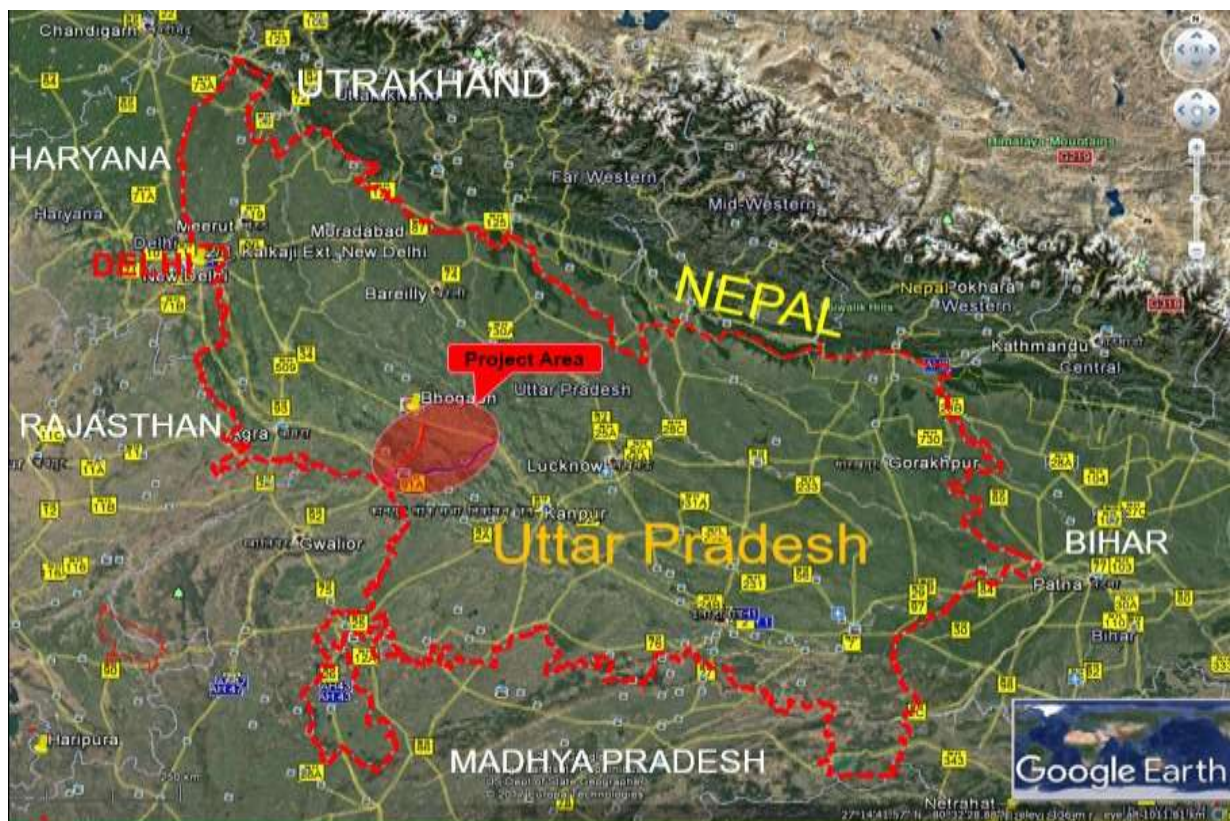


MINISTRY OF ROAD TRANSPORT & HIGHWAYS (GOVERNMENT OF INDIA)

Environmental Impact Assessment including Environmental Management Plan for Upgradation of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh



Environment Impact Assessment (EIA) Including Environment Management Plan (EMP)

**REDECON (INDIA) PRIVATE LTD
(June 2021)**

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List of Abbreviations

ADT	Average Daily Traffic
AADT	Annual Average Daily Traffic
AH	Affected Household
AMSL	Above Mean Sea Level
ASI	Archaeological Survey of India
AP	Affected Person
BDL	Below Detection Limit
BPL	Below Poverty Line
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
CA	Compensatory Afforestation
CaCO ₃	Calcium Carbonate
CBR	California Bearing Ratio
CD	Cross Drainage
CGWA	Central Ground Water Authority
CGWB	Central Ground Water Board
Ch.	Chainage
CL	Centre line
CO	Carbon Monoxide
CoI	Corridor of Impact
CPCB	Central Pollution Control Board
CPR	Common Property Resources
Cr	Chromium
CTE	Consent to Establish
CTO	Consent to Operate
CE	Chief Engineer
CGWA	Central Ground Water Authority
CoI	Corridor of Impact
CPCB	Central Pollution Control Board
CO	Carbon Monoxide
CVPD	Commercial vehicles per day
CTSB	Cement Treated Sub-Base
dB	Decibel
DC	District Collector
DEIAA	District Level Environmental Impact Assessment Authority

DFO	Divisional Forest Officer
DPR	Detailed Project Report
DO	Dissolved Oxygen
E	Easting
EC	Environmental Clearance
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMF	Environment Management Framework
EMP	Environment Management Plan
ENVIS	Environmental Information System
EPA	Environment Protection Act
FRA	Forest Right Act
GHG	Green House Gas
G.I.	Galvanized Iron
GNHCP	Green National Highways Corridor Project
GoI	Government of India
GSB	Granular Sub-base
GPS	Global Positioning System
GW	Ground water
HFL	High Flood Level
HH	House holds
HS	Homogeneous Section
IE	Independent Engineer
IMD	Indian Meteorological Department
INR	Indian Rupee
IRC	Indian Roads Congress
IS	Indian Standards
LCV	Light Commercial Vehicle
LHS	Left Hand Side
Km	Kilometer
MDR	Major District Road
MoEFCC	Ministry of Environment, Forest and Climate Change
MoRTH	Ministry of Road Transport and Highways, Govt. of India
MSA	Million Standard Axles
NBWL	National Board for Wildlife
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Laboratories
NGHM	National Green Highways Mission
NGO	Non-Governmental Organization
N	Nothing
NH	National Highways
NHDP	National Highways Development Program

NOC	No Objection Certificate
NO ₂	Nitrogen Dioxide
NPV	Net Present Value
NQ	Noise Quality
NTU	Nephelometric Turbidity Unit
OBC	Other Backward Caste
OD	Origin and Destination
ODR	Other District Road
OP	Operational Policies
PAPs	Project Affected Persons
RFCTLARR	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act
Pb	Lead
PCU	Passenger Car Units
PMGSY	Pradhan Mantri Gram Sadak Yojana
PIU	Project Implementation Unit
PM	Particulate Matter
POL	Petroleum, Oil and Lubricants
PPE	Personnel Protective Equipment
PMC	Project Management Cell
PROW	Proposed Right of Way
PUC	Pollution under Control
PUP	Pedestrian under Pass
R&R	Resettlement and Rehabilitation
RAP	Recycled Asphalt Pavement
RCC	Reinforced Cement Concrete
RHS	Right Hand Side
RoW	Right of Way
ROB	Rail Over Bridge
Rs.	Rupees
RWH	Rain Water Harvesting
SAR	Sodium Absorption Ratio
SC	Schedule Caste
SEAC	State Expert Appraisal Committee
SEIAA	State Level Environmental Impact Assessment Authority
SH	State Highway
SO ₂	Sulphur Dioxide
SOI	Survey of India
SIA	Social Impact Assessment
SOI	Survey of India
SPL	Sound Pressure Level
SQ	Soil Quality

ST	Schedule Tribe
TCS	Typical Cross Section
TDS	Total Dissolved Solids
ToR	Terms of Reference
TOEM	Tapered Element Oscillating Microbalance
UP	Uttar Pradesh
UPPCB	Uttar Pradesh Pollution Control Board
V:H	Vertical to Horizontal ratio
VDF	Vehicle Damage Factor
VOC	Vehicle Operating Cost
WB	The World Bank
WHH	Women Headed Households
WMM	Wet Mix Macadam

Weights And Measures

°C	Degree Celsius
%	Percent
Cm/hr	Centimeter per hour
Cum	Cubic Meter
dB(A)	A Weighted Decibel
gm/cm ³	Gram per Centimeter Cube
g/km	Gram Per Kilometer
ha	Hectare
km	Kilometer
Km ²	Square Kilometer
Leq	Equivalent Continuous Noise Level
µg	Microgram
µg/m ³	Microgram Per Cubic Meter
m	Meter
mg/kg	Milligram per Kilogram
m/km	Meter per kilometer
mg/l	Milligram per Liter
mg/m ³	Milligram Per Cubic Meter
mbgl	Meter Below Ground Level
PM _{2.5}	Particulate Matter of 2.5 Micron size
PM ₁₀	Particulate Matter of 10 Micron size
ppm	Parts Per Million
Sq.m.	Square Meter

Executive Summary

0.1 Project Background

The Uttar Pradesh Public Works Department (UPPWD), National Highway (NH) Division, under Ministry of Road Transport & Highways, MoRTH intends to up- grade and maintain National Highway NH-92 connecting to Bewar-Etawah Section (Km 0.000 to Km 57.346) (Package 1A & 1B) Road in the State of Uttar Pradesh.

The Contract Agreement for preparation of feasibility study and Detailed Project Report for upgradation of the project road was signed among UPPWD through MoRTH & Redecon (I) Pvt. Ltd. on 28th July, 2017.

0.2 Green National Highways Corridor Project (GNHCP)

The project road starts from Bewar at Chainage Km 0.000, coordinates 27°13'01.25"N, 79°18'07.64"E and ends at Etawahat km 57.346 at junction with NH-2, coordinates 26°47'27.00"N, 79°02'05.67"E.

Two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 is proposed to be constructed under Green National Highways Corridor Project (GNHCP) through its support to the Govt. of India's Bharatmala Pariyojana and financed by the World Bank. It will promote the vision of enhancing effectiveness of the transport network of India with cost and natural resources efficiency and safe high capacity highways. The GNHCP operation is aligned with the Government of India's objective of eliminating poverty and ensuring access to minimum standard of basic needs for all citizens through investing in growth enablers transport & connectivity infrastructure. The basic proposition of the GNHCP includes strengthening of road pavement in addition to widening to two-lane/two-lane with paved shoulder standards and promoting/ demonstrating green and resilient approaches while doing so.

NH	State	Pkg. No.	Project Road Stretch	Design Chainage		Districts en-route	Design Length (km)
				To	From		
NH-92	Uttar Pradesh	IA	Bewar to Karri	0.000	30.00	Mainpuri & Etawah	30.000
		IB	Karri to Etawah	30.00	57.346	Etawah	27.346
	Total						57.346

0.2.1 Need of the Project Road

The need of the project road is described below:

- a) The proposed project road will facilitate the transportation of agriculture produce from the surrounding areas to their market places in Uttar Pradesh and National Capital Region (NCR) by enabling movement of heavy vehicles in all weather conditions.
- b) Improvement of the road geometrics will also attract more traffic to the region which in turn help in the upliftment of the living standards of the people and will also help in reduction of accidents.
- c) To meet the demand of safe and accident free travel, upgradation of the present project road is very much needed.
- d) The necessity of the project road is summarised below:
 - To improve road safety and accidents on the existing road.
 - To reduces travel time and fuel consumption by vehicles subsequently reduction GHG emissions.
 - To creates more health facilities, educational opportunities especially for women.
 - To enhances mobility to market places.
 - To facilitates overall economic development of the region.

0.2.2 Justification and Need for the project

The objective of the project road development is to enhance and improve transport connectivity through adopting green and climate resilient construction methods for the project National Highway network.

The proposed road up-gradation is necessary for better connectivity and efficient movement of logistics. It will prove to be effective for resource efficiency and will serve as climate resilient green and safe highway for traffic movement.

The project stretch starts from Bewar on NH-92 which is a major economic corridor connecting Delhi, Aligarh, Bewar & Kanpur to Lucknow from east to west direction. All the towns are major industrial zones of Uttar Pradesh. The project stretch terminates in Etawah at 'T' Junction of NH-2 which connects Delhi & Kanpur Lucknow.

Importance of the Project Road: The importance of the project road are given below:

- NH 92 is an Interstate Highway from Bewar in UP to Gwalior in MP with lot of Religious, Commercial & Historical Importance,

- Project Road passes through Bewar, Baralokpur, Basrehar & Etawah upto MP Border,
- It Inter connects, NH 2, NH 91A, Agra – Lucknow Expressway and NH 91. (NH2 is a National Corridor & NH 91 is an Economic Corridor of UP),
- It passes through fertile Agriculture belt,
- It links Farrukhabad District which is a leading producer of Potatoes and a major Pilgrim center for Buddhists,
- It facilitates movement of Agricultural Products to Kanpur, Lucknow, Agra, Gwalior and Jhansi and manufactured goods from Kanpur, Agra and Lucknow,
- There are number of parallel roads in East-West direction and NH-92 is in North-South orientation providing connectivity to maximum usage of other roads,
- Project road links Safari Park and hence important for Tourism in Uttar Pradesh,
- Wholesale market of Garlic is located in Bewar and Wholesale Market of Potato is located in Farukkabad from where these produces are distributed to other states by using this road,
- Construction material like Stone, Sand etc. from Madhya Pradesh is supplied to various Districts of UP through this road,
- The wholesale market of Fruits and Vegetables at Etawah(Km 57+00) isupplies to various states like, MP, Maharashtra, Karnataka, Kashmir, Himachal Pradesh, etc. through this road,
- This road is a major route of “Kawarias” from MP state during Mahashivaratri Festival.
- The Road is a major route of Devotees coming to Kalivahan Mandir at Etawah, which is a major Religious center,
- The road Provides link to Indian Army Cantonment at Fatehgarh,
- Presently the Project Road is only 2 Lane with number of deficiencies and constraints.
- The existing pavement is not conforming to design standards with insufficient crust thickness,
- Bridges are mostly narrow with carriageway width of only 5.00m creating choke points,
- Culverts are mostly in poor condition having CW less than 7.00m,
- With the increasing traffic, Project Road is proposed to be widened to 2L+Paved Shoulders along with geometric improvements and other amenities,
- The proposed highway links NH 2, NH 91A, NH 91 & Agra - Lucknow Expressway,
- It provides connectivity to the following:
 - Wholesale Garlic Market at Bewar,
 - Wholesale Potato Market at Farukkabad,

- Wholesale Fruits & Vegetable Market at Ettawah,
- Safari Park at Etawah,
- Stone & Sand Quarries of MP,
- Buddhist Temple at Farrukabad,
- Kalivahan Mandir at Etawah, and
- India Army Cantonment at Fatehgarh

0.2.3 Benefits of the Project

a) Connectivity and Logistics

The proposed project road connects NH-91 at the starting and NH-2 at the 'T' Junction in Etawah Town. It will facilitate smooth transportation of heavy cargo vehicles for taking the harvested crops not only in the state of Uttar Pradesh but also in adjacent states of Rajasthan, Madhya Pradesh & Delhi, which will boost the economy of the farmers residing in the area.

The project road will also be instrumental in enhancement of tourism in the area as tourist from all across India will come to see the Etawah Lion Safari, officially Lion breeding center and multiple safari park, Etawah which is recently opened for public. Moreover, National Chambal sanctuary also called the National Chambal Gharial Wildlife Sanctuary for the protection of the critically endangered gharial and red crowned roof turtle are major tourist spot just 45 minutes drive from Etawah.

b) Resource Efficiency

The project includes the following measures towards increasing resource efficiency:

- Milling of the existing pavement and its utilization by adding aggregates to achieve proper gradation through use of Recycled Asphalt Pavement (RAP) after undergoing recycling.
- Treating the existing subgrade with cement and admixtures to increase the CBR where reconstruction is proposed, thus reducing the proposed thickness of the road compared to conventional methods for pavement design.
- Re-using cut material in the construction of pavement, structure and slope protection work after proper testing and gradation.
- Utilizing municipal/plastic waste in bituminous course by approaching private organizations that provide plastic waste materials.

c) Green Highway

The proposed project highway includes the following specific interventions:

- Reducing the requirement of quantities of natural resources (soil, aggregates) in pavement construction by using stabilization techniques (cement and/or lime), using waste products in pavement construction (fly ash), and utilizing cut materials.
- Reducing the transportation requirements of pavement construction materials because of the reduction in required quantities of these materials.
- Reducing requirement in quantity of bitumen and its transportation by using recycling of existing asphalt/bituminous wearing course and use of cement concrete pavement.
- Water conservation through redevelopment/enhancement of 34 ponds (involving de-siltation of ponds to increase storage capacity, channelizing rain water to reach ponds, plantation of trees on the boundary of ponds, and protection of slopes of ponds by grass), and development of 27 rainwater harvesting structures.
- Utilizing renewable energy sources (solar lighting) on all built-up areas (27 locations).

d) Climate Resilience Measures

The proposed project road would incorporate the following measures for enhanced climate resilience:

- Hydrology, drainage plan and protective works to be carried out for the project area. Several drainage structures will be added, and existing ones will be repaired/ rehabilitated/ reconstructed.
- Increasing the capacity of natural storage ponds to increase underground water levels.
- Providing roadside drainage in habitation sections of the project road. Stored water will be discharged in a channelized way by means of drains, for use by localities for harvesting and other daily needs.
- Bioengineering along the project stretch.

e) Safety

The project road would incorporate the following measures to improve road safety:

- A lot of accidents on this road have occurred due to insufficient

- carriageway width.
- Improvement of all major and minor junctions.
- Bypass/realignment for areas with habitations, villages/settlements.
- Uniformity in project cross-section and elements.
- Measures for pedestrian safety including at-grade pedestrian facilities with all safety measures, footpath cum drains in towns/urban areas, over-drains/paver tiles in urban/built-up areas.
- Traffic signs and markings (road studs, road signs, delineators).
- Bus bays which are properly designed so that buses and trucks are not haphazardly stopped/parked on the highway.
- Safety aspects including road junction improvement as per latest IRC manuals/codes.

f) Other Various Positive Impacts

Other various positive impacts and benefits expected from the proposed project are furnished below:

- Improvement of the project road would increase new economic and employment opportunities by catering good connection to new markets, production centre. As a result, villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local 'haats' and middlemen.
- With the project, good connectivity would attract industrialists; businessmen to set up agro-based industries and new business centre like fruits, vegetables. It will create opportunity in the uplift of poor farmers.
- Improve the condition of existing traffic flow by removing all bottlenecks at various locations.
- With road improvement, it will reduce the cost of transportation and fuel consumption.
- Increase the carrying capacity of the existing traffic volume and enable it to cater to the future traffic.
- Essential and emergency services like schools, health centre, public distribution system etc can be availed faster.

0.3 Salient Features of Project Road

The start point of the project road (NH-92) is at 'Y' Junction formed by NH-91 and NH-92 (existing 0.000 Km) at Bewar. The road passes through the districts of Mainpuri & Etawah and through important villages/towns like Kusumara, Kishni, Basrehar, Etawah and finally ends at „T" Junction of NH-19.

S.N	Description of	Details
1.	Road Sections	Package IA : Bewar to Karri (Km 0.000 to Km 30.000)
2.	Location	Uttar Pradesh
3.	Major Villages/Towns	Bewar, Kishni, Basrahar, Barlokpur, Sarsai Nawar and Etawah
4.	Terrain	Plain and Rolling
5.	Land use	The land along the project road is mostly agricultural land, followed by built up areas, where there is normally barren land.
6.	Type of soil	Loamy Silt, Silty clay, sandy and sandy clay

NH	State	Pkg. No.	Project Road Stretch	Design Chainage		Districts en-route	Design Length (km)
				To	From		
NH-92	Uttar Pradesh	IA	Bewar to Karri	0.000	30.00	Mainpuri & Etawah	30.000
		IB	Karri to Etawah	30.00	57.346	Etawah	27.346
	Total						57.346

The up-gradation proposals of existing road to two lane paved shoulder include the provisions geometric improvements, realignments, widening proposals and reconstruction, grade separators, pavement, road junctions, bridges and cross-drainages, special problems and road appurtenances. The adopted cross sectional elements as per the design standards are presented below:

S.N.	Particulars	Proposal
1	Project Stretch	Km 0.000 to Km 57.346
2	Project Length	57.346 km
3	Carriageway	7.0 m + paved shoulders+ earthen shoulders
4	ROW (m)	As shown in typical cross sections
5	Realignment	600 m (Km 51+980 to Km 52+580)
6	Bypass	4.150 km (46+420 to design chainage 50+580)

S.N.	Particulars	Proposal
7	Junctions	2 major junctions and 66 minor junction. All are improved as per IRC SP:41
8	Major Bridges	0
9	Minor Bridges	49 Reconstruction
10	Culverts	Reconstruction – 49
11	High Embankment Area	4760 m (In Package 1B)
12	Road Side Drain	18.092 km
13	Bus Bays/Bus Shelter	19
14	Toll Plaza	1
15	ROB	0
16.	Crash barrier	5646
17.	Road studs	7706 Nos
18.	Road signs	327 Nos.
19.	Delineators	2294 Nos.
20.	Footpath cum drain	18.092 Km
21.	Hazard markers	166 No"s
22.	Solar studs	340 No"s
23.	Rain Water Harvesting Structures	115 Locations
24.	Solar Streets Lights	743 Locations both sides

0.4 Baseline Environmental Conditions

Topography and Physiography: The area generally presents the appearance of an extensive level plain broken only by the sand ridges on the western border, the rolling sand hills and undulations of the Kali and Isan rivers, and the ravines along the Yamuna to the south-west. The Kali Nadi forms the boundary of this plain on the north and north-east and the Yamuna encloses it on the south-west. Both these rivers flow towards the south-east, and between them.

Geology: The project road is located in ganga alluvial plain which is sub-divided in older and newer alluvial plains.

Soil: The soil type all along the project is sandy loam with sand content between 55 and 65 percent. The Sodium Absorption Ratio is more than 1% at all locations. The soil quality analysis shows that at all the locations soil quality is basic in nature and the moisture content is between 15.3% to 22.4%. Electrical conductivity has been found to be in range of 220 to 340 μ mhos/cm. Water holding capacity is between 19.5 to 28.7%.

Hydrogeology: The project road section from Km 0+000 to Km 28+900 lies Mainpuri district is underlain by Quaternary alluvium comprising mainly clay, Kankar, sand and gravel over the basement of Pre-Cambrai Vindhyan formation. Different grades of sand and gravel form the multi aquifer system in the area. Ground water occurs under water table condition in phreatic zones and under semiconfined condition in deeper zones. The road after km 28+900 enters Etawah district, which occupies a part of Indo-Ganga plain and is underlain by quaternary sediments consisting clays, silt, kankar and sands of different grade. The sediments of newer alluvium are mainly arenaceous in nature and are found in topographically low region. These sediments are loose, unconsolidated, flood plain deposits or back swamp deposits and are confined in narrow strips all along the present drainage system.

Surface Water Resource: The project road crosses a number of streams and rivers. Main source of drainage in the project area passing through Mainpuri & Etawah district is Kali Nadi, Isan, Arind (Rind), Senger nadi, Sirsa nadi, etc. The project road is crossing many canals and distributaries. The area abounds in swamps and marshes particularly in the central portion.

The analysis of surface water quality of water bodies indicates that they have high BOD values and very low Dissolved Oxygen, in the range of 5.5 to 35.5 mg/l and 2.4 to 6 mg/l respectively. SW-5 has minimum BOD of 5.5 mg/l and maximum DO of 6mg/l. Total coliforms in surface water samples have been found to be high and ranging between 430 and 630 MPN/100ml. The Electrical conductivity for all sources vary from 263.91 to 596.65 $\mu\text{S}/\text{cm}$ and the pH lies in the range 7.4 to 8.4, i.e. basic in nature. The results indicate that there is disposal of domestic sewage in the monitored water bodies.

Ground Water: Ground water is an important source for catering to the needs of water consumption in the rural and urban areas. Therefore, any kind of deterioration in the quality of ground water owing to the developmental activities will pose threat to the local population and attention needs to be paid towards maintaining the quality of water using all possible tools. Since the ground water is used without treatment by a large portion of population for drinking purpose and domestic use, the quality of ground water is important.

The analysis results of the ground water samples at 5 locations reflect that the pH is within permissible limit. Total hardness at all locations is more than acceptable limits at Bewar, Kismi and Shekhpur, but within the permissible limits, highest value being 288.2 mg/l at GW-1 location, in

Bewar. Alkalinity is also found to be exceeding the acceptable limits at all locations with maximum value being 389.24 mg/l at Bewar. Values of Magnesium also found to be high at all locations but were under the permission value range, except at Bewar where Magnesium exceeded the permissible range of 100 mg/l and concentration found was 227mg/l. The Total dissolved solid varied from 198.6 mg/l to 413.34 mg/l at different locations along the project road. The concentration of chlorides, iron, fluoride concentration and other metals are below the permissible limit in all the samples taken along the project road.

Climate: The primary temperature, rainfall and wind features of the three Distinct Seasons of the state are:

- Summer (March–June): Hot & dry (temperatures rise to 45 °C, sometimes 47–48 °C); low relative humidity (20%); dust laden winds.
- Monsoon (June–September): 85% of average annual rainfall of 990 mm. Fall in temperature 40–45° on rainy days.
- Winter (October–February): Cold (temperatures drop to 3–4 °C, sometimes below –1 °C); clear skies; foggy conditions in some tracts.

Ambient Air Quality: Ambient air quality monitoring was conducted at five locations in respect of PM₁₀, PM_{2.5}, NO₂, SO₂ and CO. The results of air quality monitoring reflect that all the parameters are within the limits prescribed by CPCB. The test results indicate that average 24 hourly mean concentration of PM₁₀, PM_{2.5}, SO₂ and NO₂ in ambient air varied between 69.61 & 86.11 µg/m³, 25.86 & 38.81 µg/ m³, 7.37 & 8.25 µg/m³ and 14.27 & 16.37 µg/ m³, respectively along the project alignment. The average concentration of CO along the alignment varied between 436.25 and 783.75 µg/ m³. Other parameters SO₂, NO₂ and CO were also found to be within the National Ambient Air Quality Standards.

Ambient Noise Quality: To assess the background noise levels in the study area ambient noise monitoring was conducted at five locations. The ambient noise levels at all the monitoring locations were within the permissible level of residential and commercial zones as stipulated by Central Pollution Control Board. The average daytime equivalent noise levels were recorded in the range of 48.7 Leq dB(A) to 51.8 Leq dB(A) in residential areas of Barlokpur, Shekpur and Harharpur, whereas in commercial areas of Bewar and Kishni, average noise levels were 60.2 dB(A) and 58.2 dB(A) against the day time permissible value of 65 dBA.

Ecological and Biological Environment

Forest Land: The road side plantations along the Right of Way (ROW) of Highways in Uttar Pradesh have been declared as Protected Forest by the State's Department of Forest (Van Vibhag). The project require diversion of 60.379 ha forest land under the provisions of Forest (Conservation) Act, 1980.

The study area along the project road is majorly agricultural land. In the project area babul (*Acacia arabica*) grows in many places on the usar plains and is indeed, the only tree which flourishes on them. Its timber is in great demand both for fuel and carpentry. Its bark is used in tanning, its gumth in dyeing and in medicine. Beside babul other species of tree found in the area are Shishum (*Dalbergia sissoo*), Neem (*Azadirachta indica*), Papdi (*Terminalia catappa*), Siris (*Albizia lebbek*), Pipal (*Ficus religiosa*), Eucalyptus (*Eucalyptus Spp.*), Ashoka (*Polyathia longifolia*), Semal (*Salmaalial malabarica*), Gulmohar (*Delonix regia*), Akain (*Melia azedarach*), Gular (*Ficus racemosa*), Mango (*Mangifera indica*), Khair (*Acacia indica*), Bel (*Aeglamarnelos*), Bargad (*Ficus bengalensis*), Pakar (*Ficus indica*), Jamun(*Syzygium cumini*), Aonla (*Embllica officinal's*), etc.

Approximately 3132 trees are likely to be felled for upgradation of the project. All efforts will be made to minimise cutting of trees.

No rare, threatened or endangered flora or fauna is found along the project corridor.

There is no wetland along the project road as per Wetland (Conservation and Management) Rules 2017 and list of Wetlands of International Importance (Ramsar Sites).

5.0 Anticipated Environmental Impacts

The general environmental impacts expected due to the proposed upgradation of the project roads along with their suggested mitigation measures are given below. Impacts have been assessed based on the information collected from the screening & scoping of environmental attributes.

Issues	Impacts
Pre construction Phase	
Tree Cutting Permission	Approximately 3132 trees are likely to be felled for upgradation of the project. Prior permission will be

Issues	Impacts
	obtained for cutting trees required for construction of the road.
Diversion of Forest Land	The project road passes through protected forest area (road side plantation notified as protected forest area) and 60.379 ha diversion of forest land is required. Prior forest clearance will be obtained before starting the construction in the forest area.
Construction Phase:	
Topography and geology	Localised change in existing profile of the land due to borrow pits & construction of realignments.
Soil	- Earth works and newly constructed embankment will prone to erosion during rains. Erosion problems may occur on newly constructed slopes and earth fills in realignments depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Soil erosion will add siltation to the runoff during the monsoon season. - Disruption & loss of productive top soil from agricultural fields due to borrow pits - Loosening of top soil & loss of vegetative cover along the road due to excavation & back filling which will lead to enhanced soil erosion. - Run off from unprotected excavated areas can result in excessive soil erosion. - Contamination of soil is likely due to oil spill from the maintenance and operation of the construction machineries, unplanned disposal of scarified bitumen wastes, Spillage bitumen from operation of hot mix plant.
Land use	- Generation of solid wastes and Construction & Demolition Wastes from construction sites. - Changes in existing land use pattern of the proposed ROW for construction of the road.
Drainage	- Increased incidence and duration of floods due to obstruction of natural drainage courses by the road embankment. - Chances of filling of existing drainage courses during earth filling.

Issues	Impacts
Water use	• Impact on the local water sources due to use of construction water.
Water quality	• Degradation of surface water quality due to sediment transport with runoff through erosion of soil and earth may occur from activities like removal of trees, clearing and grubbing, removal of grass cover, excavation, stock piling of materials as part of the pre-construction, runoff from embankment for realignments, construction of major and minor bridges construction activities, etc. Discharge of sewage and waste from labour and plants, • Increase of sediment load in the run off from construction sites and increase in turbidity in receiving streams/water bodies. • Water pollution due to sewage from construction camps.
Fly Ash	• Utilization of Fly Ash in road construction and chances of related impact on air and water.
Air quality	• Impact on ambient air quality are anticipated due to site clearance and use of construction vehicles and machinery, transport of raw materials, borrow and quarry materials to construction sites, earthworks, stone crushing operations at the crushers, handling and storage of aggregates at the asphalt plants, Concrete batching plants, asphalt mixing plants due to mixing of aggregates with bitumen, etc. • Deterioration of air quality due to fugitive dusts emission from construction activities and vehicular movement. • Deterioration of air quality due to gaseous emissions from construction equipment & vehicular traffic. • Deterioration of air quality due to emission from asphalt and hot mix plants.
Noise level	• Impact on noise environment are anticipated due to operation and movements of construction machineries, DG set operations, operations of stone crushing, asphalt production plant and batching plants, etc. • Increase in noise level due to construction

Issues	Impacts
	activities, operation of construction equipment & vehicular traffic.
Flora& Fauna	• Felling of trees along the project road. • Cutting of trees by laborers for using wood as fuel. • Labors may poach on wildlife roaming in the area.
Construction camp	• Influx of construction work-force & suppliers who are likely to construct temporary tents in the vicinity. • Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers.
Occupational health & safety	• Occupational health and safety risks is anticipated to workers due to inadequate housekeeping and unsafe work practices at work sites. • Health problems to workers are likely due to inadequate sanitation and un-healthy environment at labour camps/plant sites.
Road safety	• Increase of incidence of accidents is anticipated due to disruptions of traffics movements in construction work zones on the project road. • Increase on incidence of road accidents due to disruptions caused in existing traffic movements.
Operation Phase	
Land use and Encroachment	• Change of land use by squatter/ encroachment within ROW and induced development outside the ROW.
Drainage	• Filthy environment due to improper maintenance of drainage.
Water quality	• Chances of contamination of water bodies from road surface run off containing oil spills due to traffic movement & accidents.
Air quality	• Air pollution due to vehicular emission from road traffic.
Noise level	• Noise pollution due to traffic noise.
Flora & fauna	• Illegal felling of road side plantation. • Effect on aquatic fauna in case of accidental spill of oil, fuel & toxic chemicals into water bodies

0.6 Analysis of Alternatives

The analysis of alternatives was carried for two lane upgradation with paved shoulders of the subproject. Analysis of alternatives was carried out for "With" and "Without" project scenarios. The minimization of environmental impacts by considering design alternatives determines the extent of mainstreaming of the environmental components. An evaluation of the bypass and alignment options for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) was carried out for arriving at the most promising alignment.

0.7 Public Consultation

Key stakeholders consultations were carried out in affected villages and key stakeholders. The comments received from participants have been incorporated in the DPR as necessary. Efforts were made to select both small and big habitations along the project road in order to get representation of all the segments of affected population. Prior intimation of at least 15 days before the planned consultation meeting was given to village office /sarpanch /villagers, so that the villagers were aware of date and location of meeting before hand for active participation. All relevant aspects of subproject design, details of land required and impact to private property were discussed with the affected communities.

0.8 Green Initiatives

The project has been designed by adopting the Green Highway Approach, which has led to substantial reduction in amount in raw materials required for the project. Use of fly ash in lieu of borrow soil, Cement Treated Sub-Base (CTSB) pavement, Recycled Asphalt Pavement (RAP) and mixing plastic in bitumen for bituminous coating have been proposed to overall reduce the requirement of virgin materials.

Use of Fly Ash

The thermal grade Indian coal contains 35 to 45% of ash resulting in generation of huge quantity of fly ash. Management and disposal of fly ash is an environmental issue. Storage of ash in ponds and mounds also require large amount of land.

The following characteristics of fly ash make it a preferred material for road construction.

- Lightweight as compared to commonly used fill material (local soils), therefore, causes lesser settlements.
- Higher value of California Bearing Ratio as compared to soil provides for a more efficient design of road pavement.
- Amenable to stabilisation with lime and cement.
- Can be compacted over a wide range of moisture content, and therefore, results in lesser variations in density with changes in moisture content.
- Easy to handle and compact because the material is light and there are no large lumps to be broken down.
- Can be compacted using either vibratory or static rollers.
- Offers greater stability of slopes due to higher angle of friction. Value of angle of internal friction increases even more upon compaction.
- High permeability ensures free and efficient drainage. After rainfall, water gets drained out freely ensuring better workability than soil, especially during monsoons. Work on fly ash fills/ embankments can be restarted within a few hours after rainfall, while in case of soil it requires much longer period. •
- Faster rate of consolidation; a major part of decrease in volume occurs during primary consolidation phase, which is generally rapid, thus making it an ideal material for road fills.
- Considerable low compressibility results in ease of compaction and shows negligible subsequent settlement within the fill.
- Conserves good earth, which is precious topsoil, thereby protecting the environment.
- Low sulphur content Indian fly ash (less than 0.6 %) can add long term strength and durability to sub grade.
- Fly Ash effectively dries wet soil and provides an initial rapid strength gain which is very useful during construction in wet, unstable ground conditions.
- Fly Ash decreases swelling potential of expansive soils.

Owing to the good CBR and reasonably low dry density and specific gravity, the fly ash can be considered as good embankment material.

Cement Treated Sub-Base (CTSB) Pavement

CTSB is made up of in-situ soils and aggregates mixed with specific quantities of cement dust. Pavements now constructed in India with CTSB are stronger than older granular base roads that have not been properly stabilized. When constructing with CTSB, it is possible to reduce the thickness of the base for the same weight and traffic volumes and still meet all IRC codes. Properly engineered CTSB pavements can distribute loads

over wider surface areas significantly reducing stress on sub-grade and increases the load-carrying specification of flexible pavements. Through various studies, it is observed that the pavement with conventional crust fails for distresses condition such as cracking, and rutting But the CSTB and CTSB better to resist in fatigue and rutting. Using CSTB/CTSB there is reduction in the bitumen consumption and the pavement thickness is reduced up to 100 mm. Also, the life of the pavements is longer than conventional pavement, hence requiring less maintenance.

Recycled Asphalt Pavement

Milling asphalt paved area instead of simply repaving over the existing asphalt surface and then laying a new asphalt pavement is a much more efficient way for a long term performance. Benefits of Recycling Asphalt:-

A. Environmental Benefits

- Recycling old asphalt reduces the amount of new oil needed in the construction process and may reduce dependence on foreign oil.
- Recycling saves on construction material waste since the recycled material is not sent to a landfill.
- Recycling the mineral particles that are produced during the process of asphalt pavement helps conserve natural resources.

B. Economic Benefits

- Save money with asphalt recycling.
- Contractors save by reducing energy, materials, and transportation costs.
- Asphalt can be recycled multiple times, ensuring its value.

C. Asphalt Benefits

The quality of asphalt pavement is improved when recycled pavement is used. There is a stronger cracking resistance because of the added mineral fillers and organic fibers used in the recycled materials. Other benefits include:

- Reduced demand for new asphalt pavement
- Reduced demand on aggregate
- Improved HMA mixes
- Improved asphalt stiffness
- Decreased likelihood for cracking
- Decreased susceptibility to rutting

- Decreased need for “virgin” asphalt

Mixing Plastic in Bitumen for Bituminous Coating

Waste plastics can be used in the production of asphalt mix. Waste plastics, mainly used for packing are made up of Polyethylene Polypropylene polystyrene. Their softening varies between 110°C – 140°C and they do not produce any toxic gases during heating but the softened plastics have tendency to form a film like structure over the aggregate, when it is sprayed over the hot aggregate at 160°C. The added bitumen spreads over the aggregate. At this temperature both the coated plastics and bitumen are in the liquid state, capable of easy diffusion at the inter phase. The shredded plastics on spraying over the hot aggregate melted and spread over the aggregate giving a thin coating at the surface. This process is further helped by the increase in the contact area.

The Plastics Coated Aggregates (PCA) is a better raw material for the construction of flexible pavement. PCA - Bitumen mix showed improved binding property and less wetting property. The cost of bitumen is much higher than that of plastics and this process also helps to save the natural resources. There is no maintenance cost for a minimum period of five years. Hence the process is cheap and eco-friendly as it saves plastic from landing into landfills.

0.9 Environmental Management Plan

Environmental management plan has been prepared for the pre-construction, construction and operation phase which mainly centered on the understanding of the interactions between the environmental settings and the project activities and the assessment of the anticipated impacts. Mitigation measures for anticipated environmental impacts have been elaborated as specific actions which would have to be implemented during the project implementation.

The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. Overall responsibility will be of Contractor for effective implementation of EMP and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities.

The PIU will be responsible to ensure implementation of EMP by the contractors with the overall accountability resting with the GNHCP-PMU. Whereas, the PIU/ Independent Engineer will ensure periodic quality audit/ guidance to the PIU and by imparting regular training, monitoring and

ensuring that all EMP provisions and requirements are translated into 'contract documents and that these requirements are implemented to their full intent and extent.

The EMP has been prepared for three stages of project road construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization Stage. The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause.

The environmental monitoring plan has been prepared construction, operation and maintenance phases. It consists of performance indicators, reporting formats and necessary budgetary provisions also.

Environmental monitoring plan has been prepared for ambient air quality monitoring, ambient noise levels, ground and surface water quality, quality of waste water discharge from labour camp during construction phases. Air quality monitoring and ambient noise levels monitoring during operation and maintenance phase.

Performance indicators parameters for each of the component have been identified and reported during various stages of the implementation.

The environmental reporting system for the monitoring programme will function at two levels (i) reporting for environmental condition indicators and environmental management indicators and (ii) reporting for operational performance indicators at the PMU/PIU level. The Contractor, Independent Engineer /PMC and PMU/PIU will operate the reporting system for environmental conditions and environmental management indicators. The reporting system will start with the Contractor who is the main executor of the implementation EMP activities. The Contractor will report to the Independent Engineer /PMC, who in turn will report to the PMU/PIU. Reporting will be weekly, monthly and quarterly.

Institutional mechanism and operational arrangements are important for EMP implementation. Within the institutional framework proposed for the project, preparation, implementation, supervision and monitoring of environment functions, particularly the Environment Management Plans (EMP), will be carried out at the three levels - national center, state level and the project/community level with an inbuilt mechanism for coordinating activities between the said levels. The Externally-Aided Projects Cell (EAP-Cell) at MoRTH, supported by a Project Management Consultants (PMC), will have the overall project implementation responsibility.

At the central level, the Chief Engineer, Externally Assisted Projects (CE, EAP), MoRTH, Govt. of India will be responsible for the over-all implementation of EMF and EMP. The CE, EAP will have all delegated administrative and financial decisions regarding the implementation of the project as well as environment management and safeguard related functions. CE (EAP) will be assisted by a team comprising Executive Engineer (EE) designated as an Environment and Social Officer (ESO) and a suitable number of technical and secretarial staff. The EE will ensure that all project activities are complied with as per the EMF and EMP.

MoRTH will engage a Project Management Consultant (PMC), which will include an Environment Specialist, to work with the CE, EAP's team. The PMC will be responsible for training, guidance, and recommendations for handling policy and implementation issues at the state and sub-project levels to comply with the EMF and requirements laid out in the EMP.

Supervision consultant/ Independent Engineer to be engaged by MORTH will provide the regular supervision and administration services. The Construction Supervision Consultant/Independent Engineer's team will have Environment and Safety personnel for day-to-day supervision and monitoring. The Environmental and Safety Officer on the Contractor's team must ensure compliance with the environmental contractual clauses and will report on progress or challenges to the Construction Supervisory team, as per the requirements/obligations stated in the Contract Document.

The environmental budget for implementation of various environmental management measures proposed for preconstruction, construction and operation of the project road has been estimated and given in EMP. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering cost.

Grievance Redressal Mechanism (GRM) arrangements to address workers' and public grievances have been prepared and functional during implementation of the project.

Chapter 1

Introduction

1.1 Project Background

The Uttar Pradesh Public Works Department (UPPWD), National Highway (NH) Division, under Ministry of Road Transport & Highways, MoRT&H intends to up-grade and maintain National Highway NH-92 connecting to Bewar-Etawah Section (Km 0.000 to Km 57.346) (Package 1A & 1B) Road in the State of Uttar Pradesh.

The Contract Agreement for preparation of feasibility study and Detailed Project Report for upgradation of the project road was signed among UPPWD through MoRTH & Redecon (I) Pvt. Ltd. on 28th July, 2017.

1.1.1 Green National Highways Corridor Project (GNHCP)

Two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 is proposed to be constructed under Green National Highways Corridor Project (GNHCP) through its support to the Govt. of India's Bharatmala Pariyojana and financed by the World Bank. It will promote the vision of enhancing effectiveness of the transport network of India with cost and natural resources efficiency and safe high capacity highways. The GNHCP operation is aligned with the Government of India's objective of eliminating poverty and ensuring access to minimum standard of basic needs for all citizens through investing in growth enablers transport & connectivity infrastructure. The basic proposition of the GNHCP includes strengthening of road pavement in addition to widening to two-lane/two-lane with paved shoulder standards and promoting/ demonstrating green and resilient approaches while doing so. The list of sub-projects identified for inclusion in this project are given below:

Sr. No.	State	Highway	Section	Length (in kms)
1.	Andhra Pradesh	NH-516E	Bowada to Vizianagram	26.94
2.	Andhra Pradesh	NH-516E	Paderu to Araku	49.37
3.	Himachal Pradesh	NH-707	Poanta Sahib to Gumma	94.99
4.	Himachal Pradesh	NH-707	Gumma to Fediz	9.80

Sr. No.	State	Highway	Section	Length (in kms)
5.	Rajasthan	NH-158	Ras-Beawar-Mandal	116.75
6.	Uttar Pradesh	NH-730C& NH-731K	Bewar- Pilibhit	183.380
7.	Uttar Pradesh	NH-92	Bewar- Etawah	57.346

1.2 Project Highway: Bewar- Etawah Road Section of NH 92

The project road starts from Bewar at Chainage Km 0.000, coordinates 27°13'01.25"N, 79°18'07.64"E and ends at Etawahat km 57.346 at junction with NH-2, coordinates 26°47'27.00"N, 79°02'05.67"E.

The project road starts at Bewar, passes through Kishni, Basrahar, Barlokpur, Sarsai Nawar, & finally ends at T-Junction of NH-2. Details of the project stretches are stated below in **Table 1.1**.

Table 1.1: Details of Project Stretches

NH	State	Pkg. No.	Project Road Stretch	Design Chainage		Districts en- route	Design Length (km)
				To	From		
NH-92	Uttar Pradesh	IA	Bewar to Karri	0.000	30.00	Mainpuri & Etawah	30.000
		IB	Karri to Etawah	30.00	57.346	Etawah	27.346
	Total						57.346

The index map of the project road has been shown in the **Figure 1.1**. The project road marked on Google Map is shown in **Figure 1.2**. The alignment marked on the Survey of India (SOI) toposheet is presented in the **Figure 1.3**.

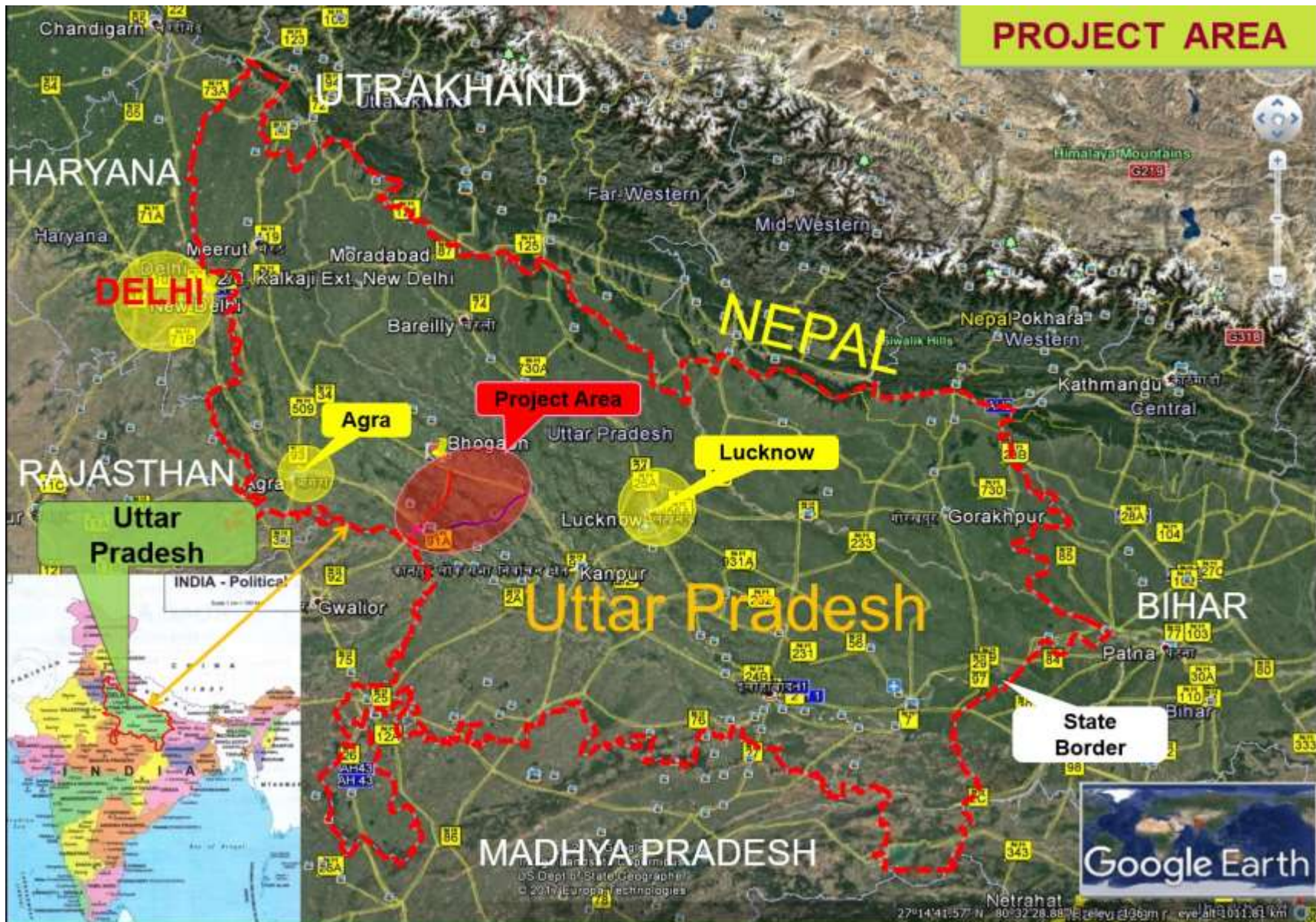


Figure 1.1: Index Map of the Project

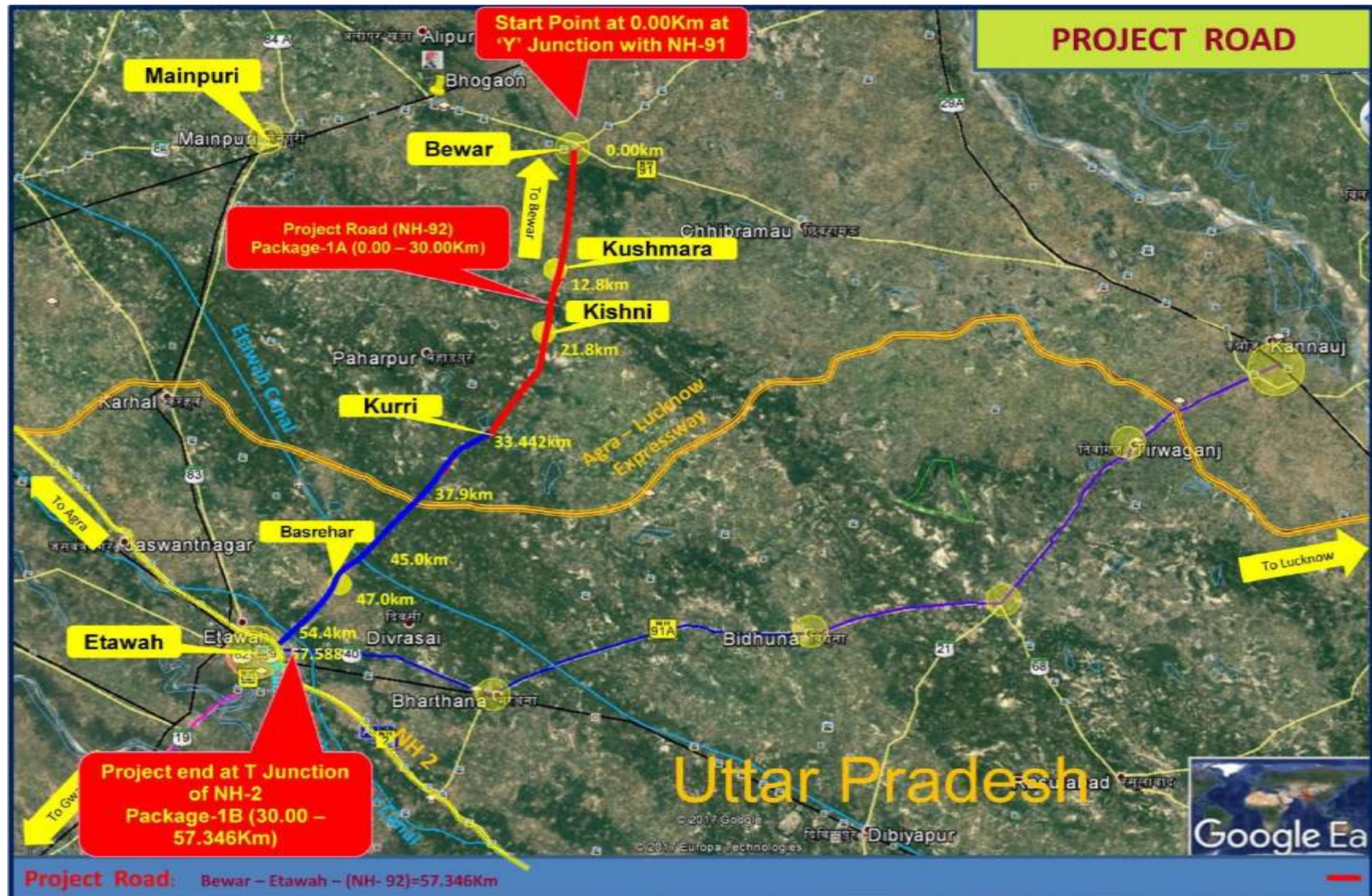


Figure 1.2: Project Road Marked on Google Map

REHABILITATION AND UP-GRADATION TO 2-LANE WITH PAVED SHOULDERS CONFIGURATION OF MAINPURI - ETAWAH SECTION (KM 0+000 TO KM 57+346) PACKAGE-1A AND PACKAGE-1B OF NH-92 UNDER GREEN NATIONAL HIGHWAYS CORRIDOR PROJECT (GNHCP) ON EPC MODE IN THE STATE OF UTTAR PRADESH.

LEGEND:-

Proposed Road Package-1A	
Proposed Road Package-1B	
Bypass	
District Boundary	
Chainage	

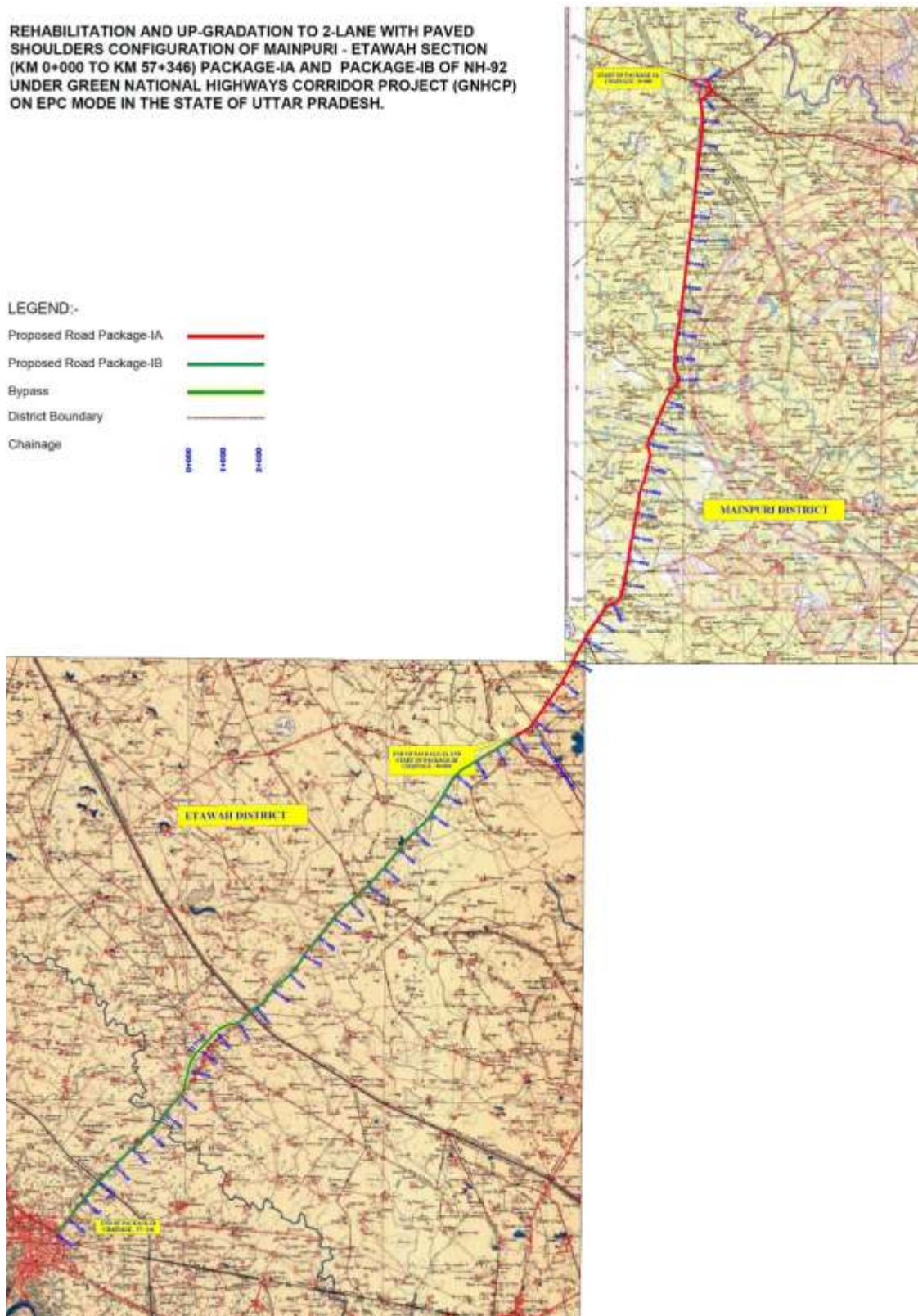


Figure 1.3: Project Road Alignment Marked on the Toposheet

1.3 Objectives of the Upgradation of the Project

The main objective of the project is for upgradation of existing road to two-lanes with paved shoulder configuration; and alleviate the current unsafe and congested conditions of the project road connecting the villages and towns, with one another and to the National Highway network for the benefit of the road users at large. A modest design speed for the safe and efficient movement of people and goods is seen as the objective and the design of consultants reflect this.

The project road is aimed to provide congestion free, safe and smooth road to the population residing along project road and other users travelling through the project road. The other objective of widening and strengthening the of project road is (with required cost effectiveness, coupled with environmental management standard) for achieving sustainable development of the region, state and ultimately to the country.

1.4 Existing Condition of the Project Road

The project road section from Bewar - Etawah Section (Km 0.000 to Km 57.346) of NH 92 passes through rural and semi urban sections. The total proposed length of the project road is 57.346 km. Major settlements along the project road are Kishni, Basrahar, Barlokpur, Sarsai Nawar. The existing project road is bituminous and varies from two lane to single lane with fair to poor riding quality. The existing road is two / single lane under the category of State Highway. The existing RoW on the project corridor varies from minimum of 9 m and maximum of 32 m as per the village revenue maps.

Details of existing road conditions are given in **Table 1.2**.

Table 1.2: Existing Road Condition

Sl. No.	Section	Chainage (from-to)	Lane Configuration	Category of Road	Existing ROW
1	Bewar to Karri	Km 0 to km 30	TwoLane	NH	20-32m
2	Karri to Etawah	Km 30 to 57.346	Two Lane	NH	20-32 m

1.5 Major Settlements on Project Road

Many villages and settlements are situated on either side of the project road. The details of settlements along the project road are presented in **Table 1.3**.

