10.0 km radius of any National Park or Wildlife Sanctuary.

Forest

Project Road transverse through both Uttarakhand and Uttar Pradesh States. As per the India State of Forest Report, 2019, the Forest Cover in the State of Uttarakhand and Uttar Pradesh is 24,303.04 sq. km and 14,805.65 respectively.

The proposed alignment is passing through strip forests declared as protected forests alongside roads, canals and railway lines. The total protected forest area is approx. 5.05 ha, hence, there will be diversion of forest land and necessary clearances shall be obtained as per requirements under Forest (Conservation) Act, 1980.

10.7.3 Social Environment

Census Profile

The population of Uttarakhand as per Census 2011, is of 1.01 Crores, an increase from figure of 84.89 Lakh in 2001 census. Total population of Uttarakhand as per 2011 census is 10,086,292 of which male and female are 5,137,773 and 4,948,519 respectively.

As per details from Census 2011, Uttar Pradesh has population of 19.98 Crores, an increase from figure of 16.62 Crore in 2001 census. Total population of Uttar Pradesh as per 2011 census is 199,812,341 of which male and female are 104,480,510 and 95,331,831 respectively.

Workforce in Project area

The people in the villages are mostly engaged in the agricultural work and economy is largely based on agricultural activities. Some people are also working in nearby industries and brick kilns.

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. The proposed alignment is passing through strip forests declared as protected forests alongside roads, canals and railway lines and approx. 76 ha. diversion of forest land is required.

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 296.618 ha of land is required for proposed highway. Total number of PAHs are affected are 67, and they are owned by 59 titleholders (TH) and 8 tenants. Total 67 PAFs comprises 270 PAPs. There are BPL-9, WHH- 1, and SC-3 households among the affected households.

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 10-1: 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	• Compensatory plantation in 1:10 ration of the trees to be cut

Particulars	Stages	Potential Impacts	Mitigation Measures
		• Heat island effect due to increase in paved roads • Low spatially restricted short-term impact	• 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, Construction & Operation	• In Road slopes and spoils • Erosion in excavated areas	• Embankment protection 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	• Regular Sprinkling of Water • Fine materials to be completely covered, during transport and stocking.

Particulars	Stages	Potential Impacts	Mitigation Measures
		material	• 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 transportation	• Air pollution Norms will be 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 24700 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 • Impact on Dolphin and Gharials present in Beas River Conservation Reserve • Impact on migratory birds in Kali Bein Conservation Reserve (if any)	• Compensatory Plantation • Speed breaker, Signage and limit in sensitive areas • Construction of Cable Stayed Bridge over Beas River • Construction of single span girder over Kali Bein River

Particulars	Stages	Potential Impacts	Mitigation Measures
		• Accidental run over	
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 • 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

11.1 Declaration by the Expert

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

Signature : 

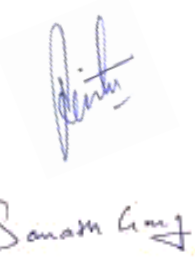
Name of EIA Coordinator : Dr. Raj Kumar Singh

Date : 10.08.2021

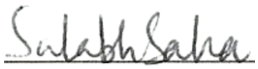
Period of Involvement : January 2021 to till date

Contact Information : Feedback Infra Pvt. Ltd.
10th Floor, Tower 10C,
DLF Cyber City Phase III, Gurgaon

Functional Area Experts:

Sl. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task)	Signature & Date
1	AP	Dr. Raj Kumar Singh & Navneet Kumar	January 2021 to till date **Task:** • Preparation of Scope for baseline study • selecting locations of sampling stations • Crosschecking of monitoring data • Impact assessment for air quality • Mitigation measures for air pollution	
2	AQ	Pintu Kumar & Saurabh Kumar Garg	January 2021 to till date **Task:** • Crosschecking of monitoring data • Running Models • Mitigation measures for air pollution	
3	LU	Vikrant Kumar	January 2021 to till date Task: • Preparation of various land use maps • Crosschecking of Maps • Impact assessment of land use • Mitigation measures for land Use	

Sl. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task)	Signature & Date
4	WP	Pintu Kumar	January 2021 to till date **Task:** • preparation of Scope for baseline study • Crosschecking of monitoring • Impact assessment for water quality • Mitigation measures for water pollution	
5	SE	Kankanala Rajasekhar & Dibya Kumar Das	January 2021 to till date **Task:** • Socio-economic survey of the area • Impact on inhabitants • Consultations • Management plan	
6	EB	Dr. Raj Kumar Singh	January 2021 to till date **Task:** • Ecology & biodiversity surveys of the study area • Preparation of inventory of flora and fauna • Consultations with institutional and community • Collection of Road kill data • Impact and mitigation measures for ecology	
7	HG	Dinesh Kumar Verma	January 2021 to till date **Task:** • Review of Hydro-geological pattern of the area • Assessment of project impacts • Development of Management plan	
8	Noise / Vibration	Saurabh Kumar Garg	January 2021 to till date **Task** • Noise monitoring scoping • Noise impact analysis • Preparation of management plan	
9	RH	Pintu Kumar	January 2021 to till date **Task:** • Hazard Identification • Risk Assessment • Preparation of management plan	

Sl. No.	Functional Areas	Name of the expert/s	Involvement (Period & Task)	Signature & Date
10	SC	Dr. Raj Kumar Singh	January 2021 to till date **Task:** • preparation of Scope for baseline study • Crosschecking of monitoring data • Impact assessment for Soil quality • Mitigation measures for Soil pollution	
11	Geo	Salabh Saha	January 2021 to till date Task: • Geological study of the project • Impact assessment with respect to Geological feature • Mitigation measures with respect to geology	
12	SHW	Saurabh Kumar Garg	January 2021 to till date Task: • Preparation of SHW Report • Impact assessment for SHW • Mitigation measures for SHW	

Declaration by authorized person of the accredited consultant organization

I, Sanjay Singh hereby, confirm that the above-mentioned experts prepared the EIA report for

Development of 6-lane access controlled spur to Haridwar from Delhi-Saharanpur-Dehradun Economic Corridor in the States of Uttar Pradesh & Uttarakhand. I also confirm that EIA Coordinator (EC) has gone through the report, and the consultant organization shall be fully accountable for any misleading information.

It is certified that no unethical practices, plagiarism involved in carrying out the work and external data / text has not been used without proper acknowledgement while preparing this EIA report.

Signature:

Name: Sanjay Singh

Designation: Senior Principal Engineer

Name of the EIA consultant organization: Feedback Infra Pvt. Ltd.

NABET Certificate No. & Issue Date: **NABET/EIA/1821/RA0116 dated 11th Jan 2019**