Table 1.3: Chainage Wise List of Settlements along the Alignment

S. No.	Existing Chainage(Km)		Length (Km)	Name of the Village
	From	To		
1	0.000	1.200	1.200	Bewar
2	1.200	2.300	1.100	Manjhola
3	1.550	2.000	0.450	Bhawalpur
4	2.300	3.050	0.750	Fatehpur Gani
5	3.050	3.850	0.800	Bajhera
6	3.850	4.100	0.250	Saraichak Govindpu
7	4.000	5.650	1.650	Chilaunsa
8	5.650	6.600	0.950	Paraunkha
9	6.600	8.500	1.900	Bara
10	8.500	9.900	1.400	Kundhi
11	9.900	10.200	0.300	Maheshpur
12	10.200	13.100	3.100	Kismra Dehat
13	13.200	11.200	2.000	Dharman Gadpur
14	13.100	15.050	1.950	Kusmara
15	15.050	16.750	1.700	Dadaus
16	16.750	18.900	2.150	Arsara
17	18.900	20.500	1.600	Saunasee
18	20.500	24.200	4.300	Kishni
19	24.200	26.500	2.300	Jatpura
20	26.500	29.000	2.500	Pharaijee
21	26.500	28.650	2.150	Khijarpur
22	28.650	30.000	1.350	Sarsai Nawar
23	30.000	31.000	1.000	Sarsainawar
24	31.000	33.000	2.000	Tirkhi Tirlokpur
25	33.000	38.000	5.000	Barlokpur
26	38.000	40.000	2.000	Moonj
27	39.000	40.000	1.000	Agupur-Gopalpur
28	42.000	43.000	1.000	Chobiya
29	43.000	47.000	4.000	Bhaktiyarpur
30	47.000	49.000	2.000	Basrehar
31	48.000	49.000	1.000	Badri Pooth
32	48.000	49.000	1.000	Shekupur Saraiya

S. No.	Existing Chainage(Km)		Length (Km)	Name of the Village
	From	To		
33	49.000	51.000	2.000	Akbur Pur
34	51.000	53.000	2.000	Amritpur
35	53.000	54.000	1.000	Udaypur
36	54.000	55.000	1.000	Harharpur
37	55.000	57.000	2.000	Dattawali
38	57.000	57.376	0.376	Etawah Town

Source: Detailed Project Report

1.6 Need of the Project Road

The need of the project road is described below:

- a) The proposed project road will facilitate the transportation of agriculture produce from the surrounding areas to their market places in Uttar Pradesh and National Capital Region (NCR) by enabling movement of heavy vehicles in all weather conditions.
- b) Improvement of the road geometrics will also attract more traffic to the region which in turn help in the upliftment of the living standards of the people and will also help in reduction of accidents.
- c) To meet the demand of safe and accident free travel, upgradation of the present project road is very much needed.
- d) The necessity of the project road is summarised below:
 - To improve road safety and accidents on the existing road.
 - To reduces travel time and fuel consumption by vehicles subsequently reduction GHG emissions.
 - To creates more health facilities, educational opportunities especially for women.
 - To enhances mobility to market places.
 - To facilitates overall economic development of the region.

1.7 Justification and Need for the project

The objective of the project road development is to enhance and improve transport connectivity through adopting green and climate resilient construction methods for the project National Highway network.

The proposed road up-gradation is necessary for better connectivity and efficient movement of logistics. It will prove to be effective for resource efficiency and will serve as climate resilient green and safe highway for traffic movement.

The project stretch starts from Bewar on NH-92 which is a major economic corridor connecting Delhi, Aligarh, Bewar & Kanpur to Lucknow from east to west direction. All the towns are major industrial zones of Uttar Pradesh.

The project stretch terminates in Etawah at 'T' Junction of NH-2 which connects Delhi & Kanpur Lucknow.

Importance of the Project Road: The importance of the project road are given below:

- NH 92 is an Interstate Highway from Bewar in UP to Gwalior in MP with lot of Religious, Commercial & Historical Importance,
- Project Road passes through Bewar, Baralokpur, Basrehar & Etawah upto MP Border,
- It Inter connects, NH 2, NH 91A, Agra – Lucknow Expressway and NH 91. (NH2 is a National Corridor & NH 91 is an Economic Corridor of UP),
- It passes through fertile Agriculture belt,
- It links Farrukhabad District which is a leading producer of Potatoes and a major Pilgrim center for Buddhists,
- It facilitates movement of Agricultural Products to Kanpur, Lucknow, Agra, Gwalior and Jhansi and manufactured goods from Kanpur, Agra and Lucknow,
- There are number of parallel roads in East-West direction and NH-92 is in North-South orientation providing connectivity to maximum usage of other roads,
- Project road links Safari Park and hence important for Tourism in Uttar Pradesh,
- Wholesale market of Garlic is located in Bewar and Wholesale Market of Potato is located in Farukkabad from where these produces are distributed to other states by using this road,
- Construction material like Stone, Sand etc. from Madhya Pradesh is supplied to various Districts of UP through this road,

- The wholesale market of Fruits and Vegetables at Etawah(Km 57+00) isupplies to various states like, MP, Maharashtra, Karnataka, Kashmir, Himachal Pradesh, etc. through this road,
- This road is a major route of “Kawarias” from MP state during Mahashivaratri Festival.
- The Road is a major route of Devotees coming to Kalivahan Mandir at Etawah, which is a major Religious center,
- The road Provides link to Indian Army Cantonment at Fatehgarh,
- Presently the Project Road is only 2 Lane with number of deficiencies and constraints.
- The existing pavement is not conforming to design standards with insufficient crust thickness,
- Bridges are mostly narrow with carriageway width of only 5.00m creating choke points,
- Culverts are mostly in poor condition having CW less than 7.00m,
- With the increasing traffic, Project Road is proposed to be widened to 2L+Paved Shoulders along with geometric improvements and other amenities,
- The proposed highway links NH 2, NH 91A, NH 91 & Agra - Lucknow Expressway,
- It provides connectivity to the following:
 - Wholesale Garlic Market at Bewar,
 - Wholesale Potato Market at Farukkabad,
 - Wholesale Fruits & Vegetable Market at Ettawah,
 - Safari Park at Etawah,
 - Stone & Sand Quarries of MP,
 - Buddhist Temple at Farrukabad,
 - Kalivahan Mandir at Etawah, and
 - India Army Cantonment at Fatehgarh

1.8 Benefits of the Project

a) Connectivity and Logistics

The proposed project road connects NH-91 at the starting and NH-2 at the 'T' Junction in Etawah Town. It will facilitate smooth transportation of heavy cargo vehicles for taking the harvested crops not only in the state of Uttar Pradesh but also in adjacent states of Rajasthan, Madhya Pradesh & Delhi, which will boost the economy of the farmers residing in the area.

The project road will also be instrumental in enhancement of tourism in the area as tourist from all across India will come to see the Etawah Lion Safari, officially Lion breeding center and multiple safari park, Etawah which is

recently opened for public. Moreover, National Chambal sanctuary also called the National Chambal Gharial Wildlife Sanctuary for the protection of the critically endangered gharial and red crowned roof turtle are major tourist spot just 45 minutes drive from Etawah.

b) Resource Efficiency

The project includes the following measures towards increasing resource efficiency:

- Milling of the existing pavement and its utilization by adding aggregates to achieve proper gradation through use of Recycled Asphalt Pavement (RAP) after undergoing recycling.
- Treating the existing subgrade with cement and admixtures to increase the CBR where reconstruction is proposed, thus reducing the proposed thickness of the road compared to conventional methods for pavement design.
- Re-using cut material in the construction of pavement, structure and slope protection work after proper testing and gradation.
- Utilizing municipal/plastic waste in bituminous course by approaching private organizations that provide plastic waste materials.

c) Green Highway

The proposed project highway includes the following specific interventions:

- Reducing the requirement of quantities of natural resources (soil, aggregates) in pavement construction by using stabilization techniques (cement and/or lime), using waste products in pavement construction (fly ash), and utilizing cut materials.
- Reducing the transportation requirements of pavement construction materials because of the reduction in required quantities of these materials.
- Reducing requirement in quantity of bitumen and its transportation by using recycling of existing asphalt/bituminous wearing course and use of cement concrete pavement.
- Water conservation through redevelopment/enhancement of 34 ponds (involving de-siltation of ponds to increase storage capacity, channelizing rain water to reach ponds, plantation of trees on the boundary of ponds, and protection of slopes of ponds by grass), and development of 27 rainwater harvesting structures.

- Utilizing renewable energy sources (solar lighting) on all built-up areas (27 locations).

d) Climate Resilience Measures

The proposed project road would incorporate the following measures for enhanced climate resilience:

- Hydrology, drainage plan and protective works to be carried out for the project area. Several drainage structures will be added, and existing ones will be repaired/ rehabilitated/ reconstructed.
- Increasing the capacity of natural storage ponds to increase underground water levels.
- Providing roadside drainage in habitation sections of the project road. Stored water will be discharged in a channelized way by means of drains, for use by localities for harvesting and other daily needs.
- Bioengineering along the project stretch.

e) Safety

The project road would incorporate the following measures to improve road safety:

- A lot of accidents on this road have occurred due to insufficient carriageway width.
- Improvement of all major and minor junctions.
- Bypass/realignment for areas with habitations, villages/settlements.
- Uniformity in project cross-section and elements.
- Measures for pedestrian safety including at-grade pedestrian facilities with all safety measures, footpath cum drains in towns/urban areas, over-drains/paver tiles in urban/built-up areas.
- Traffic signs and markings (road studs, road signs, delineators).
- Bus bays which are properly designed so that buses and trucks are not haphazardly stopped/parked on the highway.
- Safety aspects including road junction improvement as per latest IRC manuals/codes.

f) Other Various Positive Impacts

Other various positive impacts and benefits expected from the proposed project are furnished below.

- Improvement of the project road would increase new economic and employment opportunities by catering good connection to new markets, production centre. As a result, villagers would be able to transport their produce faster and get more profit margins instead of depending solely on local 'haats' and middlemen.
- With the project, good connectivity would attract industrialists; businessmen to set up agro-based industries and new business centre like fruits, vegetables. It will create opportunity in the uplift of poor farmers.
- Improve the condition of existing traffic flow by removing all bottlenecks at various locations.
- With road improvement, it will reduce the cost of transportation and fuel consumption.
- Increase the carrying capacity of the existing traffic volume and enable it to cater to the future traffic.
- Essential and emergency services like schools, health centre, public distribution system etc can be availed faster.

1.9 Need of Environmental Impact Assessment Study (EIA)

The objective of the environmental assessment of the project road is the characterisation of the existing status of the environment, to identify the probable adverse and positive impacts on the environment and community due to the proposed project and to delineate various measures to mitigate the adverse impacts and to enhance positive environmental impacts.

The environmental assessment provides tool for decision-making as well as it helps in ensuring the sustainable development with mitigating adverse environmental impacts by providing site specific Environmental Management Plan (EMP). In order to achieve these objectives, detailed surveys and monitoring have been carried out along the proposed project road to identify Valued Ecosystem Components (VEC) and project specific significant environmental issues (SEI).

1.10 Scope of Environmental Impact Assessment (EIA)

The scope of EA is to meet the Environmental Framework requirements and environmental assessment guidelines of the World Bank.

- Collecting primary and secondary environmental baseline data within the project boundary and surrounding areas;
- Assessing potential adverse environmental impacts that might arise during design, construction and operation phases with respect to design proposal of the project and using the environmental baseline study;
- Suggesting appropriate mitigation measures to effectively manage potential adverse environmental impacts; and
- Analyse the alternatives in terms of alternatives of upgradation of the alignment, technology, design and operation, including the "without and with project" situation. A detailed analysis for each of the alternatives, was carried out to analyse the feasibility in terms of capital and recurrent costs; their suitability under local conditions and quantify the environmental impacts to the extent possible, and attach economic values where feasible and explain the rationale behind the preferred/chosen option
- Consultation with the public/key stakeholders and incorporate their concerns into the project design;
- Developing an Environmental Management Plan (EMP) including environmental monitoring plan to implement suggested mitigation measures and management plans to minimise adverse impacts through effective management systems including formulation of monitoring and reporting requirements;

1.11 Approach and Methodology of EIA Studies

The methodology for the EIA study employs a traditional approach of identifying the environmental sensitivities along the project corridor and analysing the environmental issues identified. The EIA process simultaneously informs the design of the project road about these issues so that necessary modification can be carried to minimise these environmental concerns. Thereafter, the impact assessment that is carried out would identify the impacts which are still likely and also identify mitigation measures which need to be adopted during the construction and operation of the National highway.

1.11.1 Environmental Screening And Scoping

Environmental screening exercise of the project road was undertaken to facilitate inputs on environmental considerations; apart from social, economic and traffic & transport considerations. Further, this report will also provide scoping inputs in determining the major environmental issues and defines the scope of work for conducting environmental assessment.

As per the recommendation of the Environmental Screening, detailed Environmental Assessment will be taken up as a next step of the consultants in the assignment. The scoping exercise defines geographical boundaries for the project road for impact assessment as well as defining the project influence area to assess the impacts due to project interventions during construction and operation phases.

The environmental screening typically identifies the natural habitats (e.g. national parks, wildlife sanctuaries, sacred groves, protected areas, forests, water bodies etc.), major rivers and waterways, notified cultural heritage sites and any other potentially sensitive areas. The information available from secondary sources along with the inputs from the site visits and consultation with local people are used to identify these issues and sensitive receptors which might be located along the project corridor.

1.11.2 Delineation of The Project Impact Zone

For carrying out further environmental studies and subsequently the assessment it was required to delineate the Corridor of Impacts (COI) and project influence zone. Depending on the severity of impact the project influence zone has been classified as:

Corridor of Impact (COI) And Project Influence Zone

- a) The area of the proposed Right of Way (ROW) has been considered as the Corridor of Impact.
- b) Project Impact Zone is the 10km area on either side along the alignment. For land use study, are within 500 m on either side of the project road has been considered.

1.11.3 Collection of Primary And Secondary Environmental Data

Primary and secondary data were collected through field monitoring and various verifiable sources for different environmental components e.g. ambient air, soil, water, noise, climate, physiography, ecology, etc.

1.11.4 Collection of Primary Baseline Information

For gathering the baseline environmental condition along the project corridor baselines studies were conducted. These baseline studies carried out included:

- Baseline environmental surveys for assessing the ambient air, ground and surface water, soil and noise levels;
- Enumeration of trees to identify the location, number, types spread, girth etc. Local name, value of the trees within the proposed RoW;
- Ecological surveys to identify the habitats and the flora and fauna;
- Structure enumeration to identify the one likely to be impacted;
- Socio-economic surveys to identify the condition of the impacted persons.

In addition to the above survey interactions were carried out with the populations along the project corridor to gather local level information on the following:

- Local practices and traditions with respect to conservation and use of natural resources;
- Farming practices and Cropping pattern;
- Perception of the people about the project;
- Traffic surveys were used to estimate the present and future traffic; and
- Preliminary engineering surveys to identify the topographical features.

This information was used to develop the baseline environmental condition in the project area and identify the environmental sensitivities which might still get affected by the proposed alignment. The sources from which baseline information gathered are presented in **Table 1.4.**

Table 1.4: Secondary Data Collected for EIA Studies

Environmental and Social Aspect	Parameters of Concern	Source of Information
Climatic Condition in the Project Influence Area	Temperature and Rain Fall	IMD (Indian Metrological Department)

Environmental and Social Aspect	Parameters of Concern	Source of Information
Soil & Geology	Soil type and its stability, Fertility of the Soil potentiality for soil erosion	Geological Survey of India, State Mining Department
Slopes	Direction of slope, percentage of slope	Contour Survey, Satellite Imagery and Survey of India topographic sheets
Drainage/ Flooding	Existing drainage map and flooding level including its extent of water spread. Identification of drainage channel and its catchments area around the Project stretch	Satellite Imagery/ Toposheet /Hydrology study/State Water Resource Department.
Water Bodies and Water Quality	Identification of water bodies/canal/drainage channels where the run off surface water will flow/due to erosion and also due to spillage oil and other hazardous materials. Status of surface water and ground water quality	Topo sheets/field study. Hydrological data from the CGWA Reports
Air Quality	Air quality status of the project area.	Monitoring of the ambient air quality carried out by an NABL Accredited Laboratory.
Ambient Noise levels	Existing noise level in the project area	Monitoring of the ambient air quality carried out by an NABL Accredited Laboratory.
Forest Within Proposed ROW Legal Status – Protected Areas, Endangered Plant and Animal, Ecological Sensitive Area, Migratory Corridor/ route	Status of the forests, Conservation of forest area, & endangered plant and animal and any other species	Department of Forest, Govt. of Uttar Pradesh, DFOs, Discussion with local community and local FRO

Environmental and Social Aspect	Parameters of Concern	Source of Information
Trees and Vegetation Cover	Identification of existing tree species and the project influence area	Forest Department and Field Survey.
Settlements within the PROW	Settlements & its population along the corridor. Its location & numbers	Population/ District Census report 2011. Topographic survey data.
Cultural / Heritage and Ancient Structures.	Conservation areas if any Protected structures, monuments and heritage structures.	Archaeological Survey of India, State Archaeological Department

1.11.5 Consultation With Key Stakeholders

During the EIA process, a preliminary identification of key stakeholders was carried out. An inventory of actual / potential stakeholders, including local groups and individuals, local institutions which may be directly or indirectly affected by the project or with interest in the development activities in the region was made at a preliminary stage. This inventory was arrived through discussions with local UPPWD official and also in consultation with members of the local community.

Consultation with the community is a continual process that was carried out during the EIA study and would also be continued during the construction and operation phases of the project. The consultations with community and local institution like panchayat also helped in developing preliminary understanding of the requirement of people in the area and identification of the enhancement proposals.

1.11.6 Impacts Identification And Evaluation

The principal impact assessment (IA) steps comprise of the following:

- Impact prediction: to determine what could potentially happen to resources/ receptors as a consequence of the project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/ receptor.

- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

The collected baseline data shall be analyzed to establish the existing environmental conditions and identify the potential environmental impacts due to the proposed project on land environment, water environment, air & noise environment, biological environment and socio-economic and health environment. Based on the assessed impacts both negative & positive, environmental mitigation / enhancement measures shall be recommended.

1.11.7 Analysis of Alternatives

Since the project is the widening of existing road, therefore, alternative assessment has been undertaken for construction technology only.

1.11.8 Public Consultation with key Stakeholders

Stakeholders were consulted for identification of environmental and social issues prevailing in the area and incorporate their opinion while designing the alignment.

1.11.9 Environmental Management And Monitoring

The final stage in the EIA Process is preparation of the management and monitoring measures that are needed to ensure:

- a) Anticipated environmental impacts and their associated project components remain in conformance with applicable regulations and standards; and
- b) Mitigation measures are effectively implemented.

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation & function. The EMP envisages the plans for the proper implementation of management measures to be adopted during design, construction and operation stages of the proposed project to reduce the adverse impacts arising out of the project activities. The EMP shall address the following:

Stage-wise Environmental Management Measures: This includes a list of all project-related activities at different stages of project (pre-construction stage, construction stage and operation & maintenance stage), remedial measures, reference to laws/ guidelines, monitoring indicators & performance target and institutional responsibility.

Institutional Arrangements: Responsibilities for implementing the mitigation and management measures suggested in EMP shall be defined in this section.

Environmental Monitoring Program: To ensure the effective implementation of the EMP, it is essential that an effective monitoring program be designed and carried out. Monitoring schedule during construction and operation stages is to be prepared covering parameters to be monitored, location of the monitoring sites, frequency and duration of monitoring and institutional responsibilities for implementation and supervision.

Monitoring and Reporting Procedure: The procedures shall be designed to ensure early detection of conditions that require corrective action. It shall provide information on the progress and results of mitigation and institutional strengthening measures.

EMP Budget: The budgetary provision for the implementation of the environmental management plan is to be worked out, which shall be integrated into the total project costs.

1.12 The Limitations of EIA Study

The EIA report is based on the preliminary designs which were prepared for the road. The final Highway design will be verified and finalised by the contractor within the Scope of Services given by MORTH before the initiation of construction. Even though no major changes are expected in the design the EIA report needs to be verified against the final engineering design. Further, the report has been developed on certain information available at this point of time, scientific principles and professional judgement to certain facts with resultant subjective interpretation. Professional judgement expressed herein is based on the available data and information.

1.13 Structure of The EIA Report

The EIA report for the project road has been prepared complying country regulations and The World Bank Guidelines for Environmental Assessment. The EIA report has been structured in the following Chapters:

Executive Summary in the beginning of the EIA report.

Chapter 1 as Introduction describes background, brief description of project road, needs and benefits of the project road, scope of environmental assessment, needs of EIA study, approach and methodology adopted and structure for EIA report.

Chapter 2 as Project Description describes existing road conditions and facilities, traffic projections, right of way, proposed realignment, proposed roadway improvements, bridge and cross drainage structures, junctions improvement, underpass, community facilities, construction materials requirement and sources, way side amenities, road safety improvement proposal, etc.

Chapter 3 as Policy, Legal and Administrative Framework presents the legal and administrative framework of World Bank, Government of India and Government of Uttar Pradesh. This section underlines various clearances, permissions, consents involved for the project road at the State level and at the Central level.

Chapter 4 as Baseline Environmental Conditions presents the existing environmental conditions along the corridor, which were ascertained by conducting a field survey along with collection of secondary information pertaining to the corridor. Primary data for various environmental parameters was generated using suitable monitoring devices. The methodology was strictly adhered to the stipulated guidelines by MOEF&CC and CPCB.

Chapter 5 as Anticipated Environmental Impacts describes identification and evaluation of anticipated environmental impacts caused on various environmental and social parameters by the various activities proposed for the upgradation of the project road.

Chapter 6 as Analysis of Alternatives presents analysis of alternatives carried out during EIA studies considering with and without project, alternatives for bypass and realignment, pavement technologies, construction materials, etc.

Chapter 7 as Green Initiatives Chapter describes green highway, green initiatives, GHG emissions reductions and climate resilient initiatives adopted in the project and estimated GHG emissions reduction.

Chapter 8 as Consultations with Key Stakeholders provides details of consultation carried out in order to know the feedbacks of local population and

the project affected people (PAP). Key stakeholder Consultation meetings were held with the stake holders to record their views on the environmental issues pertaining to the road and the suggested remedies to be adopted for the proposed project road.

Chapter 9 as Environmental Management Plan describes mitigation measures to avoid or minimization of anticipated environmental impacts during design, preconstruction, construction and de-mobilization phases. Environmental Management Plan that includes institutional aspects of the project implementation and cost estimates for implementation of EMP.

Annexure referred in the EIA report have been enclosed at the end of EIA report as Annexure.

Chapter 2

Project Description

2.1 Existing Highway

The Uttar Pradesh Public Works Department (UPPWD), National Highway (NH) Division, under Ministry of Road Transport & Highways, MoRT&H intends to up-grade and maintain National Highway NH-92 connecting to Bewar-Etawah Section (Km 0.000 to Km 57.346) (Package 1A & 1B) Road in the State of Uttar Pradesh.

The start point of the project road (NH-92) is at 'Y' Junction formed by NH-91 and NH-92 (existing 0.000 Km) at Bewar. The road passes through the districts of Mainpuri & Etawah and through important villages/towns like Kusumara, Kishni, Basrehar, Etawah and finally ends at „T" Junction of NH-19.

The project area is mainly passing through the village settlement and urban patches. The features of existing alignment showing the important structures along the road, forest and non-forest areas, river / canals, ponds, industries, etc., is shown on a strip map given in **Annexure 2.1**.



Agriculture Land Along the Road



Built-up Section Along the Road



Road Sides View

2.1.1 Terrain

Terrain along the road/highway is classified by the general slope of the country across the highway alignment as per IRC-73 2015 and with this criteria the entire length of the project road on NH 92 from Bewar to Etawah is in plain and rolling terrain.

2.1.2 Road Section and Pavement

The existing carriageway of the project highway is generally of 2-lane configuration except few built-up sections where 4 lane configurations is present. The carriageway width varies in between 6.00 m to 9.00 m.

2.1.3 Existing Carriageway Width

The existing project road is bituminous and varies from two lane to single lane with fair to poor riding quality. The details of existing carriageway and improvement proposal are given below in **Table 2.1**

Table 2.1: Details of Existing Carriageway

Sr. No.	Section	Chainage (km)	Lane Configuration	Category of road	Existing ROW
1	Bewar to Etawah	Km 0+000 to Km 57+346	Two Lane	NH-92	8-32 m

Source: Detailed Project Report

2.1.4 Existing Right-of-way

Existing ROW as per information procured by Revenue Department is between 6m to 37m. The proposed additional ROW varies from 15m to 30m, also it exceeds at the locations where there is realignment or other project facilities have been proposed.

The details of package wise existing RoW are given below in **Table 2.2:**

Table 2.2: Details of Existing RoW

Existing Location (km)		EROW (m)
From	To	
Package 1A		
0.000	1.172	26-37
1.172	1.492	24-32
1.492	2.320	28-32

Existing Location (km)		EROW (m)
From	To	
2.320	3.020	28-32
3.020	3.830	24-30
3.830	4.050	22-31
4.050	5.660	23-32
5.660	6.610	24-34
6.610	8.385	21-33
8.385	9.965	25-33
9.965	10.305	25-29
10.305	11.208	33-32
11.208	15.050	32-34
15.050	16.750	30-33
16.750	18.920	33-34
18.920	20.540	32-34
20.540	24.265	29-34
24.265	26.235	28-34
26.235	26.780	15-18
26.780	28.360	25-27
28.360	28.885	17-22
28.885	29.345	22-25
29.345	30.000	22-25
Package 1B		
30+000	30+180	18
30+180	30+430	17
30+430	30+450	18
30+450	30+540	28
30+540	30+605	27
30+605	30+800	28
30+800	30+930	30
30+930	31+085	31
31+085	31+310	28
31+310	31+430	26
31+430	31+614	26
31+614	31+700	28
31+700	31+815	24

Existing Location (km)		EROW (m)
From	To	
31+815	31+880	22
31+880	31+980	20
31+980	32+050	22
32+050	32+108	24
32+108	32+200	20
32+200	32+350	24
32+350	32+420	28
32+420	32+485	22
32+485	32+520	20
32+520	32+690	21
32+690	32+818	20
32+818	32+870	20
32+870	32+925	21
32+925	33+070	21
33+070	33+200	20
33+200	33+355	20
33+355	33+376	24
33+376	33+570	24
33+570	33+770	24
33+770	33+980	24
33+980	33+990	18
33+990	34+166	18
34+166	34+195	18
34+195	34+291	18
34+291	34+310	16
34+310	34+330	16
34+330	34+385	16
34+385	34+424	16
34+424	34+460	18
34+460	34+515	18
34+515	34+544	18

Existing Location (km)		EROW (m)
From	To	
34+544	34+583	16
34+583	34+597	16
34+597	34+603	15
34+603	34+620	15
34+620	34+626	16
34+626	34+672	16
34+672	34+677	16
34+677	34+779	16
34+779	34+787	16
34+787	34+819	16
34+819	34+827	16
34+827	34+893	17
34+893	34+903	18
34+903	34+940	18
34+940	35+003	18
35+003	35+100	17
35+100	35+107	17
35+107	35+110	16
35+110	35+190	14
35+190	35+210	14
35+210	35+213	12
35+213	35+230	12
35+230	35+271	12
35+271	35+302	12
35+302	35+312	12
35+312	35+330	12
35+330	35+350	12
35+350	35+418	13
35+418	35+428	13
35+428	35+478	15
35+478	35+495	15

Existing Location (km)		EROW (m)
From	To	
35+495	35+505	16
35+505	35+532	16
35+532	35+544	16
35+544	35+578	16
35+578	35+605	14
35+605	35+610	14
35+610	35+620	12
35+620	35+642	9
35+642	35+652	6
35+652	35+706	6
35+706	35+716	4
35+716	35+724	4
35+724	35+770	5
35+770	35+780	6
35+780	35+858	7
35+858	35+912	8
35+912	35+942	8
35+942	35+943	9
35+943	35+985	9
35+985	35+995	8
35+995	36+010	8
36+010	36+021	8
36+021	36+028	6
36+028	36+050	6
36+050	36+063	6
36+063	36+076	8
36+076	36+093	10
36+093	36+095	10
36+095	36+133	10
36+133	36+140	8
36+140	36+148	8

Existing Location (km)		EROW (m)
From	To	
36+148	36+170	8
36+170	36+200	8
36+200	36+213	10
36+213	36+256	10
36+256	36+264	8
36+264	36+286	7
36+286	36+306	9
36+306	36+310	10
36+310	36+318	11
36+318	36+328	11
36+328	36+338	11
36+338	36+373	12
36+373	36+396	12
36+396	36+415	12
36+415	36+417	10
36+417	36+449	10
36+449	36+464	10
36+464	36+480	12
36+480	36+508	12
36+508	36+534	12
36+534	36+550	12
36+550	36+578	15
36+578	36+593	15
36+593	36+603	16
36+603	36+627	16
36+627	36+668	16
36+668	36+705	16
36+705	36+729	14
36+729	36+744	12
36+744	36+754	12
36+754	36+759	9

Existing Location (km)		EROW (m)
From	To	
36+759	36+762	9
36+762	36+774	8
36+774	36+828	9
36+828	36+838	10
36+838	36+866	10
36+866	36+900	10
36+900	36+915	12
36+915	36+928	12
36+928	36+958	15
36+958	36+962	15
36+962	36+975	14
36+975	37+025	14
37+025	37+058	13
37+058	37+072	13
37+072	37+143	14
37+143	37+146	16
37+146	37+150	18
37+150	37+170	18
37+170	37+175	18
37+175	37+181	16
37+181	37+195	14
37+195	37+205	14
37+205	37+216	13
37+216	37+230	12
37+230	37+266	12
37+266	37+291	13
37+291	37+301	13
37+301	37+306	14
37+306	37+311	14
37+311	37+316	16
37+316	37+343	16

Existing Location (km)		EROW (m)
From	To	
37+343	37+358	16
37+358	37+378	16
37+378	37+430	14
37+430	37+450	14
37+450	37+468	14
37+468	37+610	14
37+610	37+617	14
37+617	37+625	14
37+625	37+680	20
37+680	37+750	20
37+750	37+816	20
37+816	37+821	16
37+821	37+852	16
37+852	37+910	15
37+910	37+914	15
37+914	37+925	14
37+925	38+069	14
38+069	38+099	16
38+099	38+149	16
38+149	38+199	15
38+199	38+215	15
38+215	38+258	15
38+258	38+365	16
38+365	38+420	16
38+420	38+465	16
38+465	38+486	16
38+486	38+498	13
38+498	38+545	13
38+545	38+682	13
38+682	38+722	13
38+722	38+725	14

Existing Location (km)		EROW (m)
From	To	
38+725	38+743	14
38+743	38+811	15
38+811	38+853	16
38+853	38+956	16
38+956	39+045	17
39+045	39+094	17
39+094	39+100	16
39+100	39+115	17
39+115	39+130	17
39+130	39+167	17
39+167	37+292	17
37+292	39+296	17
39+296	39+428	20
39+428	39+505	20
39+505	39+533	19
39+533	39+545	19
39+545	39+670	18
39+670	39+680	17
39+680	39+705	17
39+705	39+767	17
39+767	39+865	16
39+865	39+909	16
39+909	39+918	16
39+918	40+042	14
40+042	40+058	14
40+058	40+120	16
40+120	40+170	16
40+170	40+195	18
40+195	40+286	18
40+286	40+295	18
40+295	40+327	17

Existing Location (km)		EROW (m)
From	To	
40+327	40+386	17
40+386	40+406	18
40+406	40+413	16
40+413	40+545	16
40+545	40+500	15
40+500	40+580	15
40+580	40+700	32
40+700	40+760	28
40+760	41+105	26
41+105	41+200	24
41+200	41+550	24
41+550	41+800	28
41+800	41+825	26
41+825	41+845	26
41+845	42+000	24
42+000	42+130	16
42+130	42+270	16
42+270	42+360	28
42+360	42+500	26
42+500	42+605	22
42+605	42+650	18
42+650	42+875	20
42+875	43+070	24
43+070	43+125	24
43+125	43+221	26
43+221	43+556	26
43+556	43+827	26
43+827	43+863	24
43+863	43+893	20
43+893	44+030	20
44+030	44+125	20

Existing Location (km)		EROW (m)
From	To	
44+125	44+310	20
44+310	44+325	19
44+325	44+442	19
44+442	44+444	17
44+444	44+473	17
44+473	44+480	16
44+480	44+493	14
44+493	44+511	15
44+511	44+516	16
44+516	44+542	18
44+542	44+551	18
44+551	44+568	20
44+568	44+594	22
44+594	44+650	22
44+650	44+950	18
44+950	46+400	20
46+400	50+580	Re-alignment 30mtr Acquisition Proposed
51+580	52+320	24
52+320	52+970	24
52+970	53+140	20
53+140	53+252	19
53+252	53+345	20
53+345	53+660	20
53+660	53+870	20
53+870	54+000	19
54+000	54+270	21
54+270	54+600	22
54+600	54+710	22
54+710	54+735	20
54+735	54+785	20
54+785	54+815	22

Existing Location (km)		EROW (m)
From	To	
54+815	54+865	21
54+865	54+880	22
54+880	54+895	27
54+895	54+970	27
54+970	54+992	27
54+992	55+100	24
55+100	55+105	24
55+105	55+180	30
55+180	55+260	30
55+260	55+340	28
55+340	55+390	28
55+390	55+415	26
55+415	55+430	25
55+430	55+513	28
55+513	55+535	29
55+535	55+600	25
55+600	55+650	25
55+650	55+750	20
55+750	55+830	18
55+830	55+890	18
55+890	55+900	18
55+900	55+930	18
55+930	55+940	18
55+940	55+960	19
55+960	55+975	20
55+975	56+080	20
56+080	56+110	20
56+110	56+150	30
56+150	56+320	30
56+320	56+345	26
56+345	56+370	28

Existing Location (km)		EROW (m)
From	To	
56+370	56+460	30
56+460	56+660	25
56+660	56+820	24
56+820	56+880	25
56+880	56+945	25
56+945	57+000	24
56+980	57+050	20
57+050	57+135	17
57+135	57+270	16
57+270	57+290	20
57+290	57+346	20

2.1.5 Accident Prone Locations

Accidental blackspot identified in the following locations are given in the **Table 2.3**.

Table 2.3: Black Spot Locations

Sl. No.	From (km)	To (km)	Location
1.	35.850	35.900	Baralokpur
2.	46.850	47.000	Town Basrehar
3.	51.500	51.600	Amritpur Village
4.	57.050	57.150	Barthana Chawk

2.2 Traffic Projection

AADT is the base year (2017-18) traffic. This is a product of ADT and seasonal variation factor. Seasonal variation factor can be derived using various methods. For this survey seasonal correction factor has been taken as 1.00. Vehicle data from existing toll booth, check posts etc. or sale details of petrol and diesel fuels along the corridor are the commonly used sets of data. In the present case fuel sale data is used, which is collected from various fuel outlets along the project stretch. Sales of motor spirit or petrol (MS) and high speed diesel (HSD) in each month for the last two years are used to arrive at seasonal correction factors.

The study aims at obtaining the existing traffic and travel characteristics on the project corridor and forecasting the same for the project horizon year considering various constituent streams and various scenarios. The results of this analysis will form inputs for developing capacity augmentation proposals, designing the pavement, design of intersections, decisions regarding grade separators, pedestrian facilities and carrying out economic and financial analysis. The average daily traffic (ADT) has been converted to average annual daily traffic (AADT) using seasonal correction factors. The AADT is the input for various analyses like traffic forecast, capacity augmentation, pavement design, economic and financial analysis etc.

The projected traffic volume for the project road is given in **Table 2.4**:

Table 2.4: Projected Traffic Volume

Road Section	Traffic Projections							
	2020		2025		2030		2035	
	Nos	PCU	Nos	PCU	Nos	PCU	Nos	PCU
(0+000-57+346)	1855	7424	2367	9475	3021	12093	3856	15434

2.3 Development Proposal for Proposed Upgradation of the Project Road

2.3.1 Design Speed/Parameters

The following design standards have been adopted as per Indian Roads Congress (IRC) guidelines, contained in IRC: 73, IRC: 86, IRC: 38, IRC 58-2011 and IRC: SP: 23 and is given in **Table 2.5**:

Table 2.5: Design Parameters

Item	Plain / Rolling Terrain
Design Speed (kmph)	Ruling -100 Kmph Min.- 80 kmph
Sight distance (minimum)	180 m
Proposed Land width (ROW)	Open areas - 30m Built-up areas - 30 m
Lane configuration	2-lane with paved shoulders
Formation width	As per Typical cross sections
Camber/cross fall	2.5 %
Shoulders	2.5 % for paved shoulder and 3.0 % for earthen shoulder
Side Slope	1 (V): 2 (H) Fill (Fill height upto 3.0 m)

Item	Plain / Rolling Terrain
	1 (V): 1.5 (H) Fill (Fill height 3 m to 6.0 m) 1 (V): 1 (H) Cut
Maximum super-elevation	7.0 %
Radii of horizontal curves in plain/hilly terrain (m)	Ruling Min – 400 m / 150m Absolute Min – 250 m / 75m
Drains	“Rectangular “shape on - either side where warranted depending on Site Condition.

Source: Detailed Project Report

2.3.2 Alignment

In general, roadway width in 2 lane sections shall be 14.00 which includes 7.00 m main carriageway and 1.50 m paved shoulder & 2.00 m earthen shoulders on each side. In Urban section of 2 Lane stretches service road has been proposed of 5.5 m carriageway with RCC Drain (1.50 m) on each side.

2.3.3 Bypass

One bypass has been proposed in Package 1B from design chainage 46+420 to design chainage 50+580. Total design length of the proposed bypass is 4.160 km.

2.3.4 Realignments

Realignment has been proposed for 600 m length from design chainage 51+980 to design chainage 52+580.

2.3.5 Widening Proposal with Typical Cross Section

The widening proposals for package – 1A & 1B are given below:

- **Road Width** - Road width for plain and built-up areas have been shown in Typical Cross Sections provided in subsequent sections.
- **Carriageway Width** - Two Lane Carriage way (3.5m for each lane) has been proposed.
- **Shoulders** - Unpaved shoulders of 2.00 wide and paved shoulder of 1.50m have been proposed on either side of the Carriage way.
- **Widening Scheme**- The widening scheme is provided in **Table 2.6**.

Typical cross sections for the upgradation of the project road are given in **Figure 2.1 to 2.4**.

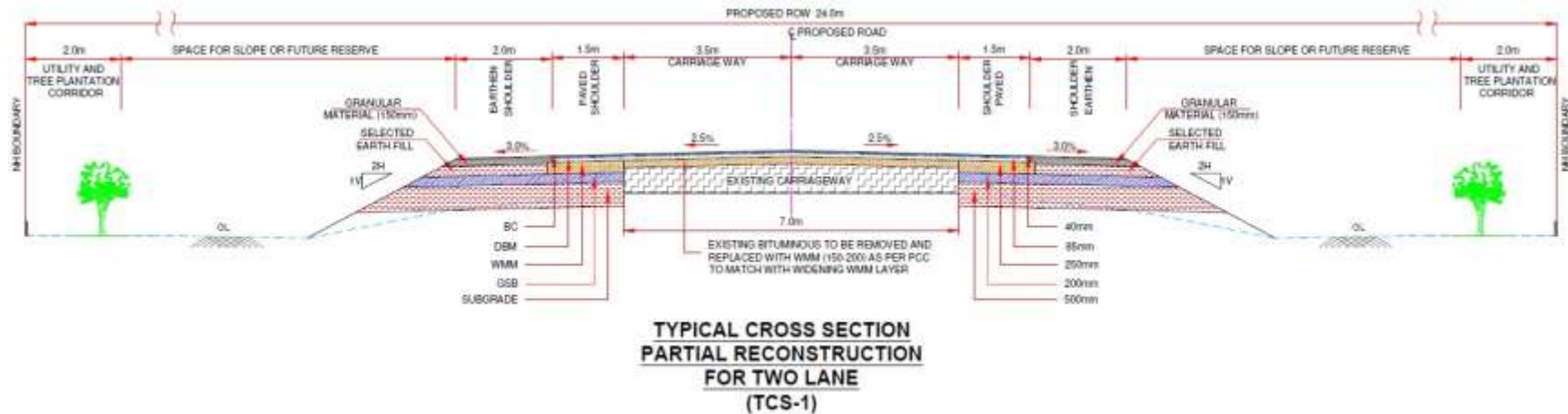


Figure 2.1: Typical Cross Section Partial Reconstruction for Two Lane

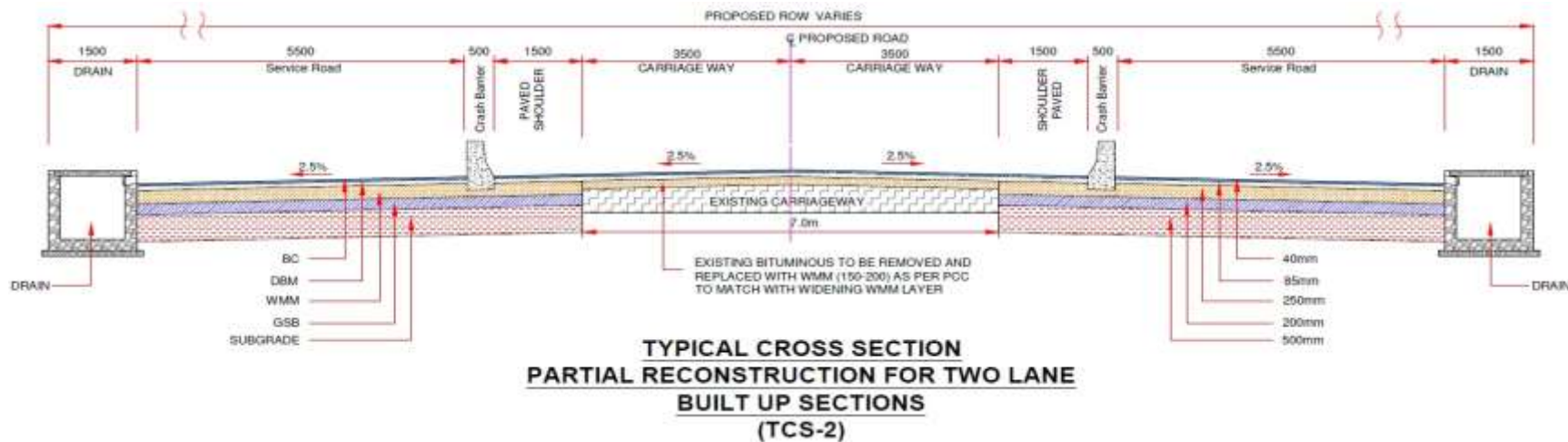


Figure 2.2: Typical Cross Section Partial Reconstruction for Two Lane in Built-up Section

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

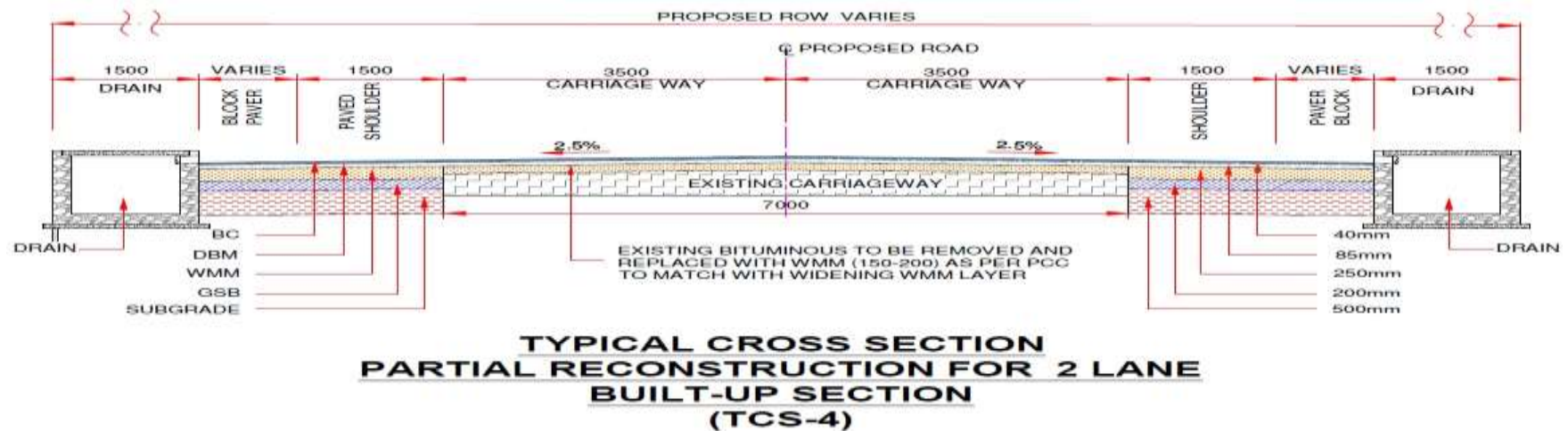


Figure 2.3: Typical Cross Section Partial Reconstruction for Two Lane in Built-up Section

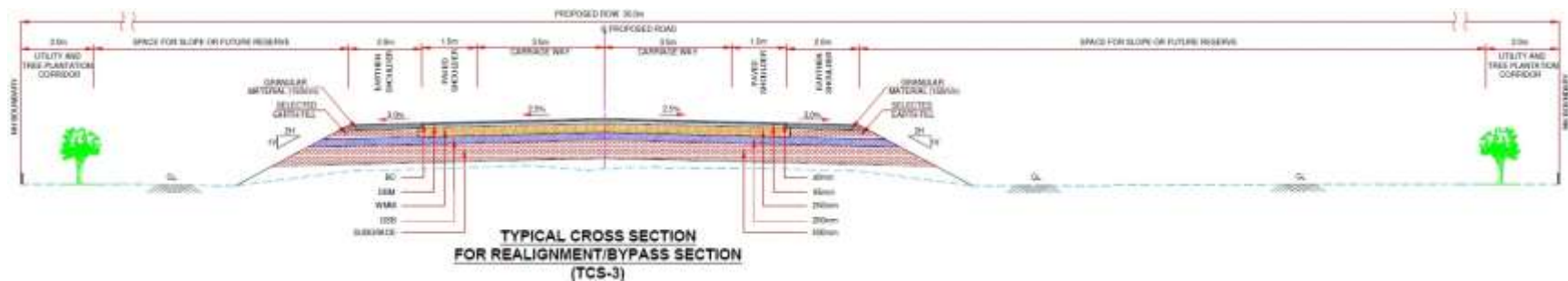


Figure 2.4: Typical Cross Section for Realignment/Bypass Section

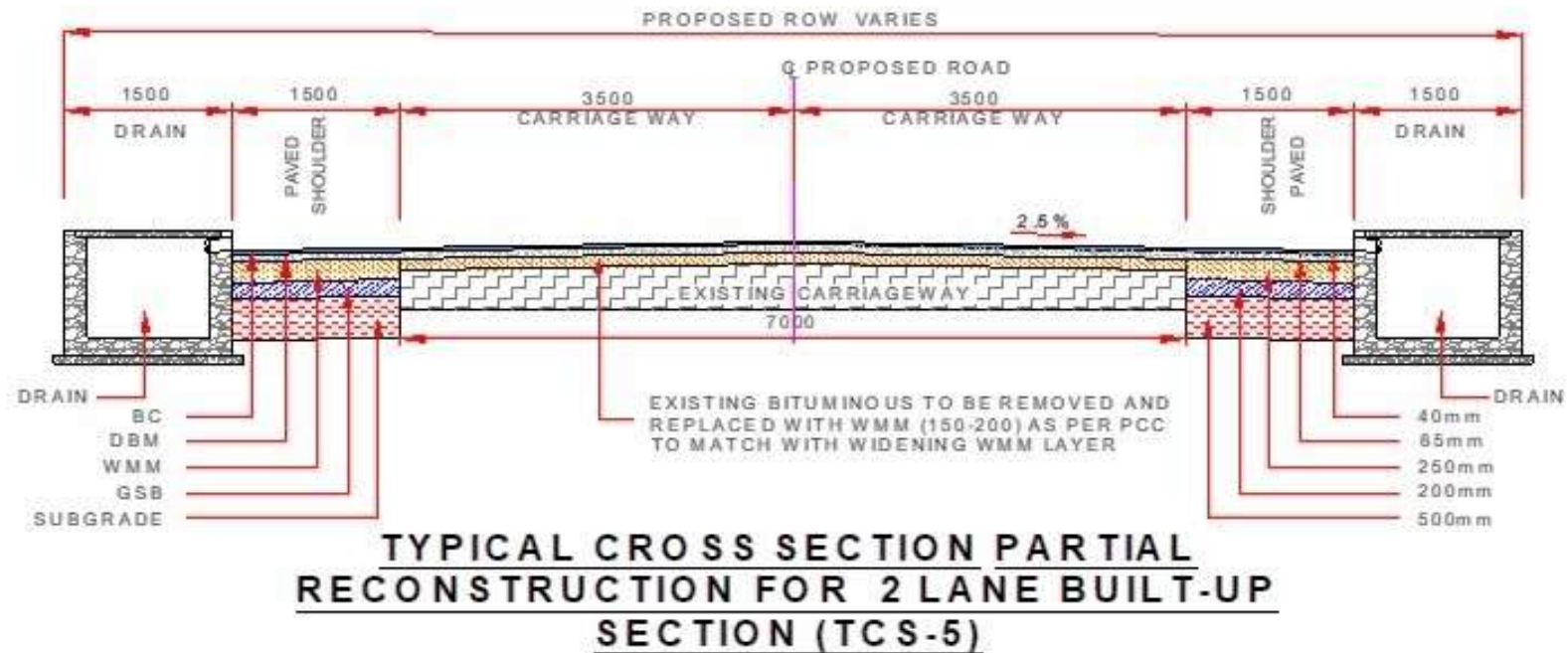


Figure 2.5: Typical Cross Section for Partial Reconstruction for 2 Lane Built up Section (TCS-5)

Table 2.6: Widening Scheme of Project Road (Package-1A & 1B)

SI No.	Design Chainage (m)		Length (Mm)	Applicable TCS	Remarks
	From	To			
1.	0+000	1+000	1000	TCS-2	TCS for partial reconstruction for two lane in built-up section (varying PROW)
2.	1+000	12+000	11000	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
3.	12+000	14+000	2000	TCS-4	TCS for partial reconstruction for two lane in built-up section (varying PROW)
4.	14+000	21+100	7100	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
5.	21+100	23+500	2400	TCS-2	TCS for partial reconstruction for two lane in built-up section (varying PROW)
6.	23+500	35+800	12300	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
7.	35+800	36+700	900	TCS-5	TCS for partial reconstruction for two lane in built-up section (varying PROW)
8.	36+700	46+380	9680	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
9.	46+380	50+600	4220	TCS-3	TCS for realignment / bypass section
10.	50+600	51+950	1350	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
11.	51+950	52+350	400	TCS-3	TCS for realignment / bypass section
12.	52+350	54+600	2250	TCS-1	TCS for partial reconstruction for two lane, 24m PROW
13.	54+600	55+100	500	TCS-2	TCS for partial reconstruction for two lane in built-up section (varying PROW)
14.	55+100	55+600	500	TCS-4	TCS for partial reconstruction for two lane in built-up section (varying PROW)
15.	55+600	57+346	1.746	TCS-2	TCS for partial reconstruction for two lane in built-up section (varying PROW)

Source: Detailed Project Report

2.3.6 Junctions Improvement

The package wise details of junctions improvement are described below:

Package-1A

There are 1 major junction and 40 minor junctions on the existing project road. Details of the junction improvement are given in **Table 2.7**.

Table 2.7: Junctions Improvement along the Project Road

Sl. No.	Existing Location (km)	Type	Side	Details
1.	0.460	+	BOTH	Major junction
2.	1.120	Y	RHS	Minor junction
3.	2.330	T	RHS	Minor junction
4.	3.240	T	LHS	Minor junction
5.	3.325	T	LHS	Minor junction
6.	3.385	T	RHS	Minor junction
7.	3.825	T	LHS	Minor junction
8.	4.970	T	RHS	Minor junction
9.	5.355	T	LHS	Minor junction
10.	6.100	T	RHS	Minor junction
11.	6.515	T	LHS	Minor junction
12.	7.170	T	RHS	Minor junction
13.	7.500	T	RHS	Minor junction
14.	8.260	T	LHS	Minor junction
15.	8.630	T	RHS	Minor junction
16.	9.285	T	LHS	Minor junction
17.	10.360	T	LHS	Minor junction
18.	11.225	T	RHS	Minor junction
19.	12.370	T	RHS	Minor junction
20.	13.000	T	RHS	Minor junction
21.	13.530	+	BOTH	Minor junction
22.	14.570	T	RHS	Minor junction
23.	16.050	T	RHS	Minor junction
24.	16.270	T	LHS	Minor junction
25.	17.005	T	LHS	Minor junction
26.	17.095	T	RHS	Minor junction
27.	18.150	T	RHS	Minor junction
28.	18.385	T	RHS	Minor junction

Sl. No.	Existing Location (km)	Type	Side	Details
29.	18.835	T	LHS	Minor junction
30.	20.650	T	RHS	Minor junction
31.	21.660	T	RHS	Minor junction
32.	22.040	Y	LHS	Minor junction
33.	22.275	T	LHS	Minor junction
34.	23.740	T	RHS	Minor junction
35.	24.760	+	BOTH	Minor junction
36.	26.125	+	BOTH	Minor junction
37.	26.825	T	RHS	Minor junction
38.	27.600	T	LHS	Minor junction
39.	27.915	T	RHS	Minor junction
40.	28.550	T	LHS	Minor junction
41.	29.170	T	RHS	Minor junction

Package-1B

There are 1 major junction and 26 minor junctions on the existing along the project road. Details of junction improvement are given in **Table 2.8.**

Table 2.8: Existing Junctions

Sl. No.	Existing Location (Km)	Type	Side	Details
1.	30.885	T	RHS	Minor junction
2.	32.100	Y	LHS	Minor junction
3.	32.420	T	LHS	Minor junction
4.	32.945	T	RHS	Minor junction
5.	34.075	T	RHS	Minor junction
6.	37.225	T	LHS	Minor junction
7.	38.055	T	LHS	Minor junction
8.	38.400	T	LHS	Minor junction
9.	38.490	T	RHS	Minor junction
10.	40.400	T	RHS	Minor junction
11.	40.660	T	RHS	Minor junction
12.	41.015	T	RHS	Minor junction
13.	41.220	T	LHS	Minor junction
14.	41.340	T	RHS	Minor junction
15.	41.550	T	RHS	Minor junction
16.	42.595	T	LHS	Minor junction

Sl. No.	Existing Location (Km)	Type	Side	Details
17.	42.740	T	RHS	Minor junction
18.	43.675	T	LHS	Minor junction
19.	44.750	+	BOTH	Minor junction
20.	46.255	+	BOTH	Minor junction
21.	51.260	+	BOTH	Minor junction
22.	51.880	T	RHS	Minor junction
23.	52.530	T	LHS	Minor junction
24.	54.660	T	RHS	Minor junction
25.	56.360	+	BOTH	Minor junction
26.	56.580	T	LHS	Minor junction
27.	57.600	T	RHS	Major junction

2.3.7 Culverts & Bridges

The summary of improvement/ development proposals of existing structures as well as proposed additional new structures is presented in **Table 2.9** and **Table 2.10**:

Table 2.9: Summary of Improvement/ Development Proposals of Structures

S. No.	Type of Structure	Nos.	Development/ Improvement Proposals
1.	Minor Bridges	17	Needs to be Reconstructed
2.	Culverts	49	37 Needs to be Reconstructed 12 needs to be widened

Details of existing bridges and development proposals are given below:

Table 2.10: Details of Existing Bridges and Development Proposals

Type of Structure	Existing	Proposed
Major Bridge (Package 1A)	NILL	N/A
Minor Bridge (Package 1A)	8 Nos.	All bridges need to be reconstructed
Major Bridge (Package 1B)	NILL	N/A
Minor Bridge (Package 1B)	9 Nos.	All bridges need to be reconstructed

The package wise details of existing bridges and their development proposals are given in **Table 2.11**.

Table 2.11: Package Wise Details of Existing Bridges and Their Development Proposals

S. N.	Location (Km.)	Existing					(Recons./ Widen. New Cons./ Retained)	Proposed	
		Design Chainage	No. of Span	Span (Exp.to Exp.) (m)	Carriage Way Width	Type of Structure		Span (Exp. To Exp.)(m)	Type of structure
	Package1A								
1.	2+200	2+200	6	6x 2.5	5	Arch	Reconstruction		RCC Girder
2.	6+931	6+931	3		6	RCC slab	Widening	1x15	RCC Box
3.	10+250	10+250	3	3x9	5	Arch	Reconstruction	3x15	RCC Girder
4.	14+740	14+740	1	1x12	7	Arch	Reconstruction	1x25	RCC Girder
5.	15+450	15+450	2	2x12.2	8	Arch	Reconstruction	1x25	RCC Girder
6.	16+780	16+780	3	3x7.5	7	Arch	Reconstruction	1x25	RCC Girder
7.	20+580	20+580	1	1x6	7	RCC Slab	Widening	1x6	RCC Box
8.	23+640	23+640	1	1x6	7	RCC slab	Widening	1x6	RCC Box
9.	24+880	24+880	1	1x6	7	RCC Slab	Widening	1X6	RCC Box
10.	28+378	28+378	1	1x6	7	Rcc Slab	Widening	1x6	RCC Box
11.	30+000	30+000	3	3x3.3	5	Arch	Reconstruction	1x12	RCC Girder
	Package1B								
1.	32+500	32+500	2	1x12	5	Arch	Reconstruction	1x12	RCC Box
2.	33+980	33+980	1	1x6	5	Rcc slab	Widening	1x6	RCC Box
3.	39+100	39+100	3	3x3.5	5	Arch	Reconstruction	1x12	RCC Girder
4.	40+400	40+400	3	3x5	5	Arch	Reconstruction	1x15	RCC Girder
5.	45+850	45+850	2	2x8.2	5	Arch	Reconstruction	1x20	RCC Girder
6.	52+050	52+050	4	4x10	5	Arch	Reconstruction	2x25	RCC Girder
7.	55+635	55+635	2	2x7	5	Arch	Reconstruction	1x15	RCC Girder

2.3.8 Pavement

Flexible pavement has been proposed as per IRC 37:2018 except at toll plaza location where rigid pavement as per IRC 58 has been proposed. Low heat emission cement (Portland pozzolana cement) should be used for construction of road. Pavement Design consideration is given in **Table 2.12.**

Table 2.12: Pavement Design Considerations

1.	Design MSA	20 MSA (*)
2.	Design Life	15 year (upto Year 2038)
3.	Growth Rate	5%
4.	Vehicle Damage Factor	As mentioned in para 0.11.2
5.	Lane Distribution Factor	0.75
6.	CBR	>8%

The summary of all pavement options for the project road is given in **Table 2.13**.

Table 2.13: Summary of All Pavement Options

Pavement Composition	Pavement Thickness (in mm)
1. Bituminous Concrete - BC	30
2. Dense Bituminous macadam- DBM	90
3. Wet Mix Macadam - WMM	250
4. Granular Sub base - GSB	200
5.Total Thickness of the pavement	570
6. Subgrade	500

2.3.9 High Embankment Locations/Slope Protection Measures

The provision of slope protection on high embankment conforming to IRC-SP-56:2011 has been provided at the locations given in **Table 2.14** by plantation of vetiver grass on slopes, turfing of grass and provision of chute drains.

Table 2.14: High Embankment Locations

S. No.	Start Design Chainage	End Design Chainage	Design Length(km)	Remarks
	Package 1B			
1.	46+4250	50+580	4160 m	By pass
2.	51+980	52+580	600	Realignment
	Total Length in Package		4760	

2.3.10 Road Side Drains

In the project road, 18.092 km roadside drain (both sides) have been provided in design, The road sections where roadside drains have been provided are given **Table 2.15**:

Table 2.15: Location Details of Road Side Drains

Sl. No	Design Chainage		Length in (Km)	Road Side
	From	To		
	Package – 1A			
1.	0.000	1.000	1.000	Both
2.	12.000	14.000	2.000	Both
3.	21.100	23.500	2.400	Both
	Package–1B			
4.	35.800	36.700	0.900	Both
5.		55.100	0.500	Both
6.	55.100	55.600	0.500	Both
7.	55.600	57.346	1.746	Both
		Total	9.046	LHS
			9.046	RHS
	Total Length of drain		18.092	BHS

2.3.11 Bus Shelter and Bus Bay

There are very few existing bus-stops along the project road. The existing bus shelters are between 1 m to 3 m from road carriage way and are in poor condition.

Bus shelter/bays locations along the project road are given in **Table 2.16**.

Table 2.16: Proposed Bus Shelter/Bus Bays Locations

S.No.	Existing Ch.	Design Chainage	Side
1	1+625	1+300	LHS
2	1+725	1+400	RHS
3	18+235	18+250	LHS
4	18+790	18+320	RHS
5	22+970	22+480	LHS
6	22+970	22+480	RHS

S.No.	Existing Ch.	Design Chainage	Side
7	26+825	26+340	LHS
8	26+825	26+340	RHS
9	29+955	29+450	LHS
10	29+955	29+450	RHS
11	33+305	32+800	LHS
12	33+305	32+800	RHS
13	37+405	36+900	LHS
14	37+405	36+900	RHS
15	45+315	44+800	LHS
16	45+315	44+800	RHS
17	48+680	48+160	LHS
18	50+895	50+370	RHS
19	52+665	52+140	LHS

2.4 Toll Plaza

Toll plaza is proposed at Chainage 44+620 to 44+940 on the project road. Toll plaza may have facilities of user fare display, digital traffic lights, overhead lane signs, toll collection cabins, automatic barriers, data loggers and computer systems, weighbridge, toll office, ambulance, accident help vehicles, toe vehicle, crane, rest room, sanitary facilities for toll collection staff, etc.

2.5 Rain Water Harvesting

Rainwater harvesting has been provided in the project road as per details given below:

Package 1A & 1B:

60 Nos. of RWH pits in Package 1A.

55 No"s of RWH pits in Package 1B.

2.6 Solar Street Lights

Solar street lights have been proposed in habitation area, junction locations, major bridge locations and Toll plaza as per IRC SP 73:2015. 80 Nos single arm & 360 Nos Double arm solar lights are provided in the Package 1A while

60 nos of single arm & 243 nos of Double arm solar lights are provided in Package 1B.

2.7 Proposed Road Safety

Cautionary sign boards, solar studs, thermoplastic bar markings, junctions ahead sign boards, speed limit sign board, rectro-reflective lines, road marking, hazard markers, chevron marking etc. are being provided throughout the highway.

Safety

Proper safety precautions are recommended on roadway width, the safety items to be provided are:

- W Beam crash barrier/ Concrete Crash Barrier on either side of carriageway,
- Pavement Marking on Centre and edges lines,
- Provide adequate warning of hazards,
- Providing Bio-turfing for Slope protection,
- Toe wall where embankment height is more than 3 m.

The details of road safety features are given below in **Table 2.17**.

Table 2.17: Road Safety Features in Package 1A & 1B

S.N.	Provisions	Details
1.	Crash barrier	5646
2.	Road studs	7706 Nos
3.	Road signs	327 Nos.
4.	Delineators	2294 Nos.
5.	Footpath cum drain	18.092 Km
6.	Hazard markers	166 No"s
7.	Solar studs	340 No"s

Road Side Furniture

Road side furniture shall be provided in accordance with Section 11 of the Manual of specification and standards for two laning of highways through PPP. Details of road side furniture are given in **Table 2.18** below:

Table 2.18: Road Side Furniture

S. No.	Description	Unit	Quantity
	Package-1A & 1B		
1.	Providing and fixing RCC boundary pillars including cost of reinforcement and two coats of painting with ready mix oil bound paint complete as per drawing and Technical Specifications Clause 806.	Nr.	1147
2.	Providing and fixing PCC/RCC hectometer, kilometer and 5th kilometer stones including cost of reinforcement complete as per Technical Specifications Clause 804.		
	200-metre stone	Nr.	230.00
	Kilometre stone	Nr.	46.00
	5th km. stone	Nr.	12.00
3.	Providing and laying Pavement marking with hot applied thermoplastic material complete as per drawing and Technical Specifications Clause 803		
	a) Lane/ Centre line/Edge line	Sqm	24675.00
	b) Diagonal and chevron marking	Sqm	155.00
	c) Stops, stop line , pedestrian marking etc	Sqm	80.00
4	Directional Arrows, Lettering etc. as per drawing No.61 of MORTH Type Designs for Intersections on National Highways	Nr.	18
5	Providing and laying kerb painting with ordinary paints grade-I (IS:164) complete as per drawing and Technical Specifications Clause 803	LM	1420

2.8 Construction Materials Requirements

The construction materials requirements for the project road are given in the **Table 2.19**.

Table 2.19: Construction Materials Requirements for The Project Road

Sl. No.	Material	Quantity required as per Green Highway Approach	Average Lead in km
1.	Borrow Soil (cum)	532148	Local Etawah within 5.00 Km
2.	Flyash (cum)	-	Fly Ash has not been proposed to be used in construction.
3.	Aggregates (cum)	342502	Mainpuri, Ramnagar (Jhansi), Etawah
4.	Bitumen (ton)	6766	Mathura Approx. 180 Km
5.	Waste Plastic (ton)	15	Locally Available
6.	Filler @ 2 percent of Weight of Aggregates.	3544	Locally Available Etawah
7.	Cement (cum)	8359	Locally Available Etawah
8.	Sand (cum)	15439	Locally Available Etawah
9.	Water (KI)	6150504	Locally Available Etawah

The lead charts for sand sources for Package 1A and 1B are given in **Figure 2.6** and **Figure 2.7**, respectively.

2.9 Manpower Requirement

Manpower requirement will depend on construction works at one point of time. However, as an estimate 250 to 300 manpower will be deployed in each package. It is estimated that about 70 to 80% workers will be from local area. Remaining skilled workers, operators, supervisors and engineers may be from outside area.

2.10 Construction Methodology

The construction methodology for the project road is given below:

A. Pre-construction Activities

- Clearances/NOCs applicable to the project are required to be obtained by the Contractor,

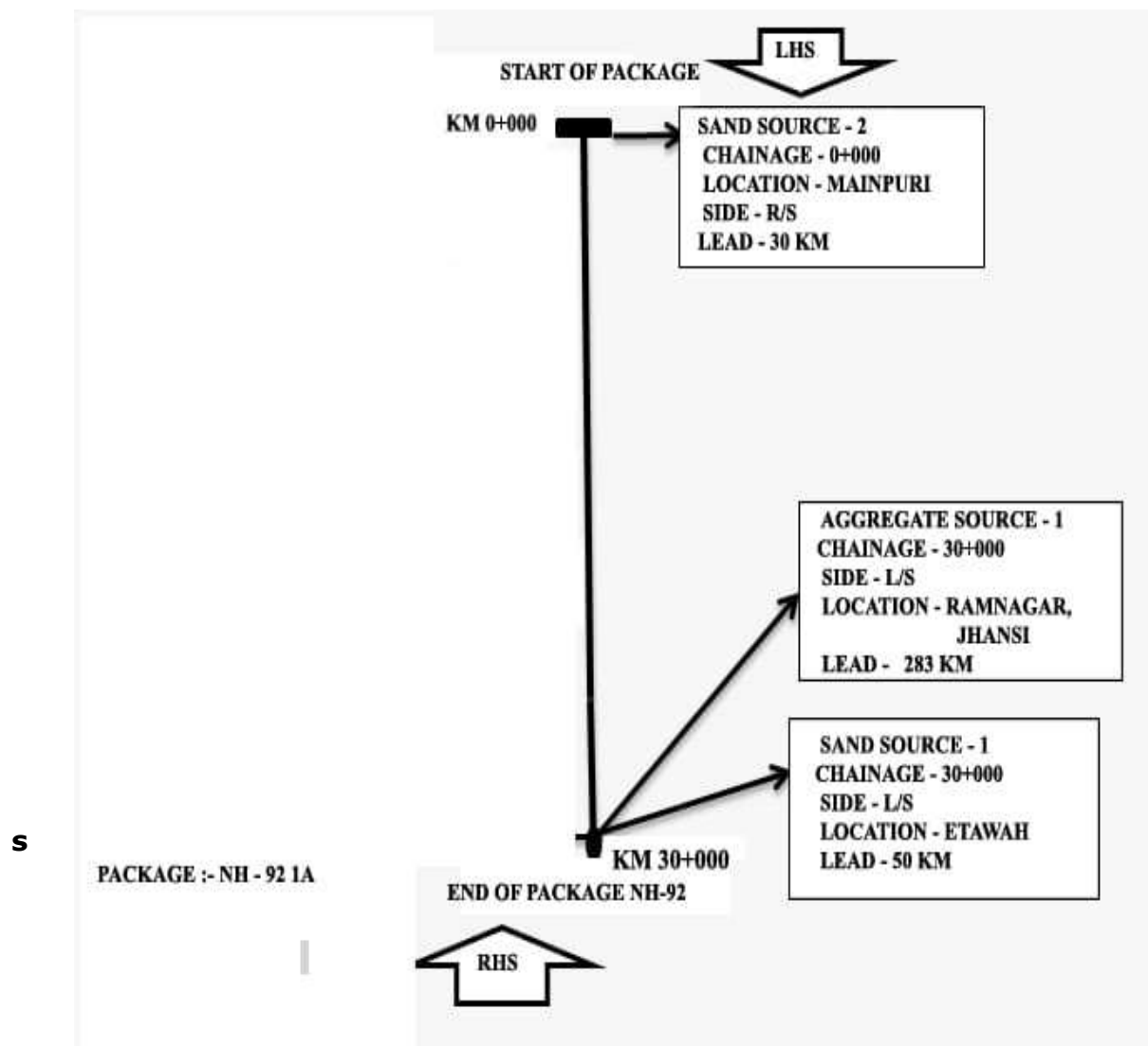


Figure 2.6: Lead Chart for Sand Sources for Package 1 A

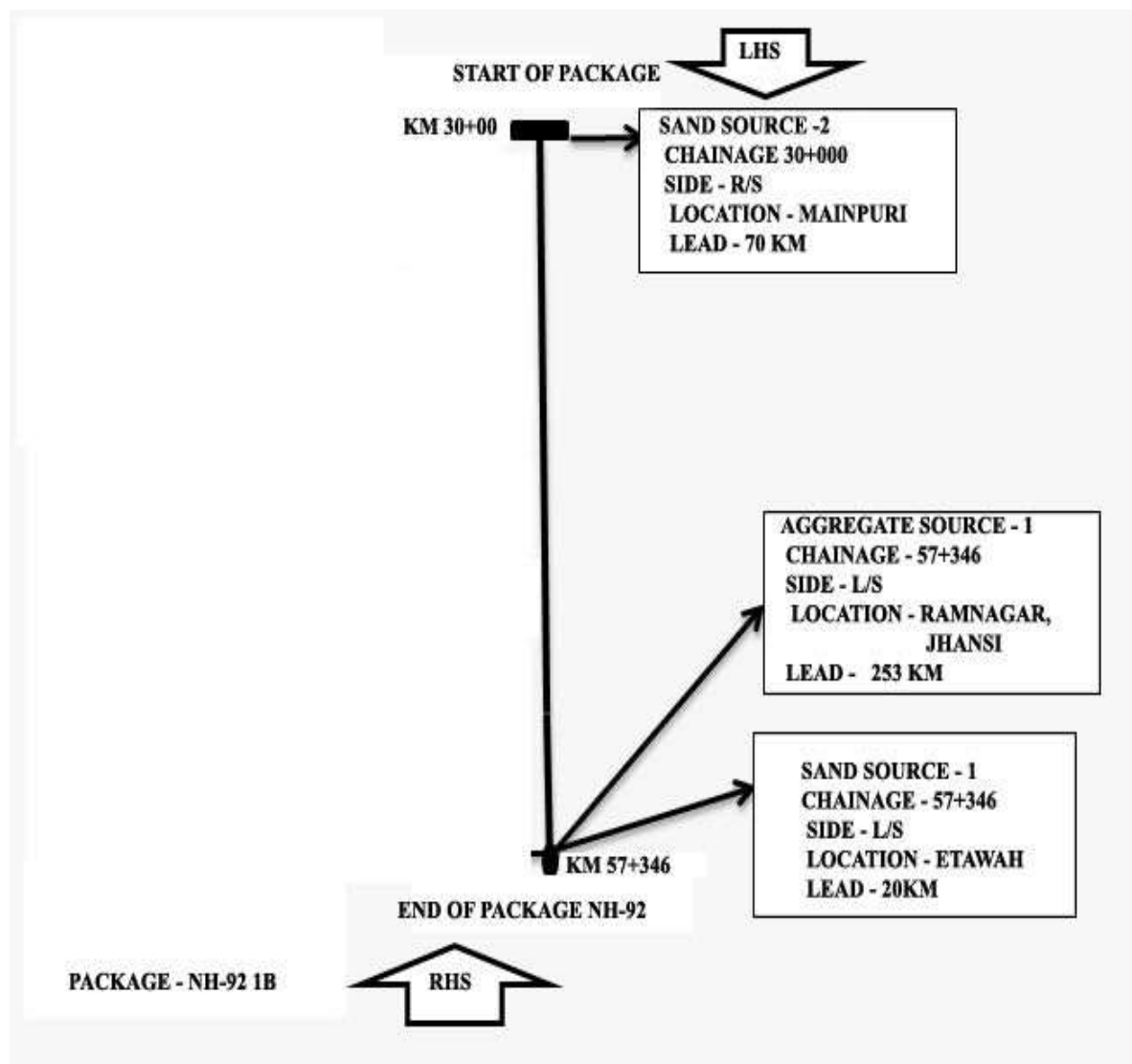


Figure 2.7: Lead Chart for Sand Sources for Package 1 B

- 3rd party insurances including Contractor's All Risk Insurance, Workman Compensation, insurances for equipment utilized for construction,
- Location for construction camp, plant & machinery has to be identified and permissions to be obtained from concerned body for setting up construction camp,
- Procurement of machinery considering EHS provisions of the contract,
- Land acquisition and transfer of ownership,
- Marking of alignment, Relocation of utilities, clearing of vegetation, Dismantling of structures,
- Identification of borrow area, quarry area and waste disposal sites.

B. Construction Stage

Site Clearing

- Clearing and Grubbing of the Road Construction Area
- Traffic diversion & management
- Operation of camp & maintenance yard

Material Procurement

- Operation of borrow areas, crusher plants.
- Material transport & storage including oil & chemicals

Construction Activities

- Embankment construction
- Sub-grade construction
- Construction of bridge, culverts, drains, flyovers, toll plaza, junctions, interchange etc.
- Environmental monitoring,
- Operation of batching plant, GSB, WBM, other machinery,
- Operation of HMP, transport and laying of hot mix, bituminous waste,
- Rainwater harvesting structures.

C. Post Construction Stage

- Decommissioning,
- Decommissioning of camps,
- Removal of C&D waste,

- Site restoration & rehabilitation.

2.11 Construction Period

The period of construction for the project road has been taken as 24 months.

Chapter 3

Policy, Legal And Regulatory Framework

This section presents the national and state level environmental legislations and regulations; and World Bank Policies relevant to the Two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 in Uttar Pradesh. The various environmental regulations applicable and regulatory consents and clearances required for the proposed up-gradation project are also been incorporated in this section.

3.1 Legal Framework

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer, the legislation has been jointly entrusted to the Ministry of Environment, Forests and Climate Change (MoEF&CC) at National level, whereas Uttar Pradesh Pollution Control Board (UPPCB) at state level in the present context to two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 in Uttar Pradesh.

3.2 Applicable National and State Regulations

The key environmental and other regulations relevant to two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 in Uttar Pradesh is presented in **Table 3.1**.

Table 3.1: Environmental Regulations Relevant to the Project

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
1	Environment (Protection) Act, 1986	To protect and improve overall environment	Yes	It is an umbrella legislation. Various notifications, rules and schedules are promulgated under this act.	--	MoEF&CC; UPPCB
2	Environmental Impact Assessment Notification, 2006 &	Prior environmental clearance for	Yes	Project road is not covered under the preview of EIA Notification 2006 towards obtaining	No. Prior Environmental Clearance	SEIAA/ DEIAA

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
	subsequent activities	designated activities for category A and B projects under the EIA Notification 2006 & subsequent activities		an EC#. However, for opening of stone quarry, prior environmental clearance will be required from SEIAA/DEIAA	for opening stone quarry	
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 km 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	Yes	There are four coal based Thermal Power Plants within a distance of 100km from the project road, namely: • NTPC Thermal Power Plant, Dadri at Dadri in Gautam Budha Nagar district • Harduaganj Thermal Power Plant owned by Uttar Pradesh Vidyut Utpadan Nagar Limited (UPVUNL) in Aligarh district • UPRVUNL Jawaharpur Thermal Power Plant in Village Malawan, district Etah • Rosa Thermal Power Plant at Rosa village in Shahjahanpur district Two power stations are located within a distance of 100km to 300km from the project road, namely:	Essential Use of Fly ash in the Road	MORTH

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		as amended from time to time regarding use of fly ash		• Panki Thermal Power Station located at Panki in Kanpur district • Parichha Thermal Power Station located at Parichha in Jhansi district Therefore, use of fly ash in the project is warranted in the project as per above notification. Fly ash can provide technically viable, environmentally sound & cost-effective alternative to natural borrow soil.		
4	Forest Conservation Act, 1980	To check deforestation by restricting conversion of forested areas into non-forested areas	Yes	Road side plantation along Sections of the Project road are notified protected forest. In the project road 192.777 ha protected forest diversion will be required.	Prior Forest Clearance for diversion of Forest Land for Non Forestry Use	MoEF&CC /Dept. of Forest, Govt. of Uttar Pradesh
5	Trees Cutting Permission	Permission for felling of road side trees on forest and private land	Yes	Tree cutting permission for forest land will be at the time of forest clearance. Trees on private land shall be felled after taking permission	Tree Cutting Permission	District Authority/ Forest Dept.
6	Air (Prevention and Control	To control air pollution & controlling	Yes	This act is applicable for construction phase to control stack/fugitive	Consent to Establish (CTE) and	UPPCB

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
	of Pollution) Act, 1981	emission of air pollutants as per the prescribed standards.		emissions and to manage ambient air quality at project site and ancillary activities like crusher plant, hot mix plant, concrete batch mix plant, WMM Plants, DG Set etc, for the road. The NAAQ standards (CPCB) for Ambient Air Quality have been promulgated by the MoEF&CC for various land uses. The NAAQ standards (CPCB) for Ambient Air Quality have been promulgated by the MoEF&CC for various land uses.	Consent to Establish (CTO) and Consent to Operate for hot mix plant, batching plant and WMM Plants, DG sets, etc.	
7	Water Prevention and Control of Pollution) Act1974	To control water pollution by controlling discharge of liquid pollutants as per the prescribed standards	Yes	This act is applicable for construction phase of the road to manage to liquid effluent discharges from worker camp, concrete batch mix plant, etc. .	Consent to Establish (CTE) and Consent to Operate (CTO) for plants and workers camps, etc.	UPPCB
8	Noise Pollution (Regulation and Control) Rule 2000	The standards for noise for day and night have been promulgated by the MoEF&CC for various land uses.	Yes	This act will be applicable for all construction equipment/ plant and machinery including vehicles deployed for construction of the proposed road to regulate ambient	None	UPPCB

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
				This act will be applicable to regulate noise nuisance during construction phase		
9	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	The rules will be applicable to used oil generated from construction equipment/ machinery during construction works. The rule includes storage, handling, transportation procedures and requirements for safe disposal of hazardous wastes	Hazardous Waste Authorization with CTE and CTO	UPPCB
10	Construction and Demolition Waste Management Rules, 2016	Safe disposal and management of construction and demolition wastes	Yes	This rule is applicable to generation of wastes resulting from demolition of bridge and culvert structures and scarifying of surface of existing road and from road construction activities.	Construction and Demolition Waste Management Plan should be prepared, prior to commencement of works	Local Municipal Corporations
11	Solid Waste Management Rules 2016	Collection and disposal of municipal solid waste	Yes	This rule is applicable to all forms/types of solid waste generated at construction activities, camp site, plant sites, etc..	Solid Waste Management Plan should be prepared, prior to commencement of works	Local Municipal Corporations
12	Mines and Minerals (Development and Regulation) Amendment Act, 2015	This act has been notified for safe and sound mining activity.	Yes	The construction of project road will require aggregate through mining from riverbeds and quarries	Permit and lease for stone quarry	Department of mining, State Government

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
13	Minor Mineral and concession Rules, 2015	For opening stone quarry	Yes	Regulate use of minor minerals like stone, soil, river sand etc.	Permit and mining lease for stone quarry	District Collector
14	The Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996	To regulate the employment and conditions of construction workers and to provide for their safety, health and welfare measure and for other matter incidental thereto	Yes	To ensure safety and welfare measures for workers employed at construction sites. Compliance to provisions of health and safety measures for the construction workers in conformity with BOCW rule concerning safety and health in construction. These regulations to be complied with during the construction of proposed road works.	None. Safety and welfare measures for work force employed at construction sites are to be regulated in conformity with this act.	State Labour Department
15	Bonded Labour System (Abolition) Act, 1976 along with Rules, 1976	An Act to provide for the abolition of bonded labour system with a view to preventing the economic and physical exploitation of the weaker sections of the people and for	Yes	Contractors shall employ numbers of Labours during Construction Phase. Contractor will ensure that there is no Bonded Labour by him or sub contractors.	Labour License	State Labour Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		matters connected therewith or incidental thereto				
16	Contract Labour (Regulation and Abolition) Act 1970 along with rules, 1971	The Object of the Contract Labour Regulation and Abolition) Act, 1970 is to prevent exploitation of contract labour and also to introduce better conditions of work	Yes	Contractors shall employ numbers of work-force during Construction Phase. The Act applies to the Principal Employer of an Establishment and the Contractor where in 20 or more workmen are employed or were employed even for one day during preceding 12 months as Contract Labour.	Labour License	State Labour Department
17	Employees Provident Funds and Miscellaneous Provisions Acts 1952 along with EPF Scheme Rules and Forms	It is a beneficent piece of social welfare legislation aimed at promoting and securing the well-being of the employees	Yes	Contractors shall be employing Workman more than 20 persons during Construction Phase	Compliance of regulations	State Labour Department
18	Employees State Insurance Act 1948 along with Rules and Regulations	Protect the interest of workers in contingencies such as sickness, maternity, temporary or	Yes	Contractor shall be applying large number of labours during construction which will include both Men and Women		State Labour Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		permanent physical disablement, death due to employment injury resulting in loss of wages or earning capacity. the Act also guarantees reasonably good medical care to workers and their immediate dependents.			Insurance	
19	Equal Remuneration Act, 1976 along with allied Rules	An Act to provide for the payment of equal remuneration to men and women workers and for the prevention of discrimination, on the ground of sex, against women in the matter of employment and for	Yes	Contractor shall be applying large number of labours during construction which will include both Men and Women.	Compliance of regulations	State Labour Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		matters, connected therewith or incidental thereto.				
20	Inter State Migrant Workmen (Regulation of Employment and Conditions Service Act	Act of the Parliament of India enacted to regulate the condition of service of inter-state labourers in Indian labour law. The Act's purpose is to protect workers whose services are requisitioned outside their native states in India. Whenever an employer faces shortage of skills among the locally available workers, the act creates provision to employ better skilled	Yes	Contractor Shall be employing large number of workers during Construction from other States also.	Compliance of regulations	State Labour Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		workers available outside the state				
21	Minimum Wages Act 1948 along with Central Rules 1950	To ensure that workman gets at least minimum wages as fixed by Govt. Minimum wages sets the lowest limit below which wages cannot be allowed to sink.	Yes	Contractor Shall be employing large number of workers during Construction	Compliance of regulations	State Labour Department
22	Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participations) Act, 1995 along with Rules, 1996 and National Trust for Welfare of Persons with Disabilities Act, 1999 with rules 2000.	Contractor Shall be employing large number of workers during Construction on creation of barrier free environment, social security, etc.	Yes	Contractor Shall be employing large number of workers during Construction.	Compliance of regulations	State Labour Department
23	Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	The Act provides in detail the legislative provisions regarding	Yes	These rules will be applicable to road users	--	Motor Vehicle Department

S. No.	Act / Rules	Purpose	Applicable	Reason for Applicability	Regulatory Clearances Required	Authority
		licensing of drivers/ conductors , registration of motor vehicles, control of motor vehicles through permits, special provisions relating to state transport undertakings, traffic regulation, insurance, liability, offences and penalties.				

Note: The subproject is national highway and expansion of highway is proposed in the form of upgradation/ widening. As per EIA Notification, 2009 and amendment dated 22 Aug 2013, environmental clearance is required for expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40 m on existing alignments and 60 m on realignments and bypasses. In the subproject additional right of way or land acquisition is less than 20 m on existing alignments. Therefore, Environmental Clearance and Environmental Impact Assessment are not required for the subproject as per EIA Notification 2009.

3.3 World Bank Safeguard Policies Applicable to Project Road

The safeguard policies of the World Bank relevant to the Two lane upgradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 in Uttar Pradesh are given in **Table 3.2**.

Table 3.2: Relevant and Applicability of WB Safeguard Policies

S. No .	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
1.	OP/BP 4.01 Environmental Assessment	Overall governing policy intended to ensure Bank-financed projects are environmentally sound and sustainable	All potential impacts due to the improvement and up-gradation project road are to be assessed and necessary mitigation measures are to be incorporated accordingly.	Triggered
2.	OP/BP 4.36 Forests	Policy is intended to support sustainable and conservation-oriented forest management, harness potential of forests to reduce poverty in a sustainable manner, integrate forests into sustainable economic development, and protect vital local and global environmental services and values of forests.	The proposed improvement and upgradation of the project road is passing through forest area and prior forest clearance is required for diversion of forest land for non forest purpose.	Triggered
3.	OP/BP 4.11 Physical Cultural Resources	Policy is intended to ensure that projects identify and inventory cultural resources that are potentially affected by the project. Projects should include mitigation measures, when there are adverse impacts on physical cultural resources.	Construction of road will be on existing road corridor and will avoid cultural property resources (CPR) and therefore does NOT warrant shifting or affect CPRs. However, there may be direct or indirect impact on nearby cultural properties along the road.	Triggered

S. No .	World Bank Safeguard Policy	Key Features	Policy Applicability to Sub Project	Policy Triggered Or Not
4.	OP/BP 4.11 Involuntary Resettlement	Involuntary Resettlement Policy addresses direct economic and social impacts from project activities that may cause involuntary taking of land resulting in: (i) relocation or loss of shelter, (ii) loss of assets or access to assets, and/or (iii) loss of income sources or livelihoods	The proposed improvement and upgradation of the project road require land acquisition and Involuntary Resettlement.	Triggered
5.	OP 09 Pesticide Management	The objective of this policy is to reduce reliance on synthetic chemical pesticides, promote Integrated pest management (IPM) and Integrated Vector Management (IVM) Minimize the environmental and health hazards of pesticide use.	In the subproject tree plantation will be done by Forest Department. In roadsides plantation, synthetic chemical pesticides are not used. Usually, organic manure is used at the time of sapling plantation.	Not Triggered.

3.4 Indian Road Congress (IRC) Code Applicable for the Project Road

The key Indian Road Congress (IRC) Codes applicable for the project road with respect to environment are given in **Table 3.3**:

Table 3.3: Indian Road Congress Code of Practices for Project Road

Sl. No.	IRC Code Theme	Year	Purpose
1.	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation	IRC:34-2011	Construction in water logged areas
2.	Recommended Practice for Construction of Earth Embankments and Sub-Grade for Road Works (First Revision)	IRC:36-2010	Issues relating to Borrow pits
3.	Guidelines for Pedestrian Facilities	IRC: 103 -1988	Safety of pedestrians
4.	Recommended Practice for Recycling of Bituminous Pavements	IRC:120-2015	For recycling of bituminous pavements
5.	Guidelines for Use of Construction and Demolition Waste in Road Sector	IRC:121-2017	Use of Construction and Demolition Waste in Road Sector
6.	Guidelines on Landscaping and Tree Plantation	IRC:SP:21-2009	Landscaping and Tree Plantation along of the road
7.	Guidelines on Road Drainage	IRC: SP: 42-1994	Drainage
8.	Highway Safety Code	IRC: SP: 44-1994	Highways safety
9.	Guidelines for Use of Flyash in Road Embankments	IRC:SP:58-2001	Use of Flyash in Road Embankments
10.	Guidelines for Use of Geotextiles in Road Pavements and Associated Works	IRC:SP:59-2002	Use of Geotextiles in Road Pavements and Associated Works
11.	Guidelines for Soil and Granular Material Stabilization Using Cement Lime and Fly Ash	IRC:SP-89-2010	Soil and Granular Material Stabilization Using Cement Lime and Fly Ash
12.	Guidelines on Requirements for Environmental Clearance for Road Projects	IRC:SP-93-2017	Requirements for Environmental Clearance for Road Projects

Sl. No.	IRC Code Theme	Year	Purpose
13.	Guidelines for the use of Waste Plastic in Hot Bituminous Mixes (Dry Process) in Wearing Courses	IRC:SP-98-2013	Use of waste plastic in hot bituminous mixes (dry process) in wearing courses
14.	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion	IRC:SP-100-2014	Use of Cold Mix Technology in Construction and Maintenance of Roads Using Bitumen Emulsion
14.	Interim Guidelines for Warm Mix Asphalt	IRC:SP-101-2014	Warm Mix Asphalt
15.	Guidelines on Preparation and Implementation of Environment Management Plan	IRC:SP-108-2015	Preparation and Implementation of Environment Management Plan

3.5 Environmental Standards

Environmental standards applicable to the Two lane up-gradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH 92 in Uttar Pradesh are National Ambient Air Quality Standards, 2009 are given below:

- National Ambient Air Quality Standards, 2009
- Ambient Noise Standards
- Drinking Water Quality Standards-IS:10500:2012
- CPCB Standards for Surface Water Use

3.6 World Bank Guidelines for Environmental, Health, and Safety Guidelines for Toll Roads

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For

complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at: www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

World Bank Guidelines for Environmental, Health, and Safety Guidelines for Toll Roads are given in **Annexure 3.1** at the end of EIA report.

Chapter 4

Baseline Environmental Conditions

4.1 General

This chapter provides the details of the baseline environment conditions along the project road. Baseline environment includes physical, biological and the socioeconomic environment. The study of baseline environment features of the project road will help in determining the sensitivity and related impacts due to proposed project activities.

Considering the existing environmental scenario, potential impacts of proposed project improvement will be identified and accordingly management plan will be proposed in forthcoming sections. The baseline environmental conditions will help in comparing and to monitor the predicted negative and positive impacts resulting from the project during construction and operation phases.

Ambient air quality monitoring, noise levels measurement, soil characteristics and water quality samples were collected along the project road to prepare a baseline database. All necessary information required for environmental study has been collected either through primary survey or through secondary data sources and community consultations.

4.1.1 Study Area

The project impact area has been considered Right of Way (ROW), while project influence area is 10 km either side from the edge of RoW. Collection of primary information has been limited to project impact area only. However, environmental sensitivity assessment has been undertaken for 10 km distance from the project road.

4.1.2 Study Period

The baseline study was commenced with an initial review and reconnaissance survey of the study area. Baseline environmental monitoring and analysis for one month was carried out by M/s Noida Testing Laboratories, Greater Noida during the month of February 2021.

4.1.3 Data Collection

The efforts have been made to collect the latest information both at regional as well as local level especially along the project road. The team has undertaken the site visit and key stakeholders consultation along the project road. The outcome of baseline study is discussed in the following sections.

4.1.4 Primary Data

The field study has been carried out to collect primary data in the study corridor, which involves:

- Physical environmental conditions including topography and physiography, geology, meteorology, water source resources, ambient air quality, noise levels, soil and ground and surface water quality, landuse, community structures, archeological monuments, industries, etc.
- Biological environmental conditions including environmentally sensitive areas, terrestrial ecology, and biodiversity.

Environmental monitoring was carried out for a period of one month (February, 2021) for environmental parameters air, water (surface and ground), noise and soil. The environmental monitoring reports as submitted by the laboratory are enclosed in **Annexure 4.1**.

4.1.5 Secondary Data

Data collection from the secondary sources has been done from various authentic and published sources. The following are some important information available from secondary sources:

- The project objectives, technical information on existing road features from Contract Document and design report;
- Climatic condition & long-term meteorological data from Indian Meteorological Department and Government websites;
- Geology, soil, topography and water table from government websites & district groundwater brochure of CGWB;
- Land Use from Survey of India Topo-sheet, Google Earth & field observation during surveys; and
- Ecological information from State Forest Dept., ENVIS, Other Govt. of India / State Govt. Websites.

The project road is located in the state of Uttar Pradesh and passes through the districts of Mainpuri & Etawah District. Physical environmental conditions are described in the following subsections:

4.2 Topography and Physiography

The area generally presents the appearance of an extensive level plain broken only by the sand ridges on the western border, the rolling sand hills and undulations of the Kali and Isan rivers, and the ravines along the Yamuna to the south-west. The Kali Nadi forms the boundary of this plain on the north and north-east and the Yamuna encloses it on the south-west. Both these rivers flow towards the south-east, and between them.

The topography along the project road is plain and rolling. The physiographical map of the state showing the project road is given in **Figure 4.1**.

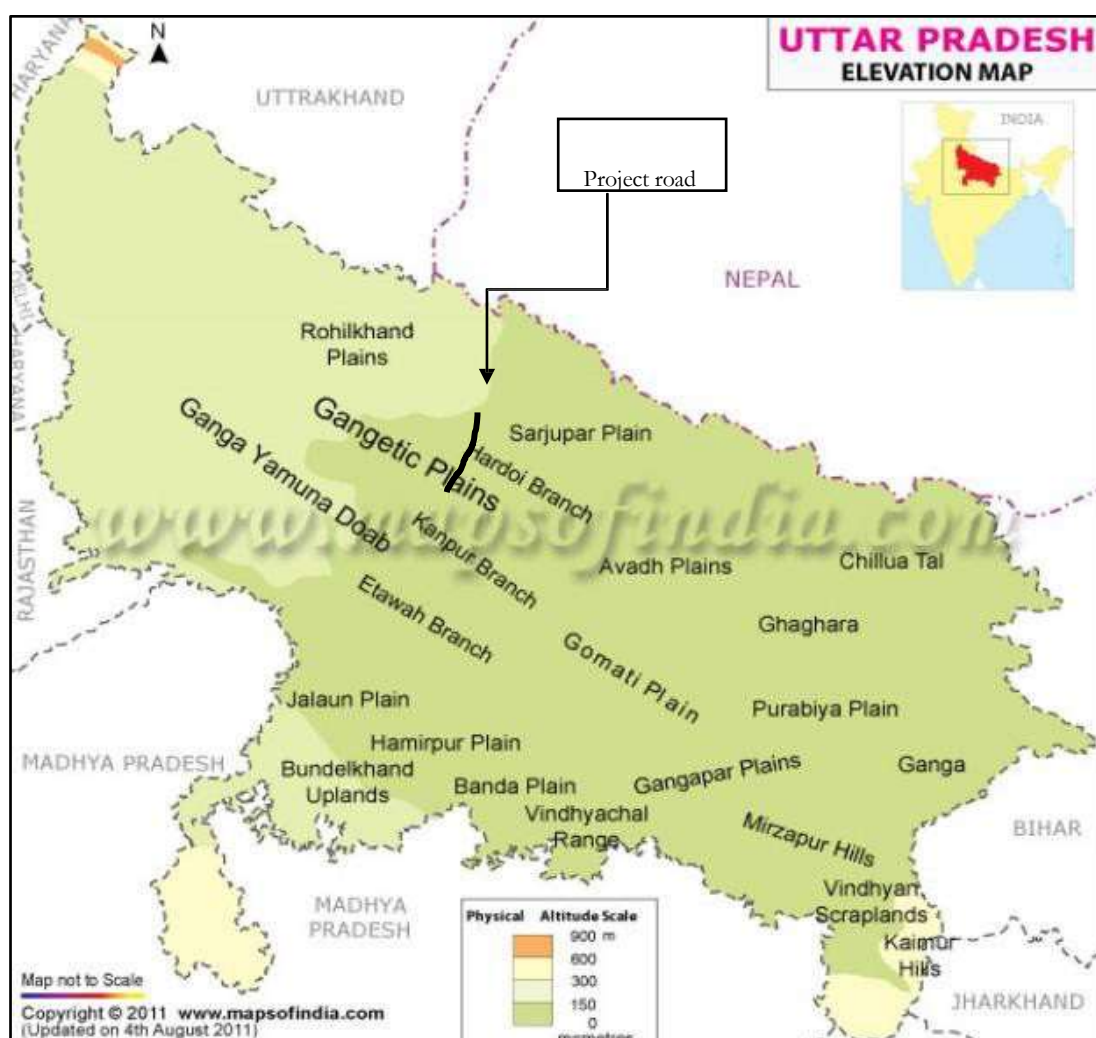


Figure 4.1: Physiographic Map showing Project Road

4.3 Geology

The project road is located in Ganga alluvial plain which is sub-divided in older and newer alluvial plains.

The section of project road passing through Mainpuri district forms part of the Central Ganga Alluvial Plain (Upper Gangetic Plain as per the Agro-climate zone classification) which is an extensively leveled tract intercepted by sand ridges on its western border, the rolling sand hills and undulations of the Kali and Isan rivers. The terrain has gentle slope from north-west to south-east with a gradient of 0.2 m/km.

After this, the road enters Etawah district, the central and northeastern portion of the district are monotonous plain. Land whereas a southern and southwestern part of the district shows ravinous land with small narrow deep depression usually carved by the running water. Ground water prospects in the hydro-geomorphic units are generally very poor between the doab of the Yamuna & Chambal River. The geological map of Uttar Pradesh showing project road is shown in **Figure 4.2**.

4.4 Seismicity

According to 2014 seismic zoning map of India, the state of Uttar Pradesh falls in Zone III & IV, which are moderate active and high risk zone of seismic hazard. The project districts Mainpuri and Etawah fall under Zone III as shown in the **Figure 4.3** and **Figure 4.4**:

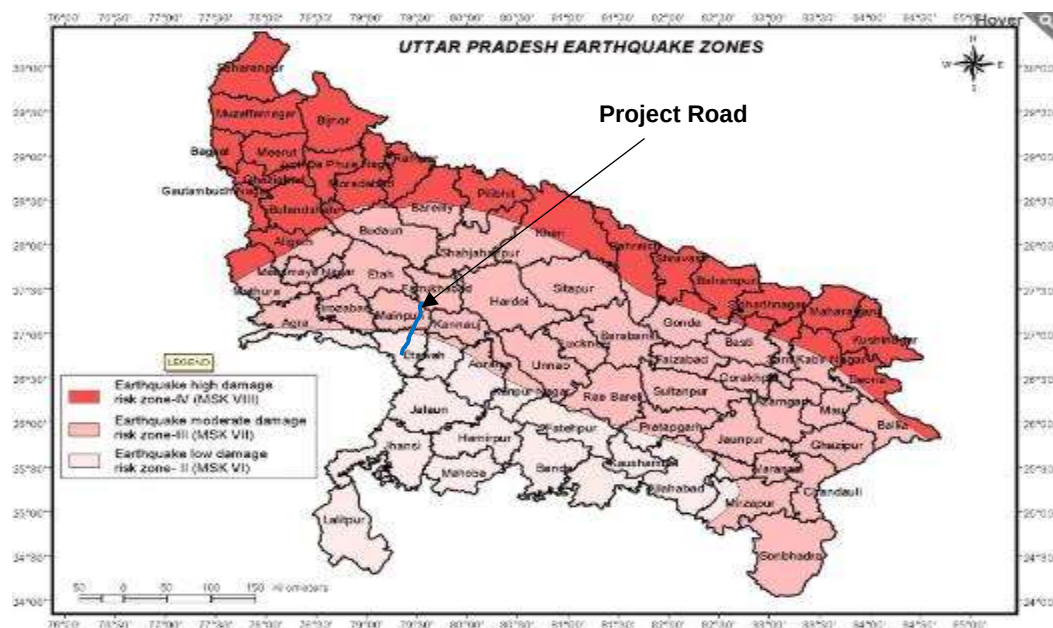


Figure 4.3: Seismic Zonation Map of Uttar



Figure 4.4: Project Road on Seismic Zonation

4.5 Soil Characteristics and Quality

Generally, the soil of the both district Etawah & Mainpuri are typical of those found elsewhere in the Indo-Gangtic plain, and are classified on two principles according as the distinctions recognised are natural or artificial. Both are well understood and commonly employed by the cultivator. Of the natural divisions Bhur is the name of the soil containing a large proportion of sand, while Matyar is the name of that containing a large proportion of clay, and between these two extremes is a loamy soil called Domat having clay and sand more evenly divided as its name implies. A lighter soil than Domat is known as Pilia, coming between Domat and Bhur. In favourable circumstances matiyar yields good crops of rice. The barren soil known as Usher found at the heads and partly down the courses of the smaller rivers such as Ahnaiya and Puraha, the Sengar and Arind and the numerous minor esteems, and appears to be a clay deposit too compact to permit of cultivation in places too impregnated with Reh and other deleterious minerals substances to permit growth of even grass.

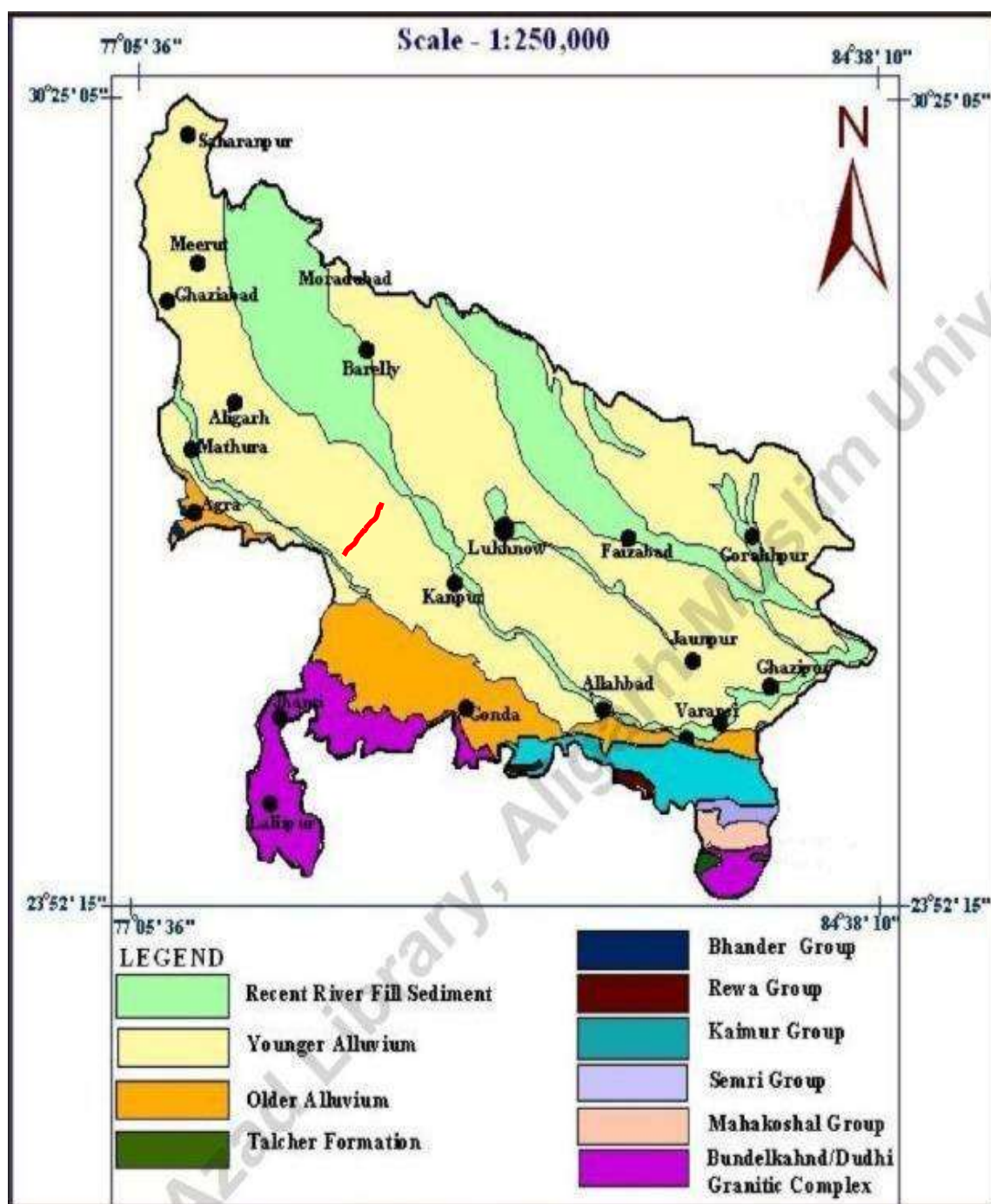


Figure 4.2: Project Road on Geological Map of Uttar

The soil of Etawah is mainly sandy and sandy loam, which is easily transportable by rain water after detaching causing severe soil erosion. Thus the soils have high water absorbing and low water holding capacity. The soils are very deep and alluvial having various types of soil textured on the surface as well as in the deeper strata down below.

The shallow and the deep tube well are plane in the sandy strata having good ground water table/aquifer.

Soil map of Uttar Pradesh showing project road is presented in **Figure 4.5**.

Soil Quality Along the Project Road

The soil samples were collected from 5 locations along the project road, as shown **Figure 4.6**:

The details of soil sampling locations are provided in **Table 4.1**. The analytical results for each location are provided in **Table 4.2**. Field photographs for soil sample collection are shown in **Figure 4.7**.

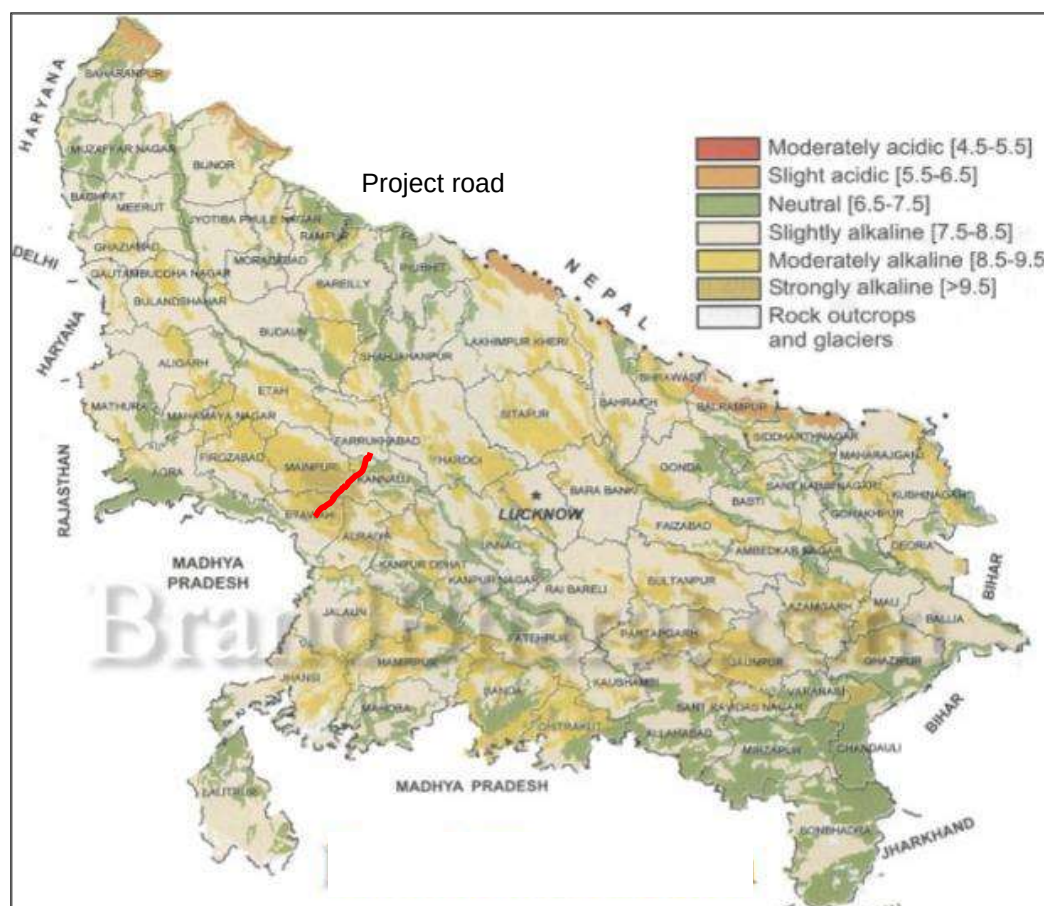


Figure 4.5: Soil Map of Uttar Pradesh Showing

Table 4.1: Soil Sampling Locations

Location Code	Name of Location	Date	GPS Coordinates
SQ-1	Bewar near Ch. 0+000	26/02/2021	27°12'57.40"N 79°18'4.55"E
SQ-2	Kishni near Ch. 24+200	26/02/2021	27° 1'3.03"N 79°15'21.20"E
SQ-3	Barlokpur near Ch. 38+000	26/02/2021	26°55'40.66"N 79°10'11.96"E



Figure 4.6: Soil Sampling Locations



Figure 4.7: Field Photographs for Soil Samples Collection

Table 4.2: Analytical Results of Soil Sampling of the Study Area

Test Parameter	Units	SQ-1	SQ-2	SQ-3	SQ-4	SQ-5	Method of Testing
		Bewar	Bahadurpur	Daudapur	Bhunda Harbanspur	Mathu Dandi	
pH(1:5 suspension)		7.82	7.54	7.7	7.88	7.88	IS:2720(Part-26)
Electrical Conductivity at 25°C (1:5 Suspension.)	µmhos/cm	340.26	250.46	220.12	280.4	223.5	IS:2720(Part-21)
Calcium (as Ca)	mg/kg	480.1	410.6	400.3	390.8	390.8	STP/SOIL
Magnesium (as Mg)	mg/kg	28.2	32.4	35.42	38.1	38.1	STP/SOIL
Organic Matter	% by mass	0.46	0.64	0.38	0.26	0.27	IS:2720(Part-22)
Potassium (as K)	mg/kg	90.2	88.82	94.62	83.1	90.4	STP/SOIL
Water Holding Capacity	% by mass	26.5	19.5	28.7	25.6	24.6	STP/SOIL
Porosity	mq/100/g m	40.24	37.82	37.6	34.5	34.5	STP/SOIL
Texture	-	Sandy Loam	Sandy Loam	Sandy Loam	Sandy loam	Sandy loam	STP/SOIL
Sand	%by mass	57.6	55.4	60	65.6	60	STP/SOIL
Clay	%by mass	22.8	26.6	24.1	18	20	STP/SOIL
Silt	% by mass	19.6	18	15.9	16.4	20	STP/SOIL
Sodium	mg/100g	190.2	206.1	180.1	200.08	190.5	STP/SOIL
Sodium Absorption Ratio	% By mass	1.22	1.09	1.34	1.14	1.12	STP/SOIL
Nitrogen	mg/100g	0.05	0.03	0.08	0.09	0.09	STP/SOIL
Phosphorus	mg/kg	0.8	0.42	0.64	0.86	0.86	STP/SOIL
Bulk Density	grm/cc	1.3	1.44	1.58	1.2	1.2	STP/SOIL
Infiltration Rate	mm/hr	13	15	9	12	12	STP/SOIL
Moisture	%	15.3	18	22.4	17.1	17.1	STP/SOIL
Sulphates	mg/1000g	55.2	63.4	48.6	51.6	57.4	STP/SOIL
Available Sulphur (as S)	mg/kg	22.6	25.4	28.36	25.78	24.62	STP/SOIL
Available Manganese (as Mn)	mg/100g	2.14	1.86	1.74	1.06	2.56	STP/SOIL

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Test Parameter	Units	SQ-1	SQ-2	SQ-3	SQ-4	SQ-5	Method of Testing
		Bewar	Bahadurpur	Daudapur	Bhunda Harbanspur	Mathu Dandi	
Available Iron (as Fe)	mg/kg	46.4	38.26	36.28	41.26	40.8	STP/SOIL
Sodium as Na	mg/kg	55.68	62.5	71.22	80.3	66.8	STP/SOIL

Source: Test Report of Environmental Monitoring

Soil Analysis Results

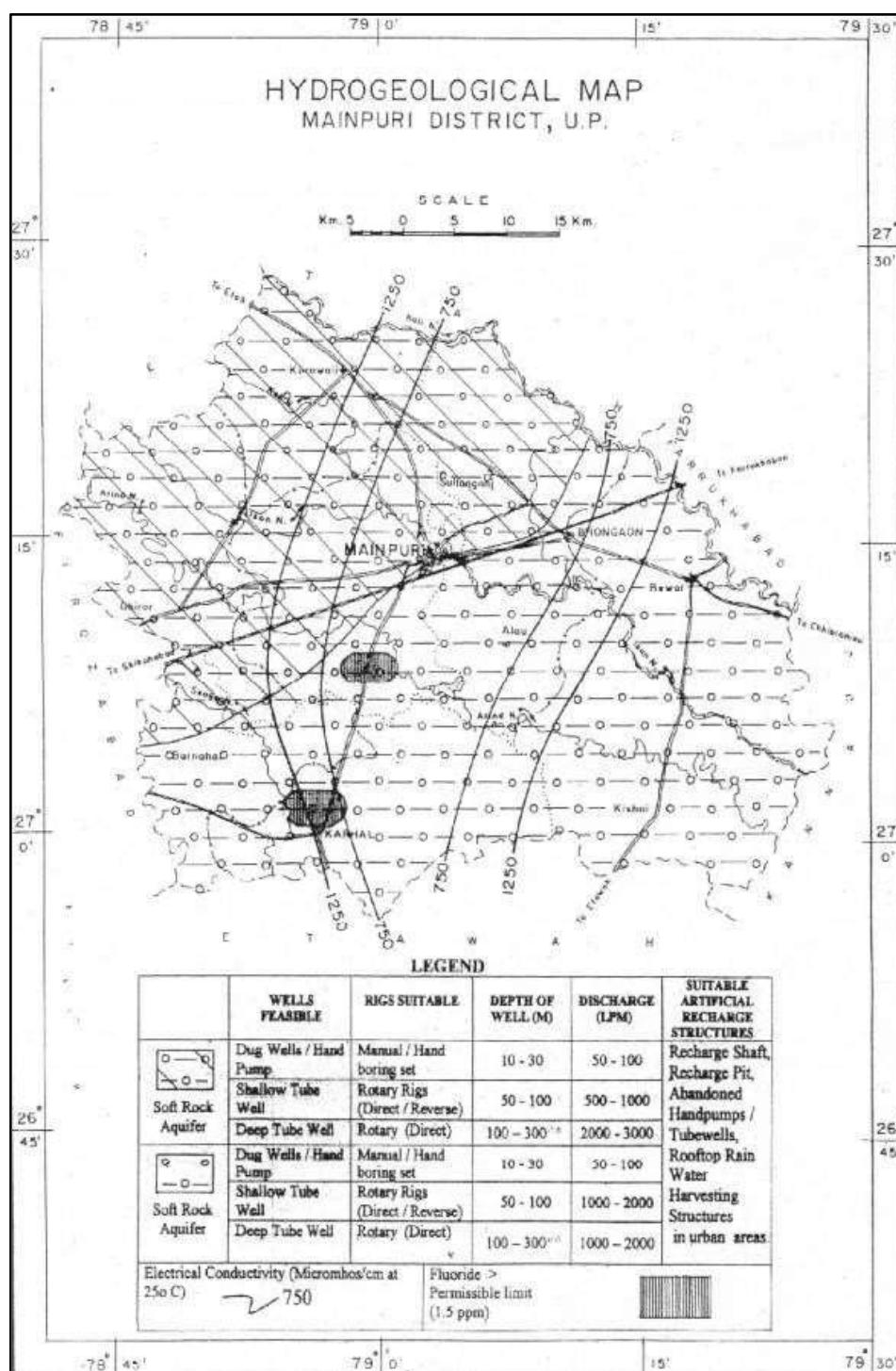
The soil type all along the project is sandy loam with sand content between 55 and 65 percent. The Sodium Absorption Ratio is more than 1% at all locations. The soil quality analysis shows that at all the locations soil quality is basic in nature and the moisture content is between 15.3% to 22.4%. Electrical conductivity has been found to be in range of 220 to 340 $\mu\text{mhos/cm}$. Water holding capacity is between 19.5 to 28.7%.

4.6 Hydrogeology

The project road section from Km 0+000 to Km 28+900 lies Mainpuri district is underlain by Quaternary alluvium comprising mainly clay, Kankar, sand and gravel over the basement of Pre-Cambrai Vindhyan formation. Different grades of sand and gravel form the multi aquifer system in the area. Ground water occurs under water table condition in phreatic zones and under semi-confined condition in deeper zones.

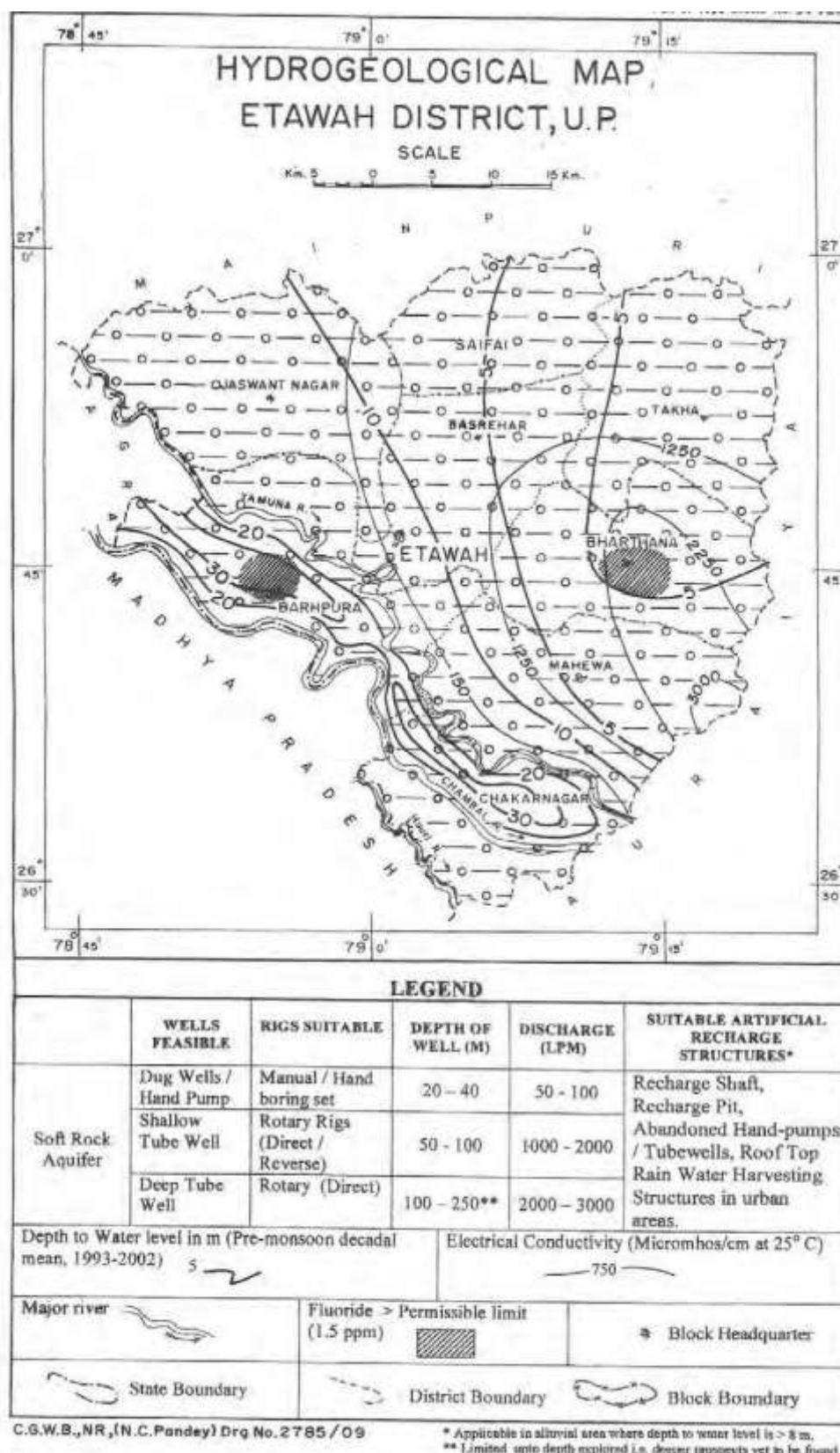
The road after km 28+900 enters Etawah district, which occupies a part of Indo-Ganga plain and is underlain by quaternary sediments consisting clays, silt, kankar and sands of different grade. The sediments of newer alluvium are mainly arenaceous in nature and are found in topographically low region. These sediments are loose, unconsolidated, flood plain deposits or back swamp deposits and are confined in narrow strips all along the present drainage system. The newer alluvial material along the river Yamuna comprises mainly micaceous mineral while in the northern parts along the bed of the river Senagar the younger alluvial material resembles mineralogically to older alluvial material as it is formed by the reworking of older alluvium through alluvial action. The younger alluvial material occupying extreme southern parts of the district differs in composition as the river Chambal originating from plateau region, south of Etawah district, comprising mainly sand stones. The older alluvial material generally occupy the region of higher elevation. These sediments are argillaceous in nature and relatively compact. The clays predominate over sandy horizon in older alluvium. The top silty/sandy clay bed mixed with kankar constitute the water table shallow aquifer generally caters the groundwater to the dug wells and the groundwater in this aquifer occurs under unconfined conditions.

Hydrogeological maps of Mainpuri and Etawah Districts are shown in **Figure 4.8** and **4.9**.



Source: District Ground Water Brochure, Mainpuri District CGWB

Figure 4.8 : Hydrogeological Map of Mainpuri District



Source: District Ground Water Brochure, Etawah District CGWB

Figure 4.9 : Hydrogeological Map of

4.7 Water Environment

4.7.1 Surface Water Resource

The project road crosses a number of streams and rivers. Main source of drainage in the project area passing through Mainpuri & Etawah district is Kali Nadi, Isan, Arind (Rind), Senger nadi, Sirsa nadi, etc. The project road is crossing many canals and distributaries. The area abounds in swamps and marshes particularly in the central portion. Surface water bodies crossed by the project road area given in **Figure 4.10**:





Figure 4.10: Water Bodies Crossed By the

4.7.2 Floods

Of the various natural disasters, floods are the most commonly occurring in Uttar Pradesh, affecting almost every year some part of the state or the other. Important rivers, which create floods in the State, are the Ganga, the Yamuna, the Ramganga, the Gomti, the Sharda, the Ghaghra, the Rapti and the Gandak. The Ganga River basin of U.P. experiences normal rainfall in the region from 60 cm to 190 cm of which more than 80% occur during the southwest monsoon. The rainfall increases from west to east and from south to north. Similar is the pattern of floods, the problem increases from west to east and south to north. Out of the 240.93 lakh hectares geographical area of the State about 73.06 lakh hectares is flood prone. As per the Irrigation Department's estimate, only 58.72 lakh can actually be protected. The eastern districts as well as those situated in the Terai region bordering Nepal are the most affected. Due to floods, an average of 26.89 lakh hectares is affected annually. Apart from these, loss of human life also occurs. The flood prone areas in the project area are shown in **Figure 4.11**. The map of area affected by flood in Uttar Pradesh is shown is **Figure 4.12**.

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bawar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

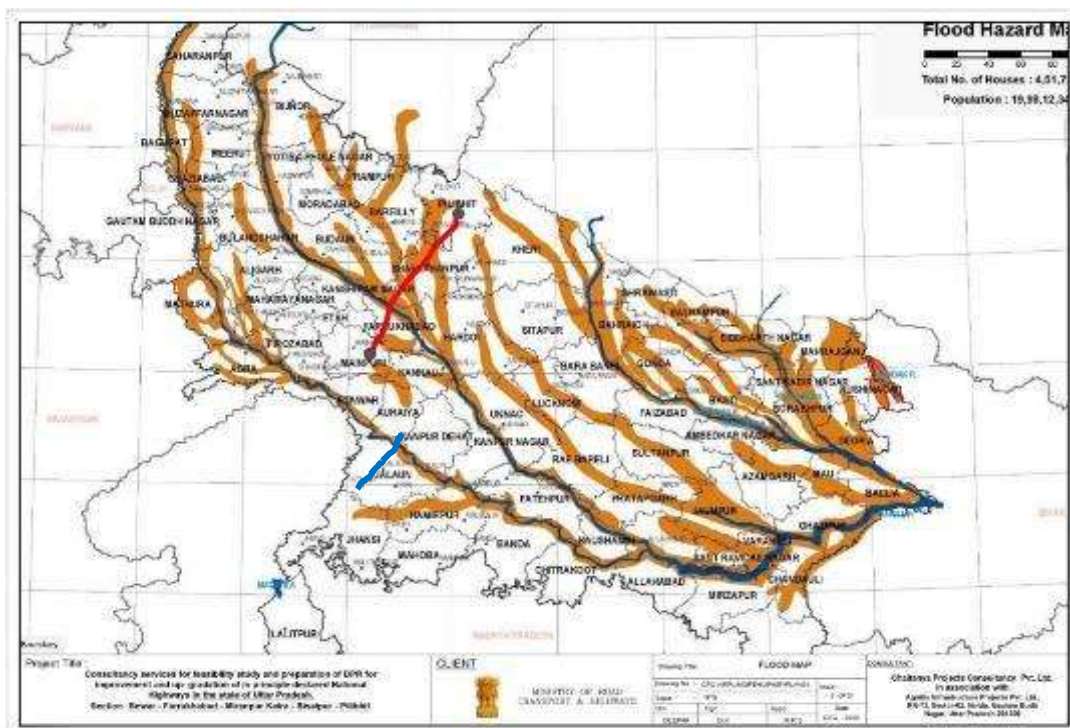


Figure 4.11 : Flood Hazard Vulnerability Map

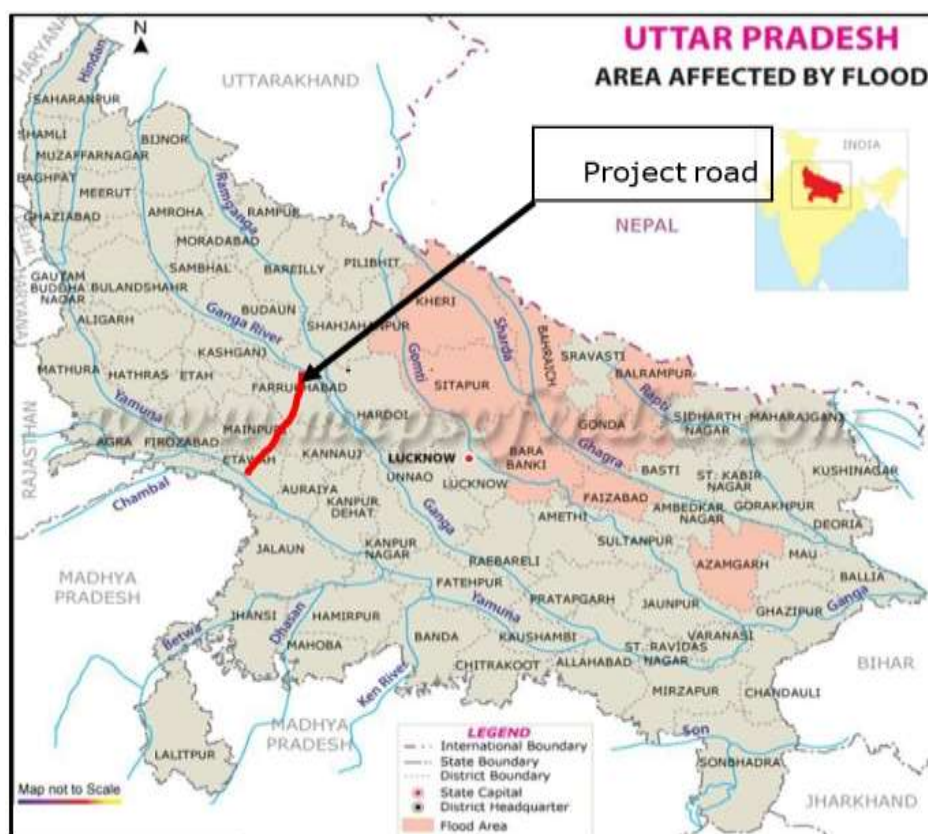


Figure 4.12: Map of Area Affected by Flood in

4.7.3 Ground Water

Ground water has been found to be an important source for catering to the local needs of water consumption in the rural and urban areas. Therefore, any kind of deterioration in the quality of ground water owing to the developmental activities will pose threat to the local population and attention needs to be paid towards.

maintaining the quality of water using all possible tools. Since the ground water is used without treatment by a large portion of population for drinking purpose and domestic use, the quality of ground water is of more concern.

Ground water is an important source for catering to the needs of water consumption in the rural and urban areas. Therefore, any kind of deterioration in the quality of ground water owing to the developmental activities will pose threat to the local population and attention needs to be paid towards maintaining the quality of water using all possible tools. Since the ground water is used with out treatment by a large portion of population for drinking purpose and domestic use, the quality of ground water is important.

Depth of Ground Water as per CGWA

Mainpuri District- pre-monsoon depth to water level during May'2012 was 1.37 - 8.59 m bgl and post-monsoon depth to water level during Nov'2012 was 1.39 - 8.05 mbgl

Etawah District- The major granular zones (Sand mixed with Kankar and gravel) have been found at depth 30-170 mbgl, 175-217 mbgl, and 255-326 mbgl.

4.7.4 Surface and Ground Water Quality

The details of locations of ground and surface water samples are provided in **Table 4.3** and **Table 4.4**, respectively. The analytical results of ground and surface water are given in **Table 4.5** and **Table 4.6**, respectively. Surface water samples were analysed based on CPCB classification and the ground water samples were analyzed for all essential characteristics and for most of the desirable characteristics specified in IS 10500:2012. The water sampling locations maps are shown in **Figure 4.13** and **4.14**, respectively. Ground and surface water sampling photographs are shown in **Figure 4.15** and **Figure 4.16**, respectively.



Figure 4.13: Ground Water Sampling Locations

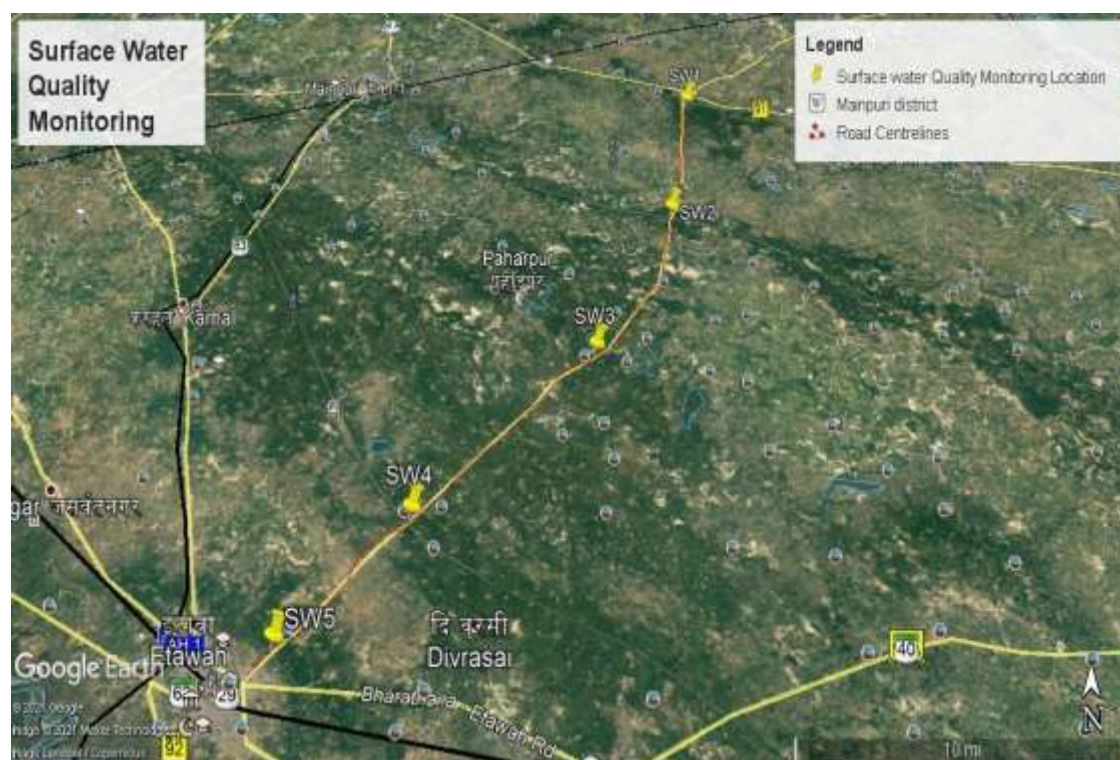


Figure 4.14 : Surface Water Monitoring Locations



Figure 4.15: Ground Water Sampling Photographs



Figure 4.16: Surface Water Sampling Photographs

Table 4.3:Details of Ground Water Sampling Locations

Location Code	Locations Name	Date of Sampling	GPS Coordinates
GW-1	Bewar Near Ch. 0+000	26/02/2021	27°12'58.08"N 79°18'5.95"E
GW-2	Kishni Near Ch. 24+200	26/02/2021	27° 1'4.57"N 79°15'22.75"E
GW-3	Barlokpur Near Ch. 38+000	26/02/2021	26°55'44.39"N 79°10'16.41"E
GW-4	Shekpur Saraiya Near Ch. 48+000	26/02/2021	26°51'44.01"N 79° 6'13.28"E
GW-5	Harharpur Near Ch. 55+000	26/02/2021	26°48'21.72"N 79° 2'57.94"E

Table 4.4 :Details of Surface Water Sampling Locations

Location Code	Locations Name	Date of Sampling	GPS Coordinates
SW-1	Bewar	27°14'10.15"N 79°19'45.49"E	23-May-20
SW-2	Bahadurpur	27°23'56.24"N 79°37'37.17"E	23-May-20
SW-3	Daudapur	27° 38'24.06"N 79°39'42.79"E	25-May-20
SW-4	Bhunda Harbanspur	28°10'39.18"N 79°43'46.34"E	25-May-20
SW-5	Mathu Dandi	28°34'13.26"N 79°48'20.74"E	26-May-20

Analysis results for ground and surface water analysis are given in **Table 4.5** and **Table 4.6**, respectively.

4.7.5 Analysis Result for Ground water Analysis

The test results of the ground water samples at all the locations reflect that the pH is within permissible limit. Total hardness at all locations is more than acceptable limits at Bewar, Kismi and Shekhpur, but within the permissible limits, highest value being 288.2 mg/l at GW-1 location, in Bewar. Alkalinity is also found to be exceeding the acceptable limits at all locations with maximum value being 389.24 mg/l at Bewar.

Values of Magnesium also found to be high at all locations but were under the permission value range, except at Bewar where Magnesium

exceeded the permissible range of 100 mg/l and concentration found was 227mg/l. The Total dissolved solid varied from 198.6 mg/l to 413.34 mg/l at different locations along the project road. The concentration of chlorides, iron, fluoride concentration and other metals are below the permissible limit in all the samples taken along the project road.

4.7.6 Surface Water Analysis Result

The analysis of surface water quality of all the water bodies reveal that they have high BOD values and very low Dissolved Oxygen, in the range of 5.5 to 35.5 mg/l and 2.4 to 6 mg/l respectively. SW-5 has minimum BOD of 5.5 mg/l and maximum DO of 6mg/l. Total coliforms in surface water samples have been found to be high and ranging between 430 and 630 MPN/100ml. The Electrical conductivity for all sources vary from 263.91 to 596.65 $\mu\text{S}/\text{cm}$ and the pH lies in the range 7.4 to 8.4, i.e. basic in nature. The results indicate that there is disposal of domestic sewage in the monitored water bodies.

Table 4.5: Ground Water Quality Along The Project Road

S.N.	Test Parameter	Units	Results					IS-10500: 2012- Drinking Water Standards	
			GW-1	GW-2	GW-3	GW-4	GW-5	Acceptable Limits	Permissible Limits
1.	Temperature (°C)	(°C)	15	16	15	15	16	-	-
2.	pH	-	7.86	7.66	7.36	7.44	7.32	6.5-8.5	No Relaxation
3.	Electrical Conductivity	Microm/hos/cm	755.16	762.26	412.36	425.22	395.85	-	-
4.	TDS	mg/l	413.34	395.24	205.16	210.22	198.6	500	2000
5.	TSS	Mg/l	BDL	BDL	0.41	BDL	BDL	-	-
6.	Dissolved Oxygen	mg/l	4.8	3.8	5.6	4.2	3.9		
7.	Alkalinity as (CaCO ₃)	mg/l	389.24	386.12	216.16	208.14	205.23	200	600
8.	Total Hardness (as CaCO ₃)	mg/l	288.2	245.56	182.44	205.32	195.25	200	600
9.	BOD (at 27°C 3-Days)	mg/l	BDL	BDL	BDL	BDL	BDL	-	-
10.	COD	mg/l	BDL	BDL	5.5	BDL	BDL	-	-
11.	Nitrate (as NO ₃)	mg/l	0.24	0.12	0.66	0.12	0.24	45	No Relaxation
12.	Chloride (as Cl)	mg/l	28	48	12.6	20.5	18.4	250	1000
13.	Phosphates	mg/l	0.04	0.05	0.03	0.06	0.08	-	-
14.	Sulphate (as SO ₄)	mg/l	58.7	62.6	42.3	38.6	40.5	200	400
15.	Sodium (as Na)	mg/l	42.7	62.5	42.5	40.2	38.6	-	-
16.	Potassium (as K)	mg/l	2.5	3.8	2.7	3	2.6	-	-
17.	Calcium (as CaCO ₃)	mg/l	56.8	52.3	55.4	48.2	47.3	75	200
18.	Magnesium (as CaCO ₃)	mg/l	227	41.2	32.6	38.6	32.5	30	100
19.	Silica	mg/l	33.2	28.6	32.5	30.5	37.5	-	-
20.	Oil & Grease	mg/l	<1.0	<1.00	<1.00	<1.00	<1.01	-	-
21.	Residual Sodium Carbonate	mg/l	116	86	72	78	65	-	-
22.	Lead (as Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	No Relaxation

S.N.	Test Parameter	Units	Results					IS-10500: 2012- Drinking Water Standards	
			GW-1	GW-2	GW-3	GW-4	GW-5	Acceptable Limits	Permissible Limits
23.	Arsenic (as As)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05
24.	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	No Relaxation
25.	Cadmium (as Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	No Relaxation
26.	Chromium (as Cr ⁶⁺)	mg/l	<0.001	<0.01	<0.01	<0.01	<0.01	0.05	No Relaxation
27.	Total Chromium (as Cr ⁶⁺)	mg/l	<0.01	<0.05	<0.05	<0.05	<0.05	0.05	No Relaxation
28.	Copper (as Cu)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1.5
29.	Zinc (as Zn)	mg/l	0.18	0.19	0.003	0.12	0.16	5	15
30.	Iron (as Fe)	mg/l	0.86	0.78	0.03	0.78	0.76	0.3	1
31.	E. coli	MPN per 100ml	Absent	Absent	Absent	Absent	Absent	Shall be Non-detectable	
32.	Total coliform	MPN per 100ml	Absent	Absent	Absent	Absent	Absent	Shall be Non-detectable	

Source: Environmental Baseline Monitoring

Table 4.6: Surface Water Quality Along The Project Road

S.N.	Test Parameter	Unit	Surface Water Analysis Results					Method of Testing
			SW-1	SW-2	SW-3	SW-4	SW-5	
1	pH	-	8.44	8.40	7.58	7.55	7.42	IS:3025 part 11 1983 RA-2012
2	E. Conductivity	µs/cm.	532.8	531.5	596.65	595.45	263.91	IS: 3025 Part 10 1984 RA-2002
3	Dissolved Oxygen	mg/L	2.5	2.4	2.8	2.7	6.0	IS: 3025 Part 38 1989 RA-2003
4	Total Dissolved Solids	mg/L	346.32	345.29	387.92	387.48	171.54	IS: 3025 Part 16 1984 RA-2006
5	Total Hardness	mg/L	213.75	211.68	182	181.24	131.08	IS: 3025 Part 21 2009
6	Total Alkalinity	mg/L	235	234.8	224.5	225.1	132	IS: 3025 Part 23 1986, RA-2003
7	B.O.D (3 days at 27°C)	mg/L	22.5	22.4	35.5	35.2	5.5	IS: 3025 Part 44 1993 RA-2009
8	C.O. D	mg/L	66.7	66.2	62.2	61.86	12.2	-
9	Chloride as Cl	mg/L	44.62	45.86	50.16	50.12	18	IS: 3025 Part 32 1988, RA-2009
10	Fluorides as F-	mg/L	1.42	1.35	0.35	0.34	0.15	IS: 3025 Part 60 2008
11	2- Sulphate as SO ₄	mg/L	35.2	34.7	44.8	44.2	12.62	IS: 3025 Part 24 1986, RA-2003
12	Nitrates as NO ₃	mg/L	5.75	5.68	0.78	0.67	3.82	IS: 3025 Part 34 1988, RA-2003
13	Phosphate as PO ₄	mg/L	0.48	0.44	0.55	0.51	0.42	IS: 3025 Part 31 1988, RA-2003

S.N.	Test Parameter	Unit	Surface Water Analysis Results					Method of Testing
			SW-1	SW-2	SW-3	SW-4	SW-5	
14	BI-carbonate as HCO ₃	mg/L	110.22	109.54	114.2	113.15	130	IS: 3025 Part 51
15	Iron as Fe	mg/L	0.05	0.05	0.053	0.04	0.042	IS: 3025 Part 53
16	Chromium as Cr	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025 Part 52 2003
17	Cadmium as Cd	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025 Part 41 1992
18	Lead as Pb	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025 Part 47 1994
19	Copper as Cu	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS 3025 Part 42 1992
20	Arsenic as	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	IS: 3025 Part 37 1988, RA-2003
21	Selenium as Se	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS: 3025 Part 56 2003
22	Phenolic Compound as C ₆ H ₅ OH	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	IS: 3025 Part 43 1992, RA-2003
23	Zinc as Zn	mg/L	0.42	0.41	0.48	0.46	0.46	IS 3025 Part 49 1994
24	Sodium	mg/L	41	40.5	60.26	59.8	8.5	IS: 3025 Part 45 1993, RA-2009
25	Potassium	mg/L	5.5	5.2	2.8	2.7	2.6	IS: 3025 Part 45 1993, RA-2009
26	Calcium	mg/L	55.65	54.4	48.1	47.68	38	IS: 3025 Part 40
27	Magnesium	mg/L	18.2	18	12	11.8	8.8	IS: 3025 Part 46
28	Anionic detergents as MBAS	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	Annex K of IS 13428:2005
29	Oil and grease	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	IS 3025 Part 39

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S.N.	Test Parameter	Unit	Surface Water Analysis Results					Method of Testing
			SW-1	SW-2	SW-3	SW-4	SW-5	
								1991
30	SAR		0.35	0.34	0.32	0.31	0.36	
31	Coliform	MPN/100ml	240	320	270	310	250	--
32	Total Coliform	MPN/100ml	510	630	480	440	430	IS 15185: 2002

Source: Environmental Baseline Monitoring

4.8 Climate

The primary temperature, rainfall and wind features of the three distinct seasons of the state are:

- Summer (March–June): Hot & dry (temperatures rise to 45 °C, sometimes 47–48 °C); low relative humidity (20%); dust laden winds.
- Monsoon (June–September): 85% of average annual rainfall of 990 mm. Fall in temperature 40–45° on rainy days.
- Winter (October–February): Cold (temperatures drop to 3–4 °C, sometimes below –1 °C); clear skies; foggy conditions in some tracts.

Mainpuri District: The climate of the district is characterized by hot summer and very cold winter. The summer season is very hot and temperatures may rise upto 40-45°C. During winters the district is affected by cold waves and minimum temperatures may drop down to one-two degrees below freezing point.

Etawah District: The climate is characterized by hot dry summer and a pleasant cold winter. May is generally the hottest month with mean maximum temperatures of 41°C. The maximum temperatures of the district touches 46.8°C while minimum is around 3.3°C.

Summary of the long-term meteorological scenario of all the four project districts is as follows:

4.8.1 Rainfall

The rainfall data for the period 2014-2018 was collected for Mainpuri and Etawah District are presented in **Table 4.7**.

Table 4.7: Average Annual Rainfall Data for Project Districts

Month	Mainpuri				
	2014	2015	2016	2017	2018
January	44.6	16.6	1.6	9.1	0.0
February	12.3	0.0	1.2	0.0	1.6
March	14.6	46.7	3.1	8.9	0.0
April	2.7	15.4	0.0	0.0	2.0
May	0.0	10.0	12.4	9.0	6.0
June	15.2	18.4	22.2	38.9	2.6
July	101.8	127.6	112.0	269.0	284.3

Month	Mainpuri				
	2014	2015	2016	2017	2018
August	34.7	82.8	151.2	130.4	295.6
September	39.3	9.1	5.0	131.1	152.5
October	0.5	0.0	7.1	0.0	0.0
November	0.0	0.0	0.0	0.0	0.0
December	9.4	9.7	0.0	0.0	0.0
Month	Etawah District				
	2014	2015	2016	2017	2018
January	44.6	16.6	1.6	9.1	0.0
February	12.3	0.0	1.2	0.0	1.6
March	14.6	46.7	3.1	8.9	0.0
April	2.7	15.4	0.0	0.0	2.0
May	0.0	10.1	12.4	9.0	6.0
June	15.2	18.4	22.2	38.9	2.6
July	101.8	127.6	112.0	269.0	284.3
August	34.7	82.8	151.2	130.4	295.6
September	39.3	9.1	5.0	131.1	152.5
October	0.5	0.0	7.1	0.0	0.0
November	0.0	0.0	0.0	0.0	0.0
December	9.4	9.7	0.0	0.0	0.0

Source: Indian Meteorological Department, Govt. of India

4.8.2 Climatological Data of Past 30 years

A. Temperature

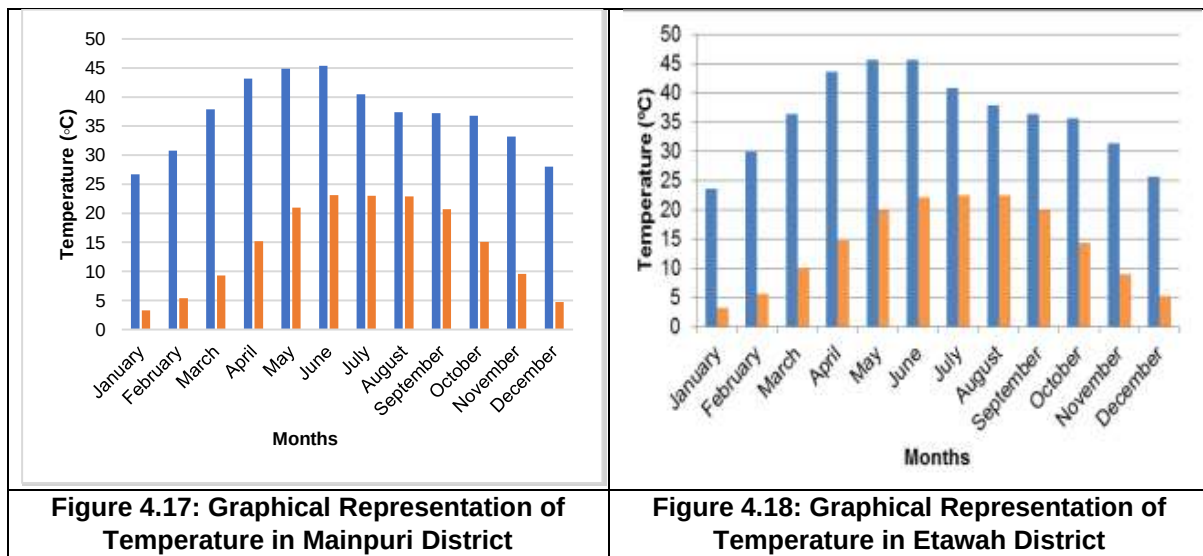
The climatological data of 30 years (1981-2010) of the IMD stations along the project road, i.e. Mainpuri and Etawah have been considered for analyzing the climatology of the project influence area as given in **Table 4.8** which may be representative of the climatic conditions for the study area in general.

The dust storms and severe heat waves are common in the districts between April and May months. The temperature within the districts begins to rise by the end of February till May which is the hottest month of the year and the coldest months are December and January.

Table 4.8: Maximum and Minimum Temperatures (IMD 1981-2010)

Month	Temperature (°C)		Temperature (°C)	
	Avg. Max	Avg. Min	Avg. Max	Avg. Min
	Mainpuri District		Etawah District	
January	26.7	3.3	25.4	3.2
February	30.8	5.4	28.5	5.1
March	37.9	9.3	35.3	8.9
April	43.2	15.2	40.0	13.4
May	44.9	21.0	42.5	18.5
June	45.4	23.1	43.0	20.3
July	40.5	23.0	37.8	22.4
August	37.4	22.9	36.7	22.5
September	37.2	20.7	35.7	19.5
October	36.8	15.1	34.6	12.5
November	33.2	9.6	34.6	7.7
December	28.0	4.7	26.9	4.4

The graphical representation of maximum and minimum temperature of Mainpuri and Shahjahanpur District is given in **Figure 4.17** and **Figure 4.18**.



B. Humidity

The average humidity in the project districts ranges from 45% to 81% in the morning and from 28% to 70% in the evening within the Mainpuri district and from 50% to 84% in the morning and from 33% to 77% in the evening within the Etawah district as shown in **Table 4.9**.

Table 4.9: Average Morning and Evening Humidity (%)

Month	Humidity (%)			
	Avg. Morning	Avg. Evening	Avg. Morning	Avg. Evening
	Mainpuri District		Etawah District	
January	81	60	84	66
February	75	51	76	56
March	61	40	65	45
April	47	28	48	33
May	45	28	50	34
June	58	43	61	48
July	79	68	78	69
August	84	77	86	80
September	80	70	86	77
October	71	59	80	69
November	71	59	78	66
December	79	63	83	70

Source: Climatological Normals (1981-2010)

The graphical Representation of Morning and Evening Humidity in Mainpuri and Shahjahanpur District is given in **Figure 4.19** and **Figure 4.20**.

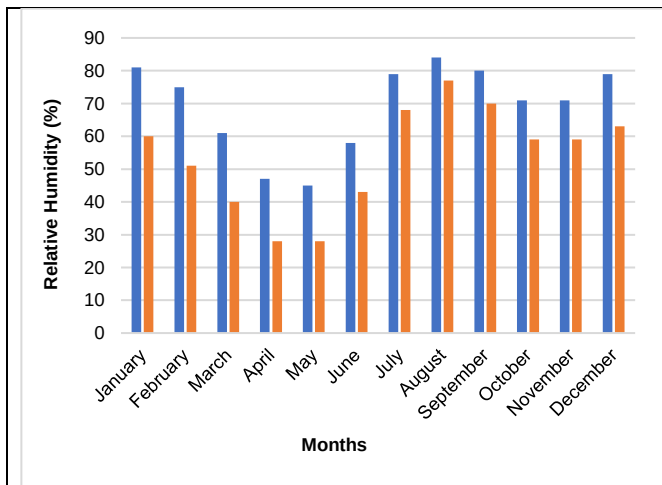


Figure 4.19: Graphical Representation of Relative Humidity in Mainpuri District

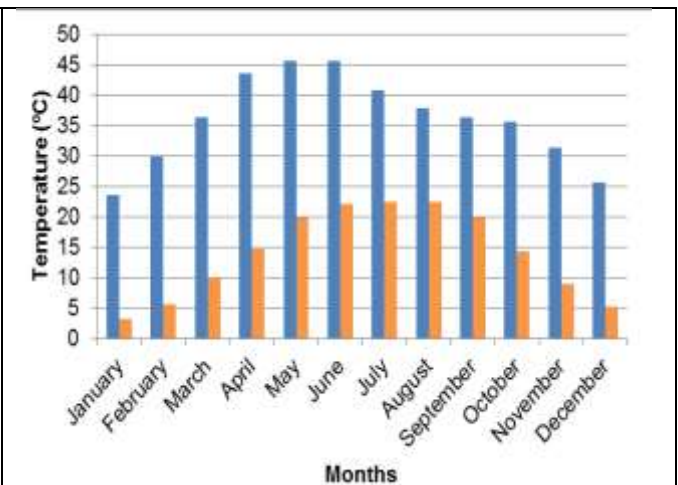


Figure 4.20: Graphical Representation of Relative Humidity in Etawah District

C. Wind Speed

Wind speed and wind direction have a significant role on the dispersion of atmospheric pollutants and therefore, the air quality of the area. Ground level concentrations for the pollutants are inversely proportional to the wind speed in the down wind direction, while in upwind direction no effect will be observed and in cross wind direction partial effect due to the emission sources is observed.

The graphical representation of wind speed within Mainpuri district is given as **Figure 4.21**.

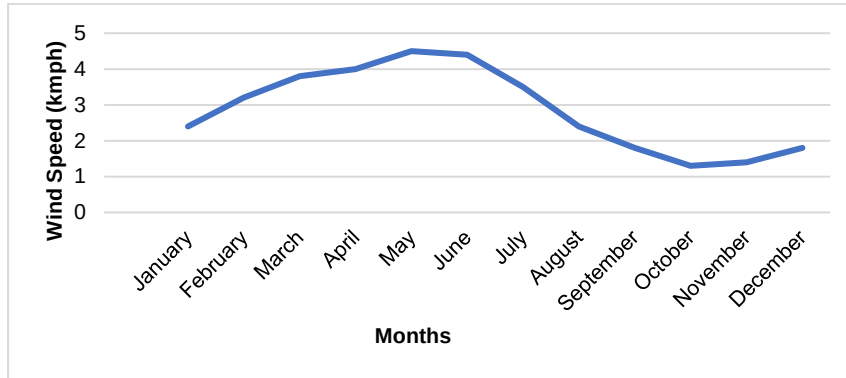


Figure 4.21: Graphical Representation of Wind Speed (IMD Mainpuri, 1981-2010)

4.9 Ambient Air Quality

M/s Noida Testing Laboratory (A NABL Accredited laboratory) was engaged for ambient air quality monitoring along the project road. Five sampling stations were set up for monitoring of ambient air quality within the study area. Monitoring locations were selected following the CPCB guidelines for ambient air quality monitoring so as to accord an overall idea of the ambient air quality scenario in the study area along the project road. Logistic considerations such as accessibility, security and availability of reliable power supply were also considered while finalizing the monitoring locations. ambient air quality monitoring locations are given in **Table 4.10** and the air quality monitoring locations marked on google map are shown in **Figure 4.22**. Field photographs taken during air sample collection are provided in **Figure 4.23**.

Table 4.10: Details of Air Quality Monitoring Locations

Monitoring Station Code	Location	GPS Coordinates
AAQ-1	Bewar near Ch. 0+000	27°12'57.23"N 79°18'3.96"E
AAQ-2	Kishni near Ch. 24+200	27° 1'5.00"N 79°15'21.12"E
AAQ-3	Barlokpur near Ch. 38+000	26°55'42.21"N 79°10'14.29"E
AAQ-4	Shekpur Saraiya near Ch. 48+000	26°51'48.12"N 79° 6'17.51"E

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AAQ-5	Harharpur near 55+000	Ch.	26°48'16.34"N 79° 2'49.77"E



Figure 4.22: Air Quality Monitoring Locations

Ambient air quality monitoring was conducted for the following parameters:

- Particulate matter of size less than 2.5 micron or PM_{2.5}
- Particulate matter of size less than 10 micron or PM₁₀
- Sulphur Dioxide (SO₂)
- Nitrogen Dioxide (NO₂)
- Carbon monoxide (CO)

Ambient air quality monitoring was conducted for one month in pre-monsoon season (February 2021) at a frequency of twice a week at each station adopting a 24-hours schedule. CO has been measured 1- hourly.

The ambient air quality monitoring resultant are presented in **Table 4.11** and graphical presentation of monitoring data against NAAQ Standards is shown in **Figure 4.24**.

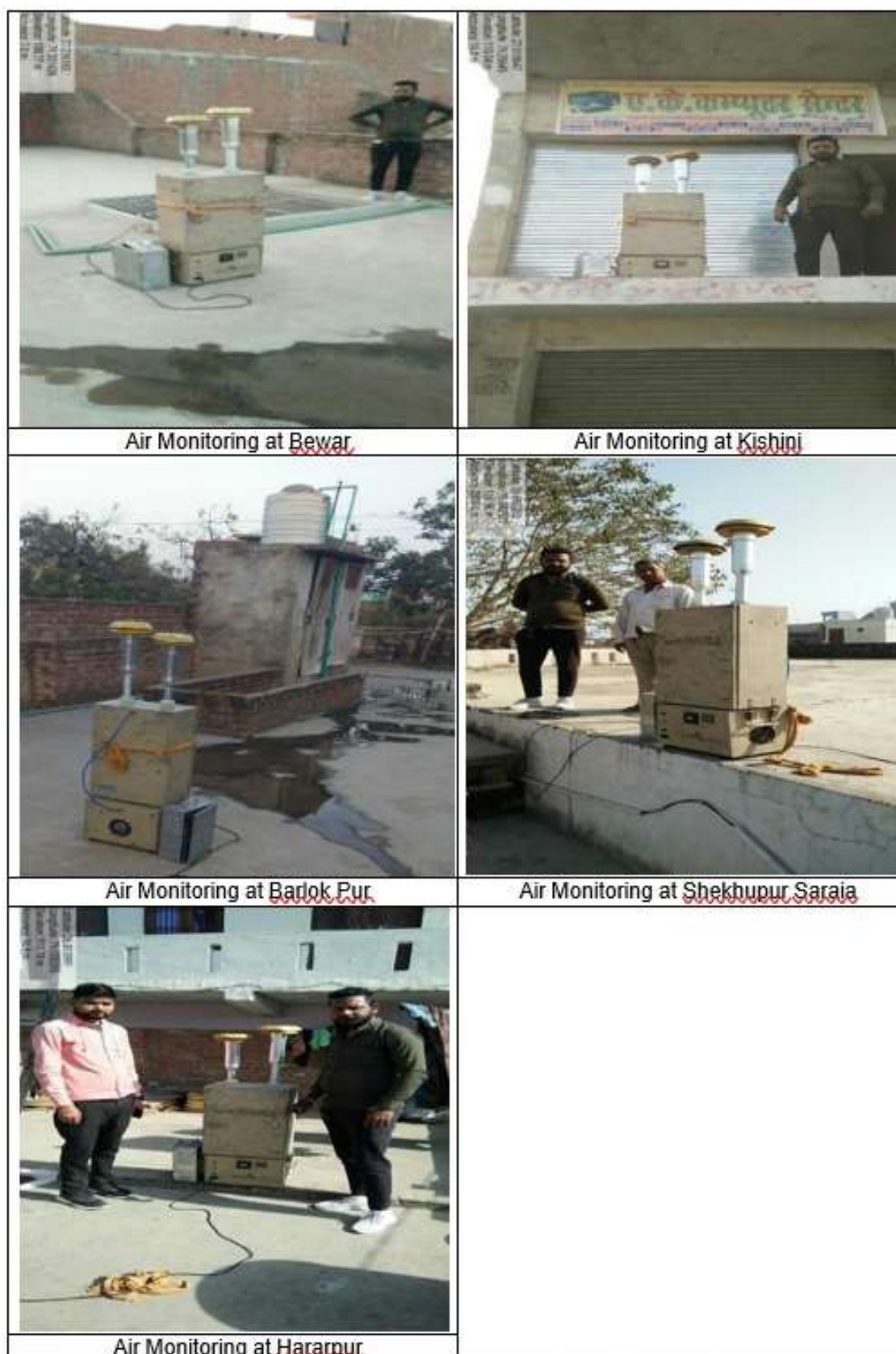


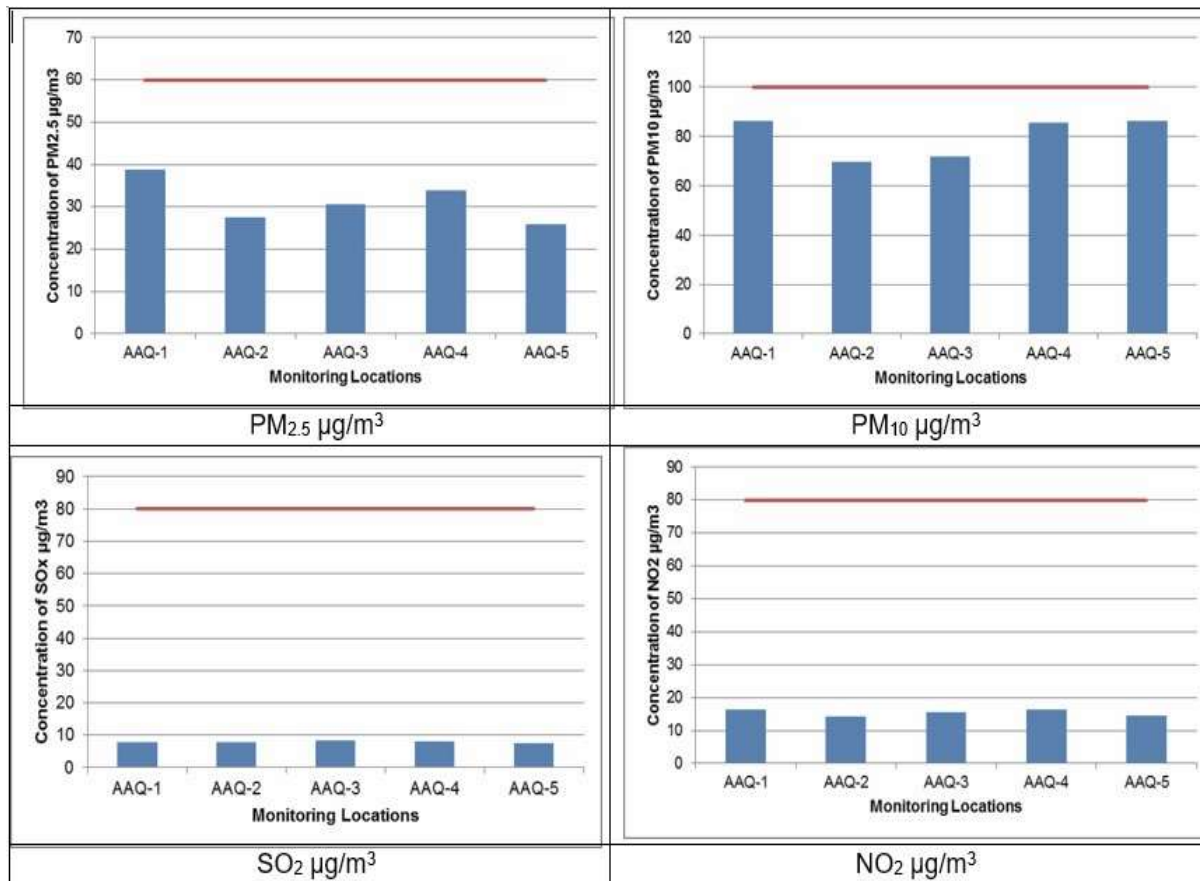
Figure 4.23: Field Photographs for Ambient Air

Table 4.11: Ambient Air Quality along the Project Road

Locations	PM ₁₀ (µg/ m ³)				PM _{2.5} (µg/ m ³)			
	Max.	Min.	Avg.	Limit	Max.	Min.	Avg.	Limit
AQ-1	95	70.8	86.11	100	44.2	32.6	38.81	60
AQ-2	75	60.6	69.61	100	32.4	22.4	27.51	60
AQ-3	78.6	67.2	71.6	100	34	27.6	30.64	60
AQ-4	91.5	70.8	85.59	100	38.2	25.8	33.89	60
AQ-5	95	70.8	86.11	100	30.8	21.2	25.86	60

Locations	SO ₂ (µg/m ³)				NO ₂ (µg/m ³)				CO (mg/m ³)			
	Max.	Min.	Avg.	Limit	Max.	Min.	Avg.	Limit	Max.	Min.	Avg.	Limit
AQ-1	8.9	7.1	7.84	80	17.5	15.2	16.38	80	820	740	783.7	4000
AQ-2	8.2	7.2	7.81	80	16.4	12.6	14.28	80	510	350	440	4000
AQ-3	8.8	7.6	8.23	80	17.5	13.2	15.48	80	620	520	573.7	4000
AQ-4	8.5	7.3	7.98	80	17.5	15.2	16.38	80	820	740	783.7	4000
AQ-5	8.4	6	7.38	80	16.8	11	14.5	80	520	360	436.2	4000

The graphical representation of the ambient air monitoring data is as follows:



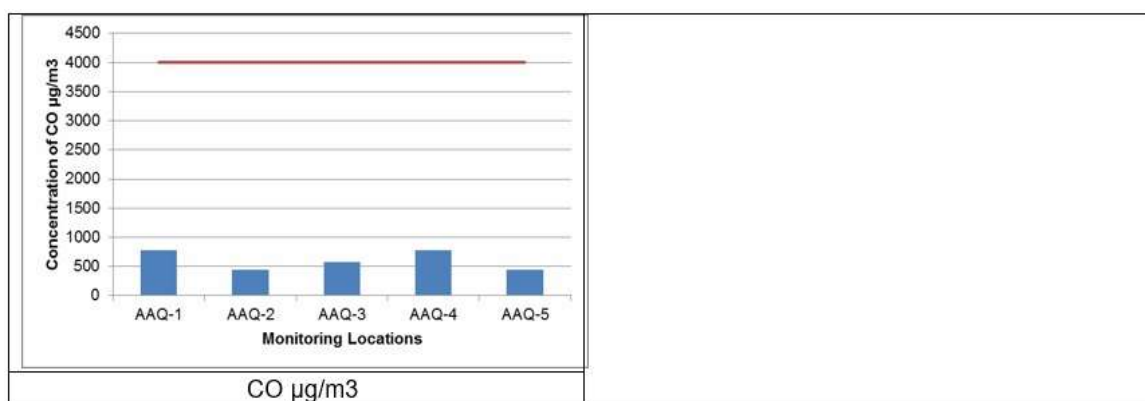


Figure 4.24: Graphical Representation of the Air Quality Data

Result Analysis

The results of air quality monitoring reflect that all the parameters are within the limits prescribed by CPCB. The test results indicate that average 24 hourly mean concentration of PM₁₀, PM_{2.5}, SO₂ and NO₂ in ambient air varied between 69.61 & 86.11 µg/m³, 25.86 & 38.81 µg/m³, 7.37 & 8.25 µg/m³ and 14.27 & 16.37 µg/m³, respectively along the project alignment. The average concentration of CO along the alignment varied between 436.25 and 783.75 µg/m³.

4.10 Noise Environment

Road construction activity is a major source of noise generation due to movement and operation of machineries, heavy vehicles, loading and unloading of construction materials, apart from high noise levels at the asphalt plants (90 - 100 dB (A)). During the operation phase, noise is generated from vehicle movement in three ways, namely from the vehicle body parts, from the tyre-roadway system (also known as the rolling noise) and from the driver behaviour, such as use of horns.

The noise level depends upon the type and condition of tyres and pavement. At higher speed, these types of noise increase at same rate. At lower speeds in urban areas, where lower gears are used, noise from the vehicle body parts tends to be independent of vehicle speed whereas noise from the tyre-roadway system becomes less important. Driver behaviour contributes to road noise by using vehicle's horns, sudden breaking on vehicle speed, depending on the road surface and whether the surface is wet or dry.

Traffic operation and industrial activities alongside the road are also the major source of noise pollution in the area. However, people were found disconcerted for noise related issues. Hence, Noise level in the study area is not the major issue of concern.

In the present study, sound pressure levels (SPL) have been measured by a sound level meter. Since loudness of sound is important for its effects on people, the dependence of loudness upon frequency must be taken into account in noise impact assessment. This has been achieved by the use of A-weighting filters in the noise-measuring instrument which gives a direct reading of approximate loudness. A-weighted equivalent continuous sound pressure level (Leq) values have been computed from the values of A-weighted sound pressure level measured with the help of noise meter.

Five different locations were chosen for assessment of ambient noise quality in study area, as shown on google map below in **Figure 4.25**.

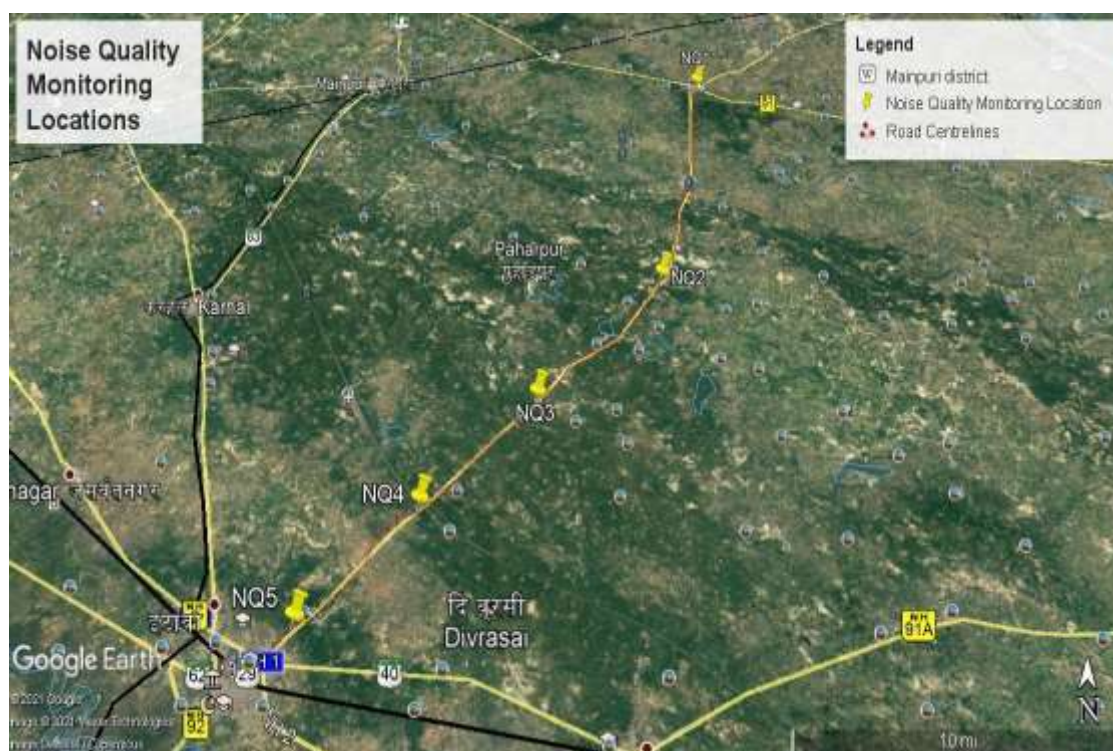


Figure 4.25: Noise Quality Monitoring Locations

Monitoring has been carried out once in a season at each location. Details of noise sampling location are presented in **Table 4.12**. Field photographs taken during noise sample collection are provided in **Figure 4.26**.

Table 4.12: Details of Noise Sampling Locations

Location Code	Name of Location	GPS Coordinates	Zone Type
NQ-1	Bewar Ch 0+000	27°12'57.01"N 79°18'3.71"E	Commercial
NQ-2	Kishni Near Ch. 24+200	27°1'5.46"N 79°15'21.39"E	Commercial
NQ-3	Barlokpur Near Ch.38+000	26°55'42.62"N 79°10'14.69"E	Residential
NQ-4	Shekpur Saraiya Near Ch. 48+000	26°51'48.28"N 79° 6'17.83"E	Residential
NQ-5	Harharpur Near Ch. 55+000	26°48'12.23"N 79° 2'47.91"E	Residential

To establish the baseline environment scenario, noise measurements along the project road were carried out. The ambient noise quality as collected is presented in **Table 4.13** and graphical presentation of the concentration against NAAQ standards is shown in **Figure 4.27**.





Figure 4.26: Field Photographs for Noise Sampling

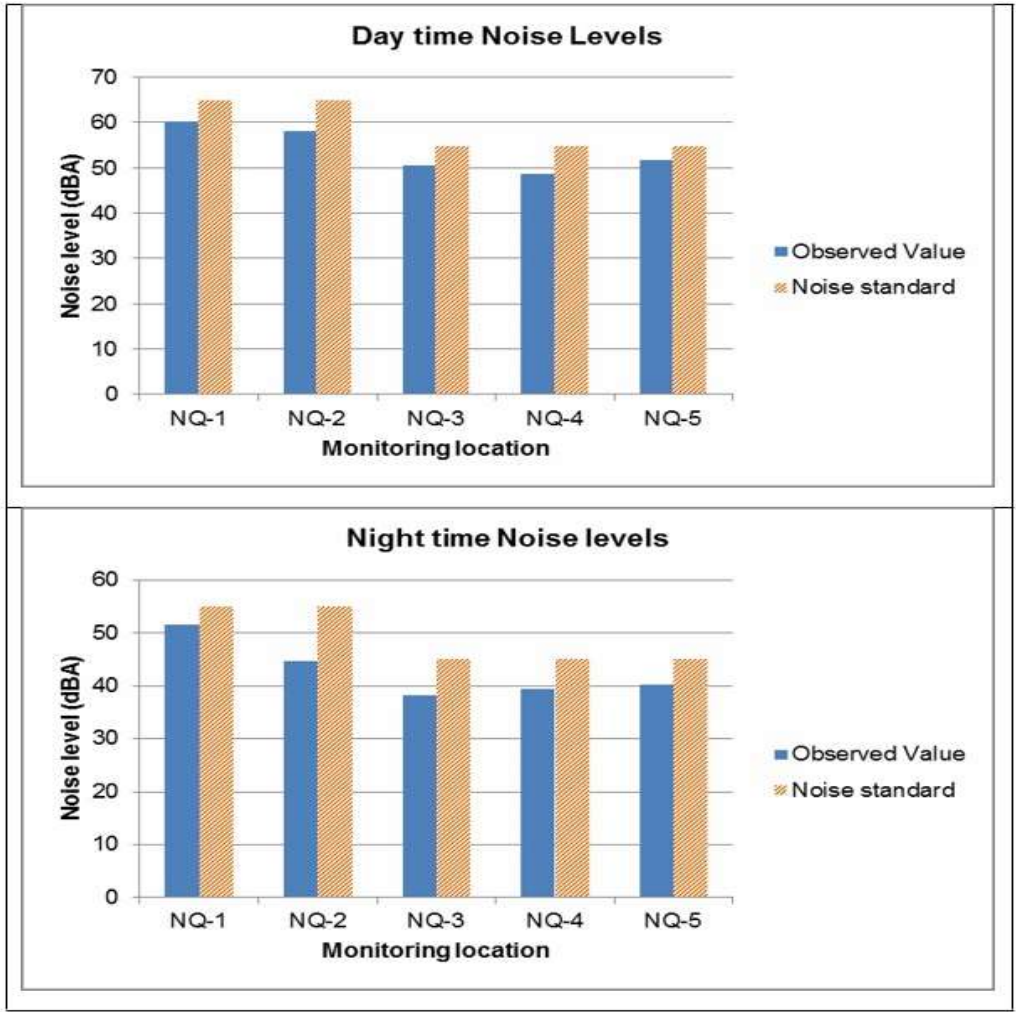


Figure 4.27: Graphical Representation of

Table 4.13: Ambient Noise Quality along the Project Corridor

S.No.	Para-meter	Noise Results									
		NQ-1		NQ-2		NQ-3		NQ-4		NQ-5	
		Result (dBA)	Noise Std. (Res.)	Result (dBA)	Noise Std. (Res.)	Result (dBA)	Noise Std. (Res.)	Result (dBA)	Noise Std. (Com.)	Result (dBA)	Noise Std. (Com.)
1.	Day Time	60.2	65	58.2	65	50.6	55	48.7	55	51.8	55
2.	Night Time	51.6	55	44.7	55	38.2	45	39.4	45	40.2	45

Day Time Noise Level - 6:00 AM to 10:00 PM

Night Time Noise Level - 10PM to 6AM

Result Analysis:

The ambient noise levels at all the monitoring locations were within the permissible level of residential and commercial zones as stipulated by Central Pollution Control Board. The average daytime equivalent noise levels were recorded in the range of 48.7 Leq dB(A) to 51.8 Leq dB(A) in residential areas of Barlokpur, Shekpur and Harharpur, whereas in commercial areas of Bewar and Kishni, average noise levels were 60.2 dB(A) and 58.2 dB(A) against the day time permissible value of 65 dBA.

4.11 Land Use Pattern

Land Use The Land Use/ Land Cover map of the study area of the project road (Bewar to Etawah Section of NH-92 in the State of Uttar Pradesh) is prepared using Resourcesat-2 ortho rectified LISS-III data derived from Bhuvan. Interpretation of satellite imagery is done using visual interpretation technique and individual classes were interpreted using their visual characteristics. Ground truth has been carried out to validate the interpretation accuracy and reliability of remotely sensed data, by enabling verification of the interpreted details and by supplementing with the information, which cannot be obtained directly on satellite imagery. Digital image processing techniques like classification of False Color Composite (FCC) image, were applied for the mapping of the land use land cover classes of the provided area from the satellite data. The LULC database is prepared with 5 class LULC Classification Scheme. Output is in GIS vector file format, prepared using LCC projection and WGS84 as datum. The existing land use around the project road primarily comprises of agricultural land followed by Built-up area. The land use map for a

buffer length of 500m around the project road centerline has been prepared to a scale of 1:25000 based on recent satellite imagery (LISS-III). Below table describes the land use / land cover of the study area. The land use land cover map based on satellite imagery within 500m buffer area around the project road is shown in below figures. Land use map for the project road is attached as **Annexure 4.2**.

The land use along the project corridor is predominantly agricultural, followed by built-up area, plantation and water bodies respectively. The land use pattern for the entire road is shown by a pie chart in **Figure 4.28**.

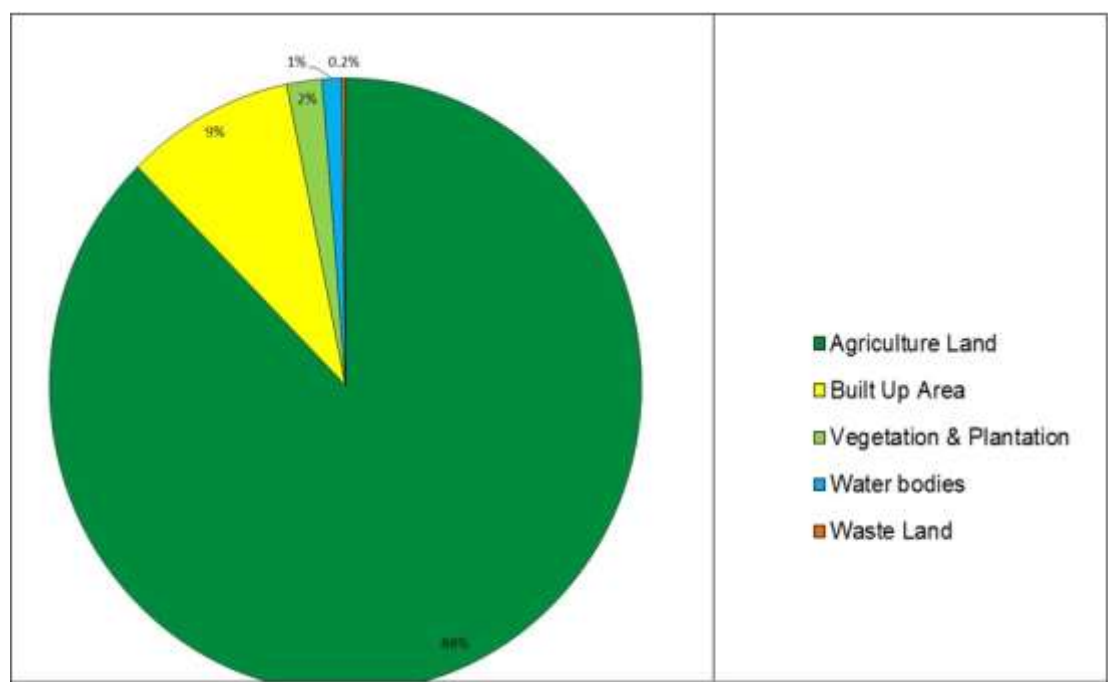


Figure 4.28: Landuse Map for the Project Road

4.12 Ecological and Biological Environment

4.12.1 Forests

The project road starting in Mainpuri district and ending in Etawah district does not cross any major forest area other than Protected Forest which is road side plantation declared as protected forest by the Uttar Pradesh Government.

The road alignment marked on the map of Uttar Pradesh state is shown below in **Figure 4.29**.

The road side plantation along the carriageway within the Right of Way (ROW) of National and State Highways in Uttar Pradesh have been declared as Protected Forest by the State's Department of Forest (Van Vibhag) and accordingly the land within the ROW was transferred to the Forest Department vide notification No. 1115/XIV-331-50 dated February 10,1960. Hence, the project will attract diversion of forest land under the provisions of Forest (Conservation) Act, 1980.

Roadside plantation along the project road is notified as protected forest and will need diversion of Protected Forest land for none forestry use. Forest clearance application for the same has been submitted to the Forest Department, as per details given below in **Table 4.14**.

4.12.2 Roadside Trees

Plantation of trees along the project section has been recorded within the RoW. Within the RoW total 3132 trees (1601 trees Left Hand Side and 1531 trees Right Hand Side) are growing. The summary of trees to be felled in the Package 1A and 1B is given in **Table 4.15**. Grith wise details of trees within the ROW are given **Annexure 4.3**. The predominant tree species along the project road are Papdi (*Terminalia catappa*), Eucalyptus (*Eucalyptus globulus*), Siris (*Albizia lebbbeck*), Shisham (*Dalbergia sissoo*), Paakad (*Ficus virens*), Neem (*Azadirachta indica*) and Sagaun (*Tectona grandis*). Apart from these Amaltas (*Cassia fistula*), Babul (*Vachellia nilotica*), Bakain (*Melia azedarach*), Gular (*Ficus racemosa*), Mango (*Mangifera indica*), Peepal (*Ficus religiosa*), etc. Most of the trees are confined within 10 m distance from existing central line of the road.

Table 4.14: Forest Clearance Status of The Project Road

Package	Project Length (km)	Districts	Forest Division	Forest area applied online (Ha.)	FCA online Application Number	FCA Online Application status#
NH-92 Package-1A	30.000	Mainpuri	Social Forestry Division Mainpuri	35.378	FP/UP/ROAD /53919/2020	Pending at DFO/DCF
		Etawah	Social Forestry Division Etawah	1.017		
		Total Area (Pkg. 1A)			36.395 Ha.	
NH-92 Package-1B	27.346	Etawah	Social Forestry Division Etawah	23.984	FP/UP/ROAD /57961/2020	Pending at DFO/DCF
Grand Total	57.346	Total Area (Pkg. 1A+1B)		60.379 Ha.		

Note : #= As on 20 June 2021

Table 4.15: Summary of Trees to be felled in the Package 1A and 1B

Package	Forest Division	District	Chainage	Side (LHS)	Side (RHS)	Total no. of trees to be felled
NH-92 Package-1A	Social Forestry Division Mainpuri	Mainpuri	Ch 0.000 to Ch 29.100	654	657	1311
	Social Forestry Division Etawah	Etawah	Ch 29.100 to Ch 30.000	45	55	100
Sub Total				699	712	1411
NH-92 Package-1B	Social Forestry Division Etawah	Etawah	Ch 30.000 to Ch 57.346	902	819	1721
Sub Total				902	819	1721
Total				1601	1531	3132

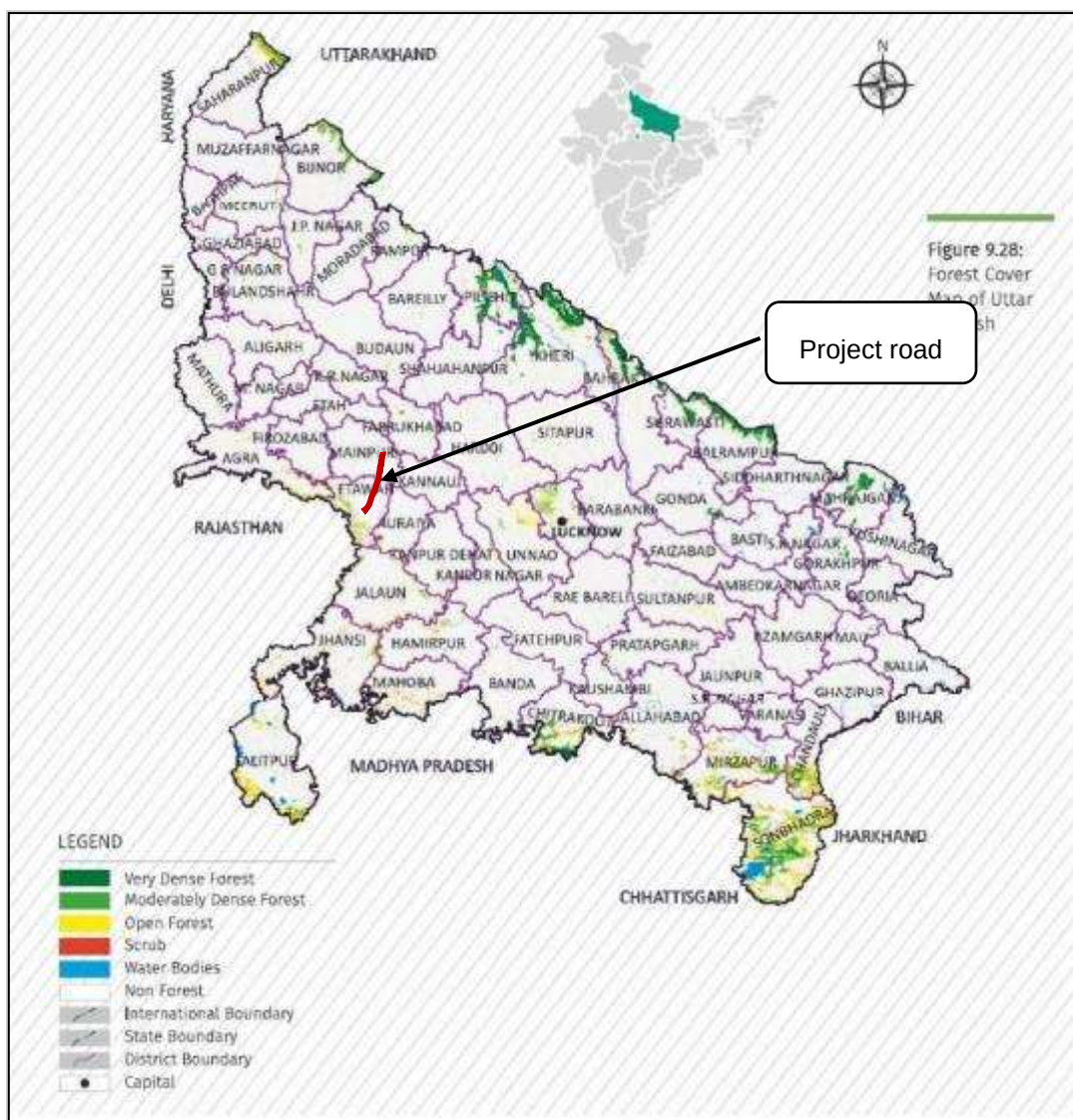


Figure 4.29: Forest Cover Map of Uttar Pradesh State Showing Project Road

4.12.3 Flora in Study Area

The study area along the project road is majorly agricultural land. In the project area babul (*Acacia arabica*) grows in many places on the usar plains and is indeed, the only tree which flourishes on them. Its timber is in great demand both for fuel and carpentry. Its bark is used in tanning, its gumth in dyeing and in medicine. Beside babul other species of tree found in the area are Shishum (*Dalbergia sissoo*), Neem (*Azadirachta indica*), Papdi (*Terminalia catappa*), Siris (*Albizia lebbeck*), Pipal (*Ficus religiosa*), Eucalyptus (*Eucalyptus Spp.*), Ashoka (*Polyathia longifolia*), Semal

(Salmalia malabarica), Gulmohar (Delonix regia), Akain (Melia azedarach), Gular (Ficus racemosa), Mango (Mangifera indica), Khair (Acacia indica), Bel (Aeglamarnelos), Bargad (Ficus bengalensis), Pakar (Ficus indica), Jamun(Syzygium cumini), Aonla (Embllica officinal's), etc.

4.12.4 Wildlife Sanctuary/ National Park/ Tiger Reserve or Eco-sensitive Zones

Uttar Pradesh has one National Park and 23 Wildlife Sanctuaries. The project stretch does not pass through any wildlife sanctuary, national park or notified ecologically sensitive areas or any other significant area of ecological interest, neither any such environmental sensitive locations are located within 10 Km radius on either side of the project road. National parks and wildlife sanctuaries in Uttar Pradesh are shown in **Figure 4.30**.

The Saman Bird Sanctuary which lies in Mainpuri district, is at an aerial distance of more than 25 km from the project road in South-West (SW) direction.

4.12.5 Threatened or Endangered Species

No rare, threatened or endangered flora or fauna is found along the project corridor.

4.12.6 Wetlands of Ecological Importance

There is no wetland along the project road as per Wetland (Conservation and Management) Rules 2017 and list of Wetlands of International Importance (Ramsar Sites).

4.12.7 Fauna

The project districts of Mainpuri and Etawah do not abound in wild animals. Among carnivorous animals the Jackal (*Coni aureus*) and Fox (*Vulpes bengalensis*), are fairly common. Other animals found are the monkey (*Innus rhesus*), Hare (*Lepus ruficandatus*), Nilgai (*Boselaphus tragocamelus*) and Lomri (*Vulpes vulpes*). Ayeen fauna found are partridge, quail, pigeon and peacock. Many varieties of snakes are also found.

4.12.8 Aquatic Ecosystem

The rivers crossed by the project road are quite polluted due to discharge of domestic and industrial wastes into the river at various locations. No endangered / important faunal aquatic species is present in these rivers.



Figure 4.30: National Park and Wildlife Sanctuary in Uttar Pradesh

4.13 Socio-Economic Conditions

4.13.1 Demographic Profile

Demographic profile has an important bearing on the development process. The basic demographic details of the project districts are presented in **Table 4.16** below:

Table 4.16: Demographic Profile of Project District

Description	Mainpuri	Etawah
Actual Population	1,868,529	1,581,810
Male	993,377	845,856
Female	875,152	735,954
Population Growth	17.02%	18.15%
Area Sq. Km	2,760	2,311
Density/km ²	677	684
Proportion to Uttar Pradesh Population	0.94%	0.79%
Sex Ratio (Per 1000)	881	870
Child Sex Ratio (0-6 Age)	884	875
Average Literacy	75.99	78.41
Male Literacy	84.53	86.06
Female Literacy	66.30	69.61
Total Child Population (0-6 Age)	284,349	227,470
Male Population (0-6 Age)	150,943	121,295
Female Population (0-6 Age)	133,406	106,175
Literates	1,203,885	1,062,003
Male Literates	712,110	623,583
Female Literates	491,775	438,420
Child Proportion (0-6 Age)	15.22%	14.38%
Boys Proportion (0-6 Age)	15.19%	14.34%
Girls Proportion (0-6 Age)	15.24%	14.43%

Source: District Census Handbook, Census of India, 2011

4.13.2 Socio-economic Survey

Socio-economic survey was carried out during the study and same have been presented in Social Impact Assessment (SIA).

A census survey of all the displaced persons (DPs) was carried out for the subproject in the month of July, 2020 with an objective to identify the persons who would be displaced by the subproject and to make an inventory of their assets that would be lost to the subproject, which would be the

basis of calculation of compensation. A structured census questionnaire was used to collect detailed information on affected households/ properties for a full understanding of impacts in order to develop mitigation measures and resettlement plan for the DPs. The survey team was trained by the resettlement specialist and the survey was closely monitored on a regular basis. Additionally, socio-economic data was also collected as part of the social impact assessment (SIA) study. The census survey includes the following:

- Inventory of the 100% land and non-land assets
- Categorization and measurements of potential loss
- Physical measurements of the affected assets/structures
- Identification of trees and crops
- Household characteristics, including social, economic and demographic profile
- Identification of non-titleholders
- Assessment of potential economic impact

During Census survey July 2020 for Package 1A (Ch. 0+000 to 30+000), it was found that 80 Encroachment Structures (including 64 Kiosk) and 12 CPRs will be affected in the project. No Private structure will be affected by project also and no land will be acquired in this package. Total of 92 structures will be impacted due to project activities. Out of 92 structures, 16 are encroachers, 64 are Kiosk, 7 Govt. structures, and 5 religious structures. These all structures are being built on government land.

As per Primary Survey July 2020 for Package 1B, it was found that Total 170 Structure will be affected by project. Also 14.006 hectare Land will be acquired in this package (Ch. 30+000 to 57+346). Total no. of 170 structures will be impacted due to project activities. Out of total, 38 are private structures, 63 are encroachers, 60 are Kiosk, 6 Govt. structures, and 3 religious structures will be affected. Out of total, 62.35% of the affected structures are permanent, 2.35% of structure is semi-permanent and 35.30 % of the structures are temporarily built up (Kiosk).

The brief summary of social census survey is presented in **Table 4.17**, **Table 4.18** and **Table 4.19** below:

Table 4.17: Categorization of Ownership Status

Ownership type	Number (Pkg. 1A)	Number (Pkg. 1B)	Number (Total)
Landowners (titleholders)	0	216	216
Impact on structures	92	170	262
Title-holder (Structure)	0	38	38
Non-Title-holder(Structure)	80	123	203
Community Asset	12	9	21

Source: Primary Survey, July 2020

Table 4.18: Impact of on Land (Only in Pkg. 1B)

Impact on Land (Total)	14.0062 Ha.
	(216 Numbers)
Impact on Govt. Land	1.5898 Ha.
	(64 Numbers)
Impact of on Land	12.3991 Ha.
	(148 Numbers)
Impact on Other Land	0.0174 Ha.
	(4 Numbers)

Source: Primary Survey, July 2020

Table 4.19: Impact of the Project on Affected Structures

SI. No.	Impact Category	Properties	Likely Impact		
			Package 1A	Package 1B	Total
A	Private Structure	Residential	0	14	14
		Commercial	0	11	11
		Residential + Commercial	0	13	13
		Others (Compound walls, Cattle Sheds)	0	0	0
		Total	0	38	38

SI. No.	Impact Category	Properties	Likely Impact		
			Package 1A	Package 1B	Total
B	Encroachment	Residential	13	6	19
		Commercial	3	30	33
		Residential + Commercial	0	27	27
		Others (Compound walls, Cattle Sheds)	0	0	0
		Total	16	63	79
C	Kiosk	Residential	0	0	0
		Commercial	64	60	124
		Total	64	60	124
D	Govt. Structure (CPR)	School	0	2	2
		College	0	1	1
		Gram Panchayat	0	0	0
		Police Chowki	1	1	2
		Bus Stop	5	1	6
		Public Toilet	0	0	0
		Nagar Panchayat	1	0	1
		Other	0	1	1
		Total	7	6	13
E	Religious	Temple	5	2	7
		Mosque	0	1	1
		Other	0	0	0
		Total	5	3	8
Grand Total (A+B+C+D+E)			92	170	262

Source: Primary Survey, July 2020

4.13.3 Industry

The development of economy is possible only through industrial development. Industries located in the project districts are described below:

Mainpuri District: The district Mainpuri has sound agriculture base but the industrial potential is low. Lack of infrastructure, enterprise and insight among the people has been the major constraint in the industrial growth of

the district. There are two medium scale industries. The main units are of rice mill, flour mill, cardboard factory, etc.

Etawah District: The district Etawah primarily thrives on the agro-based industries as it located on the fertile plains of Doab. Although the infrastructure is sound realistically yet it lacks in being a major base for any sort of an industry. Eventually, the growth rate of economy in the district is also not satisfactory. The local people of Etawah city and its surroundings lack adequate knowledge of technology and business, another reason for the absence of industrial development being the dearth of talented people in the region. The manufacturing industry has a moderate presence in the area though the district of Etawah was once a flourishing manufacturing center for the cotton-based industry.

4.13.4 Trade and Commerce

Mainpuri District: Most of the trade and traffic of the district in the past flowed along the grand trunk, which ran through the district. With the development of roads, the trade has increased in volume and a large number of trucks operate in the district, carrying goods to and from Kanpur, Agra, Delhi, Farrukhabad, Etawah, Etahand other towns. The agriculture commodities dominate the expert trade. Wheat, pulses, potatoes, oil seeds, ghee, rice and oil are the main commodities, which are exported. Fish is exported to Kolkata. Glassware, electric bulbs and leather goods are also exported. Cloth, general merchandise, chemicals, utensils, fertilizers, electric goods, paper, petrol, kerosene oil are imported. Shikohabad, Bewar, Kusmara, Sirsaganj and Ghiror are the main trade centers of the district.

Etawah District: Production of cotton yarn is the main industrial operation in the district. The small-scale trade bodies in Etawah manufacture wheat flour, rice, dal, oils, chemicals, plastic products, engineering products, electrical goods, crockery, textile products, leather items and other types of accessories. These small-scale production units, found in the fringes of the city of Etawah and other towns of the district, have grown considerably over the last couple of decades. here is a total of about 53 small production units in Etawah for extraction of oil, flour and pulses as oilseeds, wheat and pulses are locally grown in Etawah. There are around 46 units in Etawah, Bakewar, Auraiya and Bharthana for the manufacturing of buckets, pans, crushers and different types of agricultural equipment such as ploughs. Iron is the basic material used for the production of these items.

4.13.5 Transport

Mainpuri District: The roads of the district can be classified as national highways, state highways, district roads, roads in the jurisdiction of the local bodies and other departments. The state public work department looks after the national highway, the state highways and the major district. District is situated in the branch railway line between Farrukhabad and Shikohabad. The total length of railway line in the district is 53 km with 7 railway stations. Lack of communication through railways is detrimental in the economic progress of the district.

Etawah District: There are many major roadways that serve the district of Etawah including the Etawah city. The 23-kilometre long Etawah-Mainpuri Road and the 8 kilometres long Etawah Bharthana Road join Etawah to other nearby places in the district. The 171-kilometre long National Highway 92, is the major highway that links Etawah to many important locations near and far. The NH 92 joins Gwalior to Bhongaon and other parts of Uttar Pradesh including Etawah, Malanpur and Bind.

4.13.6 Minerals and Mining

The area has no mineral of economic importance. The alluvium in the district consists of clay, sand, kankar and reh. Clay is found all over the district and is utilized in preparing bricks, toys, pottery, etc.

4.13.7 Agriculture and Cropping Pattern

The economy of the area is agriculture based. Since the canals were opened for irrigation, a marked change in the technique and pattern of cultivations has been noticeable in the district. Agriculture department is educating the farmers in the use of new implements, better seeds and improved cultural practices. The agriculture year is divided into three generally recognized seasons of harvests which here also go by the usual names of Kharif, Rabi and Zaid. The last named is of very little importance and consists of melons, Kakri, Khira, vegetables, Spices, Tobacco and a number of low grade cereals. The main Kharif cereals in the district in order of the area they cover crops like paddy, maize and bajra. Among the Kharif pulses, urad, moong and moth are the main crops though they occupy very small areas. In Rabi season, the lead is taken by wheat which is the most valuable of all the food grains. It is sown alone as well as mixed with barley, gram, pea or mustard. The area under pure wheat cultivation has no doubt increased in recent years, but the old practice of sowing it mixed with other crops has not altogether disappeared.

4.13.8 Animal Husbandry

The animals in the area are of ordinary type, yet there is ample scope of the development of animal husbandry in the district. Sheep and goats are generally reared by the Gadariyas for their flesh and skin, wool obtained from the sheep is used for making coarse blankets locally. Considerable progress has been made in improving the breed of the cattle. Artificial insemination service for breeding cows and buffaloes is going on in the district. For promotion of milk production, the district has Milk production federation under which there were sufficient milk cooperative societies.

4.13.9 Fishery

There is organized fishing in the area. The rivers and ponds of the area contain a plentiful of fish. To make progress in fishery centre of Fishery Development Authority has been established in the districts. The authority provides loans and grants to piscicultures. Fish finds a ready sale in the local markets and are used as food by good number people. For the upliftment of poor people specially fishermen, many tanks have been given for fisheries on lease. There are many people engaged in fishery in the project districts.

4.13.10 Archaeological Monuments

No archaeological / historical monuments are present along the project road.

Chapter 5

Anticipated Environmental Impacts

5.1. Environmental Impacts & Issues

This section presents identification and evaluate of anticipated impacts on the various relevant physical, biological and cultural environmental components along the project corridor during pre-construction, construction and operation phases of the two lane upgradation with paved shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92. The planning of the proposed project intervention points towards the impacts in the pre-construction, the construction stages and the operation stages. The subsequent sections deal with the prediction of impacts due to the project on the physical, biological and socio & cultural environment **Tables 5.1** and **5.2** below presents the general environmental impacts expected due to the proposed upgradation of the project road. Environmental impacts have been assessed based on the information collected from the project activities as per DPR, screening & scoping of environmental attributes, and baseline data collected during the EIA study.

The following impacts zone and project influence area have been considered for impacts identification and evaluation as result of proposed upgradation of the project road.

Corridor of Impact (CoI): For open Section is the 17m wide strip on either side, beyond Right of Way, RoW and for buildup Section is the 24m wide strip on either side, beyond Right of Way, RoW

Project Influence Area (PIA): PIA is the 10km area on either side along the alignment.

The quantum of anticipated impacts on physical, biological and socio-economic environment has been discussed in detail in subsequent paragraphs.

5.2 Impact Matrix

The project impact matrix has been prepared taking into consideration the positive and negative impacts that the proposed development will have. **Table 5.3** below presents the said matrix:

Table 5.1 : Anticipated Impacts on Physical & Biological Environment

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
Environmental component Affected		Removal of Old Structures	Removal of trees and vegetation	Earth works including and borrow area	Laying of pavement	Vehicle & Equipment operation & maintenance	Asphalt & crusher plants	Sanitation & Waste (labour campus)	Vehicle operation
Air		Dust generation during dismantling	Reduced buffering of air pollution, Hotter, drier microclimate along the road	Dust generation	Asphalt odour and emissions	Dust, Pollution	Soot, Odour, gaseous Dust, Pollution	Odour / Smoke from Cooking of food	dust, vehicular emissions
Land	Impact on productive land if land acquisition required	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil	Land contamination due to improper disposal of bitumen waste/ solid wastes	Contamination by fuel and lubricants and compaction	Contamination and compaction of soil at camp& Plants	Contamination from Wastes and sewage	--
Water	Impact on Water Sources	Siltation due to loose earth	Siltation due to loose earth	Alteration of drainage, Break in continuity of ditches Siltation, Stagnant water pools in quarries and borrow area.	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by asphalt leakage or fuel	Contamination from wastes and untreated sewage disposal	Spill Contamination by fuel, lubricants and washing of vehicles

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Road Operation
		Noise Pollution	High Noise due to machinery	Noise Pollution	Noise pollution	Noise pollution	Noise Pollution	--	
Flora	Tree cutting		Loss of Biomass and vegetation cover due to Removal of vegetation	Lowered productivity loss of ground for vegetation	--		Lower productivity Use as fuel wood	Felling trees for fuel	Compensatory plantation and road side plantation

Table 5.2: Anticipated Impact on Social and Cultural Environment

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Env. Component Affected	Design decisions & Implementation policies	Land acquisition	Removal of Structures	Removal of trees & vegetation	Earth works including quarrying	Laying of Pavement	Vehicle & machine operation & maintenance	Asphalt and crusher plants	Labour Camps	Vehicle operation	-
Agricultural land	-	Change in land prices	Change in land economic value	Loss of standing crops	Loss of productive land	-	-	Dust on agricultural land reduce n productivity	-	-	Conversion of Agricultural Land
Buildings and built structures in ROW	-	-	Loss of structures, Debris generation, Noise and Air pollution	-	Dust Deposition on structures	-	Noise, vibration may cause damage to structures near to road	Dust accumulation on building and structure	-	Vibration and noise	Change in building use and characteristics
People and Community	Impact on nearby community structure,	-	Impact on people and loss of livelihood	Loss of shade & community tree.	Health hazard to people	Odour and dust	Noise and Air pollution and discomfort	Air and noise pollution and discomfort	Community clashes with migrant labour	Risk of accident due to increase in speed on smooth carriageway	Induced pollution and increase in accident rate
Cultural Assets	-	Impact on access to cultural structure	Displacement loss of structure from RoW	--.	--	-	--	Dust accumulation	-	Damage from vibration & air pollution	-

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Project Activity	Planning and Design Phase	Pre Construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utility and amenities	Dust accumulation on water bodies	Pressure on existing amenities		-
Labour's Health & Safety	-	-	-	-	Stagnation of water and disease	Asphalt odour and dust	Accident and injuries to labour/public	Impact on health due to inhale of dust	Health hazard from raw sewage disposal /wastes	Road safety issues	-

Table 5.3: Impact Matrix

S.N.	Parameters	
	Negative Impacts	
1	Hand pumps	Nil
2	Pond Area	1
3	Relocation Religious Properties	8
4	Transfer of Agriculture Land (ha)	12.3991
5	Earth (Cum)	532148
6	Quarry Materials (Cum) (Aggregate)	342502
7	Water (Cum)	6150504
8	Nos. of trees to be felled	3132
9	Hill Cutting	Nil
	Positive Impact	
1	Enhancement Sites (Nos.)	Design has been proposed to Enhancement sites.
A.	Cultural/Religious Properties (Nos.)	21
B.	Surface Water Body (Nos.)	Nil
C.	Educational Institute (Nos.)	3
D.	Safe Access to Educational Institute (Nos.)	Nil
E.	Enhancement of Bus Bays (Nos.)	19 Bus Bays Proposed
F.	Rotary Junctions (Nos.)	Nil
G.	Village Gates (Nos.)	Nil
H.	Sitting Arrangement (Nos.)	Nil
I.	Vegetative Barrier (Nos.)	Nil
J.	Trees Saving (Nos)	Design has been proposed to keep the land requirement minimum, hence saving trees along road
K.	Wastes Reuse	Nil
2	Proposed Plantation	Compensatory afforestation on approx. 110 Ha. land
3	Road Safety Measures	
A.	Major Junction Improvement (Nos)	69 (All are improved as per IRC SP:41)
B.	Proposal for Rotary Junctions	None
C.	Intersection/Access Improvement	Will be provided at strategic locations as per design
D.	Bus Bays	19
E.	Pedestrian Crossing	Zebra crossing at strategic locations
F.	Street Lighting (Locations)	Nil

G.	Signage Boards (Nos.)	Will be provided at strategic locations as per design
H.	Side Walk (Locations)	Footpath cum drain will be provided at strategic locations as per design
I.	Traffic Calming Measures Locations	Details given in Chapter 2
J.	Lined Drains (Length in Km)	Nil
K.	Four Lane Section (Length in Km)	Nil
L.	Crash Barriers/Guard Rails (Lengths)	Nil

5.3 Impacts on Topography, Physiography and Geology

Construction Phase

The two lane upgradation with paved shoulders of Bewar - Etawah Section (Km 0.000 to Km 57.346) of NH 92 is traversing mostly through plain territory. Therefore, cutting and filling activity will be involved in existing alignment of the project road.

The proposed up-gradation of the project road will be confined along the existing alignment except proposed bypass and realignment. The design has not suggested any substantial change in the height of the embankments of the existing alignment. The overall topography of the area is not going to alter due to minor changes in geometry & profile and two realignments construction.

During construction of the project, following environmental impacts are anticipated on topography and physiography:

- minor changes are anticipated in existing profile of the land due to borrow pits and construction of re-alignments and improvement of sharp curb.
- disturbance on geological setting due to quarrying.
- uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.
- construction of embankments for realignments,
- debris disposal,
- construction of diversions roads for construction of bridge and culverts.

Physiographic impacts could be due to the construction of the embankments and improvement of sharp curbs. The height and width of the embankment will be altered, when the road is widened and rehabilitated as per the new design for the project road.

In most of the stretch along the project road, project will stick to the existing ROW without any noticeable changes.

Borrow earth will be required in the project road for filling and will be obtained from several borrow areas to be opened in the nearby areas or from the existing approved borrowing areas. Except the construction of embankments, there would not be any other impacts to geomorphology of the area during construction stage.

Most of the excavated materials from existing road will be left reused as construction materials. If not used, contractor may dispose of this in the nearby areas causing untidiness near disposal areas. Therefore, this is seen as a potential impact. It may increase soil erosion and could generate considerable impacts on natural drainage courses, and siltation to runoff during rains.

Likely impact on the geological resources will occur from the extraction of construction materials like borrow of earth, granular sub-base and aggregates for base courses, culverts and bridges.

Operational Phase

The proposed upgradation of the project road will not cause any topographic, physiographic and geological changes during operational stage.

5.4 Impact on Seismological Characteristics

The project road is located in seismic zone III and zone IV as per BIS classification with low seismic risk. All cross-drainage structures and bridges on the project roads need to consider the seismic coefficients with regards to the seismic energy propagation along the fragile geological/lithological strata.

The construction and operation phase of the project road are not expected to add the seismicity issues due to the project road.

5.5 Impact on Soil

Construction Phase

Soil Erosion: Erosion of top-soil can be considered a moderate, direct and long-term negative impact resulting from the construction of existing road. The potential for soil erosion is pervasive during the construction stage, especially in realignment and earth work on the existing alignment. Starting with clearing and grubbing, vegetation will be stripped away, exposing raw soil. Earth works and embankment will also prone to erosion during rains.

Road Slopes and Spoils: Erosion problems may occur on newly constructed slopes and earth fills in realignments depending on soil type, angle of slope, height of slope and climatic factors like wind (direction, speed and frequency) and rain (intensity and duration). Soil erosion will add siltation to the runoff during the monsoon season.

Construction of New Bridges and Culverts: Along the project road reconstruction/widening of bridges and culverts is planned. Major bridge, minor bridge and culverts are proposed to be constructed in the project road. Construction of bridges involves excavation of natural water channels bed and banks for the construction of the foundation and piers. If the residual spoil is not properly disposed of, increased sedimentation in downstream of the bridge may take place during the monsoon. Also, the bridge-end fills require armouring to ensure minimum gullying and slumping.

During the construction period, some amount of drainage alteration and downstream erosion/siltation is anticipated. Some of these alterations may be because of construction of temporary traffic detours/diversion. Except for these temporary works, in almost all cases there should be an improvement in the drainage characteristics of the surrounding area due to improved design and added culvert/ditch capacity. Changes in the drainage pattern due to the raising of the road profile has not been discussed in specific cases, as the likely impact will not adverse and does not warrant mitigation as the road design itself takes care of cross drainage.

Generation of Debris: The major source of debris generation is dismantling of existing cross drainage structures, scarifying of bitumen from carriageway and removal of existing road for upgradation.

Quarries and Borrow Areas:

The excavation of quarries and borrow pits used for obtaining aggregate materials and soil for road construction can cause direct, and indirect long-term major adverse impacts on the environment. While loss of productive soil is the most direct negative impact from borrow areas, other significant indirect negative impacts can also occur. Since most of the construction materials would be available from existing quarries nearby, relatively few new borrow areas may be required. One of the long-term residual adverse impacts of borrow pits not reclaimed, is the spread of mosquitos. Mosquitoes breeding and multiplying in stagnant water that collects in these pits can affect human health in villages in close vicinity.

Borrow areas will be identified by the contractor and finalized for procurement of borrow earth in consultation with Authority Engineer. The contractor will take borrow areas on lease from owners and rehabilitated after borrowing of required quantity of earth.

Generation of Debris: The major source of debris generation is dismantling of existing cross drainage structures, scarifying of bitumen from carriageway and removal of existing road for upgradation.

Chainage wise Details of Scarified BT Layer: Scarifying of bitumen shall be generated from Ch. 0 to 57+346 excluding bypass and re-alignment =52.58 Km. Scarified of bitumen may contaminate soil, if not disposed in environmentally sound manner.

Contamination of Soil: In this project, contamination of the soil may take place, from the following activities at the construction zones, construction labor camps, construction plant sites and other auxiliary facilities required for the construction. Details of the activities from which the contamination can occur are presented below:

- Scarified bitumen wastes,
- Debris generation due to dismantling of structures,
- Runoff from muck disposal area,
- Maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from the operation of the construction machineries, maintenance

- and diesel storage and diesel generator sets,
- Spillage bitumen from operation of hot mix plant,
- Wastes from the residential facilities for the labour and officers at camp site, and
- Storage and stock yards of bitumen

Operation Phase

No significant impact is anticipated on soil along the road during operational phase.

5.6 Water Environment

5.6.1 Water Resource - Impacts

A. Surface Water -Impacts

The project road crosses a number of water bodies which include Kali Nadi at Km 3+500, Ganga at Km 39+800, Ramganga at Km 53+150, Deora at km 133+350 and some other tributaries and distributaries. The project road is crossing many natural streams, which remain dry in non-rainy days. There are perennial rivers crossed by the project road. No potential impact is anticipated on surface water bodies during the pre-construction phase.

Construction Phase

The water demands for the construction work may pose stress on the public water supply if the water for construction and allied activities are taken from the public source as the project area. The main source of water for construction and other related activities will be a mixture of surface water source and ground water source. Ground water may be used by installing bore wells at different locations such as at camp sites and plant sites. Separate water supply arrangement for construction and allied works will be made in from ground water/surface water source away from public water supply source so that there is no interfere with the normal public water supply. The water for the construction will be taken after taking prior permission from Competent Authority and comply with all the requirements of State Ground Water Authority/ Irrigation Department. The Contractor will take all the measures in order to minimize wastage of water during the construction. The baseline study indicates that the area along the project falls under safe to subcritical zones in

terms of ground water availability, usage and water balance and recharging capacity.

The estimated water requirement is 30787 kl for the entire project length and the abstraction of water will not be confined to a single location but will be extended at different locations, therefore pressure on a single aquifer will not be significant. The Source of water for construction shall be identified by the Contractor depending upon the location of construction sites, construction camp and plant site locations in consultation with line department and will obtain all necessary statutory permits for usage of water before start of abstraction of water. Depending on the source of water there could be minor depletion of water sources due to the construction water requirements.

Operation Phase

During operation phase, no impact is anticipated on surface water resources.

B. Ground Water - Impacts

Construction Phase

Along the project road, ground water resources are available and ground water will be exploited through mostly from tube wells, where surface water sources are not available. Therefore, the eventual impact of the proposed upgradation of the project road will be negated to a considerable extent.

Operation Phase

During the operation phase, ground water resource will not be affected significantly. Therefore, no significant impact is anticipated during operation phase. However, rainwater harvesting will be provided along the project road in unpopulated areas.

5.6.2 Water Quality - Impacts

A. Impact on Surface Water Quality

Degradation of surface water quality due to sediment transport with runoff through erosion of soil and earth may occur from activities like removal of trees, clearing and grubbing, removal of grass cover, excavation, stock piling

of materials as part of the pre-construction and construction activities. The soil type present along the project corridor consists of the loamy/silty soil, which are prone to erosion. The impacts due to increased sediment laden run-off will make the water more turbid. This is a significant negative impact on the water bodies/flowing streams. Heavier sediment may smother the algae growing in the lower strata and could completely alter the nature of the watercourse. Excessive sediment loads may also mean disruption to areas of fish breeding/aquatic life.

Contamination of Surface Water - The degradation of the surface to a much less extent ground water quality can occur from pavement construction works, bridges construction works, construction plants, machinery and accommodations of workers. The sources of water pollution from the construction activities are as follows:

- Water flow from scarified bitumen materials,
- Rain-water flow from muck disposal area,
- From the foundation works of the bridges and culverts such as piling and excavation for open/well foundations,
- Oil spills from the maintenance of the machinery and operation of the diesel generator sets on site,
- Oil spill from diesel storage and parking places,
- Operation of the emulsion sprayer and laying of hot mix,
- Discharge of sewage and waste from labour and plants,
- Storage and stock yards of bitumen and emulsion.

Degradation of water quality is also possible due to accidental discharges into water-courses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas.

Operation Phase

During normal operation phase, no impact is anticipated on the surface water quality.

B. Impact on Groundwater Quality

No impact is anticipated on ground water during pre-construction phase.

Construction Phase

- During construction phase, ground water quality can be affected due to following reason:
- Spillage of diesel, lube oil and used oil could lead to ground water pollution in long term and can affect ground water quality.
- Leached water from scarified bituminous waste materials entering into ground.
- Disposal of solid wastes, used POL wastes, oil contained cotton wastes in non-environmentally sound manner and leaching to ground water.

Operational Stage

During the normal operation phase, no impact is anticipated on the ground water quality of the area.

C. Floods Related Impacts

Pre construction phase impacts

The natural drainage channels are crossed by the project road. Pre-construction activities such as tree removal and clearing and grubbing will not lead to any flood related impacts.

Construction Phase

During construction phase, the project activities are unlikely to create localized flood related issues. Nevertheless, various construction activities could temporarily worsen the flooding problem due to improper drainage conditions on account of the contractor's poor engineering practices and negligence. If the high intensity rainfall continues for many days a number of sections along the project road could develop flooding situation.

Operation Phase

During operation phase, flood related impacts would not be appeared as culverts and cross drainage structures will be reconstructed/ constructed and widened to maintain proper drainage. Therefore, no flood related impact is anticipated during operation phase.

5.7 Impact on Air Environment

Construction Phase

During construction phase, there will be two main sources of air emissions *i.e.* mobile sources and fixed sources. Mobile sources are mostly vehicles involve in construction activities while emissions from fixed sources include diesel generator set, construction equipment and excavation/grading activities those produce dust and gaseous emissions.

Certain amount of dust and gaseous emissions will be generated during the construction phase from excavation machines and road construction machines. Pollutants of primary concern include Particulate Matter (PM_{2.5}) and Particulate Matter (PM₁₀). However, suspended dust particles may be coarse and will be settled within a short distance from construction area. Therefore, anticipated impact on ambient air quality will be temporary and restricted within the closed vicinity of the construction activities along the project road only.

Considerable amount of emissions of carbon monoxide (CO), unburned hydrocarbon, sulfur di-oxide, particulate matters, nitrogen di-oxide (NO₂), etc, will be generated from the hot mix plant and may cause air pollution problem in nearby areas.

Summarily, generation of dust is likely due to:

- Site clearance and use of construction vehicles and machinery, etc.
- Transport of raw materials, borrow and quarry materials to construction sites,
- Earthworks,
- Stone crushing operations at the crushers and handling of aggregate,
- Handling and storage of aggregates at the asphalt plants,
- Concrete batching plants, and
- Asphalt mixing plants due to mixing of aggregates with bitumen.

Generation of dust is a critical issue and is likely to have adverse impact on health of workers and vegetation in surrounding areas. Generation of exhaust gases is likely due to movement of heavy machinery for clearance of the RoW for construction. High concentration of HC and NO_x are likely from hot mix plant operations. Toxic gases are released through the heating process during

bitumen production. Although the impact will be much localized, it can be dispersed downwind depending on the wind speeds.

Air Pollution Modelling for Construction Phase

During the construction phase, the activities related to earthwork, borrow area operations, transport of material, storage and handling of construction materials, quarrying and/or stone crushing operations, movement of construction vehicles on unpaved roads, hot-mix plant, handling of cement in batching plants and other others would contribute to the increased dust levels in terms of PM₁₀, PM 2.5, and other air pollutants like SO₂, and NO₂, and carbon monoxide levels.

Considerable amount of emissions of carbon monoxide (CO), unburned hydrocarbon, sulfur di-oxide, particulate matters, nitrogen di-oxide (NO₂), etc, will be generated from the hot mix plant & DG sets and may cause air pollution problem in nearby areas.

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) was formed to introduce state-of-the-art modeling concepts into the EPA's air quality models. Through AERMIC, a modeling system, AERMOD, was introduced that incorporated air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

AMS/EPA Regulatory Model (**AERMOD**) is a steady-state plume model. It is designed to apply to source releases and meteorological conditions that can be assumed to be steady over individual modeling periods (typically one hour or less). AERMOD has been designed to handle the computation of pollutant impacts in both flat and complex terrain within the same modeling framework. In fact, with the AERMOD structure, there is no need for the specification of terrain type (flat, simple, or complex) relative to stack height since receptors at all elevations are handled with the same general methodology. To define the form of the AERMOD concentration equations, it is necessary to simultaneously discuss the handling of terrain.

AERMET is an input data processor that is one of the regulatory components of the AERMOD modeling system. It incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts.

Air Quality Impacts Prediction

Quantitative assessment for predicted level of pollutants concentration has been done using ISC-AERMOD, a recommended model by USEPA for prediction of air quality from point, area and line sources. It is based on Gaussian dispersion which incorporates the Pasquile-Gifford (P-G) dispersion parameters for estimating horizontal cross wind and vertical dispersion.

After drawing the road alignment and putting the information related to carriageway width, vertical dimension, source elevation, base elevation and release height, the model converts the road alignment to the number of volume sources. The model then simulates the effect of emissions from continuous/variable volume sources on neighbourhood air quality and identified uniform cartesian grid receptors. The model is an hour-by-hour steady state Gaussian model which takes into account special features like Terrain adjustments, Gradual plume rise, Buoyancy-induced dispersion, Complex terrain treatment, etc. The total road alignment has been taken into consideration for the prediction of vehicular exhaust emission.

Major criteria pollutants generated due to vehicular exhaust is CO and hence is taken into consideration in this study.

Details	Emission factor (g/km)
	CO
Year 2020	3.56
Year 2045	4.61

Predicted Incremental Concentrations

Details	Parameter(mg/m ³)	Parameter(mg/m ³)
	2020	2045
	CO	CO
Maximum Concentrations (Etawah)	0.800	1.1

Carbon Monoxide (CO) predictions for the year 2020

The predicted 1st high 8 Hour values of CO are varying from place to place in Bewar –Etawah project road stretch. The maximum concentration of CO predicted is 930 µg/m³ (0.930 mg/m³) in year 2020. When compared with the National Ambient Air Quality Standard (NAAQS) of 2 mg/m³ (2000 µg/m³) for

8 hour, predicted values are well below the prescribed standard limit near the project corridor.

Carbon Monoxide (CO) predictions for the year 2045

The predicted 1st high 8 Hour values of CO are varying from place to place in Bewar –Etawah project road stretch. The maximum concentration of CO predicted is 1292 µg/m³ (1.292 mg/m³) in year 2045. When compared with the National Ambient Air Quality Standard (NAAQS) of 2 mg/m³ (2000 µg/m³) for 8 hour, predicted values are well below the prescribed standard limit near the project corridor.

In the existing scenario, due to lesser width and higher roughness, the average vehicle speed is low, which results in more exhaust gas emissions. In the post- project scenario, improved road conditions and congestion free traffic movement will reduce emissions.

Furthermore, lower growth of traffic and better road conditions with improved average speed, which constitutes about 95% of the total project road length, will not have any significant increase in concentration of CO even after 25 years of operation, subject to regular maintenance of the road condition and maintaining the average speed of traffic. However, in Bewar –Etawah road project, the emissions will increase significantly due to increase in traffic density.

The Isopleths of CO concentration along the project stretch are given below in **Figures 5.1 to 5.4.**

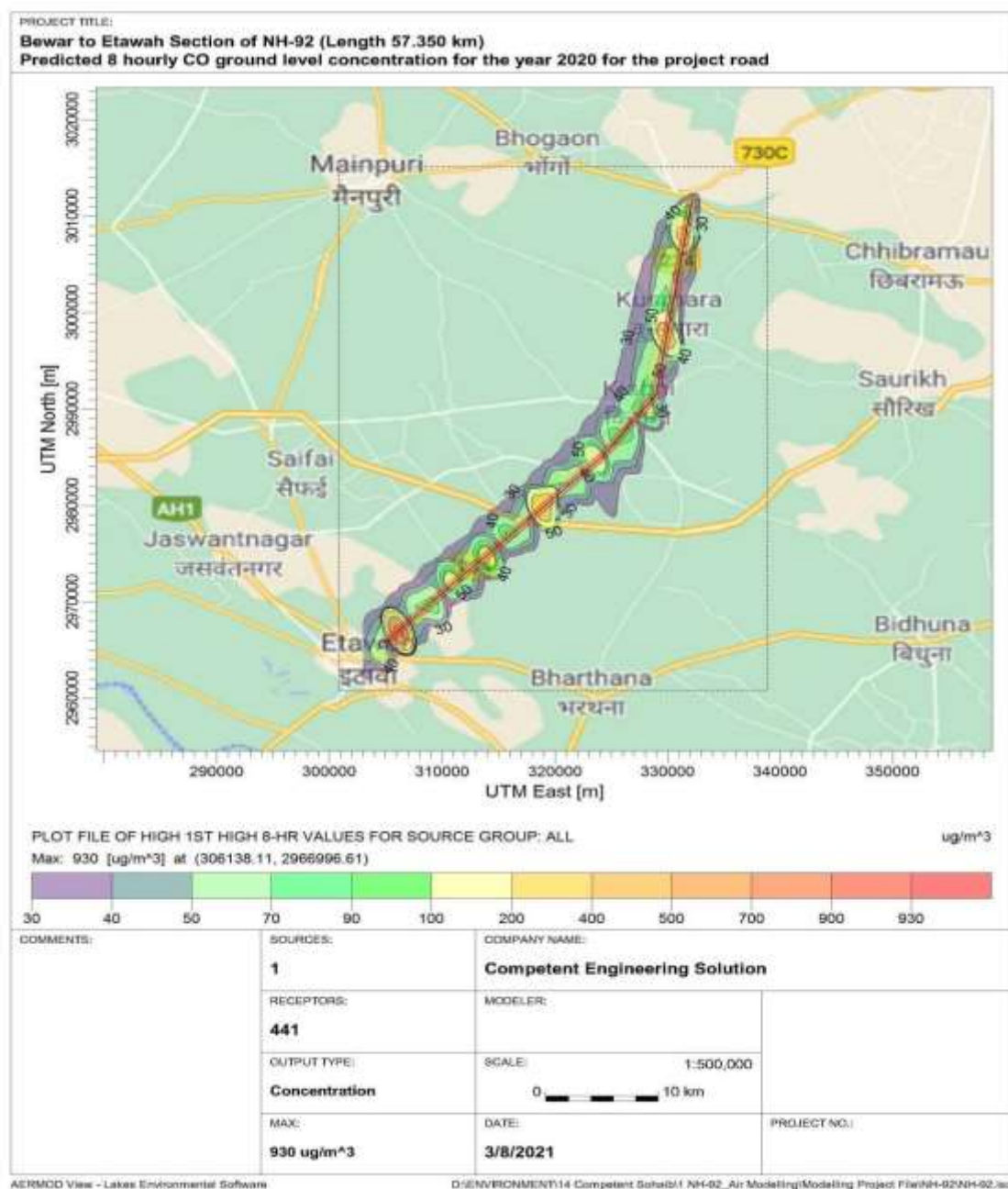


Figure 5.1: Isopleth of Incremental GLC of Carbon Monoxide (CO) from Bewar – Etawah Road Project for the year 2020

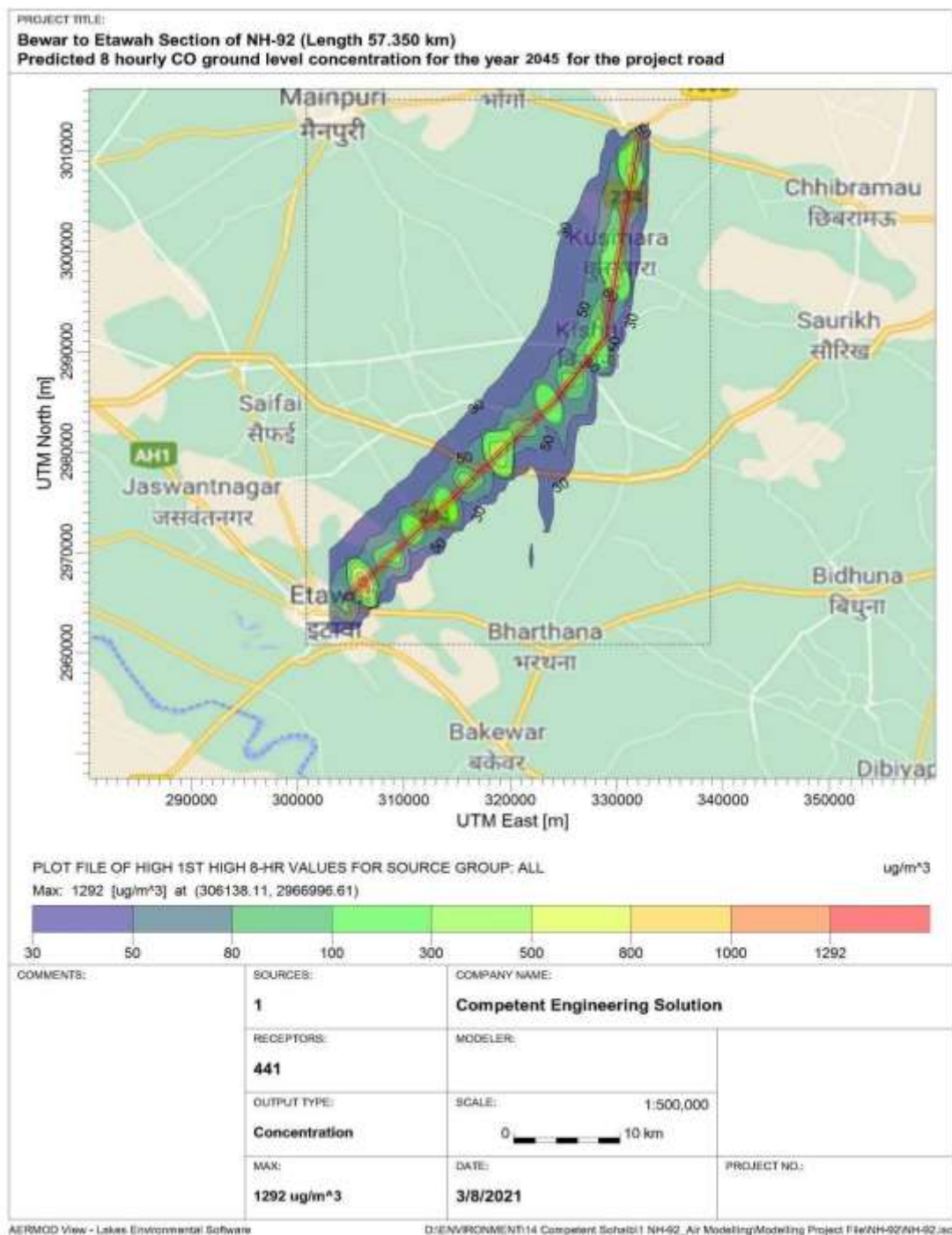


Figure 5.5: Isopleth of Incremental GLC of Carbon Monoxide (CO) for Project Road for the year 2045

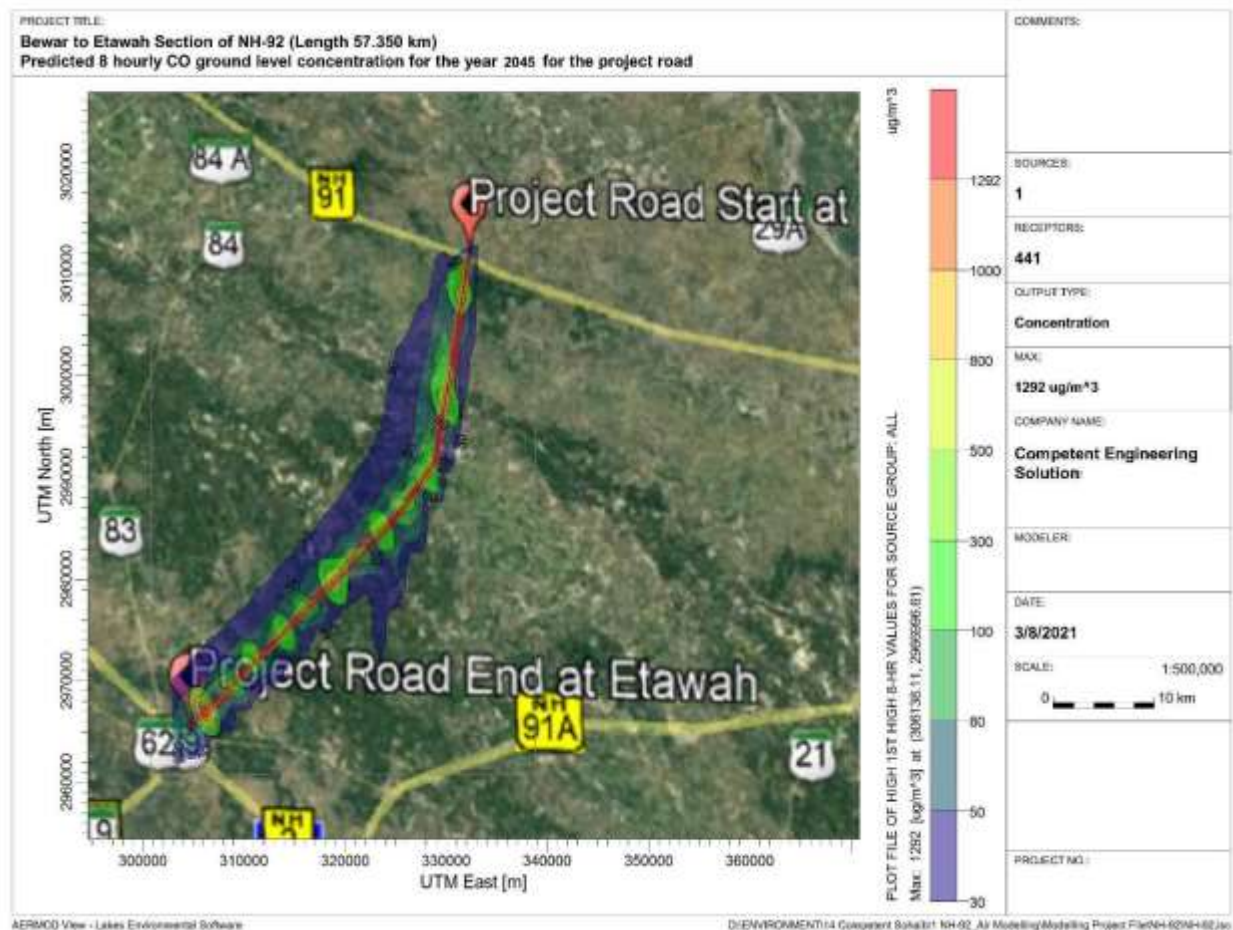


Figure 5.4: Isopleth of Incremental GLC of Carbon Monoxide (CO) from Project Road for the year 2045 (Google Earth)

Operational Phase

During operational phase, the congestion will be relieved to an optimum level on the project road. Widening and improvement along the project road could result in improved surface condition and traffic capacity. During the operation phase, vehicular emission will be emitted from vehicular movement on the roads.

5.8 Impact on Noise Environment

Construction Phase

Highway traffic noise is a complex phenomenon because its intensity and characteristics vary with time depending upon the frequency as well as type of vehicles on the road. The impacts of noise due to the project roads will be of temporary significance locally in the construction phase. **Table 5.4** below present the source of noise pollution and the impact categorization.

Table 5.4: Source of Noise Pollution and Impact Categorization

Sn.	Phase	Source of Noise pollution	Impact categorization
1.	Pre-construction	• Man, material & machinery movements • establishment of labor camps, onsite offices, stock yards and construction plants	• all activities will last for a short duration and also shall be localized in nature
2.	Construction Phase	• Plant Site - stone crushing, asphalt production plant and batching plants, diesel generators etc • Work zones - Community residing near to the work zones	• Plant Site: Impact will be significant within 250m. • Work zones: Such impacts again will be of temporary nature as the construction site will go on changing with the progress of the works.

Construction - Related Noise

With regards to noise related impacts, construction phase is a difficult stage. During this period noise impacts will be high due to operation of construction machineries and the conflict with the regular traffic requiring more honking of vehicle horns and more stop and go (acceleration and deceleration process).

All temporary noise related impacts in the immediate vicinity of the project roads will occur during the construction activities. This will be occurred along

the construction zones as well as construction camps, hot mix plants, WMM plants, crusher and quarry sites (if required).

- Increase in noise level due to construction activities like operation of construction equipment & vehicular traffic.
- Operation of construction machinery will lead to rise in noise level to the range between 80-95 dB(A). The magnitude of impact from noise will depend upon types of equipment to be used, construction methods and also on work scheduling. Typical noise level of various activities associated with highway projects is presented below in **Table 5.5**.

Table 5.5: Typical Noise Level of Various Activities Associated With Highway Projects

Sl. No.	Construction Activity	Noise Level dB(A)
1.	Grading & Clearing	84
2.	Excavation	89
3.	Foundations	88
4.	Erection	79
5.	Finishing	84

Note: Measured at Leq assuming 70 dB(A) ambient noise level

Noise levels will be based on the types of construction work anticipated and the likely equipment required for construction.

The construction noise is generally intermittent and depends on the type of operations, location and function of the equipment and the equipment usage cycle, it attenuates quickly with increases in distance. The noise level generated from a source will decrease with distance as per the following empirical formula (inverse square law).

$$SPL2 = SPL1 - 20\log_{10}(r_2/r_1)$$

where, SPL1 and SPL2 are the sound pressure levels at distance r_1 and r_2 respectively.

Considering the stationary construction equipment as a point source generating 90 dB(A) at a reference distance of 2 m, computed minimum distance required from the stationery source to meet the permissible noise limits during day time for different land use categories are given in **Table 5.6**.

Table 5.6: Minimum Distance Required from Stationary Noise Source

Category	Permissible Limits in Day Time (CPCB)	Distance Required (m)
Silence zone	50 dB(A)	200
Residential	55 dB(A)	113
Commercial	65 dB(A)	36
Industrial	75 dB(A)	11

From the above table it may be noted that residence within 113 m from the road will be exposed to a noise higher than the permissible limit. The impacts will be significant on construction workers, working close to the machinery.

Project Road Noise Modeling

Dhwani-pro noise model is developed to undertake construction, industrial and traffic noise propagation studies for noise assessment. The model is used to predict the impact of noise on receptors from the noise generation source. It is also used to predict impact due to group noise sources in the industrial complex (multiple sound sources) and traffic.

A noise propagation modeling study has been conducted to find out the impact from the noise generated because of the estimated total traffic flow as well as the significance of these impacts. The noise modeling has been done taking into account the design speed at various stretches and the stretches with restricted speeds have also been considered.

Noise modeling for the project road was conducted for Bewar to Etawah section of NH-92 based on the traffic predictions for the year 2020 and 2047. The average noise level predicted for 2020 and 2047 are 54 dB(A) and 60 dB(A) respectively at a distance of 45m from the center line at Bewar location. The maximum noise level predicted is 70 dB(A) at 15m distance from the center line in the year 2020 and will be 75 dB(A) also within 15m from the center line in the year 2047. The predicted average noise levels are below the stipulated limits for residential / commercial areas at the selected road project stretch.

The contour map showing noise levels due to traffic at the project stretch has been shown in for year 2020 and 2047 Figure 5.7 and Figure 5.8, respectively.

Operational Noise

During operation phase, noise levels will be reduced due to smooth flow of traffic on reconstructed/upgraded road. However, traffic will be increased on the road in due course of time and subsequently noise levels are expected to increase.

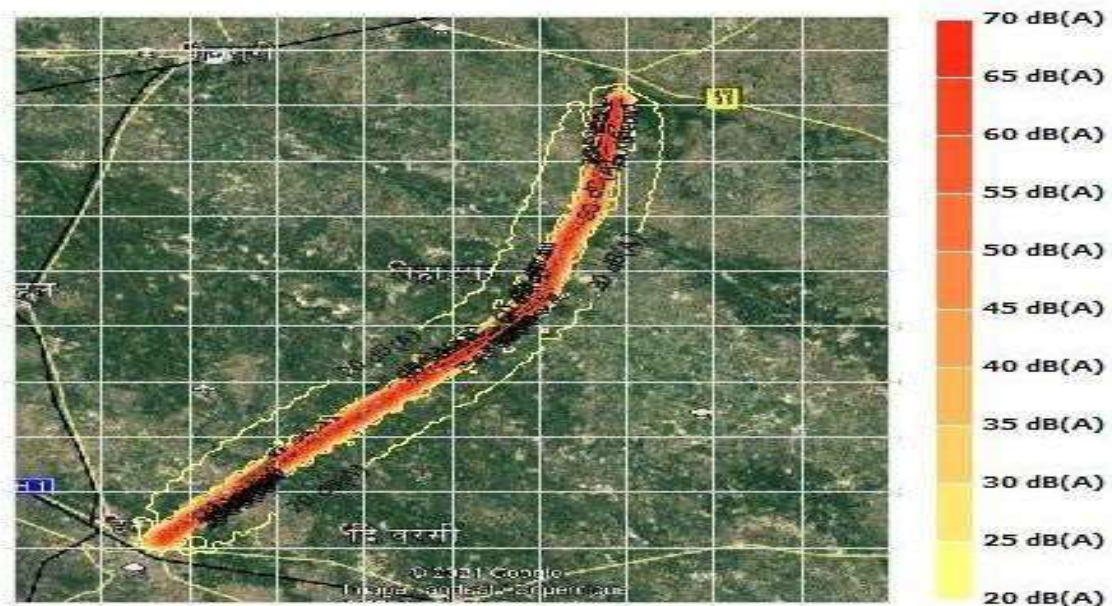


Figure 5.5: Contour Map Showing Noise Levels Due to Traffic at the Project Stretch in 2020

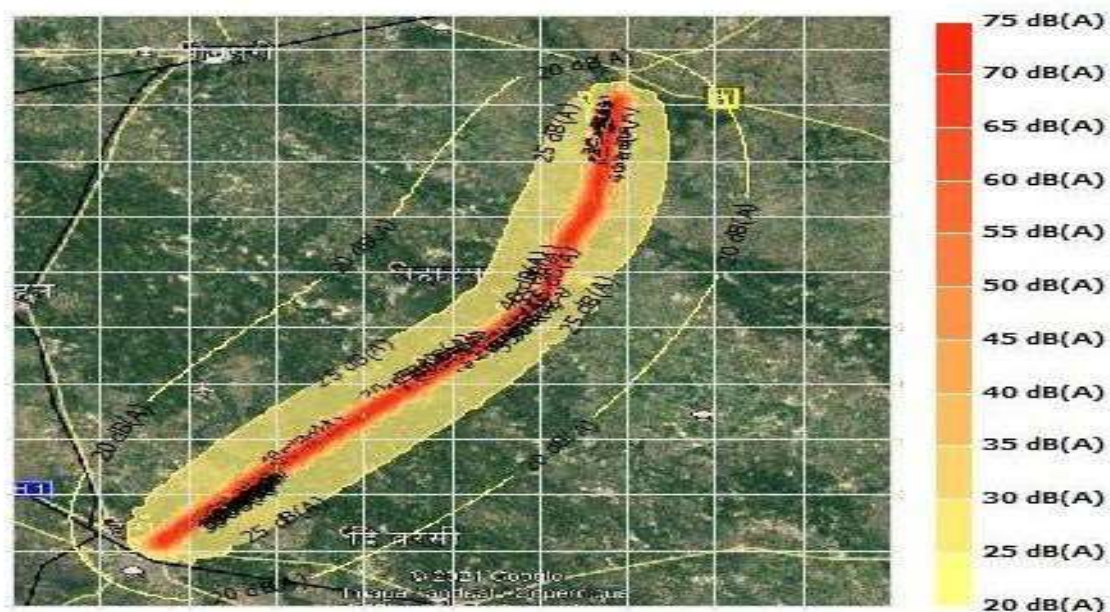


Figure 5.6: Contour Map Showing Noise Levels Due to Traffic at the Project Stretch in 2045

5.9 Impact on Biological Environment

5.9.1 Anticipated Impacts

Forest Area

The proposed up-gradation of the project road involves 60.379 ha protected forest area, therefore diversion of 60.379 ha protected forest land will be required. Package wise details of forest land diversion for the Project Road are given in **Table 5.7**.

Table 5.7: Forest Land Diversion Required for the Project Road

Package	Project Length	Districts	Forest Division	Forest Area (Ha.)
NH-92 Package-1A	30	Mainpuri	Social Forestry Division Mainpuri	35.378
		Etawah	Social Forestry Division Etawah	1.017
			Total Area	36.395 Ha.
NH-92	27.376	Etawah	Social Forestry Division Etawah	23.984
			Total Area	60.379 Ha.
			Grand Total of Package 1A & Package 1B	35.378

The major impact in this project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users. **Table 5.8** below presents the major adverse impacts on the flora & fauna and the indicators chosen to assess the impacts for this study.

Table 5.8: Impacts Due To Construction and Indicators

Impacts Due To Construction	Indicators
Diversion of Forest Land	60.379 ha Protected Forest Land
Tree felling	3132

Wildlife

There is no wildlife sanctuary, national park or bioreserve along the project roads. Therefore, no impact is anticipated on wildlife due to up-gradation of the project road.

Tree Cutting

Existing road side vegetation and trees were recorded during the field survey. Crops fields and open land are observed on both sides of the project road. Indigenous of trees are likely to be cut down due to the upgradation. Depending on the final design for upgradation/widening of the project road, the tree cutting and resultant pressure on flora and fauna (mainly avifauna) could be the potential impact during preconstruction/ construction. Along the project road, approximately 3132 trees are growing within the ROW/PROW. Necessary efforts have been made for minimisation of tree cutting during finalisation of widening scheme and design of the alignment of the project road. Package wise details of trees cutting required for the project road are given in **Table 5.9**.

Table 5.9: Package Wise Details of Trees Along the Project Road, Trees Saved and Trees Cutting Required

Packages	Length in km	District	Trees to be Felled
NH-92 Package- 1A	30	Mainpuri	1411
		Etawah	
NH-92 Package- 1B	27.376	Etawah	1721
Total	57.376		3132

Source: Joint Tree Survey with Forest Officials

As mentioned above, approximately 3132 trees are likely to be felled for upgradation of the project. Trees growing within the proposed toe line (bottom of formation) will need to be removed for upgradation of the project road. Roadside trees with strong and rigid stems can pose safety hazards. Some trees obstruct clear sight distances. Others have a propensity to overturn when old and are potential safety hazards depending upon age and decay condition. All such trees that are safety hazards need to be cleared.

There will be a significant, direct impact due to cutting of the roadside trees, it includes:

- The loss of shade.
- Loss of tree products.
- Loss of birds nesting place.
- Removal of roadside trees will also reduce comfort levels for slow moving

traffic and pedestrians.

- The removal of trees would lead to erosion and contributes to the loss of the micro-ecosystems developed on the roadside.
- Besides these trees act as noise barrier, dust absorption, pollutant sequester, etc.

Removal of Vegetation

Clearing and grubbing is the foremost requirement to start the construction activities of the project roads. The impact due to removal of vegetation includes:

- Dust generation during windy atmosphere.
- Loss of productive top soil.
- Soil erosion during rainy season, may lead to water contamination.

Measures have been taken in reducing and curtailing the clearing and grubbing of excess land.

Impact of Dust on the Vegetation Growth

During the construction activities, dust will be emitted and deposited on the leaves of vegetation/crops along the project roads. Dust deposition on the leaves will affect the photosynthesis process and subsequently hamper the growth of the plants.

5.10 Impact on Socio-Economic Environment

Construction and operation phases of the project road will have some beneficial impact on social environment. Some increase in income of local people is expected as some local unskilled, semiskilled and skilled persons will gain direct or indirect employment during construction phase. Since the immigration of work force during construction phase is likely to be very small, the social impacts on literacy, health care, transport facilities and cultural aspect are expected to be insignificant.

The impacts of the construction of the project road on the socio-economic environment are systematically discussed under the following categories:

- Influx of construction workers,

- Economic impacts,
- Relocation of community structures within the proposed ROW.

Influx of Construction Workers

Although the construction contractors are likely to use un-skilled labour drawn from local communities, use of specialized road construction equipment will require trained personnel not likely to be found locally. Sudden and relatively short-lived influxes of construction workers to communities along the project will have the potential to 'skew' certain demographic variables and the traditional social coherence.

It is anticipated that the construction labour inputs for the construction of the project road will be in the order of about 100 to 150 persons per day. However, this number will fluctuate and the number in any particular activities will be lower.

Economic Impacts

The relatively short-lived economic impacts of the construction phase are likely to be experienced in local communities for the duration of construction, as workers will make everyday purchases from local traders. This is likely to give a short-lived stimulus to these traders that will disappear as soon as the construction is complete. Wider, flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials and the payment of wages and salaries.

Impact on Religious Structures and Cultural Properties

Few religious structures are located along the project road. Some of these religious structures may be partially or fully affected during up-gradation of the project road. Shifting of religious structures is sensitive issue, therefore, local community and followers of religious structures should be taken in to confident.

Common Property Resources

Along the project road, few community structures are located, which are used by local communities. The partial or total impact on these common property resources is anticipated due to up-gradation of the project road. These should

be properly relocated and rehabilitated before start the construction or proper access to such common properties should be provided.

Adverse socio-economic impacts include all disruptions on the social and economic interactions of communities due to the road project. This involves effect on both the adjacent communities (mostly direct) as well as the nearby communities (mostly indirect).

5.11 Impacts Relating To Human Health & Safety

Poor sanitation arrangement and improper methods used for collection and disposal of solid wastes and effluent, accommodation without ventilation, unhygienic food, electrical safety, risk from mosquito and reptile etc at the construction workers camp will impact human health and safety.

5.12 Road Safety Aspects

Increase of incidence of accidents is anticipated due to disruptions of traffic movements on the in construction work zones on the project road.

5.13 Safety and Health Related Issues

Safety and health related issues for the project road are given below:

- Occupational health and safety risks to workers due to inadequate housekeeping and unsafe work practices at work sites.
- Health problems to workers due to inadequate sanitation and unhealthy environment at labour camps/plant sites.

5.13.1 Key Impacts Health and Safety Impacts on Workers and Community

Health and Safety Issues Related to Workers

- Unsafe acts and practices in work zone affecting safety of workers.
- Working on the road without traffic management plan and road safety signages.
- Health impacts due to exposure to dust emissions and high noise levels.
- Working on the road and plants/crushers without personal protective equipment.

- Health and safety issues while working with hot bitumen.
- Health issues due to poor ventilation in accommodation and sanitation at labour camps.
- Improper manual handling and lifting of construction materials and equipment.
- Allowing workers in construction works without proper training.
- Safety and health issues during excavation and earth cuttings.
- Electrical hazards on the works and plant sites.
- Fire in flammable materials like diesel, bitumen, welding gases, etc.

Issues Related to Community Health and Safety

- Dust emissions and high noise levels from road works and plants/crushers during construction phase.
- Odour due to release of raw sewage from camps without treatment.
- Obstructing access to houses during road and drains construction.
- Accidents due to poor work zone safety and lack of safety signages on the road.
- Accidents/injuries due to improper work zone safety.
- Water logging in front of houses due to rise in embankment.
- Health issue dues to stagnation of water in roadside drains.

Chapter 6

Analysis of Alternatives

The mandate of the current project is to widen the existing road to 2 lanes with provision of paved shoulder in the build-up sections and hence there is no alternative site is involved. However, the chapter discusses about the "With" and "Without" project scenarios. The methodology that has been adopted for the evaluation of the alternates route for construction of project road and the selection is based on engineering, economic, environmental and social considerations. The minimization of environmental impacts by considering design alternatives determines the extent of mainstreaming of the environmental component. This chapter looks at the decisions made during the project when alternatives were available and describes the rationale behind each decision.

6.1 Project Improvement

The improvement/up-gradation proposals of the existing road to two lane paved shoulder include the provisions geometric improvements, realignments, widening proposals and reconstruction, pavement, road junctions, bridges and cross-drainages, special problems and road appurtenances. The adopted cross-sectional elements as per the design standards and salient features of the project are presented below **Table 6.1**.

Table 6.1: Project Improvement

S.N.	Particulars	Existing	Proposal
1	Project Stretch	Km0.000to Km 57.588	Km0.000 to Km 57.346
2	Project Length	57.588	57.346 Km
3	Carriageway	3.50to 7.0m	7.0m +paved shoulders+ earthen shoulders
4	ROW(m)	20 to35m	As shown in typical cross sections
5	Realignment	Nil	Nil
6	Junctions	2 Major & 67 Minor	All are improved as per IRC SP:41
7	Major Bridges	None	None
8	Minor Bridges	17	12 Minor Bridge to be Reconstructed 6 Minor Bridge to be Widened

S.N.	Particulars	Existing	Proposal
9	Culverts	49	Reconstruction– 34 Nos To be widened – 15 Nos
10	Pontoon Bridge	Nil	Nil
11	Toll Plaza	Nil	1
12	Bypass	Nil	1
13	ROB	Nil	Nil
14	Wayside amenities	Bus bays: 3Nos in very poor condition	Bus bays: 19 Nos. Truck laybys: Nil

6.2 With and Without Project Alternatives

6.2.1 Without Project Scenario

The road is passing through many settlements and the traffic flow is impacted by narrow carriageway. The existing unsafe conditions and the adverse environmental consequences in terms of the environmental quality along the road would continue to worsen in the absence of the proposed improvements. Moreover, if it is decided not to proceed with the project, then it will result into continuation of unsafe road conditions, more travel time and more fuel consumption, reduced socio-economic development of this area and region. Therefore, the no-action or do minimum 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 road improvements and impede economic development of the area.

6.2.2 With Project Scenario

The 'with project' scenario is found to have a positive impact in the long run on social, environmental, economic and financial matters. This scenario includes the widening and improvement to two/four lanes of the existing single intermediate lane stretch as envisaged in the project objectives. The scenario would thereby, contribute to enhance the growth potential of the region.

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 implementation of best environmental practices. Wherever negotiation of negative impact has not been possible, appropriate mitigation and enhancement measures will be taken for

effective offset of the environmental damages inflicted due to the project. Comparative assessments of the “with and without” project scenarios are presented in the **Table 6.2.**

Table 6.2:Comparative Analysis of With and Without Project Scenario

Component	"With" Project Scenario	'Without" Project Scenario
Highway Geometrics	Two lane configuration carriageway with paved and earthen shoulders and geometric improvements	Existing 5.5m to 6m carriageway with 0.9 m to 1.5 m earthen shoulder
Design Speed	80 - 100 kmph in plain topography	Average speed is 40 - 50 kmph
Congestion in Settlements	Free flow of traffic due to widened carriageway	Congestion in urban areas
Felling of road side trees	Felling of both old and young trees. Old and weak trees near the road edge shall be a safety hazard and need to be tree plantation will be carried out as per condition imposed by the forest department.	No felling of trees. The old trees may become a safety hazard to the road users with passage of time.
Pedestrian safety	Along the settlement, road with significant pedestrian footpath has been provided in urban sections.	Pedestrian safety an issue of major concern especially along the settlements and congested sections.
Road Safety Measures	Provision of proper road markings, footpath, median and improvement of geometry to reduce accidents.	Incidents of accident shall rise with an increased traffic volume and poor quality of road.
Environmental Quality	Road design improvements through-out the stretch will improve environmental quality within the urban areas due to lowered pollution levels compared to blockage scenario and relieving of congestion.	Environmental quality will be 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

Component	"With" Project Scenario	'Without" Project Scenario
		further congestion in due course of time.
Drainage	Drainage will be improved due to reconstruction of culverts with adequate hydraulics.	These issues remain unaddressed without the project.
Sanitation	Sanitation will be improved due to provision of lined and unlined drain along the throughout the stretch	Domestic waste water handling and safe disposal is a major issues in project area
Environmental Enhancement	Environmental enhancement for , community and cultural properties	No environmental enhancement measures involved.
Social Development	Higher potential for social development due to improvement in access and consequent increase in connectivity	Social development activities will be greatly hampered by the gross inadequacy of infrastructure.
Road Side Amenities	Appropriate roadside amenities will be provided as per IRC Guidelines at various locations along the project road.	Continue to remain inadequate and unsafe road conditions.
Better Transportation Facilities	Reduction in travel time and fuel consumption for easy and fast movement. Better access to famous tourist spots and business centers.	Increased vehicle operating costs and high fuel consumption due to reduced speeds.
Enhancement of water bodies	Enhancement of water bodies, community and cultural properties	No enhancement proposal for without project scenario.
Trade and Tourist Development	Higher potential for development due to improvement in access and consequently increase in trade and tourist movement	Development activities will be severely hampered by the gross inadequacies
Economic Development	There will be increased access to	The economy will remain static.

Component	"With" Project Scenario	'Without" Project Scenario
	markets/educational/health facilities. Local people will be employed during construction of the project road	
Financial and Economic Analysis	The project is financially viable and the cost of operation and maintenance, Vehicle Operating Cost (VOC) and other ancillary cost are moderate	The cost of maintenance while catering to the projected higher traffic, accident cost, vehicle operating cost & travel
Access to basic facilities such as Markets, schools, Hospitals etc.	Easy access to basic facilities due to fine road	Difficulty in accessing the basic facilities due to heavy traffic and congestion under settlement areas.

Therefore, "With" project scenario, with its minor adverse impacts is more acceptable than the "Without" project scenario which would mean an aggravation of the existing problems. The potential benefits of the proposed road improvements are substantial and far-reaching both in terms of the geographical spread and time. Hence, it is clear that the implementation of the project will be a definite advantage to State of Uttar Pradesh in order to achieve all-round development of its economy and progress of its people.

The project will have multiple benefits. The project will release the potential of the area and fast connectivity between Uttar Pradesh, Uttarakhand and Nepal.

This project will also reduce the travel time substantially. In addition, this project road will provide further other benefits like:

- Fast and safe connectivity resulting in saving in fuel, travel time and Total Transportation cost to the society;
- Employment opportunities to local people during road construction;
- Development of local industries and agriculture;
- Development of tourism and pilgrimage;
- Transporting, processing and marketing of agricultural products;
- Reduction in accidents;

- Reduction in pollution;
- Opening of opportunities for new occupations;
- Better approach to medical & educational services and quick transportation of perishable goods like fruits, vegetables and dairy products; and
- Improved quality of life for people and so on

However, there would be an increase in the vehicular pollution-air and noise, in the vicinity of the highway. This road construction will result in loss of private properties and loss of living.

If the project is not implemented, there is likelihood that the roads presently carrying the traffic between Bewar and Etawah will deteriorate further and rampant traffic disruptions will hinder the free flow of the traffic. Increased air pollution, due to slow moving traffic and congestion, will follow suit. Noise levels in built up portions will rise due to deterioration of the pavement as well as increased honking.

6.3 Safety Aspects

While assessing the impacts, safety of the road users and the roadside communities has been found to be a major concern. A number of measures have been proposed to reduce the risk of traffic accidents. In some places, these safety measures are co-terminus with the project's impact minimization measures. Horizontal profile correction and intersection improvement has been suggested for betterment of the project corridor. Other safety measures taken are:

- Improvement of existing sharp curves,
- Improvement of existing Curve at bridge approaches.
- Provision of adequate traffic signage,
- Widening of bridge with footpath in built-up location,
- Embankment protection in approaches to bridge,
- Foot path and pedestrian guard rails in built up zone,
- Improvement of existing highway junction,
- Retro-reflective painting on roadside plantations.

6.4 Analysis of Alternatives Alignment

After having examined the feasibility of the road-improvement in the existing alignment, it is concluded that some of the project segment (mainly thickly built-up stretches) may have technical, social and environmental constraints during construction because these critical stretches are

experiencing congestion, encroachment of RoW and poor geometry. Therefore, it is pertinent to develop alternative alignment to these critical stretches. These alternatives have been analyzed keeping in view social, environmental and technical parameters and thus the best alternative has been finalized.

Criteria for Fixing Realignment

Obligatory sensitive reasons through which realignment options should not pass, are detailed in sections below.

Habitations: Proposed alignment has been fixed in such a way that it traverses at a minimum distance of 200-300m from built up areas and avoiding important buildings and structures.

Wildlife Sanctuaries, National Parks, Reserve Forest and other Eco Sensitive zones: No ecologically protected area (Wildlife Sanctuaries, National Parks, etc.) are located within 10 Km distance from the project road.

Water Bodies: The alignment has been fixed taking due consideration & importance of retaining the existing water bodies, ponds, tanks etc. as far as feasible. Important.

Structures: The components which increases the project cost are the presence of the major bridges and other structures. In order, to reduce the project cost, number of structures and their respective lengths were given due consideration while finalising the option.

Alignment should follow the existing alignment /unused / barren land to the extent possible to reduce the cost of land acquisition and carbon foot print.

Justification for Selection Present Alignment

The project mostly involves concentric widening of the existing alignment to fully utilise the available RoW. The project road shall be flexible pavement throughout the stretch. Geometric improvements at various locations have been suggested along the project corridor, where the poor geometrics warrant a deviation from the existing alignment. Care though has been taken to minimise the impact on sensitive, cultural and community features like water bodies, schools, hospitals etc.

6.4.1 Project Alignment Description

The project road starts from „Y“-Junction with NH- 91 in Bewar Town (Distt. – Mainpuri) and passes through Baralokpur, Kishni, Basrehar, Karri and ends at Etawah „T“ Junction NH-2. The design length of the project road is 57.346 km. The project road is divided into 2 packages for construction purpose as given in **Table 6.3:**

Table 6.3: Proposed Project Packages

Package-No	Chainage		Length (Km)	District
	From	To		
Package-1A	Km0+000	Km30+000	Km 30+000	Mainpuri & Etawah
Package-1B	Km30+000	Km57+346	Km 27+346	Etawah

The project road alignment is shown in **Figure 6.1:**



Figure 6.1:Proposed Alignment of the Project Road



Figure 6.2 : Alternate Routes for the Proposed Project Road

Environment Considerations

The various avoidance measures for minimising the extent of environmental impacts and avoiding the sensitive environmental features have been worked out. **Table 6.4** provides the measures that have been adopted for offsetting the environmental impacts.

Table 6.4: Environment Impact Minimization Options

Criteria	Means
Maintenance of design speed for through traffic	Improved geometrics
Improvement of Road Safety	Intersection Improvements; Geometric improvements at curves
Adequate drainage	Provision of side drain and improvement in the cross drainage structures

Criteria	Means
Reduction of air and noise pollution	Intersection improvements; speed optimization near sensitive receptors
Minimization of direct impact on sensitive receptors, cultural and religious properties	Public consultations, mitigation measures
Minimization of property acquisition	Utilization of existing RoW to the maximum extent possible, Concentric widening in habitats areas
Displacement of commercial properties	Utilization of existing RoW to the maximum extent possible, concentric widening in habitats areas
Minimization of tree loss	Maximum effort shall be given to avoid tree felling and plantation will be carried out along the corridor
Stabilization of slope	Turfing / Stone Pitching in slope/high embankment

The proposed project road will have standard two lane carriageway of 7.0 m with 1.5 m paved shoulders on either side throughout the project length. Apart from this there is provision of 19 nos. of bus bays & shelters, facilities for pedestrian movement, traffic sign boards which will not only enhance the service level but at the same time will enhance the safety to the highway users and road side communities to a great extent.

6.4.2 Alternatives for Minimization of Use of Water in Construction Activities

Alternatives considered for minimization of use of water in construction activities are given below:

- Low heat emission cement (Portland Pozzolana Cement) shall be used for construction of roads and structures;
- Plastic Sheeting and Membrane-Forming Curing Compounds shall be sprayed directly over the concrete surface and allowing it to dry. The compound forms an impermeable membrane that retards the loss of moisture from the concrete. Hence, saving the water requirement for curing activity.

6.4.3 Alternatives for construction Materials to Minimize Use of Aggregate, Bitumen, Borrow Earths

Alternatives considered for construction materials to minimize use of aggregate, bitumen, borrow earths are given below:

- Recycle of existing pavement by cold milling of existing bituminous layers;
- The new pavement in the reconstruction and realignment sections have been designed considering minimum aggregate requirements in pavement layers by using Cement Treated Sub Base (CTSB);
- Low heat emission cement (Portland Pozzolana Cement) shall be used for construction of roads and structures;
- Use of plastic waste has been proposed in wearing coat as per IRC-SP-98-2013;
- Use of fly ash at high embankment locations as per the Special Publication 58 of the Indian Roads Congress, IRC:SP:58-2001.

6.4.4 Alternatives for Protection of Slopes

Alternatives considered for protection of slopes have been considered for high embankment road sections like bridges approaches and described below:

- The provision of slope protection on high embankment have been made to conform to IRC-SP-56:2011 by providing plantation of vetiver grass on slopes, turfing of grass and provision of chute drains.
- Toe walls have been proposed at high embankment locations.

6.4.5 Alternatives for Saving Existing Community Structures

For the widening and upgrading of the existing project corridor, there is need for displacement of many community structures. As per the Bank's operational Directives the displacement should be avoided or minimized. While the land acquisition on the account of widening the road and new alignment is unavoidable, the area with the high population density could be marginalized and displacement could be minimized.

While preparing the engineering design, the prime consideration has been to minimize the social negative impacts within the limitations of technical requirements and cost effectiveness and to enhance the benefits. Despite the best efforts to minimize the negative social impact, however, land take at few places and resettlement have been unavoidable.

The existing ROW except at certain locations is wide enough to accommodate proposed developments; therefore, there is no need to acquire land for improvement of existing roads. Minimum impact corridor is considered in order to minimize displacement in the project road within the ROW. Provision has been made in the RAP to address the issues related to non-title holders affected persons.

Realignments have been proposed at various locations to avoid displacement of people as above table provided in chapter 2 along the road, at maximum locations squatters are present on project ROW, who will be compensated as per World Bank policy and RFCT LARR ACT 2013.

It has been cautioned that school and colleges located along the road are minimum impacted. The religious structure which are located within the project ROW and are impacted due to project will be reconstructed or compensated as per public opinion and mutual consent.

6.4.6 Alternatives Considered for Green Initiatives

Alternatives considered for green initiatives for the project road under the green highway have been considered for conventional approach v/s green highway approach.

The comparison statement for conventional approach v/s green highway approach for the Bewar – Etawah Section is presented in **Table 6.5**.

Total saving of Rs. 35.3 Crores is anticipated by adopting green highway methodology.

Table 6.5: Comparison Statement- Conventional Approach v/s Green Highway Approach

Conventional Approach					Green Highway Approach					
S N	Description		Unit	Quantity by Conven- tional Approah	S N	Description		Unit	Quantity by Green Highway Approach	Savi- ngs
1	Embankment	Use of Excavated Material	Cum	179436	1	Embankment	Use of Excavated Material	Cum	179436	
		Use of Soil Borrow Area	Cum	230900			Use of Soil Borrow Area	Cum	230900	
		Use of Flyash	Cum	-			Use of Flyash	Cum	-	
2	Subgrade (500 mm thick)		Cum	301248	2	Subgrade (500 mm thick)		Cum	301248	-
3	GSB (200 mm thick)	Aggregate Water	Cum	140034	3	GSB (200 mm thick)	Aggregate Water	Cum	140034	-
4	WMM (250mm) (181357 cum)	Aggregate type 1 (2.36mm to 75micron@30%)	Cum	54407	4	WMM (250mm / 150mm) (127259 Cum)	Aggregate type 1 (2.36mm to 75micron@30%)	Cum	30542	23865
		Aggregate type 2 or stone	Cum	126950			Aggregate type 2 or stone	Cum	71265	55685
		water	KL	7980			water	KL	4480	3500
5	DBM (85mm) (51872 Cum)	Aggregate type 1	Cum	30565	5	DBM (85mm) (51872 Cum)	Aggregate type 1 Fresh DBM Layer	Cum	12225	18340
		Aggregate type 2 or stone	Cum	44319			Aggregate type 2 or stone	Cum	17727	26592
		Filler @ 2 percent of weight of aggregates.	tons	2394			Filler @ 2 percent of weight of aggregates.	tons	2394	-
		Aggregate type 2 or stone Bitumen Recycled material	Cum	-			Aggregate type 2 or stone Bitumen Recycled material	Cum	31124	31124
		Bitumen	tons	5087			Bitumen	tons	3890	1197
6	BC (40mm) (24410 Cum)	Aggregate type 1	Cum	15662	6	BC (40mm) (24410 Cum)	Aggregate type 1	Cum	15662	-
		Aggregate type 2 or stone	Cum	20033			Aggregate type 2 or stone	Cum	20033	-
		Filler @ 2 percent of weight of aggregates.	tons	1150			Filler @ 2 percent of weight of aggregates.	tons	1150	-
		Bitumen	tons	2876			Bitumen	tons	2861	14
		Plastic Waste	tons	-			Plastic	tons	15	-15
7	Structure Concrete			33723	8	Structure Concrete			33723	-
	Total Cost		Crores	212.06		Total Cost		Crores	176.76	35.3

The quantity of road construction materials required as per conventional approach, Quantity required as per Green Highway approach and saving in materials are given in **Table 6.6**.

Table 6.6: Quantity of Materials Required as per Conventional & Green Highway Approach

Sl. No.	Material	Quantity required as per conventional Approach	Quantity required as per Green Highway Approach	Savings	Average Lead in km
1	Borrow Soil (cum)	532148	532148	-	Local Etawah within 5.00 Km
2	Flyash (cum)	-	-	-	
3	Aggregates (cum)	431970	342502	89468	Ramnagar (Jhansi) approx. 222Km
4	Bitumen (ton)	7963	6766	1197	Mathura Approx. 180 Km
5	Waste Plastic (ton)	0	15	-15	locally Available As a green feature waste plastic is used
6	Filler @ 2 percent of weight of aggregates.	3544	3544	-	locally Available Etawah
7	Cement (cum)	-	8359	-8359	locally Available Etawah
8	Sand (cum)	15439	15439	-	locally Available Etawah
9	Water (kL)	6154004	6150504	-	locally Available Etawah

Chapter 7

Consultation With Key Stakeholders

7.1 Objective

The Stakeholders' Consultation is an important tool to inform and educate stakeholders about the proposed development and also to consider their suggestions in the decision-making process. In order to assess the existing environment and likely impacts on Environment, informal meetings have been organized with various Government officials like the Forest & Wildlife Officials.

Public consultation has been carried out in the Project NH-92 (Bewar to Etawah) with the objectives to minimise the probable adverse impacts of the project through alternate design solutions and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project. Purpose of public consultation include the following:

- Information sharing,
- Assessment of the environmental issues in the region,
- Appraisal and assessment of the stakeholders' needs, and
- Development of specific design solutions and enhancement measures

7.2 Consultation with key Stakeholders

Stakeholders participation and community consultation was taken up as an integral part of environmental assessment process of the project. Stakeholders Consultation with key Stakeholders was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions are made. This assists in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process is helpful in reducing the stakeholders resistance to change and to enable the participation of the local people in the decision-making process.

7.3 Definition of Stakeholder

Stakeholder consultation involves the interaction of various stakeholders and the project proponent. It is highly desirable for all key stakeholders to arrive at a consensus on sensitive features, impacts and remedial actions.

Stakeholder identification was done by examining the potential impacts of the project in terms of:

- Who may be affected directly (project affected people);
- Which agencies might have responsibility for the impact management;
- Which other organizations might have an interest in monitoring proponent activities or have local knowledge to contribute; and
- Which private/ non-government sector entities might face financial and social hardships if the predicted impacts occur?

7.4 Classification of Stakeholders

Stakeholder analysis typically classifies stakeholders or all those who have an interest in the project, into three categories:

Primary stakeholders are those who are directly or indirectly affected by a project, such as the project beneficiaries and the people who are likely to be adversely affected by a project.

Secondary stakeholders are those who are involved in the delivery of the project outputs, such as the government, the implementing agency, the executing agency (e.g., contractors, consultants), if any and NGOs, etc.

External stakeholders are those who are “outside” the ambit of the project activities, but who can influence the outcome of the project, such as the media, politicians, religious leaders and other opinion leaders.

7.5 Need and Usefulness of Stakeholders Consultation with key Stakeholders

Consultation with key Stakeholders is useful for gathering environmental data, understanding likely impacts, determining community and individual preferences, selecting project alternatives and designing viable and sustainable mitigation plan.

Information Sharing

- To promote public/ stakeholder awareness about the proposed project especially amongst the potentially impacted communities/individuals.
- To educate the individuals/interested groups about the proposed course of action;
- To solicit the views of affected communities/individuals on environmental components and the significance of impacts;
- To serve as an important tool for collecting information about natural and the human environments, much of which would never be accessible through more traditional approaches of data collection;

- To ensure lessening of stakeholder/public resistance to modify the proposed activity, by involving them in the decision-making process; and
- To achieve the basis for an Environment Management Plan for the project, with the incorporation of felt needs views and preferences of the people likely to be impacted.

Appraisal & Assessment

- To inform Project Affected Communities about the provision of EMP, and to settle their felt need with mutual consent and to assist them during relocation of community property, if any
- Deduce information from the people about the local environmental issues and their dependence upon them.
- Collect peoples' perceptions about the project and how the negative effects of the project should be mitigated.

Devising Specific Solutions

- To solicit the views of affected communities/individuals on environmental and social problems.
- Receive suggestions from the affected communities about the preferences and options about the project in general and avoidance measures, mitigation/compensation measures, and benefits being provided, in particular.
- To ensure lessening of public/ stakeholder resistance to change by providing them a platform in the decision-making process.

Thus, constructive participation by the affected population can influence not only environmental and social impacts of the project corridor, but also the costs, success and duration of the main investment project itself.

7.6 Levels of Consultation

7.6.1 Local/Village level Consultations

These consultations were held in rural, suburban and urban areas along the corridor of impact of the project road to inform people about the purpose and preliminary design of the project. Such consultations provided a means to get the opinion of the people and their issues of concern at different stages of the project. Village/local level consultations were held at selected locations to understand the implication of the project impacts on various groups, especially those with a distinct degree of vulnerability.

The details of consultations carried out are:

Date	Locations
06.03.2021	Kusumara
06.03.2021	Basrehar
18.01.2021	Etawah
14.01.2021	Kusumara
08.01.2021	Kishni
10.12.2020	Bewar
29.08.2020	Kisni
28.07.2020	Bewar
27.07.2020	Kasmar
04.07.2020	Basreha Etawah
03.07.2020	Rapra Bhatta Etawah
02.07.2020	Bara Lokpur Etawah

The attendance sheets of stakeholder consultations (December 2020 – March 2021) are given in **Annexure 7.1** and photographs of these consultations are shown below:

	
Consultation with PAPs at Kusumara	Consultation with PAPs at Basrehar Bypass



Consultation with PAPs at



Consultation with PAPs at Basrehar



Consultation with PAPs at Etawah



Consultation with PAPs at Etawah



Consultation with PAPs at Etawah



Consultation with PAPs at Etawah



Consultation with PAPs at Kusumara



Consultation with PAPs at Kusumara



Consultation with PAPs at Kishni



Consultation with PAPs at Kishni



Consultation with PAPs at Bewar



Consultation with PAPs at Bewar

During the consultation matters related to environment included air quality, water quality, noise, drainage and removal of trees, the findings of which are given below in **Table 7.1**.

Table 7.2: Outcome of Stakeholder Consultations

S.N.	Issues discussed	Views and Suggestion	Mitigation Measures suggested
1	Date: 6.03.2021, Location : Kusmara		
	Air Pollution	Pollution will increase in the area due to higher movement of traffic.	Trees around the project road will help in curbing the pollution issues.
	Noise	There will be noise during construction	Activities will be planned such that noise levels do not cross permissible threshold.
	Loss of structure	Local people will lose their residential as well as commercial structure due to widening of the road.	The existing road is being widened as per the final design.
	Safety	Local villages people happy with the proposed project and they are demanding for signage along the roadside	Appropriate measures will be taken for safety.
	Widening on both side	Local people asked that widening should be on both side of the road to minimize the impact.	The existing road is being widened on both sides.
	Tree cutting	Existing trees will be cut resulting in reduction in greenery of the area	Compensatory afforestation will be carried out as per forest department norms
	Compensation for Land & Structure	Compensation should be given as per latest market rate.	Compensation will be given based on RFCTLARR Act, 2013
2.	Date: 6.03.2021, Location : Basrehar		
	Safety	Local villages people happy with the proposed project and they are demanding for signage along the roadside	Appropriate measures will be taken for safety.
	Proposed Bypass Connectivity for nearby Villages	Local people demanded that proposed bypass connectivity should be provide to the nearby villages	-

S.N.	Issues discussed	Views and Suggestion	Mitigation Measures suggested
	Occupation	Local people of the village are involved in agriculture and labour work therefore demanded employment opportunity during construction.	Local labour will be preferred during construction.
	Air quality of the area	People were concerned about air pollution due to vehicular traffic during operational stage.	Trees present along the project will result in absorption of pollutants
	Dust during construction	Dust emissions during construction will be health hazard and safety hazard	Water sprinkling will be carried out at least three times a day to suppress dust
	Water availability	There will be water requirement for construction activities and will result in conflict with local people's requirements	Water will be sourced only from approved sources with prior permissions from concerned authorities.
	Related to revenue record	People demanded that compensation to be given to the person having possession on affected land.	Ownership details of the affected land would be verified during RAP implementation. NGO will be appointed to undertake this activity and accordingly compensation will be paid.
	Compensation for Land & Structure	Compensation should be given as per latest market rate.	Compensation will be given based on RFCTLARR Act, 2013
3.	Date: 10.12.2020, Location : Bewar		
	Tree cutting	Existing trees will be cut resulting in reduction in greenery of the area	Compensatory afforestation will be carried out as per forest department norms
	Safety	Local villages people happy with the proposed project and they are demanding for signage along the roadside	Appropriate measures will be taken for safety.
	Widening on both side	Local people asked that widening should be on both side of the road.	The existing road is being widened on both sides.

S.N.	Issues discussed	Views and Suggestion	Mitigation Measures suggested
	Movement of construction vehicles	Nuisance due to movement of construction vehicles	Construction activities will be planned such that there is minimal disturbance due to construction activities
	Compensation	Compensation should be on current market price.	Compensation will be given based on RFCTLARR Act, 2013
4.	Date: 08.1.2020, Location : Kishni		
	Drainage system	Drainage system should be developed, and proposed road should not be raised from the	Accordingly drain has to be constructed
		existing road otherwise village will be bound with water during rainy season.	
	Water requirement	There will be water requirement for construction activities and will result in conflict with local people's requirements	Water will be sourced only from approved sources with prior permissions from concerned authorities.
	Movement of construction vehicles	Nuisance due to movement of construction vehicles	Construction activities will be planned such that there is minimal disturbance due to construction activities
	Air quality of the area	Public are of the view that air quality is not an issue in the area	-
5.	Date: 18.01.2021, Location : Etawah		
	Dust during construction	Dust emissions during construction will be health hazard and safety hazard	Water sprinkling will be carried out atleast three times a day to suppress dust
	Road accidents	Construction activities shall be carefully carried out as the area is prone to accidents	Necessary road safety measures will be adopted
	Water needs	There will be water requirement for construction activities and will result in conflict with local people's requirements	Water will be sourced only from approved sources with prior permissions from concerned authorities.

S.N.	Issues discussed	Views and Suggestion	Mitigation Measures suggested
	Structures	Loss of Commercial as well as Squatters structure, mean a psychological disturbance to the affected families. They demanded to save their structures.	The existing road is being widened as per the final design.
	Removal of trees	Road projects development would result in removal of large number of trees of common occurrence.	Efforts will be made to minimize tree cutting. Compensatory afforestation will be carried out as per forest department norms
6	Date: 14.01.2021, Location : Kusumara		
	Tree cutting	Road projects development would result in removal of large number of trees of common occurrence.	carried out as per forest department norms
	Dust during construction	Dust emissions during construction will be health hazard and safety hazard	Water sprinkling will be carried out atleast three times a day to suppress dust
	Compensation	Compensation should be calculated on market rate.	Compensation will be given based on RFCTLARR Act, 2013
	Occupation	Local people of the village are involved in agriculture and labor work therefore demanded employment opportunity during construction.	Local labour will be preferred during construction.
	Widening on both side	Local people asked that widening should be on both side of the road.	The existing road is being widened on both sides.

Table 7.2: Outcome of Public Consultations conducted in July-August 2020

Location	Date and Timing	Stakeholder	Issues Raised	Suggestions of PAPs (Response)	Mitigation Measures / Design Approach
Kishni	29.8.2020 11:00PM	Villagers, Vendors, Local businessmen , Property owners	Employment	Would prefer permanent employment either with PWD or contractor. Temporary employment with contractor too	As per the policy, contractor to give preference to local population
Bewar Chowk	28.07.2020 12.30 PM				
Kasmar	27.07.20 11:30PM				
Basreha Etawah	04.07.2020 12:00PM		Compensation	Cash compensation at replacement value	As per the policy, compensation will be provided at replacement value
Rapra Bhatta Etawah	03.07.2020 01:30PM				
Bara Lokpur Etawah	02.07.2020 11:30 AM				
			Safety	Speed Breaker at Urban and School area	Various safety signages will be provided. Footpath and safety railing in every urban area. Project has a separate component on road safety.
			Civic Amenities	Sanitation, Drinking Water, Internal road be provided	Will be provided in Resettlement sites
			Encroachment	Few PAPs agreed that they are encroachers but they also said that they have no space for reconstruct	Assistance to vulnerable encroachers, squatters and Kiosk as per R&R policy

The photographs of these consultations (July-August 2020) are shown below:





7.6.2 Consultations with Project Authorities, forest and wildlife Other Officials

At this stage, consultation was carried out with the U.P. Forest and Wildlife officials of all the divisions in which the alignment was likely to cross the forest areas. The basic aim of consultation was to collect the secondary data w.r.t forest and wildlife areas located near to the project road and to ascertain the location of alignment within these areas. The following secondary data were collected during the visit for carrying out the study.

- Working Plan showing the forest land details
- Details on Flora & Fauna
- Animal Crossing/ Corridor crossing the project area
- Presence of Eco-Fragile zone/ sanctuary/ National Park/ Biosphere Reserve/ Ramsar Site or any other Wet Land / Nesting-Breeding Ground
- Whether there is any habitat area of migratory species close to Project Area
- Is there any species which is not seen in recent days (Report on Local Extinction)
- Presence of Endemic / Endangered Species
- Afforestation ratio
- Boundary map of the Wildlife Sanctuaries to scale
- Notification on declaration of Eco-sensitive Zone
- Wildlife Management Plan
- Impacts due to the proposed project and suggestions to improve the Environment of the area
- Forest clearance related queries

Details of consultation with government official carried out are given below in **Table 7.3**.

Table 7.3: Outcome of Consultations with Government officials

S.No.	Consultation with Government Official	Date of Meeting	Key Issues discussed
1.	Divisional Forest Officer, Mainpuri	31 th Jan, 2021	Details on his jurisdiction boundary, common flora and fauna, presence of any engendered species, tree cutting and forest diversion and Identification for Compensatory afforestation Land required for the project.

S.No.	Consultation with Government Official	Date of Meeting	Key Issues discussed
			Status of protected forest in the area, flora and fauna, process of tree cutting, working plan of forest land
2.	Forest Range Officer, Bhogoan	31 th Jan, 2021	Presence of Eco-Fragile zone/ sanctuary/ National park/ Biosphere Reserve/ Site or any other Wet Land / Nesting-Breeding Ground, Whether there is any habitat area of migratory species close to Project Area, species which is not seen in recent days, Presence of Endemic / Endangered Species
3.	Divisional Forest Officer, Etawah	6 th March-2021	Details on his jurisdiction boundary, common flora and fauna, presence of any engendered species, tree cutting and forest diversion and Identification for Compensatory afforestation Land required for the project. Status of protected forest in the area, flora and fauna, process of tree cutting, working plan of forest land
4.	Forest Range Officer, Etawah.	6 th March, 2021	Discussion on tree counting, Presence of Eco-Fragile zone/ sanctuary/ National park/ Biosphere Reserve/ Site or any other Wet Land / Nesting-Breeding Ground, Whether there is any habitat area of migratory species close to Project Area, species which is not seen in recent days, Presence of Endemic / Endangered Species

S.No.	Consultation with Government Official	Date of Meeting	Key Issues discussed
			Compensatory afforestation Land required details for the project.

7.7 Continued Consultations and Participation

In order that the consultations continue till the implementation of the project, to redress the environmental issues likely to surface during construction and operational phases, a constant communication will be established with the affected communities and the road users. To achieve this, Contractors, in consultation with the Supervision Consultant and Independent Consultant will organize periodical meetings with the communities before the start of work, during and before the completion of work to inform them about the Construction Activities, Traffic Management Plan, Siting of Labour Camps etc. and to invite their Suggestions / Grievances.

Chapter 8

Green Initiatives

8.1 Green Initiatives and GHG Emission Reduction

The proposed project development objective is to enhance the institutional capacity of Ministry of Road Transport and Highways in improving transport connectivity through adopting green and climate resilient construction methods for the national highway network and implementing them in pilot sections of the network.

Ensuring development of a greener transport infrastructure is a must. Connectivity and efficiency are not the only requirements a transport network operation must fulfil. The third requirement is that of managing the 'externalities', *i.e.* the collateral damage suffered by the society or the cost imposed on it because of development and operation of the road network. The externalities, which are difficult to be quantitatively estimated, are health hazards (*e.g.* due to pollution), short and long-term effects of environmental degradation (*e.g.* depletion of natural resources) and adverse socio-economic impacts. Transport sector contributes 13 % of global Green House Gas (GHG) emissions and three-fourths of transport-related emissions are from road traffic. With an expanding National Highway network, it is expected that the emissions because of construction and maintenance activities would continue to rise. It will be critical to ensure that these emissions are limited by adopting construction and maintenance practices/ technologies/materials that are green *i.e.* resource efficient and low in terms of carbon footprint. Pavements are still designed traditionally, without the use of alternate materials. Consequently, natural resources required for road construction such as soil, aggregates and sand are becoming scarce – and increasingly being brought in over large distances from the construction site, leading to spiralling construction costs. The externalities associated with these could be minimized by use of local and marginal materials and industrial by-products and green technologies by appropriately integrating them into the design of pavements and embankments.

8.2 Green Highway Approach

The Project Highway shall be designed and constructed in conformity with the Specifications and Standards specified in Annex-I of Schedule-D.

The Contractor shall identify and incorporate green and resource efficient solutions within their design. These solutions might include increasing the efficiency of usage of natural resource, use of local materials and stabilization (cement, lime), using low heat generating low-grade cement, reuse of cut material in embankments and pavement layers after proper testing and balance quantity for filling low lying areas along the project corridor, use of waste products (fly ash, plastics), recycling (asphalt and granular pavement), use of bio-engineering solutions (for treatment of embankment and reinstatement of dumping, borrow and quarry sites, and protection works as required), water conservation (redevelopment/enhancement of ponds, water harvesting structures, water channelization structures to prevent erosion), plantation and use of solar energy sources for lighting.

Use of Fly Ash

The thermal grade Indian coal contains 35 to 45% of ash resulting in generation of huge quantity of fly ash. Management and disposal of fly ash is an environmental issue. Storage of ash in ponds and mounds also require large amount of land.

The following characteristics of fly ash make it a preferred material for road construction.

- Lightweight as compared to commonly used fill material (local soils), therefore, causes lesser settlements.
- Higher value of California Bearing Ratio as compared to soil provides for a more efficient design of road pavement.
- Amenable to stabilisation with lime and cement.
- Can be compacted over a wide range of moisture content, and therefore, results in lesser variations in density with changes in moisture content.
- Easy to handle and compact because the material is light and there are no large lumps to be broken down.
- Can be compacted using either vibratory or static rollers.
- Offers greater stability of slopes due to higher angle of friction. Value of angle of internal friction increases even more upon compaction.
- High permeability ensures free and efficient drainage. After rainfall, water gets drained out freely ensuring better workability than soil, especially during monsoons. Work on fly ash fills/ embankments can be restarted within a few hours after rainfall, while in case of soil it requires much longer period. •

- Faster rate of consolidation; a major part of decrease in volume occurs during primary consolidation phase, which is generally rapid, thus making it an ideal material for road fills.
- Considerable low compressibility results in ease of compaction and shows negligible subsequent settlement within the fill.
- Conserves good earth, which is precious topsoil, thereby protecting the environment.
- Low sulphur content Indian fly ash (less than 0.6 %) can add long term strength and durability to sub grade.
- Fly Ash effectively dries wet soil and provides an initial rapid strength gain which is very useful during construction in wet, unstable ground conditions.
- Fly Ash decreases swelling potential of expansive soils.

Owing to the good CBR and reasonably low dry density and specific gravity, the fly ash can be considered as good embankment material.

Cement Treated Sub-Base (CTSB) Pavement

CTSB is made up of in-situ soils and aggregates mixed with specific quantities of cement dust. Pavements now constructed in India with CTSB are stronger than older granular base roads that have not been properly stabilized. When constructing with CTSB, it is possible to reduce the thickness of the base for the same weight and traffic volumes and still meet all IRC codes. Properly engineered CTSB pavements can distribute loads over wider surface areas significantly reducing stress on sub-grade and increases the load-carrying specification of flexible pavements. Through various studies, it is observed that the pavement with conventional crust fails for distresses condition such as cracking, and rutting But the CSTB and CTSB better to resist in fatigue and rutting. Using CSTB/CTSB there is reduction in the bitumen consumption and the pavement thickness is reduced up to 100 mm. Also, the life of the pavements is longer than conventional pavement, hence requiring less maintenance.

Recycled Asphalt Pavement

Milling asphalt paved area instead of simply repaving over the existing asphalt surface and then laying a new asphalt pavement is a much more efficient way for a long term performance. Benefits of Recycling Asphalt:-

A. Environmental Benefits

- Recycling old asphalt reduces the amount of new oil needed in the construction process and may reduce dependence on foreign oil.
- Recycling saves on construction material waste since the recycled material is not sent to a landfill.
- Recycling the mineral particles that are produced during the process of asphalt pavement helps conserve natural resources.

B. Economic Benefits

- Save money with asphalt recycling.
- Contractors save by reducing energy, materials, and transportation costs.
- Asphalt can be recycled multiple times, ensuring its value.

C. Asphalt Benefits

The quality of asphalt pavement is improved when recycled pavement is used. There is a stronger cracking resistance because of the added mineral fillers and organic fibers used in the recycled materials. Other benefits include:

- Reduced demand for new asphalt pavement
- Reduced demand on aggregate
- Improved HMA mixes
- Improved asphalt stiffness
- Decreased likelihood for cracking
- Decreased susceptibility to rutting
- Decreased need for “virgin” asphalt

Mixing Plastic in Bitumen for Bituminous Coating

Waste plastics can be used in the production of asphalt mix. Waste plastics, mainly used for packing are made up of Polyethylene Polypropylene polystyrene. Their softening varies between 110°C – 140°C and they do not produce any toxic gases during heating but the softened plastics have tendency to form a film like structure over the aggregate, when it is sprayed over the hot aggregate at 160°C. The added bitumen spreads over the aggregate. At this temperature both the coated plastics and bitumen are in the liquid state, capable of easy diffusion at the inter phase. The shredded plastics on spraying over the hot aggregate melted and spread over the

aggregate giving a thin coating at the surface. This process is further helped by the increase in the contact area.

The Plastics Coated Aggregates (PCA) is a better raw material for the construction of flexible pavement. PCA - Bitumen mix showed improved binding property and less wetting property. The cost of bitumen is much higher than that of plastics and this process also helps to save the natural resources. There is no maintenance cost for a minimum period of five years. Hence the process is cheap and eco-friendly as it saves plastic from landing into landfills.

A comparative statement conventional approach v/s green highway approach is given in **Table 8.1**

Table 8.1: Comparison Statement - Conventional Approach v/s Green Highway Approach

S N	Description		Unit	Quantity by Conventional Approach	S N	Description		Unit	Quantity by Green Highway Approach	Savings
1	Embankment	Use of Excavated Material	Cum	179436	1	Embankment	Use of Excavated Material	Cum	179436	
		Use of Soil Borrow Area	Cum	230900			Use of Soil Borrow Area	Cum	230900	
		Use of Flyash	Cum	-			Use of Flyash	Cum	-	
2	Subgrade (500 mm thick)		Cum	301248	2	Subgrade (500 mm thick)		Cum	301248	-
3	GSB (200 mm thick)	Aggregate Water	Cum	140034	3	GSB (200 mm thick)	Aggregate Water	Cum	140034	-
4	WMM (250mm) (181357 cum)	Aggregate type 1 (2.36mm to 75micron@30%)	Cum	54407	4	WMM (250mm / 150mm) (127259 Cum)	Aggregate type 1 (2.36mm to 75micron@30%)	Cum	30542	23865
		Aggregate type 2 or stone	Cum	126950			Aggregate type 2 or stone	Cum	71265	55685
		water	KL	7980			water	KL	4480	3500
5	DBM (85mm) (51872 Cum)	Aggregate type 1	Cum	30565	5	DBM (85mm) (51872 Cum)	Aggregate type 1 Fresh DBM Layer	Cum	12225	18340
		Aggregate type 2 or stone	Cum	44319			Aggregate type 2 or stone	Cum	17727	26592
		Filler @ 2 percent of weight of aggregates.	tons	2394			Filler @ 2 percent of weight of aggregates.	tons	2394	-
		Aggregate type 2 or stone Bitumen Recycled material	Cum	-			Aggregate type 2 or stone Bitumen Recycled material	Cum	31124	31124
		Bitumen	tons	5087			Bitumen	tons	3890	1197
6	BC (40mm) (24410 Cum)	Aggregate type 1	Cum	15662	6	BC (40mm) (24410 Cum)	Aggregate type 1	Cum	15662	-
		Aggregate type 2 or stone	Cum	20033			Aggregate type 2 or stone	Cum	20033	-
		Filler @ 2 percent of weight of aggregates.	tons	1150			Filler @ 2 percent of weight of aggregates.	tons	1150	-
		Bitumen	tons	2876			Bitumen	tons	2861	14
		Plastic Waste	tons	-			Plastic	tons	15	-15
7	Structure Concrete			33723	8	Structure Concrete			33723	-
	Total Cost		Crores	212.06		Total Cost		Crores	176.76	35.3

The quantity of road construction materials required as per conventional approach, Quantity required as per Green Highway approach and saving in materials are given in **Table 8.2**.

Table 8.2: Quantity of Materials Required as per Conventional & Green Highway Approach

Sl. No.	Material	Quantity required as per conventional Approach	Quantity required as per Green Highway Approach	Savings	Average Lead in km
1	Borrow Soil (cum)	532148	532148	-	Local Etawah within 5.00 Km
2	Flyash (cum)	-	-	-	
3	Aggregates (cum)	431970	342502	89468	Ramnagar (Jhansi) approx. 222Km
4	Bitumen (ton)	7963	6766	1197	Mathura Approx. 180 Km
5	Waste Plastic (ton)	0	15	-15	locally Available As a green feature waste plastic is used
6	Filler @ 2 percent of weight of aggregates.	3544	3544	-	locally Available Etawah
7	Cement (cum)	-	8359	-8359	locally Available Etawah
8	Sand (cum)	15439	15439	-	locally Available Etawah
9	Water (kL)	6154004	6150504	-	locally Available Etawah

8.3 Carbon Foot Print

Carbon footprint is a commonly used term to describe the total amount of Carbon Dioxide (CO₂) and other greenhouse gas (GHG) emissions for which an individual or organization is responsible.

It is usually defined as the total amount of CO₂ and other GHGs emitted over the full life cycle of a product or service. It measures the total GHG emissions caused directly by a person, organization, event or

product.

Carbon sources or carbon emission sources are formed in the pavement structure within the boundary of the pavement system, including a series of intermediate products and the unit process of collection. Bitumen pavement construction was divided into two parts, namely, Bitumen mixture production and Bitumen mixture construction. Bitumen mixture production includes aggregate stacking, aggregate supply, bitumen heating, aggregate heating, and mixture mixing. The construction of Bitumen mixture was divided into Bitumen mixture transportation, Bitumen mixture paving, and compaction of Bitumen mixture.

In concrete pavements the stages of carbon emission includes the Cement and steel production, concrete manufactures and concrete pavement construction. The boundary of carbon emission comprises four stages: material manufacture, transportation, construction, and disposal.

The challenge of global climate change has motivated transportation agencies involved in the construction and maintenance of transportation infrastructure to investigate strategies that reduce the life cycle greenhouse gas (GHG) emissions associated with the construction and rehabilitation of highway infrastructure.

Environmental consciousness is on the rise and many transportation officials are striving to make their practices and policies greener or more sustainable.

To analyze carbon footprint, one must look at the greenhouse gas (GHG) emissions associated with the construction and maintenance of a road. Greenhouse gases include carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) etc.

CO₂ Equivalent (CO₂e)

It is used as a metric measure used to compare the emissions from various GHGs based upon their global warming potential (GWP).

CO₂ is taken as a reference for calculation of overall emissions because almost all of the materials contain the basic element as carbon, which on oxidation produces CO₂; and it is also the most prevalent GHG present in the atmosphere.

Although CO₂ and CO₂e are interrelated, they are distinct measures for calculating the global emissions. The carbon dioxide equivalent for a gas

is derived by multiplying the Tonnes of the gas by the associated GWP [4]: $\text{kgCO}_2\text{e} = (\text{Amount of a gas in kg}) * (\text{GWP of the gas})$ In line with the definition given above, the carbon footprint of the road sector can be defined as the total amount of CO₂ and other GHGs (direct and indirect) emitted over the full life cycle of a road.

Calculations

Greenhouse gas emissions are typically measured in terms of carbon dioxide equivalents (CO₂).

Over the last several years, calculations of carbon footprints have gained more importance due to the fact that the environmental norms and conditions specify a particular amount of CO₂ emissions for various activities.

The total GHG emissions caused directly and indirectly by an individual, organization or product is expressed as a CO₂e.

$$\text{CE (S)} = \text{CE (S1)} + \text{CE (S2)} + \text{CE (S3)}$$

Where, CE (S1): Carbon emissions at the material manufacture stage; CE (S2): Carbon emissions at the material transportation stage; CE (S3): Carbon emissions at the construction stage

Chapter 9

Environmental Management Plan

9.1 Introduction

Environmental Management Plan has been prepared which mainly centered on the understanding of the interactions between the environmental setting and the project activities and the assessment of the anticipated impacts. Mitigation measures for anticipated environmental impacts have been elaborated as specific actions which would have to be implemented during the project implementation. The EMP would help the contractors/PIU to implement the project in an environmentally sustainable manner and where contractors, understand the potential environmental impacts arising from the subproject and take appropriate actions/mitigation measures to properly mitigate/manage such environmental impacts. EMP can thus be considered to be an overview document for contractors that will guide environment management of all anticipated impacts in proposed two lane upgradation with paved shoulders of Bewar - Etawah Section of NH 92 in the state of Uttar Pradesh. This EMP may also be considered as flexible and will be further developed by the Contractor in the Contractor's Environmental Management Plan.

9.2 Outline of EMP and its Implementation Strategy

The EMP is a guiding and dynamic/live tool which discusses the potential environmental impacts and specific mitigation/management measures for the proposed two lane upgradation with paved shoulders Bewar - Etawah Section of NH 92. It refers to the responsibilities ensuring commitment for implementation and means of verifying/supervision whether the same has been implemented properly. The timing and frequency of monitoring along with the supervision responsibility and reporting requirements are also provided in the Environmental Management Plan. As a part of the EMP, the contractors will commit to identification of the environmental and social impacts at the project road. In case of any future changes in the project road design, the EMP will need to be updated to reflect the new scope of the activities. such revisions will be finalized in consultation with the World Bank.

The PIU/Authority Engineer will be responsible to ensure implementation of EMP by the contractor with the overall accountability resting with the GNHCP-

PMU. Where as, the Authority Engineer will ensure periodic quality audit/guidance to the PIU and by imparting regular training, monitoring and ensuring that all EMP provisions and requirements are translated into 'contract documents and that these requirements are implemented to their full intent and extent.

Overall responsibility will be of Contractor for effective implementation of EMP and adherence to all the mitigation measures as outlined in this EMP associated with their respective activities. The Contractor will require to comply with the provisions of the EMP.

9.3 Environmental Management Plan

The Environmental Management Plan (EMP) will guide the environmentally-sound construction of the project road and ensure efficient lines of communication/co-ordination between the PIU/Authority Engineer, Contractor and GNHCP-PMU. The EMP has been prepared for three stages of project road construction activities as: (i) Pre-construction Stage; (ii) Construction Stage; and (iii) Demobilization Stage. The EMP for the project road have been prepared and presented in **Table 9.1**. Various guidelines, checklists and reporting formats for implementation of EMP are given as **Annexures 9.1 to 9.19** at the end of EIA Report.

The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a proactive, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impacts of the project road; and (iv) ensure that safety recommendations are complied with.

Budgetary provisions for implementation of EMP shall be integrated with the bid/construction contract in the form of technical specifications and environmental performance requirements. The costs to be incurred on implementation of EMP shall be incidental to the civil works and therefore, no separate environment budget/cost will be provided to the contractor for implementation of EMP. The contractor will ensure effective implementation of EMP during pre-construction, construction and demobilization stages. EMP for operation stage will be implemented by PIU/PMU.

Table 9.1: Environmental Mitigation Measures and Management Plan

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A.	Pre-Construction Stage			
I.	Pre-construction Activities By the PIU			
A.1	Tree Cutting Permission	- Approximately 3132 trees are likely to be felled for upgradation of the project. All efforts will be made to minimise cutting of trees. - Prior permission will be obtained for cutting trees required for construction of the road.	PIU	PMU
A.2	Diversion of Forest Land	The project road passes through protected forest area (road side plantation notified as protected forest area) and 60.379 ha diversion of forest land is required. Prior forest clearance will be obtained before starting the construction in the forest area.	PIU	PMU
A.3	Preservation of Trees	- All efforts will be made to preserve trees including evaluation of minor design adjustments/alternatives (as applicable) to save trees. - In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood from trees cuttings will be done as per the norms of Forest Department. - Systematic documentation for the trees cutting and those saved will be maintained.	PIU	PMU
A.4	Natural Hazards			
A. 4.1	Protection for damage from Earthquake	Design considering relevant IRC guidelines for earthquake resistant measures in bridges	PIU/DPR Consultant	PMU
A 4.2	Protection of Road embankment from flood or water logging	- Improvement in existing culverts and proposal for new culverts to provide cross drainage. - Provision of road side drain (lined and earthen drains) all along the project road.	PIU/DPR Consultant	PMU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		Mitigation measures as per IRC:34 Recommendations for road construction in waterlogged area and IRC: 75 and MORT&H guidelines for Design of High Embankments		
A 4.3	Pavement to withstand extreme temperature during hot summer	Design of pavement to withstand 50 °C ambient temperature in hot summer	PIU/DPR Consultant	PMU
A.5	Utility Shifting	Prior permission will be taken from line departments of Electricity (PDD), Telecommunications (for OFC underground cables etc), water pipeline (PHE) etc. Utility shifting required to be undertaken by PIU.	PIU	PMU
A.6	Orientation of Implementing Agencies	- The PIU/Authority Engineer shall organize orientation sessions for the contractor. This shall include on-site training (general as well as specific) to the context of this project road. In training session PIU officers, project staff, contractors project managers, consultants etc will be involved. - Training of key workers and staff of the contractor about EMP implementation will be ensured before starting the construction works	PIU	PMU
II	Pre-construction Activities By the Contractor			
A.7	Appointment and Mobilization of Environment Officer	- The contractor will appoint qualified and experienced Environment Officer, who will dedicatedly work and ensure implementation of EMP including occupational health and safety issues of workers. - Contractor will inform the PIU for the appointment and mobilization each Environment Officer	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A-8	Regulatory Approvals	- Prior permission will be obtained from concerned department for any works under scope of subproject. - Labour license will be obtained from Department of Labour. - If contractor opens new stone quarry or borrow areas, prior Environmental clearance will be obtained from SEIAA/DEIAA. - For setting-up of stone crusher plant (fix or mobile), hot mix plants, WMM and Batching Plant Consent to Establish and Consent to Operate will be obtained from Uttar Pradesh Pollution Control Board (UPPCB). - If contractor intends to procure construction materials from local authorized third-party agencies, then contractor will collect and submit necessary clearance/approval to PIU/Authority Engineer from authorized third party agencies. - Permissions for taking construction water from surface water bodies and drilling borewell for extraction of ground water, permission will be obtained from competent authorities.	Contractor	Authority Engineer /PIU
A-9	Common Property Resources (CPR's)/ Cultural/ Religious Sites	- All common property resources shall be relocated and restored before the commencement of the road improvement activities. - Before commencement of works, a joint field monitoring will be conducted by the contractor and Authority Engineer/PIU to map out the alignments, to check if any CPR is being impacted due to construction works. - While relocating any CPR/cultural/religious sites, concerned agencies including Contractor shall take necessary precautions and shall provide barricades/delineation of such sites to prevent pedestrian and other road users.	Contractor	Authority Engineer /PIU
A.10	Procurement of Machinery, Crushers, Batching	All vehicles and equipment to be procured for the proposed up-gradation works of the project road will conform to the relevant Bureau of Indian Standard (BIS) norms/vehicles emission standards. The discharge standards promulgated under the	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	Plants, etc and establishment of Plants/crusher.	Environment (Protection) Act, 1986 and Motor Vehicles Act, 2019 will be strictly adhered to. - The silent/quiet equipment like DG set as per regulations will be used at the construction site or labour camp. - The contractor will maintain records of Pollution Under Control (PUC) certificates for all vehicles used during the contract period, which will be produced to PIU for monitoring and whenever required. - Specifications of construction machinery, crushers, batching plants, WMM and hot mix Plants shall comply with the requirements of the relevant environmental legislations. - Batching plant, WMM and hot mix plants shall be located minimum 250m away from population settlements preferably in the downwind direction. - Crusher shall be located as per distance criteria given by Uttar Pradesh Pollution Control Board in Consent to Establish letter.		
A.11	Construction Camp Locations Selection, Design & Lay-out	- The Contractor will obtain consent from land owners in writing for temporary use of land for construction and labour camps, etc.. - The Contractor shall submit a detailed layout plan for construction and labour camps and seek prior approval of PIU/Authority Engineer before entering into formal agreement with a land owner for setting-up such sites. - Layout of construction camp will ensure proper planning of plants, materials storage, sufficiently wide roads for free and safe movement of vehicles, construction equipment and workers.	Contractor	Authority Engineer /PIU
A.12	Arrangement for	The contractor will not take construction water from public water supply.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
	Construction Water	- The contractor shall source construction water preferentially from surface water bodies in the project area after obtaining necessary permission from the competent authority. - Boring of any tube well for water for the road construction shall be drilled only after obtaining necessary permission from Ground Water Authority. - For new borewell, prior approval will be obtained from CGWA as per latest guidelines dated 01.06.2019. - To avoid disruption/disturbance to other water users, the contractor shall extract water from identified locations in consultation with local community.		
A.13	Labour Requirement and compliance of labour regulations	- The contractor preferably will deploy unskilled/semiskilled labour from local areas to give the maximum benefit to the local community and to avoid any additional stress on the existing facilities. On an average 350 to 400 labours/ day (in all 4 packages) will be required during construction stage depending upon extent of construction work. - All applicable labour regulations will be complied by the contractor. - Necessary facilities to workers will be provided to workers as per The Building and other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996	Contractor	Authority Engineer /PIU
A.14	Traffic Management Plan- Planning for Traffic Diversions and Detours	- Detailed traffic control plan for construction phase shall be prepared by the contractor before starts the construction and same shall be submitted to the PIU/Authority Engineer for approval. - The traffic control plan shall contain details of temporary diversions, traffic safety arrangements including night time safety measures, details of traffic arrangement after cessation of work each day, safety measures undertaken for transport of	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		construction materials and arrangement of flagmen etc to regulate traffic congestion in narrow stretches in work zones. - The contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The contractor shall ensure that the diversion/detour are always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. - To maintain road safety during the construction necessary signages will be provided as per applicable IRC codes and guidelines.		
A-15	Stockyard/Storage of Construction Material and Establishing Equipment Lay-down Area	- Contractor in consultation with PIU/Authority Engineer shall identify the site for temporary storage of construction materials. These sites shall not cause an inconvenience to local population / traffic movement. - Selection of locations for materials storage and equipment lay-down areas must take into account prevailing winds, distances to adjacent settlements, general on - site topography and water erosion potential of the soil. Impervious layer on surfaces must be provided wherever necessary. - Construction materials stockpiles shall be protected from storm water (e.g. by excavating a cut-off ditch around stockpiles to keep away storm water). - Storage of fuel with non- permeable flooring (cemented floor) will be enclosed to protect from rain-water. - Equipment lay-down area will be compacted and paved by cement properly to avoid any possibility of percolation of leaked and spilled fuel or lube oils. - Runoff from Equipment lay-down area will be passed through oil & grease trap.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
A-16	Information Dissemination and Communication Activities	- Prior to construction activity, information dissemination will be undertaken by contractor at the project site. - Project information boards showing the name of work, project cost, duration, date of commencement, date of completion, executing agency and contact details (including telephone numbers) shall be displayed both sides of the road packages in both in English and Hindi. - Information boards will also be setup at the sites of construction camps and labour camps, plants and stockyard site. - Details of nodal officer with telephone numbers will be displayed for registering compliant/grievances by stakeholder/general public.	PMU Contractor	PMU Authority Engineer /PIU
B.	Construction Stage			
B.1	Procurement of Construction Materials			
B.1.1	Quarry operations & crushers for procurement for aggregate and other construction materials	- Aggregate will be obtained only from approved stone quarries and crushers having valid clearance and consents. - If contractor plans to open new stone quarry, prior environmental clearance will be obtained from SEIAA/DEIAA. - The crushers will be operated after obtaining consent to establish and consent to operate from UPPCB. - Borrow area (if required) shall be opened without obtaining necessary regulatory permission. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of Authority Engineer. - Borrowing earth shall be carried out in accordance with the IRC recommended practice for borrow pits for road embankments (IRC 36: 2010).	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.1.2	Utilization of Fly Ash in road construction and chances of ground water contamination	• Use of fly ash in road embankment has been designed as per IRC:SP:58-2001 • Four thermal power plants are located within 100km and two are located within 100km to 300km. • Fly ash will be transported to the site in covered dumper • The leaching problem can be minimized by controlling the amount of water, which infiltrates into fly ash embankment • Sides and top of the embankment will be protected using less permeable good earth. This will prevent the seepage the water from the pavement to the embankment. • Surface of the stockpile will be covered with tarpaulins.	Contractor	Authority Engineer /PIU
B.1.3	Transporting Construction Materials	• Vehicles delivering fine materials like aggregate, cement, earth, sand, etc, to the site will be covered by tarpaulin to avoid spillage of construction materials and wind blown dust from the top of vehicles. • Existing road used by vehicles of the contractor or any of his subcontractor or suppliers of materials will be kept clear of extraneous construction materials dropped by such vehicles. • The contractor will make effort to transport construction materials to the site in non- peak hours	Contractor	Authority Engineer /PIU
B.2	Work/Construction Zone Safety			
B.2.1	Work/Construction Zone Safety	• The Contractor shall prepare work zone construction safety plan as per the provisions under IRC 67-2001, IRC SP-55, which shall be duly approved by the PIU/Authority Engineer prior to start of road works. • Warning, informatory and safety signages for ongoing works shall be erected as per IRC guidelines. • Suitable retro reflective warning signages shall be placed at near construction locations and should be visible at night also.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- The contractor shall take necessary measures for the safety of traffic during construction and shall provide, erect and maintain such barricades, including signages, markings, cones, delineators, flagmen, etc as proposed and approved by PIU/Authority Engineer. The contractor shall ensure that all signs, barricades, pavement markings are provided as per applicable IRC Codes and guidelines. - At congested sites necessary signages and flagmen will be ensured to regulate traffic.		
B.3	Site Clearance (Clearing and Grubbing)			
B.3.1	Clearing, grubbing and levelling	- If required vegetation like shrubs and ground flora will be removed from the construction zone only. - All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval of PIU/Authority Engineer. - The contractor, under any circumstances will not cut or damage trees, which was not marked for cutting.	Contractor	Authority Engineer /PIU
B.3.2	Stripping, stocking and preservation of top soil	The topsoil from areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or right of use will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of Authority Engineer/PIU.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		The following precautionary measures will be taken to preserve top soil till they are used: (a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. (b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation. (c) It will be ensured by the Contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for: • Covering all disturbed areas including borrow areas, only in a case where there are to be rehabilitation • Dressing of slopes of road embankment • Reclamation of debris disposal areas. • Agricultural fields of farmers acquired temporarily land.		
B.4	Dismantling of Construction & Demolition Wastes			
B.4.1	Dismantling of old culverts/ bridges	• Demolition wastes from dismantling of culverts/bridges and will be collected and disposed as per the provision of Construction & Demolition Waste Rule 2016. • All necessary measures shall be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from obstructing flow of streams, water channels and drainage systems.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- Demolition wastes shall not be disposed in drainage channels, water bodies etc. - Demolition wastes will be collected and efforts shall be made to use demolition wastes in road construction works as per design provisions, filling, construction of side/approach roads, etc after approval of Authority Engineer.		
B.4.2	Generation & disposal of debris from dismantling of existing road	- Debris generated due to the dismantling of the existing road shall be suitably reused in the proposed construction after approval from Authority Engineer. - Scarified asphalts, dismantled road and the other construction wastes shall be appropriately re-used in road construction with the approval from Authority Engineer. - Surplus quantity of scarified bitumen wastes and other construction wastes shall be utilized for the road construction, paving of cross roads, access roads and paving works in construction sites and camps, temporary traffic diversions, or in any other manner approved by the Authority Engineer. - The Contractor will suitably dispose of unutilized debris and waste materials subject to the approval of the Authority Engineer - All arrangements for transportation during construction including dismantling and clearing debris will be considered incidental to the work and will be planned and implemented by the Contractor as approved and directed by the Environmental Expert of Authority Engineer. - The pre-identified/designed disposal locations will be a part of Solid Waste Management Plan to be prepared by	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		Contractor in consultation and with approval of Environmental Expert of Authority Engineer. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area.		
B.4.3	Disposal of construction debris	Debris generated from construction of bridge and culverts will be collected and disposed in environmental sound manner.	Contractor	Authority Engineer /PIU
B.5	Protection of Drainage and Surface Water Bodies			
B.5.1	Construction of Bridges	- Construction of cofferdam for pier construction for bridges. - Collection and disposal of piling wastes away from river. - Precautions will be taken during construction of bridges which may cause contamination of the river water due to spillage of construction material, sediment loading & increased turbidity downstream of the bridge location. - Provision of silt fencing will be kept as required. - Debris generated from other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area.	Contractor	Authority Engineer /PIU
B.5.2	Drainage and Control of Accumulation of Water	- Major bridges, minor bridges and culverts are proposed to be constructed in the proposed project: - The contractor shall ensure that natural drainage is not altered due to road construction, disposal of debris/surplus excavated materials, etc - The Contractor shall ensure that no construction materials/debris shall block the water flow or create water lodging at the culvert and bridge construction sites. - The contractor shall take appropriate remedies to remove accumulated water (if any) from the construction sites, camp sites, storage yard, excavated areas etc.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- On completion of construction or before onset of monsoon, debris from bridge and culvert construction sites shall be collected and drainage channels will be cleared properly. - Construction works should be planned well in advance prior to onset of monsoon to avoid water- accumulation. - The contractor shall take necessary precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run off in sediments are controlled. - Silt fencing shall be installed prior to the onset of the monsoon at the required locations, as directed by PIU/Authority Engineer.		
B.5.3	Siltation of Water Bodies and Degradation of Water Quality	- The project road is crossing natural streams at places, which remain dry in non-rainy days. - The Contractor will not excavate beds of any stream/ any other water body for borrowing earth for embankment construction. - The Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including wells) adjacent to the project road and around the stockpiles at the construction sites including ancillary sites close to water bodies. - The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. - The contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water/runoff does not drain into nearby watercourse. - On completion of construction of culverts and bridges, drainage channels will be cleared by collecting debris and disposed suitably. Detours/diversions constructed for construction of	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		culverts and bridges will be also be cleared before onset of monsoon.		
B.6	Slope Protection and Control of Soil Erosion			
B.6.1	Slope Protection and Control of Soil Erosion	- For construction of realignment, earth filling will be required for embankment for new road construction, which will require slope protection and control of soil erosion. - The Contractor will construct slope protection works as per design, or as directed by PIU/Authority Engineer to control soil erosion and sedimentation through use of Breast walls, Retaining Walls, gabion wall, dykes, sedimentation chambers, basins, fibber mats, mulches, grasses, slope, drains and other devices. - In the project road, slope protection and control of soil erosion in high embankment will be required at places as per details given in DPR and schedules. - Slope protection measures shall be provided along the project stretch in the form of: (1) Coco fibre/jute erosion control blanket with shrub/grass plantation, (2) Hydro seeding, (3) Interlink chain mesh with grass strips and (4) gabion wall near water bodies. - The tentative locations for above slope protection provisions are listed in Schedules for project road. Any additional locations shall be provided by Contractor after consultation with authority without any change in scope. - Additionally, the contractor shall consider use of vetiver grass to prevent /control soil erosion.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.7	Access for Visually Impaired Persons			
B.7.1	Tactile Tiles and Access Ramp	The provision for tactile tiles and Access ramp to bus shelters for visually impaired people has been provided and taken in Schedule as per Section 12 of the IRC:SP 73: 2018	Contractor	Authority Engineer /PIU
B.8	Longitudinal Drains Along Road Sections			
B.8.1	Construction of longitudinal drains along the road	- Drainage arrangement of earthen drain and RCC drain in built up locations are proposed along the project road. - At the excavation site, warning sign boards will be displayed in Hindi and English languages. - Entry of general public/unauthorized person will be restricted in construction zone. - During excavation for laying of concrete (RCC) cover drains necessary safety measures will be taken by the contractor. - Excavation of 1.5 meters deep or greater requires a sides protection unless the excavation is made entirely in stable rock. - Contractor to follow strict protocol during excavation and construction for longitudinal drain especially along the sensitive receptors like schools, religious places, community buildings, etc. - Excavated earth will be collected and disposed in pre-identified site with the approval of Authority Engineer. Excavated earth shall not be temporarily dump on the carriageway or shoulders. - Casted drain blocks and drain covers will not be stacked on the road. - To ensure elimination of excavation hazards, excavation will be carried in the presence of competent person. - Suitable barricading will be provided around the excavation site. - Proper outfalls will be provided for roadside drains - Drains will be properly covered to avoid unsafe conditions to pedestrian.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		Suitable personal protective equipment will be provided to the workers engaged in drain construction works.		
B.9	Sensitive Receptors- Impact Management			
B.9.1	Sensitive Receptors- Impact Management	- At each sensitive receptor like schools, religious places, community resources, etc and near general residential houses, the construction operations in these areas should be limited to time period of 7:30 am to 6:00 pm. - Periodic maintenance and calibration of construction equipment's/ vehicles to meet applicable CPCB emission standards. - Contractor to ensure regular dust suppression measures by way of standard and efficient water sprinkling through water tankers at these designated sensitive receptors. - Silencers/mufflers fitted construction equipment shall be used to control noise from construction activities. - Construction materials and debris will not be stored or dump near the settlements/populated areas. Debris generated from road /drain construction will be collected and disposed on daily basis. - Adequate barricading and signages will be provided in settlement areas and near schools, religious structures, community buildings, etc.	Contractor	Authority Engineer /PIU
B.10	Pollution Control			
B.10.1	Control of Water Pollution	The following water pollution control measures will be taken by the contractor: The contractor will take necessary precautionary measures to prevent entering of wastewater into streams and water bodies during construction.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- Contractor will avoid construction works close to the streams or water bodies during monsoon. - Construction vehicles shall not be washed in river water and shall not enter riverbed for that purpose. - Any type of construction wastes will not be disposed in rivers or water bodies. - Workers shall not be allowed to litter/defecate, bath or washing of cloth in the water bodies crossed by the project road. - Proper fixed or portable toilets fitted with septic tank and attached to soak pit will be provided for workers at bridges/culverts sites.		
B.10.2	Control of Water Pollution from Fuel and Lubricants	- The Contractor will ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 250 m away from rivers and water streams. - The Contractor will submit locations and layout plans of such sites prior to their establishment and will be approved by the Environmental Expert of Authority Engineer. - The contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a manner that spillage of fuels and lubricants does not contaminate the ground and subsequently water channels. - Wastewater from vehicle parking, fuel storage areas, workshops, wash down and refuelling areas will be treated in an oil interceptor before discharging into on land. - At the construction camp, oil interceptor will be provided to collect used oil generated from the workshop. Details of oil interceptor are given in sub section of EMP.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- Contractor will make arrangement for collection, storing and disposal of oily wastes to the pre-identified disposal sites as per guideline of State Pollution Control Board. - Oil spills and used oil from maintenance vehicles engines and of DG sets shall be disposed of in accordance with Uttar Pradesh Pollution Control Board (UPPCB) guidelines.		
B.10.3	Waste Water from Labour Camp	- Wastewater generated from the sanitary facilities at labour camps/construction camps/toilers at bridge construction sites will be treated in septic tank followed by soak pit. - No untreated raw sewage/waste water will be discharged into any river and water body. - Workers will not be allowed for open defecation in any circumstances. - Proper fixed or portable toilets fitted with septic tank and soak pit will be provided for workers at small labour camps for bridges construction sites.	Contractor	Authority Engineer /PIU
B.11	Air Pollution			
B.11.1	Control of Dust Pollution	- Road construction works specially earth work and movement of construction vehicles plying on the road during construction phase may add to dust and gaseous air pollution along the project road. - Frequent dust suppression like water sprinkling on the road will be ensured by the use of water tankers. - The contractor will procure the construction machineries, which conforms to the pollution control norms specified by the MoEF&CC/CPCB/UPPCB. - Regular maintenance of vehicles to be used for materials transportation and equipment will be carried and vehicular pollution check will be mandatory.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- The excavated earth /construction materials will be stored properly so that it does not generate fugitive emissions. - Cement bags will be stored and emptied in covered area to control fugitive dust emissions. - While handling and emptying cement bags, workers will wear masks, hand gloves and protective goggles. - Mask and other PPE shall be provided as a mandatory effort to the construction workers in dust prone areas.		
B.11.2	Emissions from Construction Vehicles, Equipment and Machineries	- The contractor will ensure that all vehicles, equipment and machineries used for construction works will regularly maintained and conform that pollution emission levels and comply with the requirements of CPCB and/Motor Vehicles Rules. - Pollution under control certificate (PUC) will be obtained for the all vehicles engaged in the construction, - DG sets will be provided with chimney of adequate height as per CPCB guidelines (Height of stack in meter = Height of the building + 0.2 $\sqrt{\text{KVA}}$). - Environmental monitoring will be carried out as per the monitoring plan.	Contractor	Authority Engineer /PIU
B.12	Noise Pollution			
B.12.1	Noise Levels from Construction Vehicles and Equipment's	The contractor will ensure the followings to control the noise levels and its impact: All construction equipment used in excavation, paving, concreting, etc, will strictly conform to the MoEF&CC/CPCB/UPPCB/BIS noise standards.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		• All vehicles and equipment used for construction works will be fitted with exhaust silencers/mufflers. • Maintenance and servicing of all construction vehicles and machineries will be done regularly. • Only acoustic enclosures fitted DG sets will be allowed at the construction site and labour camp. • At the construction sites within 250 m of the nearest habitation, noisy construction work and use of high noise generation equipment will be stopped during the night time between 6.00 pm to 7.30 am. • Working hours of the construction activities will be restricted around educational institutes/health centers (silence zones) up to distance of 100 m from the sensitive receptors. • Noise monitoring shall be carried out in construction areas through the approved monitoring agency.		
B.13	Archaeological Resources and Cultural Properties			
B.13.1	Chance Found Archaeological Property	• All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He/She will, immediately upon discovery thereof and before removal inform the Environmental Expert of the Authority Engineer/PIU of such discovery and carry out the PIU's instructions for dealing with the same, waiting which all work shall be stopped.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		The PIU will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.		
B.13.2	Impacts Cultural Properties	- All necessary and adequate care shall be taken to minimize impact on cultural properties which includes cultural sites and remains, religious places, monuments and any other important structures as identified during design stage. - Relocation and enhancement measures shall be taken up as per design and in consultation with local community. - Access to such properties from the road shall be maintained clear and clean.	Contractor	Authority Engineer /PIU
B.14	Personal Safety and Health			
B.14.1	Personal Safety Measures for Labours and Staff	- The contractor will take necessary measures for the personal safety of workers during construction works: - Protective safety shoes, gum boots, helmet/hard hat, hand gloves, protective goggles, safety belt, etc (as required) will be provided to the workers engaged in construction works including excavation, steel rebaring and bending, concrete works, etc. - Welder's protective eye-shields will be provided to workers who are engaged in welding works in workshops and bridge construction sites. - Earplugs/earmuff will be provided to the workers exposed to high noise levels. - High visibility safety vests will be used by all workers when on construction sites. - The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- The contractor will comply with all the precautions as required for ensuring the safety of the workmen as far as those are applicable to this contract. - The contractor will make sure that during the construction work all relevant provisions of Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. - The contractor will not employ any person below the age of 14 years for any work. - Contractor's environmental expert will carry out regular audit to identify unsafe conditions and necessary remedial measures will be taken to enhance safe working conditions in construction works.		
B.14.2	Emergency Management	- Emergency numbers will be displayed at the construction sites and camp sites, - First boxes will be made available at construction sites and camp sites, - Fire extinguishers for petroleum oil fire and electrical fire will be made available at camp sites, fuel storage sites, construction sites etc.	Contractor	Authority Engineer /PIU
B.14.3	Risk Force Measure	- The contractor will make required arrangements so that in case of any mishap during, operation of construction machinery/ vehicles, dismantling, excavation, concrete pouring, hot asphalt handling, etc all necessary steps can be taken for prompt first aid treatment. - Construction safety plan for the all the road stretches, embankment development, protection works, longitudinal drains, ancillary sites shall be prepared by the contractor and will identify necessary actions in the event of an emergency.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.14.4	First Aid Facility	- The contractor will arrange for first aid facility during construction works and at plants /camps sites: - A readily available first aid unit including an adequate supply of sterilized dressing materials, burn ointment and appliances as per the state rules will be maintained all the time by the contractor. - Availability of first aid trained persons will be ensured at the project site during construction phase. - Trained person for Cardio Pulmonary Resuscitation (CPR) at construction camps and bridge construction sites will be available. - Availability of suitable transport will be ensured all times to take injured or sick person(s) to the hospital. - Designated vehicles, which can be used as ambulance will be available at construction site at all the time.	Contractor	Authority Engineer /PIU
B.14.5	Occupational Health and Safety of Workers	- The contractor will prepare and follow the Occupational Health and Safety (OHS) plan, including provisions for emergency response plan. - Daily toolbox talks and regular training programs will be conducted for workers on Occupational Health & Safety (OHS) aspects. - All workers will be provided with requisite personal protective equipment. - Before deployment of workers at hot mix plant, WMM and Batching plants health check will be carried out. - Emergency Telephone Numbers shall be displayed at camp and plant site. - Necessary medical facilities shall be provided for workers at Labour camp and plant sites.	Contractor	Authority Engineer /PIU
B.15	Labour/Construction Camp and Project Site Management			

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.15.1	Labour Camp	• Proper barricading and boundary walls will be provided around the labour camp. • Project information board will be displayed at the labour camp site. • Emergency numbers and layout plan will be displayed at the entrance of camp site. • Electrical cables and wires will be properly arranged with proper electrical safety. Loose electrical connections will not be allowed at the labour camp. • Red danger sign with bone & skull will be displayed as per The Electrical Rules at three phase motors, electrical panels and electrical machines, DG sets, etc. • Housekeeping at labour camp will be maintained satisfactory. Daily sweeping and cleaning will be done at the labour camp. • HIV Aid awareness posters will be displayed at the camp site. • Solid waste generated at the camp site will be collected in covered waste bins. Then, it will be segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored and to be sent for recycling through scrap dealer. Biodegradable (food waste, etc) solid waste will be disposed in compost pit. Non-biodegradable inert wastes will be sent to nearest land fill site. • Drinking water, well ventilated accommodation with beds, sanitation, canteen facilities will be provided to workers at the labour camp. • Waste water and sewage accumulation will be not be allowed at and around the labour camps. • First aid facilities will be provided at the labour camp.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- Wood shall not be used for cooking food for workers. LPG cylinder will be arranged and kept with proper safety. - Suitable signages will be displayed at labour camps. - There will be separate accommodation, toilet and bathrooms in case female worker are staying or working at labour camp.		
B.15.2	Accommodation for Laborers	- Contractor will follow all relevant provisions of the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. - The location, layout and basic facility provision of labour camp will be submitted to Environmental Expert of Authority Engineer/PIU prior to their construction. - The construction will commence only upon the written approval of the Environmental Expert of Authority Engineer/PIU. - The contractor will provide necessary well ventilated living accommodation, toilets, bath rooms and ancillary facilities functional and in hygienic manner. - Proper ventilation along with standard exhaust fans will be provided in labour accommodation rooms. - Regular cleaning and sweeping will be ensured at the labour camp site. - Systematic waste collection management at labour /construction camps shall be managed as per Solid Wastes Management Rules 2016. - Standard first aid box including an adequate of sterilized dressing materials. - Mosquito nets shall be provided to all workers in the camps.	Contractor	Authority Engineer /PIU
B.15.3	HIV/AIDS Prevention Measures	Necessary HIV/AIDS prevention measures will be taken at labour camp.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		HIV/AIDS awareness program will be organized by the contractor's Environmental Officer.		
B.15.4	Potable Water for Workers	- The contractor will provide potable water facilities within the precincts of workplace, bridges/culverts construction sites and labour/construction camps at an accessible place, as per standards set by the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. - If water storage tank is provided, same will be kept such that the bottom of the tank is at least 1 meter above the surrounding ground level. - If water is drawn from any existing well/ hand pump, which is within 30 meters proximity of any toilet, drain or other source of pollution, the handpump/well water will be disinfected before it is used for the drinking. - Environmental Expert of Authority Engineer/PIU will inspect the labour camp once in a week to ensure the compliance of the EMP.	Contractor	Authority Engineer /PIU
B.15.5	Sanitation and Sewage System at Labour Camp	The contractor will ensure that: - The sewage system for the camp will be designed, built and operated in such a manner that no health hazard occurs and no pollution to the air, soil, ground water or adjacent water courses takes place, - Separate toilets/bathrooms, as required, will be provided for male and female, marked in vernacular language, - Toilets will be provided with septic tank followed by soak pit. - Adequate water supply will be provided in all toilets and urinals, - Night soil can be disposed of with the help of municipality or will be disposed of in a earthen pit to produce manure.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
B.15.6	Solid Wastes Collection and Disposal	- The contractor will provide garbage bins in the camp & construction site and ensure that these are regularly emptied and disposed of in a hygienic manner according to Solid Waste Management Plan as per Solid Waste Management Rule 2016. - Burning of solid wastes at construction site & labour camp, road-side or at any other places will not be allowed. - Solid waste generated at the construction site & labour camps, will be collected in covered waste bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag, etc) wastes. Polyethylene/plastic wastes will be stored suitably and to be sent for recycling through scrap dealer. Biodegradable (food waste, paper, etc) solid waste will be disposed in the compost pit.	Contractor	Authority Engineer /PIU
B.16	Environmental Monitoring			
B.16.1	Environmental Monitoring- Construction Stage	Environmental monitoring for ambient air quality, noise levels and ground and surface water quality will be carried out through NABL accredited laboratory as per environmental monitoring plan and in accordance to instruction of Environmental Expert of Authority Engineer/PIU.	Contractor	Authority Engineer /PIU
C.	Sites Clean-up and Restoration (On Contractor's Demobilization)			
C.1	Clean-up Operations, Restoration and Rehabilitation	- The contractor will prepare site restoration plan for construction work sites and labour/construction camp sites, which will be approved by the PIU / Environmental Expert of Authority Engineer. - The clean-up and site restoration works shall be implemented by the contractor prior to demobilization from construction site and labour/construction camps. - The contractor will clear all temporary structures, debris, construction wastes, garbage, night soils, etc in environmental sound manner.	Contractor	Authority Engineer /PIU

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
		- All disposal pits or trenches will be filled in and effectively sealed off. - All construction places including camps and any other area used/affected due to the construction works will be left clean and tidy at the contractor's expense to the entire satisfaction to the PIU/ Environmental Expert of Authority Engineer.		
C.2	Land Rehabilitation	- All surfaces hardened due to construction activities will be ripped & imported materials thereon removed and disposed in environmental sound manner. - All rubbles to be removed from the sites shall be disposed in approved disposal site. Burying of rubble on site is prohibited. - Land surfaces of works sites and camps sites shall be checked for waste materials from activities such as concreting or asphaltting and cleared in a manner approved by the PIU/ Environmental Expert of Authority Engineer. - All embankments will be trimmed, shaped and replanted to the satisfaction of the PIU.	Contractor	Authority Engineer /PIU
C.3	Borrow Area Rehabilitation	- Borrow pits shall be closed and rehabilitated in accordance with the pre-approved Borrow Area Rehabilitation and management plan for each borrow area. - The contractor shall maintain record of borrow areas used for the subproject keeping photographs of before after its rehabilitation. - IRC guidelines shall be followed for rehabilitation of borrow areas. Borrow areas shall be rehabilitated by levelling of land for agriculture or other purpose, developing fish or water harvesting ponds, etc as per owner choice and satisfaction.	Contractor	Authority Engineer /PIU
D	Post Construction Stage			

S. No.	Environmental Issues	Environmental Mitigation Measures	Responsibilities	
			Planning and Execution	Supervision/ Monitoring
D.1	Environmental Monitoring- Post Construction Stage	Environmental monitoring for ambient air quality, noise levels and water quality as per environmental monitoring plan and in accordance to instruction of Environmental Expert of PIU.	PIU	PMU
D.2	Monitoring of bio-engineering and landscaping	- Regular monitoring of bio-engineering measures and landscaping shall be carried for its performance and survival rate. - Provision will be made for manure application and watering as required.	PIU	PMU
D.3	Soil Erosion and Monitoring of Borrow Areas	- Visual monitoring and inspection of erosion of slopes, conditions of slope stabilisation measures will be carried regularly. - Frequency of monitoring and inspection will be increased during monsoon season.	PIU	PMU

Note: Management measures for labour influx management, labour-management procedures and Gender Based Violence (GBV) have been covered in SIA.

9.4 Oil Interceptors

Oil and grease from workshop and fuel storage at construction camp are major concern during construction. During construction, discharge of oil and grease is most likely from workshops, oil and waste oil storage locations, vehicle parking areas of the contractor camps. Therefore, Oil Interceptors has been considered at construction camp. The arrested spilled/used oil shall be disposed as per MoEF&CC and CPCB guidelines. However, number of interceptors will be increased as the situation demands. Actual number of oil interceptor will be decided by the Contractor with the consent of Authority Engineer. Drawing of typical oil interceptor is given in **Figure 9.1** below:

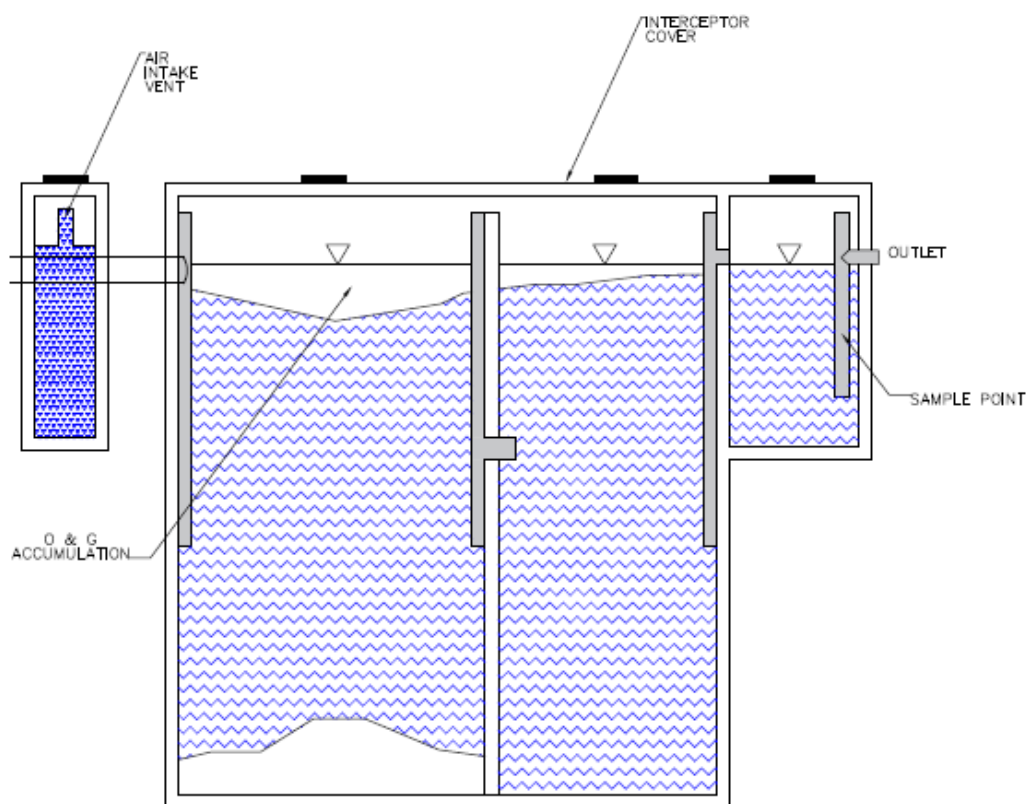


Figure 9.1 : Typical Design of Oil Interceptor

9.5 Rain Water Harvesting/Recharge Recharging

Due to constrain of availability of land within the ROW, ground water recharge pits have been proposed mainly along the proposed realignment section to improve the water table along the project road. Although, as per CGWB data, the water table of the area is generally good.

Ground water recharge pit / rainwater harvesting structure have been proposed at 115 locations as given below:

60 Nos. of RWH pits in Package 1A.

55 No"s of RWH pits in Package 1B.

Above locations of the proposed ground water recharge pits will be reviewed by the Environmental Specialist of the Authority Engineer in view of hydro geological investigation in the area. These locations should be permanent and part of maintenance of the project road.

Typical drawing of ground water recharge pit / rainwater harvesting structure is given in **Figure 9.2:**

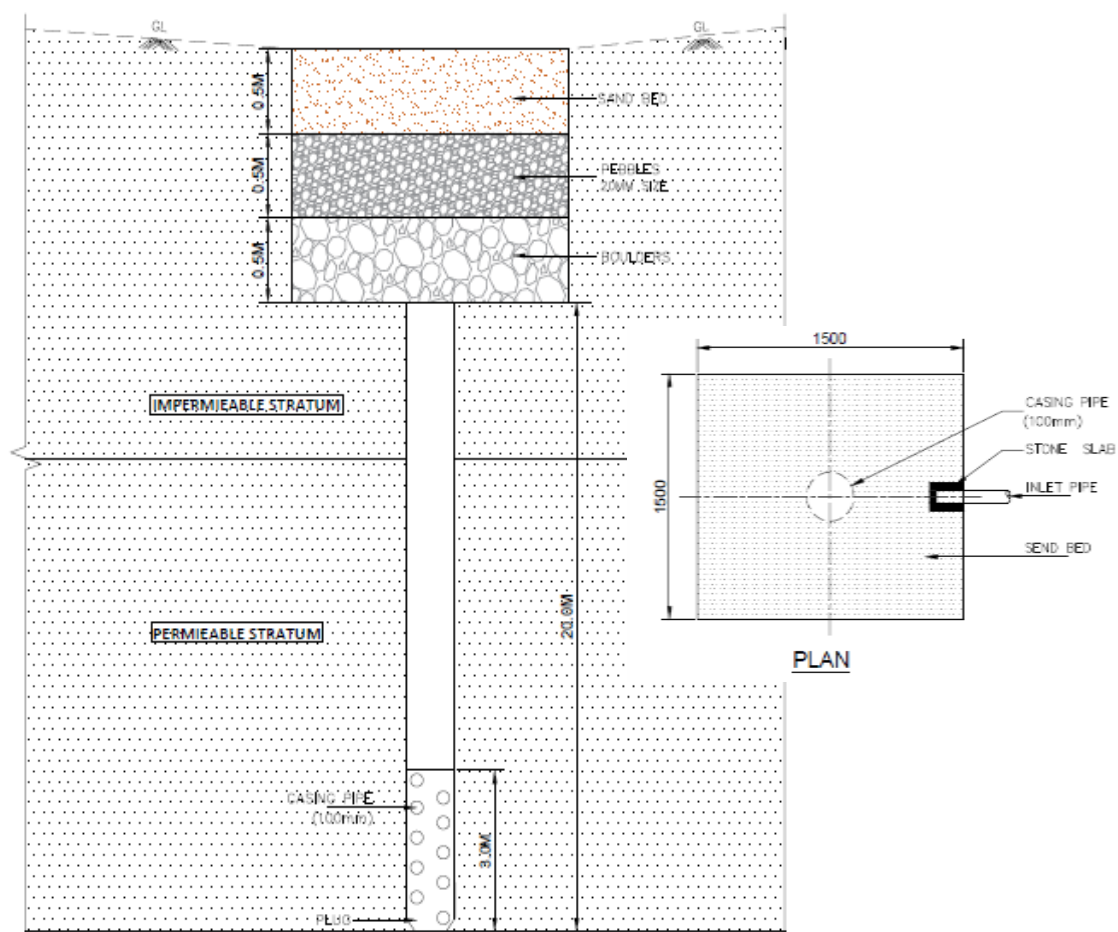


Figure 9.2: Typical Drawing of Ground Water Recharge Pit

9.6 Disposal of Bituminous Wastes

The bituminous waste will be used at the construction camps, approach roads, for filling potholes in nearby village roads.

Non reusable bituminous waste will be dumped in 30 cm thick clay lined pits with the top 30 cm layer covered with good earth for supporting vegetation growth over a period only after obtaining approval of the Authority Engineer. Typical drawing of bitumen disposal pit is shown in **Figure 9.3**.

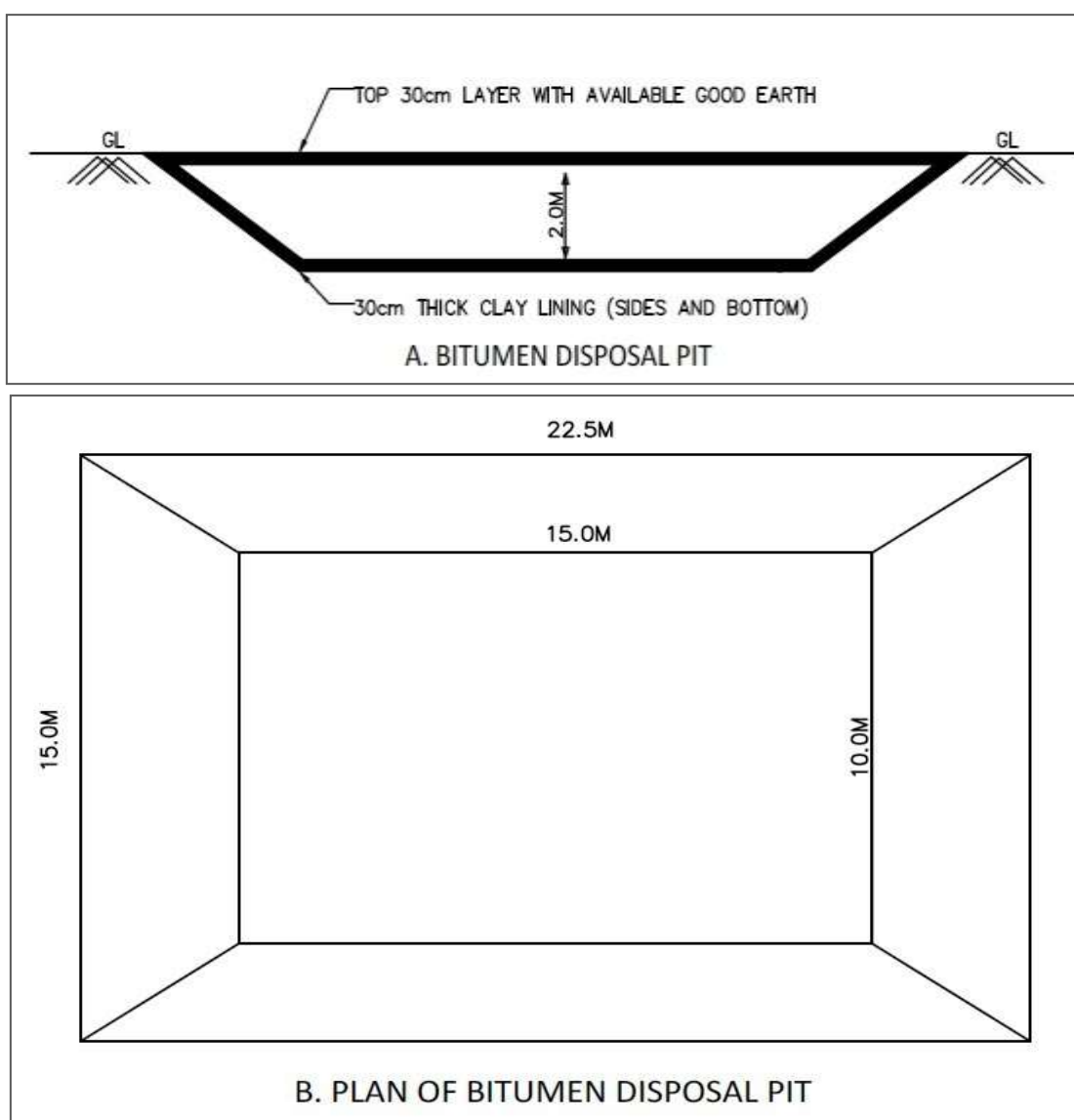


Figure 9.3: Typical Drawing of Bitumen Disposal Pit

9.7 Clause for Nonconformity to Environmental Management Plan (EMP) - Protection of the Environment

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Health, Safety & Environment (HSE) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited immediately.
- To modify the mitigation measures or implementing additional measures, if required.

9.8 Performance Monitoring Indicators

Environmental components identified of significance in affecting the environment at critical locations have been suggested as Performance Indicators. For example, near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators will be evaluated under three heads as mentioned below:

- Environmental condition indicators to determine efficacy of environmental mitigation measures for controlling air, noise and water pollution.
- Environmental management indicators to determine compliance with the suggested environmental management measures.
- Operational performance indicators have also been devised to determine efficacy and usefulness of the proposed mitigation measures for the project road.

The performance indicators and monitoring plan prepared for the project road are presented in **Table 9.2**. Details of the performance indicators parameters for each of the component have to be identified and reported during all stages of the implementation.

Table 9.2: Performance Indicators and Monitoring Plan

Sn.	Description of Item	Indicator	Stage	Responsibility
1.	Identification and verification of the earth borrow areas and stone quarries	Compliance of site selection criteria	Preconstruction	Contractor
2.	Identification of locations for the construction camp and construction plants sites	Compliance of site selection criteria	Preconstruction Phase	Contractor
3.	Progress on the tree cutting	Tree Cutting numbers	Preconstruction Phase	PIU/PMU
4.	Location of the temporary storage areas for excavated materials to be reused in road construction, embankment and sub grade.	Storage of excavated	Preconstruction and Construction Phase	Contractor
5.	Implementation of mitigation measures specified in the EMP	Prevention/ Control of Pollution	Construction Phase	Contractor
6.	Environmental monitoring as per the conditions stipulated in the consents / as described in environmental monitoring plan	Environmental conditions at construction Sites/plants/ camps	Construction Phase	Contractor
7.	Environmental monitoring in accordance with the frequency and duration of monitoring as well as the locations as per the monitoring plan. Before the onset of monsoon all the debris/excavated materials will be cleaned from the work sites and disposed of	Ambient Air Quality, Ambient Noise Level, Ground and Surface Water Quality, Silting of Water bodies	Construction Phase	Contractor through External agency and will be supervised by the Environmental Expert of Authority

Sn.	Description of Item	Indicator	Stage	Responsibility
	temporarily stock piled debris for final disposal properly away from the water bodies.			Engineer/PIU / PMC
8.	Monitoring of work zone safety	Use of PPEs and signages.	Construction Phase	Contractor and will be supervised by the Environmental Expert of Authority Engineer / PMC
9.	Implementation of the enhancement measures suggested for the pond redevelopment areas, cultural/community properties	Enhancements/ Shifting	Construction Phase	Contractor
10.	Reporting of accidents at work sites/road construction sites	Accidents Reporting	Construction Phase	Contractor
11.	Plantation of shrubs and grass and bio-engineering measures on high embankment/ enhancement sites	Landscaping	Construction and Defect Liability Period	Contractor
12.	Compensatory tree plantation and reporting of the survival rate. The survival rate should be monitored and reported on quarterly basis.	Tree Plantation and Survival Rate	Construction and Post operation Stage	Forest Department and PMU/PIU
13.	Inspection and verification of the borrow area redevelopment as specified in the redevelopment plan and satisfaction of the owners/IRC guidelines	Status of Borrow Areas	Construction and Post operation Stage	Contractor & PMU/PIU
14.	Site restoration/de-mobilization of camps and plant on completion of works	Clean-up and restoration of the sites.	De-mobilization	Contractor and will be supervised by the Environmental Expert of Authority Engineer / PMC

9.9 Environmental Monitoring Plan

The monitoring programme consists of performance indicators, reporting formats and necessary budgetary provisions. The contractors monitoring plan should be in accordance with the baseline environmental monitoring, locations provided in the environmental impact assessment report.

The monitoring plan has the following objectives:

- To ensure effectiveness of implementation of EMP
- To evaluate the performance of mitigation measures proposed in the EMP
- To comply with all applicable environmental, safety, labour and local legislation, and
- To ensure that public opinions and obligations are taken into account and respected to the required satisfaction level.

9.9.1 Monitoring Parameters and Standards

The environmental monitoring parameters and National Ambient Air Quality Standards are discussed below:

9.9.2 Ambient Air Quality Monitoring (AAQM)

The ambient air quality parameters viz: Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Particulate Matters (PM₁₀ and PM_{2.5}), shall be monitored six monthly at identified locations from the start of the construction activity. The ambient air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Table 9.3**. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.3: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural & other areas	Ecologically Sensitive Area (Notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide, (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 10	-Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide, (NO ₂) µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochhieser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter(size less than 10 µm), or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter(size less than 2.5 µm), or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation
5	Carbon Monoxide (CO), µg/m ³	8 hours* 1 hours**	02 04	02 04	-Non Dispersive Infra Red (NDIR) spectroscopy

Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals **24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

9.9.3 Noise Quality Monitoring

The noise levels shall be monitored at designated locations in accordance with the Ambient Noise Quality standards given in **Table 9.4**. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

Table 9.4: National Ambient Noise Quality Standards

Area Code	Category of Zones	Limits of Leq in dB(A)	
		Day*	Night*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone**	50	40

*Daytime shall mean from 6:00am to 10:00 pm and Night shall mean from 10:00 pm to 6:00 am

**Silence zone is defined an area up to 100 meters around premises of hospitals, educational institutions and courts, Use of vehicles horns, loud speakers and bursting of crackers are banned in these zones

9.9.4 Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coli form count, total suspended solids, total dissolved solids, Hardness, Conductivity etc. shall be monitored at identified locations during the construction stage as per standards prescribed by Central Pollution Control Board specifications presented in **Table 9.5** The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan.

Table 9.5: Surface Water Standards

S. No	Parameters	IS:2296 (Class C)	Method Adopted
1.	pH	6.5-8.5	pH meter
2.	BOD (3 day, 27°C)	3.0	DO-Azide modification of Wrinkler's Method
3.	Temperature (°C)	NS	Thermometer
4.	Dissolved oxygen	4	Azide modification of Wrinkler's method
5.	Color (Hazen)	300	Visual Comparison method
6.	Chloride (Cl)	600	Argentometric Titration
7.	Total Dissolved Solids	1500	Gravimetric Analysis
8.	Sulphates (SO ₄)	400	Barium Chloride method
9.	Oil and Grease	0.1	Partition -Gravimetric method
10.	Nitrates	50	Chromotropic acid
11.	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified. All the values in mg/l if otherwise mentioned

9.10 Monitoring Plans for Environment Conditions

For each of the environmental components, the environmental monitoring plan specifies the parameters to be monitored; location of the monitoring sites and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction stages is presented in **Table 9.6**. Monitoring plan does not include the requirement of arising out of regulation provision such as obtaining Consents for plant site operation.

Table 9.6: Brief Description of Measures

Sl. No.	Locations of Work Site	Site Safety Measures
1.	Construction Sites	Caution boards, Safety Cones, Delineators
2.	Deep Cutting	The construction zone should be barricaded with G.I Sheet or arrangement to be made as per plan approved by the PIU / PMU. [Provide Safety Sign Boards and Safety Barriers marked with reflective tapes]
3.	Temporary Diversion (if any)	Diversion Board, Barricading [Provide 'Diversion Ahead' boards at 50m, 100m and 150m ahead of diversions with reflective tape for illumination at night at the all diverted locations]
4.	Safety for the Workers	Helmets, Safety-Shoes, Goggles, Dusk mask. Etc.

Furthermore, periodical site monitoring should be carried out by the Environmental Expert of PIU for surveillance & monitoring of road safety during the road construction. The brief description of measures has been given in **Table 9.7**:

Table 9.7: Environmental Monitoring Plan

Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Implementation
Ambient Air	Construction	PM _{2.5} , PM ₁₀ , SO ₂ , NO ₂ & CO	National Ambient Air Quality Standards (NAAQM) 2009	Two samples for one week (on non consecutive days) for in winter and summer seasons (six monthly).	24 Hours Sampling, 2 Samples in on Week	Construction labour camps, plants sites and settlements along the work zones (Locations will be decided by Environmental Expert of Authority Engineer /PIU)	Contractor
Ground Water	Construction	Organoleptic and Physical, Chemical & Bacteriological Parameters	Potable Water Standards (IS 10500: 2012)	Winter and Summer Seasons	Grab Sampling Once	Construction labour camp, plants sites, settlements along the work zones (locations will be decided by Environmental Expert of Authority Engineer /PIU)	Contractor
Surface Water	Construction	pH, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), BOD, COD, Oil & Grease (O&G) and Turbidity	Indian Standards (IS:2296-1982) for inland surface waters	Winter and Summer Seasons	Grab Sampling Once from	Construction labour camp, plants sites, River and Ponds (locations will be decided by Environmental Expert of Authority Engineer /PIU)	Contractor
Noise	Construction	Level Equivalent L _{Day} and L _{Night} based	Ambient Noise Standards	Winter and Summer Seasons	Hourly noise measurements for one day in winter and	Construction labour camp, plants sites, settlements along the work zones	Contractor

Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Implementation
		on hourly Noise Measurements			summer seasons	(locations will be decided by Environmental Expert of Authority Engineer /PIU)	

9.11 Environmental Reporting System

The environmental reporting system for the suggested monitoring programme will function at two levels:

- Reporting for environmental condition indicators and environmental management indicators
- Reporting for operational performance indicators at the PMU/PIU level. Environmental monitoring involves regular checking of the environmental management issues detailed in the EMP and to ascertain whether the mitigation measures are achieving desired objectives for environmental protection, with the progress of the works. It provides the necessary feedback for the project management to keep the programme on schedule for achieving the expected outcomes.

The contractor, Authority Engineer /PMC and PIU/PMU will operate the reporting system for environmental conditions and environmental management indicators. The reporting schedule for contractors and Authority Engineer have been prepared, which are on the basis of the implementation of EMP by the Contractor and monitoring by the Authority Engineer /PMC and PMU/PIU.

The reporting system will start with the Contractor who is the main executor of the implementation EMP activities. The Contractor will report to the Authority Engineer /PMC, who in turn will report to the PMU/PIU. The reporting system will comprise the following:

- The contractor will submit monthly environmental compliance reports along with formal monthly project progress report to the Authority Engineer
- The Authority Engineer will submit separate quarterly environmental monitoring reports to PMU/PIU in addition to submission of the summary of the activities of the month in the formal monthly report including any deviations and corrective actions
- PMU/PIU will be responsible for the preparation of the targets for identified non compliances for the EMP compliance
- Solutions for further effective implementation may also emerge as a result of the compliance monitoring reports.

The photographic records will be kept providing useful environmental monitoring tools. All material sources points, disposal locations, plants

locations, camp locations, crusher locations etc will be photographed (for before and after conditions) and kept as a record will be part of progress report. A full record of construction activities and EMP implementation will be kept as part of normal contract monitoring system. The reporting and monitoring systems for various stages of construction and related activities have been proposed in **Table 9.8**.

Table 9.8: Environmental Reporting System

Item	Contractor	Construction Supervision Consultant (Authority Engineer /PMC)		PMU/PIU	
	Implementation and Reporting to Authority Engineer /PMC	Supervision	Reporting to PMU/PIU	Oversee Compliance Monitoring	Report to World Bank
Pre-construction Stage					
Sites of Camps and Plants	Weekly	Weekly	Monthly	Monthly	Quarterly
Locations of Borrow Area	Weekly	Weekly	Monthly	Monthly	Quarterly
Location of Stone Quarry	Weekly	Weekly	Monthly	Monthly	Quarterly
Shifting of Community/ Cultural Structures	Weekly	Weekly	Monthly	Monthly	Quarterly
Tree cutting and Clearing of Vegetation	Weekly	Weekly	Weekly	Weekly	Monthly
Construction Stage					
Monitoring of construction site and construction camp	Regular	Regular	Monthly	Monthly	Quarterly
Pollution Monitoring	Six Monthly	As required	In Monthly Report	In Quarterly Report	In Quarterly Report
Monitoring of Enhancements	Weekly	Weekly	Monthly	Monthly	Quarterly
Top soil preservations	Weekly	Weekly	Monthly	Monthly	Quarterly

Item	Contractor	Construction Supervision Consultant (Authority Engineer /PMC)		PMU/PIU	
	Implementation and Reporting to Authority Engineer /PMC	Supervision	Reporting to PMU/PIU	Oversee Compliance Monitoring	Report to World Bank
Borrow area/ quarry area/ debris disposal area	Weekly	Weekly	Monthly	Monthly	Quarterly
Bio-engineering and landscaping	Monthly	Monthly	Monthly	Monthly	Quarterly
Site Restoration Demobilization of Plants					
Clean-up of plants & camps sites and Restoration of Sites	Monthly	Monthly	Monthly	Monthly	Quarterly

9.12 Institutional Arrangements for Environmental Management

The environmental management requirements/guidelines/plans need to be applied and implemented at all stages of the project. This requires an institutional mechanism to deal with various processes and requirements at each stage. Within the institutional framework proposed for the project, preparation, implementation, supervision and monitoring of environment functions, particularly the Environment Management Plans (EMP), will be carried out at the three levels - national center, state level and the project/community level with an inbuilt mechanism for coordinating activities between the said levels.

Implementation Structure

The Externally Aided Projects Cell (EAP-Cell) at MoRTH, supported by a Project Management Consultants (PMC), will have the overall project implementation responsibility.

At the central level, the Chief Engineer, Externally Assisted Projects (CE, EAP), MoRTH, Govt. of India will be responsible for the over-all implementation of EMF and EMP. The CE, EAP will have all delegated administrative and financial decisions regarding the implementation of the project as well as environment management and safeguard related functions. CE (EAP) will be assisted by a team comprising Executive Engineer (EE) designated as an Environment and Social Officer (ESO) and a suitable number of technical and secretarial staff. The EE will ensure that all project activities are complied with as per the EMF and EMP.

MoRTH will engage a Project Management Consultant (PMC), which will include an Environment Specialist, to work with the CE, EAP's team. The PMC will be responsible for training, guidance, and recommendations for handling policy and implementation issues at the state and sub-project levels to comply with the EMF and requirements laid out in the EMP.

At the state level, the National Highways (NH) divisions in the state Public Works Department will be responsible for the project execution. In Project Co-ordination Unit, there will be an Environment Officer who will coordinate the preparation/implementation of EMP. He/she will ensure that these comply with requirements laid out in the EMF for GNHCP and are implemented in accordance to provisions laid out in the contract documents.

Finally, for the project road, a Project Site Team (PST) or Project Implementation Unit (PIU) will be responsible. The PST, to be headed by Executive Engineer, will oversee day to day implementation of environment, health and safety plan, including on issues pertaining to tree cutting, plantation works, utility relocation and worksite safety management.

Supervision consultant/ Authority Engineer to be engaged by MORTH will provide the regular supervision and administration services. The Authority Engineer's team will have Environment and Safety personnel for day-to-day supervision and monitoring. The Environmental and Safety Officer on the Contractor's team must ensure compliance with the environmental contractual clauses and will report on progress or challenges to the Construction Supervisory team, as per the requirements/obligations stated in the Contract Document.

Independent Quality Assurance Consultants (QAC) would be engaged to oversee the quality of the green national highway upgrading contracts,

including environment management, health and safety related aspects. This will determine whether the project is complying with regulatory performance standards. It entails a systematic, documented and periodic review of project implementation and could be a useful tool to improve project management performance on EHS aspects.

Environmental and Safety Officer (ESO)

For effective implementation and management of the EMP, the Contractor will depute an Environmental & Safety Officer (ESO) to deal with the environmental issues of the project. The subproject will be divided in package for construction purpose and separate contractor will be deployed and mobilised for each construction packages. Each contractor will deploy one Environmental and Safety Officer (ESO) to look after day to day implementation of EMP/mitigation measures and reporting. However, contractor may deploy two officers, separately for Environmental Management and Safety.

9.13 Grievance Redressal Mechanism

Grievance Redressal Mechanism (GRM) arrangements to address public/workers' grievances have been described in SIA.

9.14 Environmental Management – Budget

Implementation of Environmental Management

The environmental budget for the various environmental management measures proposed for construction and post operation of the project road is detailed in **Table 9.9**. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the engineering cost.

Table 9.9 : Budget for Implementation of Environmental Management Plan

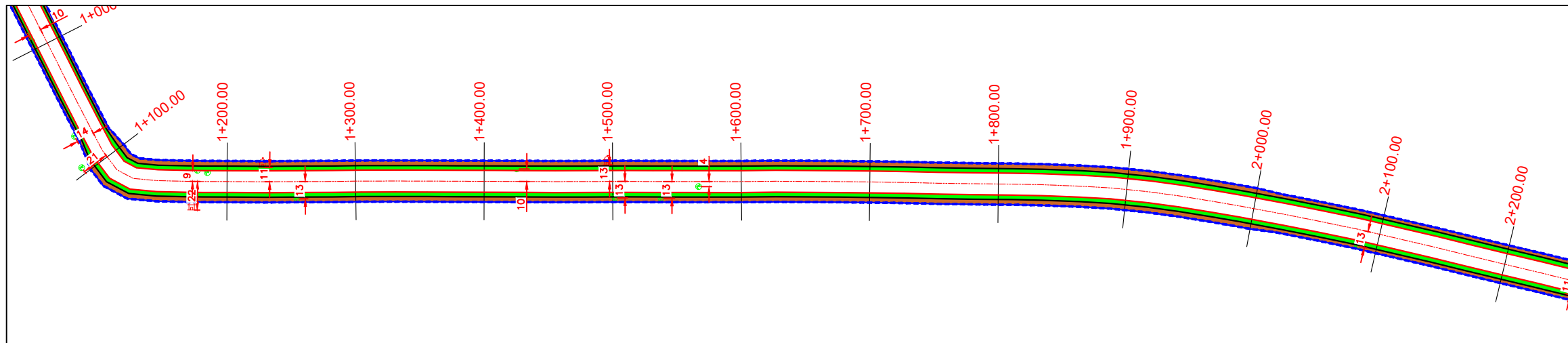
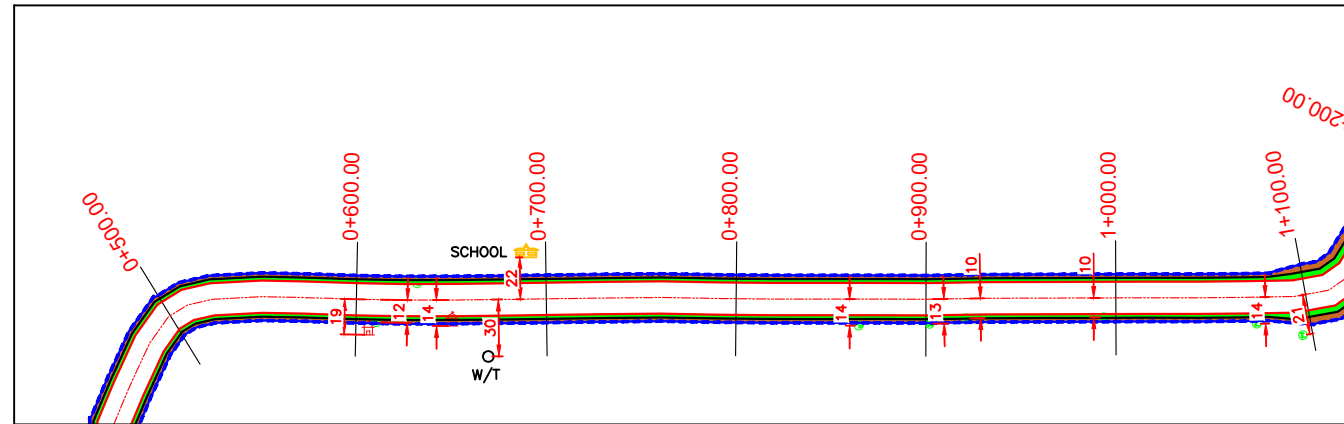
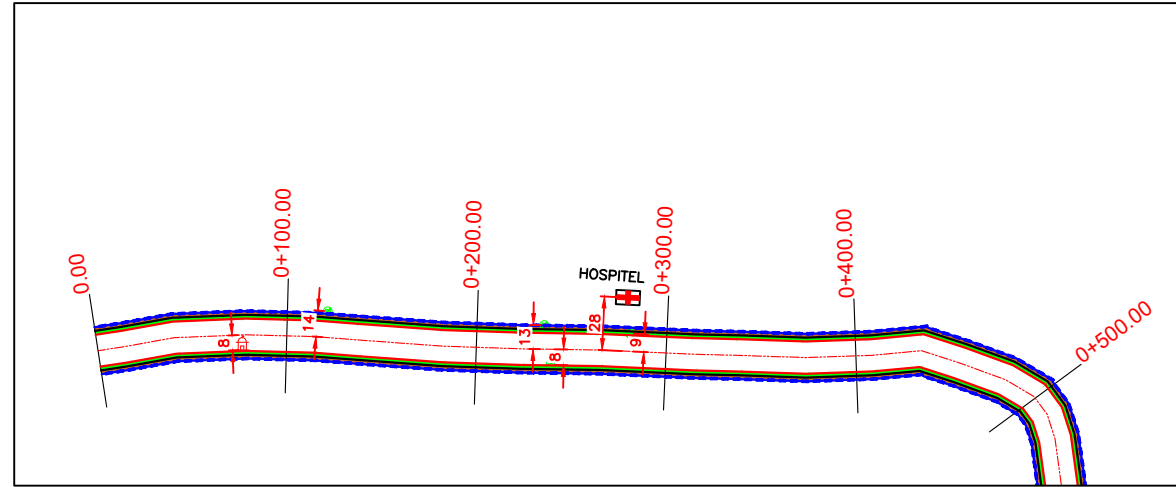
Sr. No	Component	Item	Unit Cost (INR)	Quantity	Total Cost
A. Construction Stage					
1.	Tree Cutting	Cutting of Road Side Trees for construction of road	Cost to be part of DPR		
2.	Environmental Monitoring	Ambient Air Quality noise and surface and ground water Monitoring as per monitoring plan,	Lump sum		400000
3.	Topsoil Management		Cost to be part of DPR		
4.	Air	Dust Suppression Measures	Cost to be part of DPR		
5.	Labour camp and ancillary facilities	Labour Camp and all associated facilities as per EMP	Cost to be part of DPR		
6.	Personal Protective Equipment's (PPE's)	Personal Protective Equipments like vest, helmet, safety shoe, hand gloves, gumboots, earplug, Harness belt, Welding Glasses etc	Cost to be part of DPR		
7.	First Aid Kits	First Aid Kits at the construction site, camp and ancillary sites	Cost to be part of DPR		
8.	Compensatory Plantation	Replantation of Trees (3:1)	1500	5396	14094000
9.	Oil Interceptor	Oil Interceptor at Workshop at Camp Site	50000	2	400000
10.	Borrow Area Rehabilitation and Quarry Management	Rehabilitation and Restoration	Cost to be part of DPR		
11.	Debris and Waste Disposal	Solid Wastes, Demolition Wastes, Hazardous Wastes	Cost to be part of DPR		
12.	Display of Safety Signages and Work Zone Safety	Sign boards, retro reflective tapes, cones, barriers	Cost to be part of DPR		
Project Enhancement					
13.	Embankment Strengthening (By way of plantation)	Grass Engraining with indigenous shrubs	Cost to be part of DPR		
14.	Protection on bridges, culvert and on high embankment	Slope Protection Measures	Cost to be part of DPR		
14.	Shifting of Community Property Resources,	Shifting and Relocation	Cost to be part of DPR		
15.	Capacity building	Lumpsum Budget for Capacity Building	200000		
Contingency Cost @ 5%					754700
Total Budget Cost					15848700

Annexures

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LEGEND:-

	ROAD CENTER LINE		TEMPLE		MOSQUE		POND		PROTECTED FOREST		WELL
	EROW		HAND PUMP		SCHOOL		RIVER/CANAL/NALA		NON FOREST LAND		BOREWELL
	PROW		HOSPITAL		WATER TANK (W/T)		BALANCE LAND				

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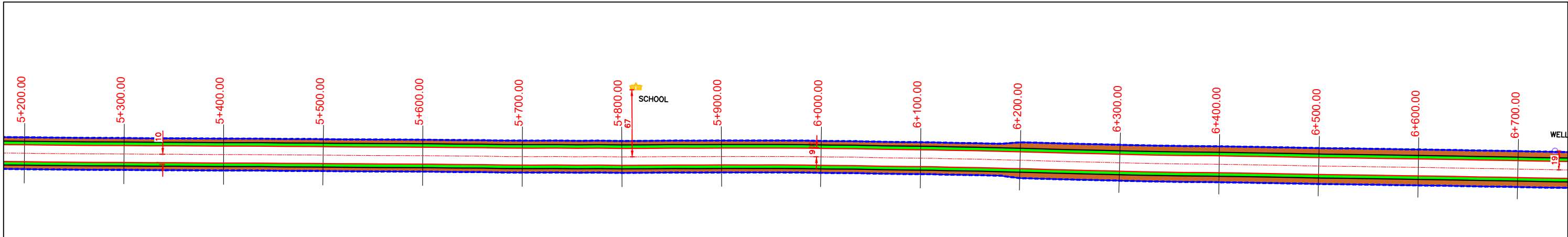
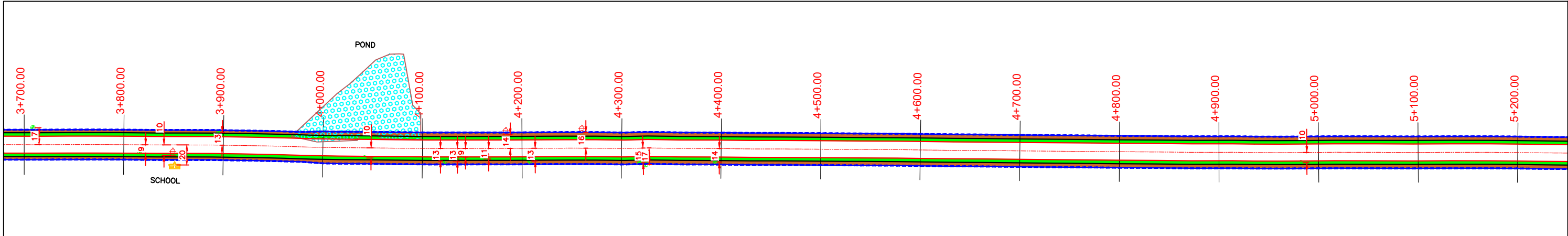
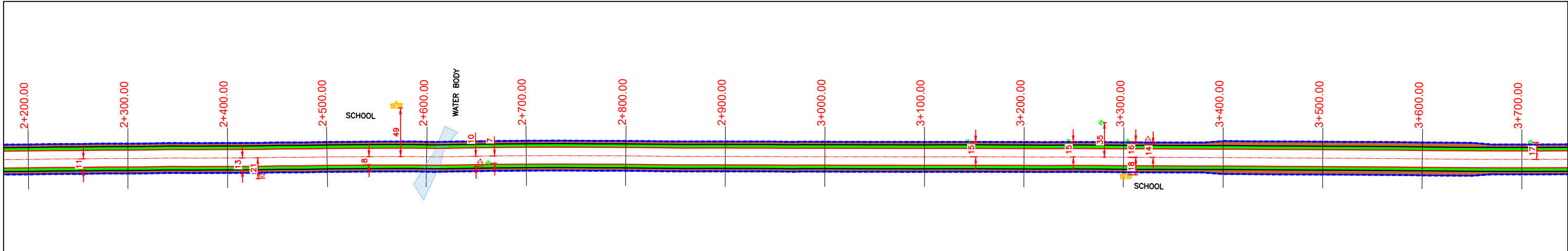
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LEGEND:-

ROAD CENTER LINE

EROW

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PROTECTED FOREST

NON FOREST LAND

BALANCE LAND

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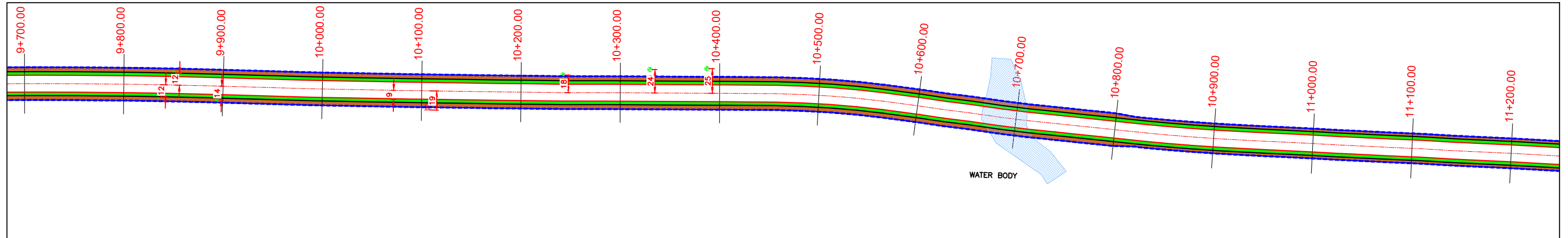
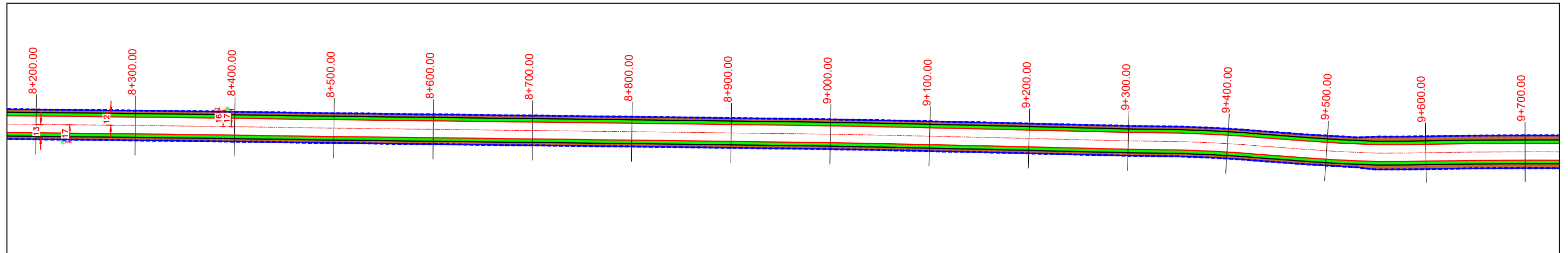
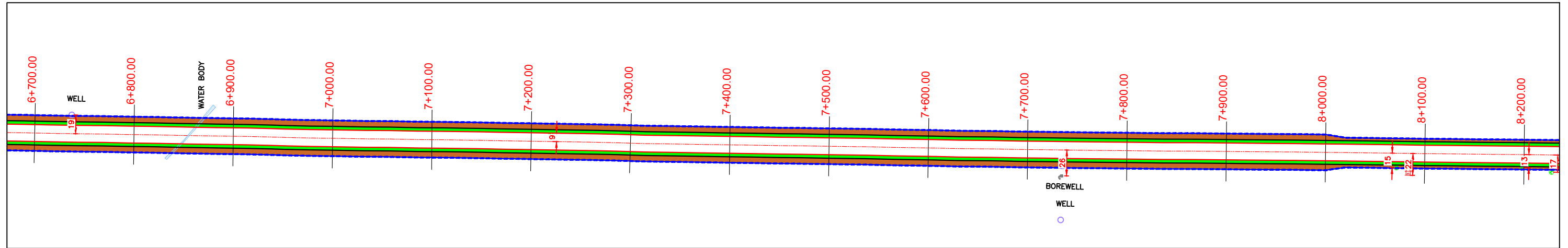
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	Drawing No. :- STRIP/PLAN/002		Sheet :	Redecon (India) Pvt. Ltd. E-49/4, Okhla, Phase-II, Pocket-D, Okhla Industrial Area, NewDelhi-110020	
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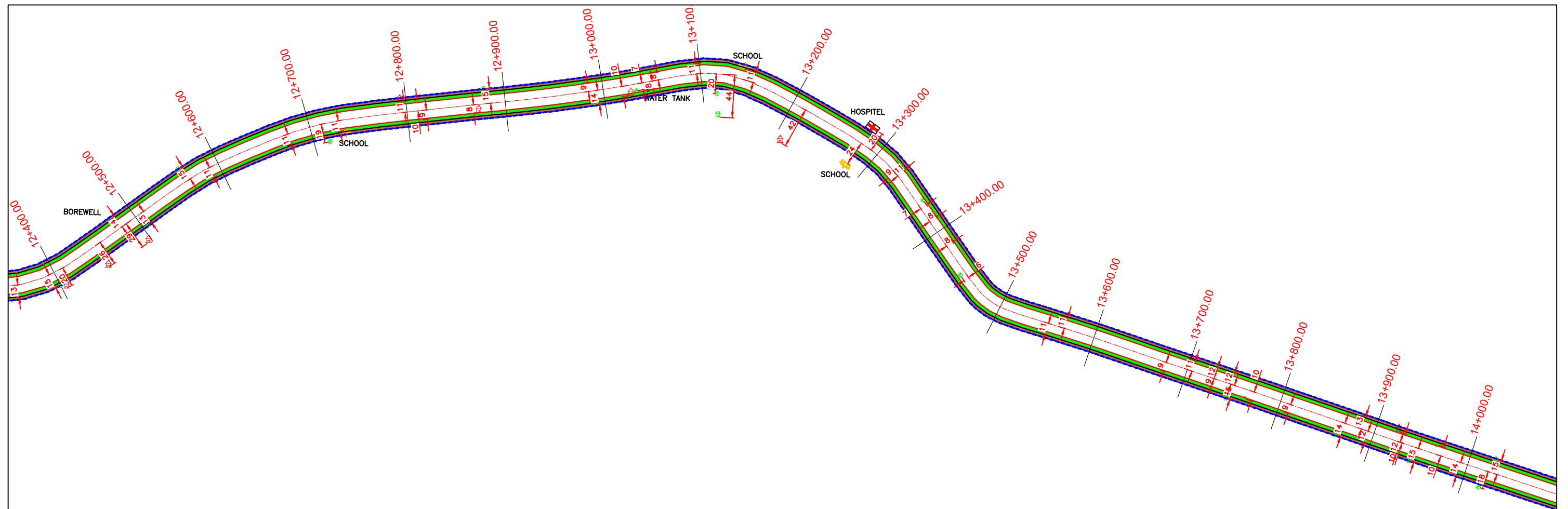
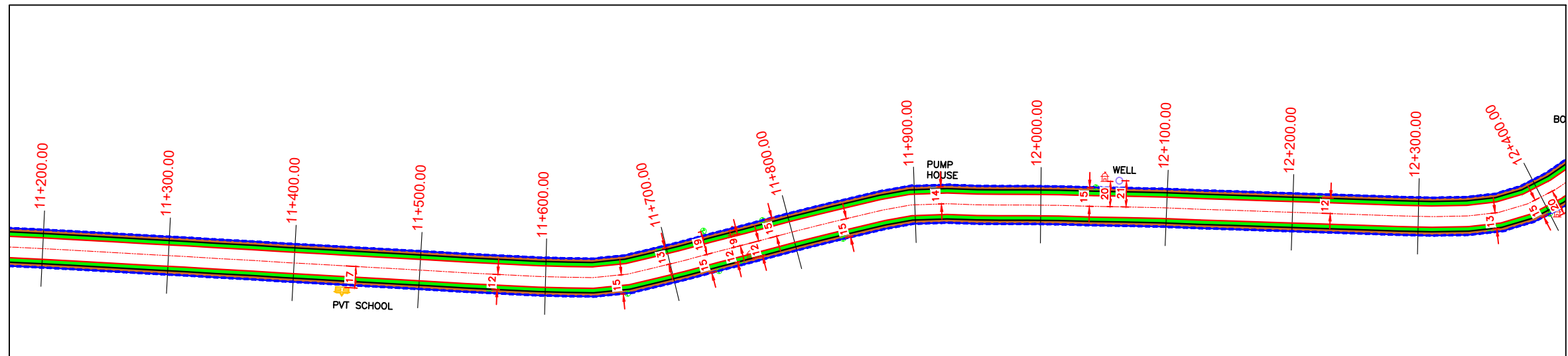
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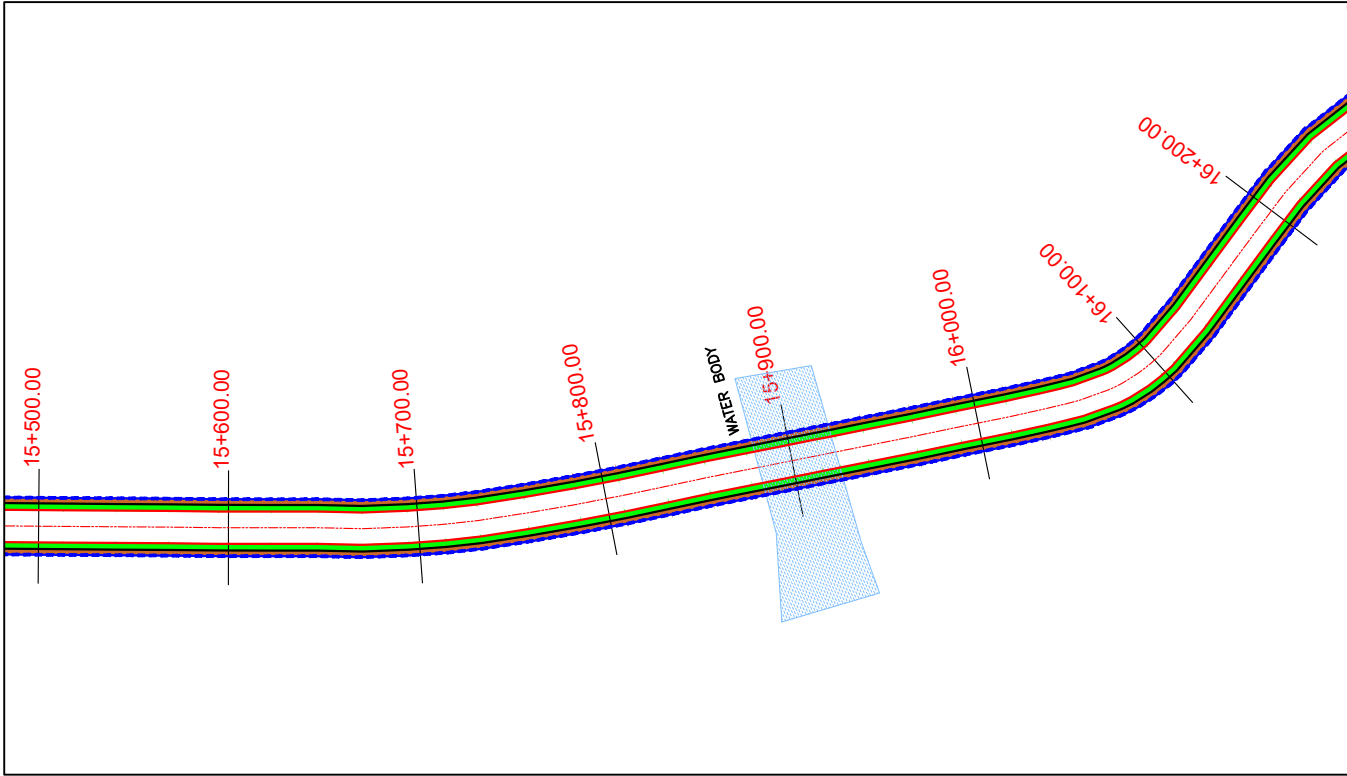
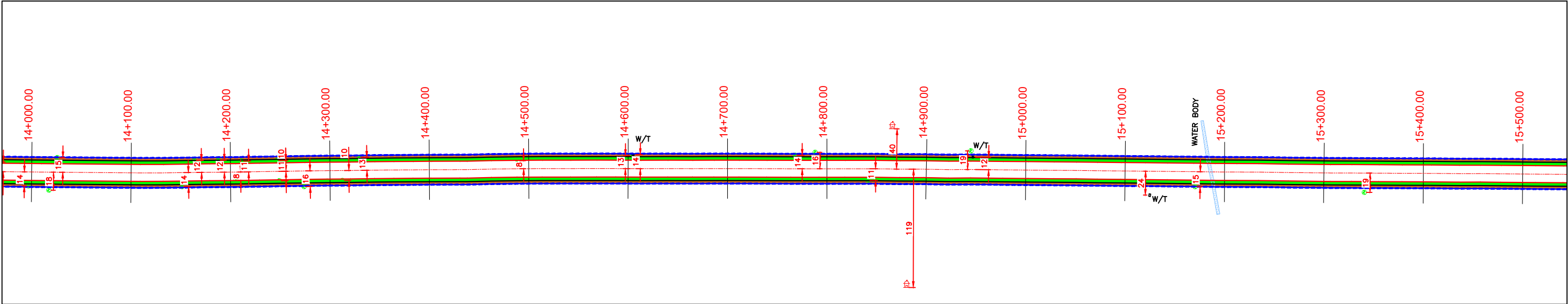
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- ROAD CENTER LINE
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- HOSPITAL
- MOSQUE
- SCHOOL
- WATER TANK (W/T)
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- RIVER/CANAL/NALA
- PROTECTED FOREST
- NON FOREST LAND
- BALANCE LAND
- WELL
- BOREWELL

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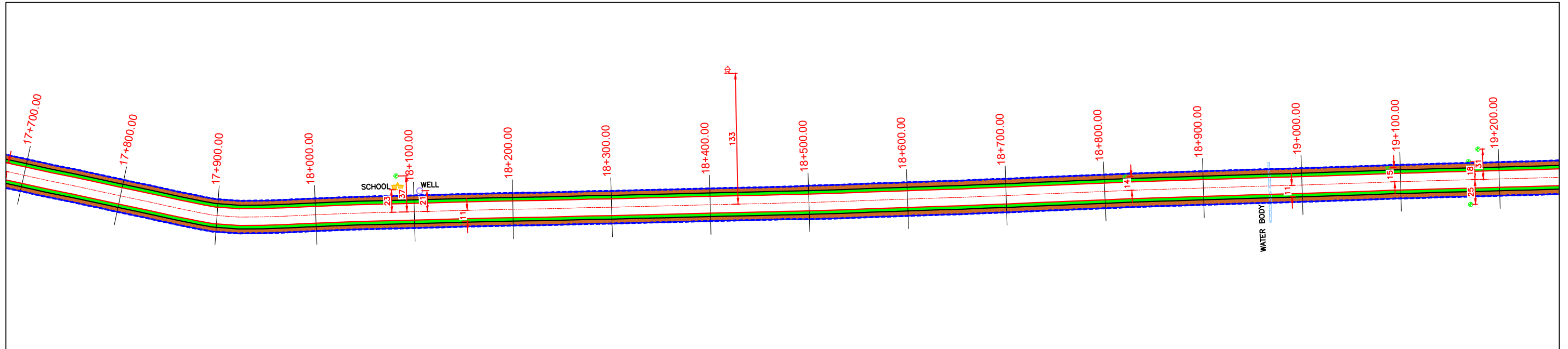
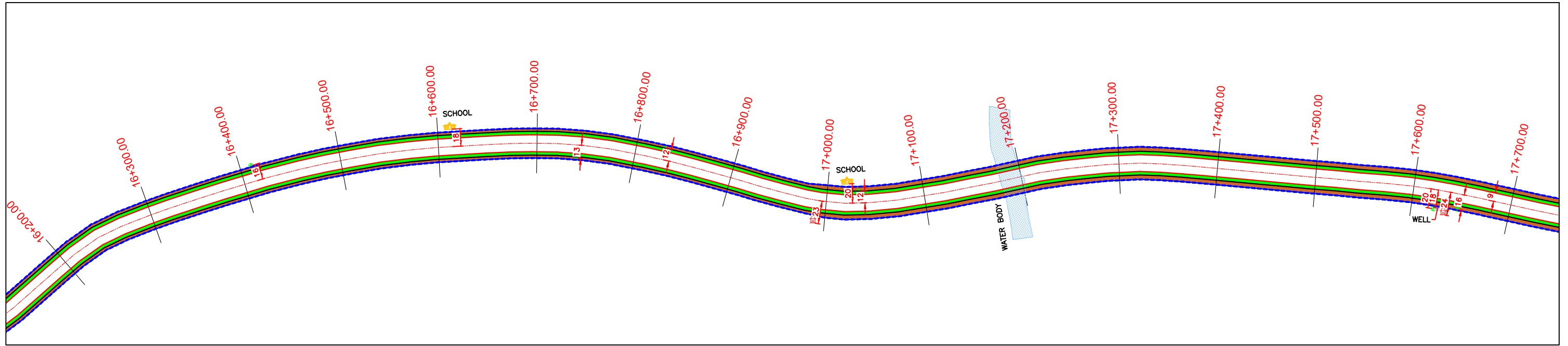


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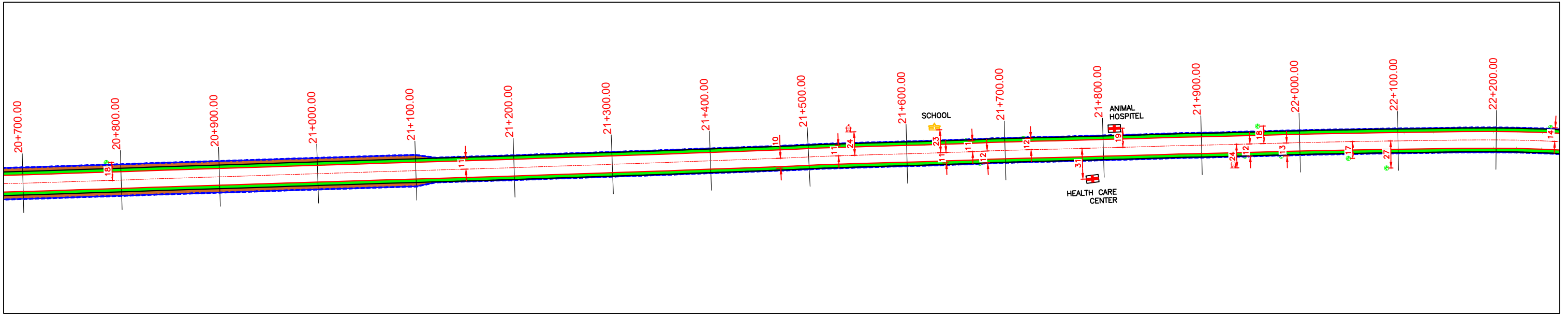
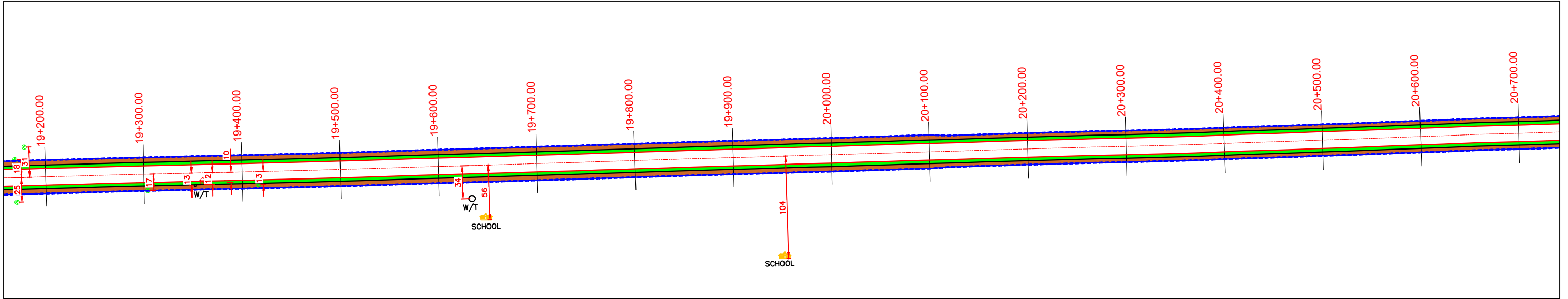
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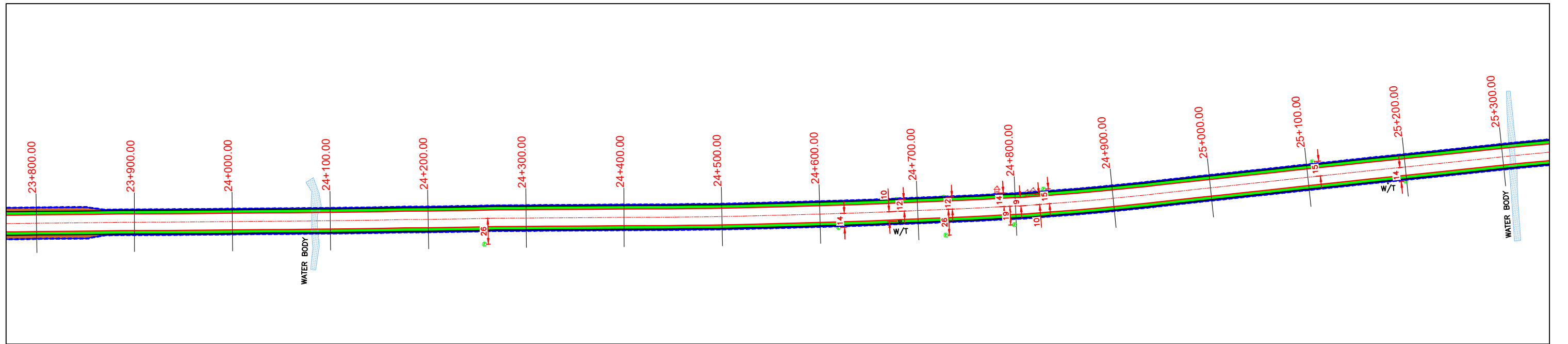
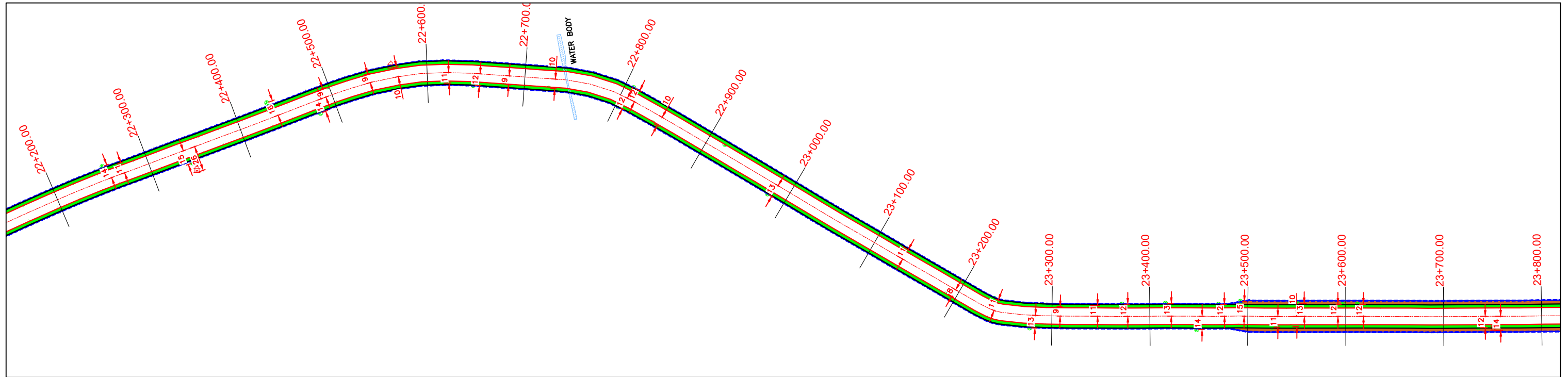
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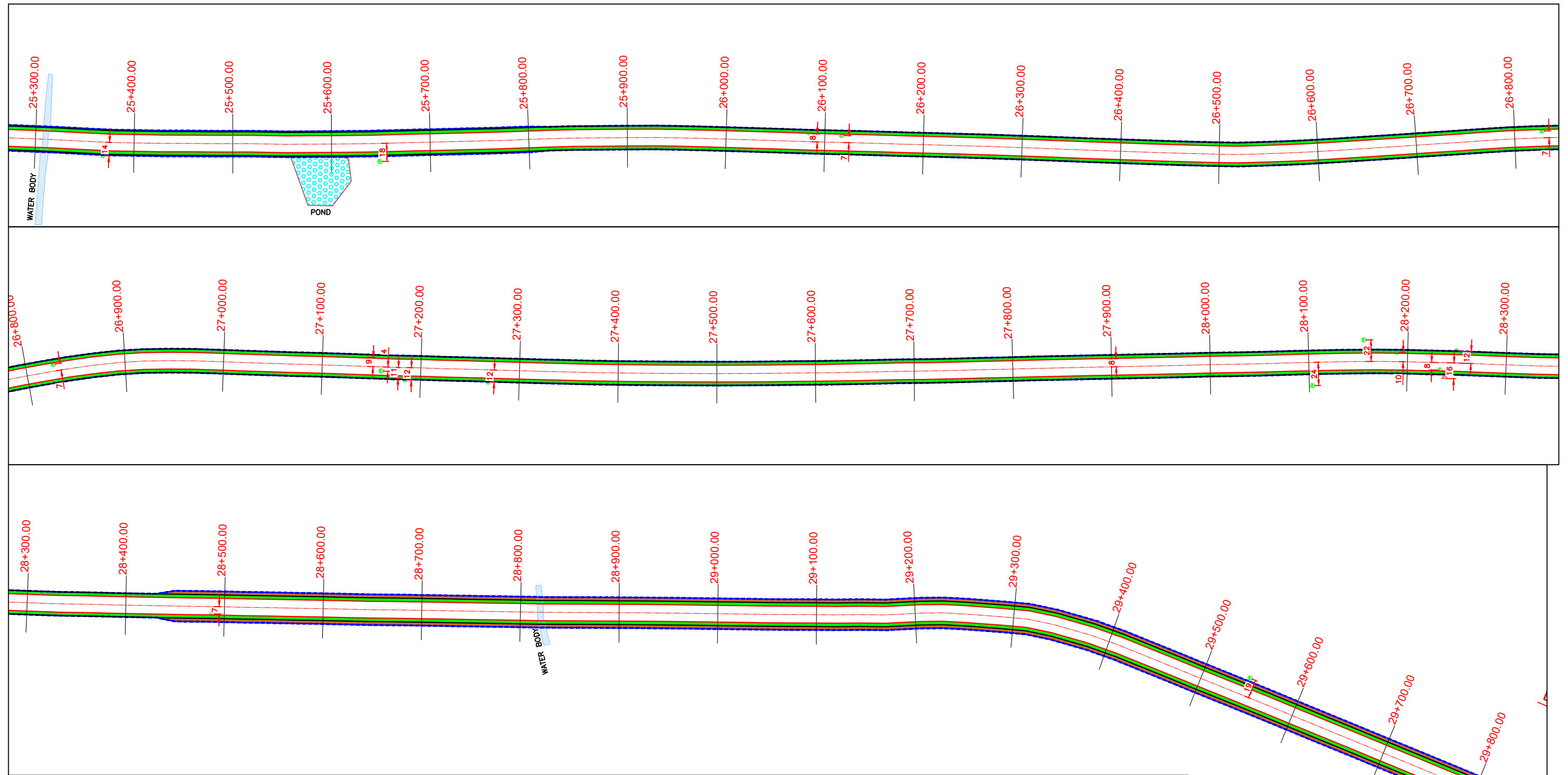
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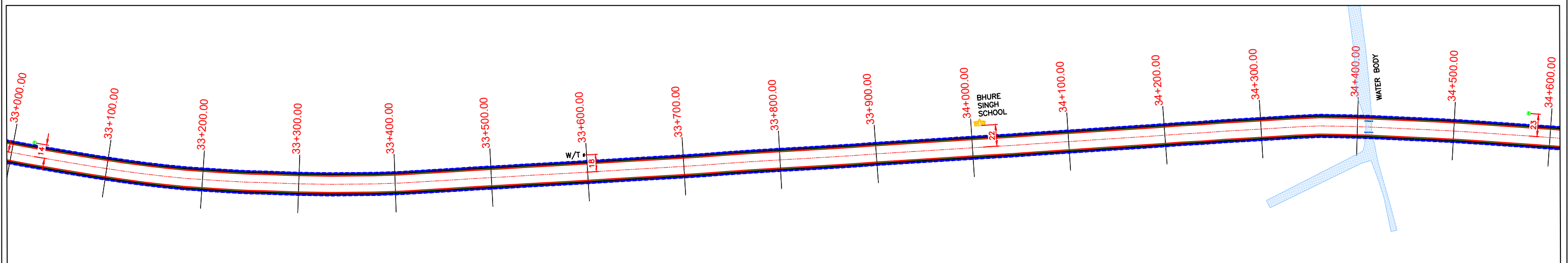
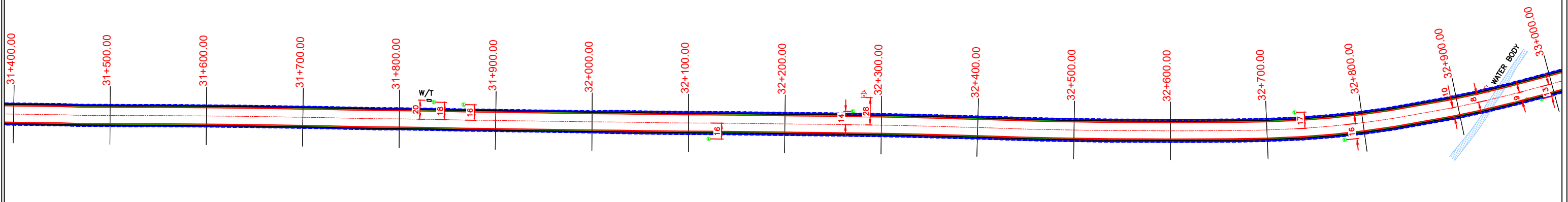
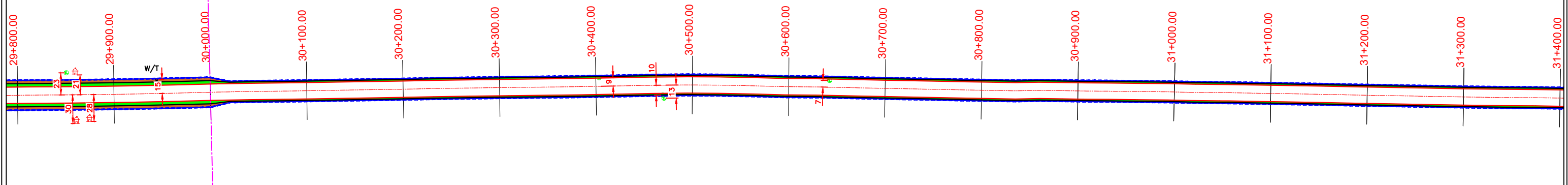
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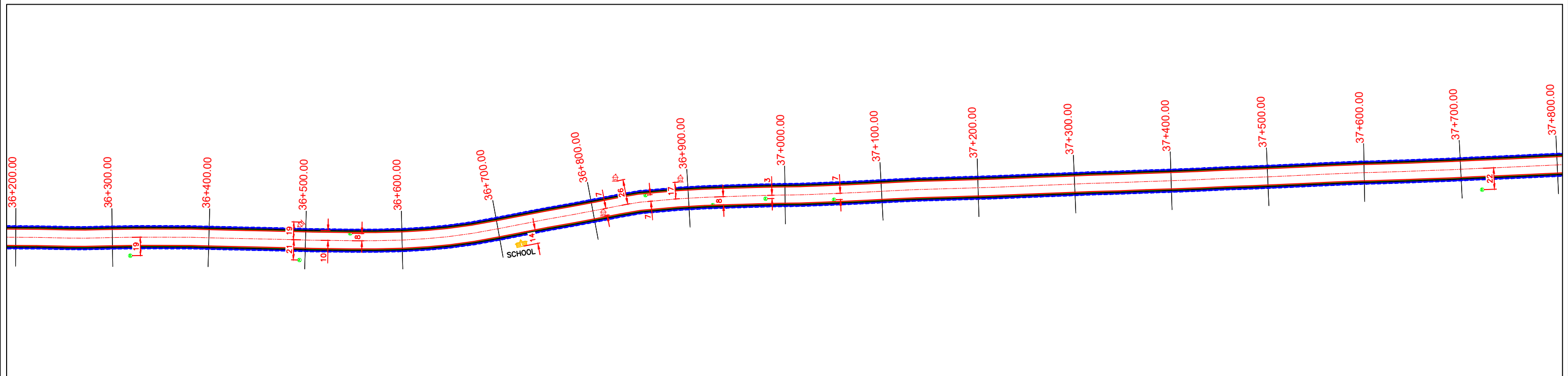
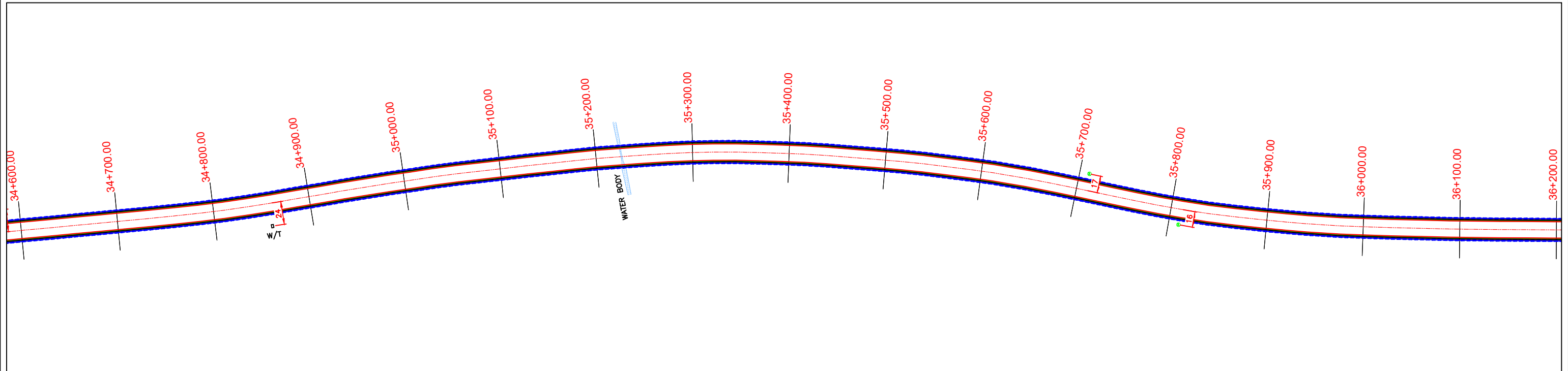
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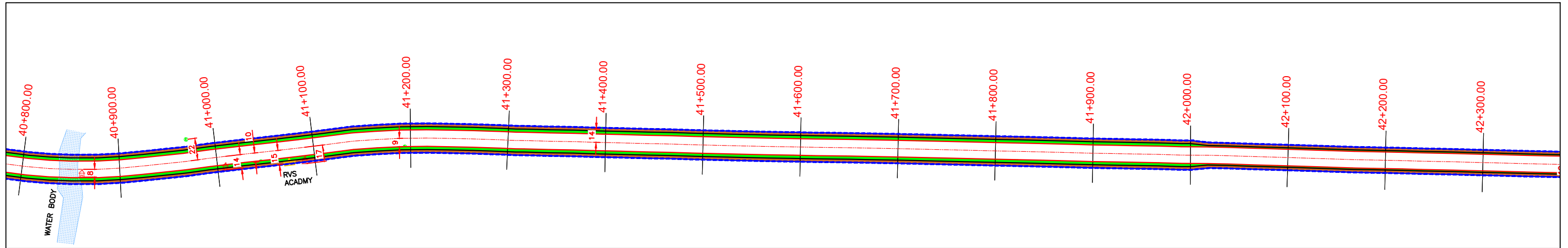
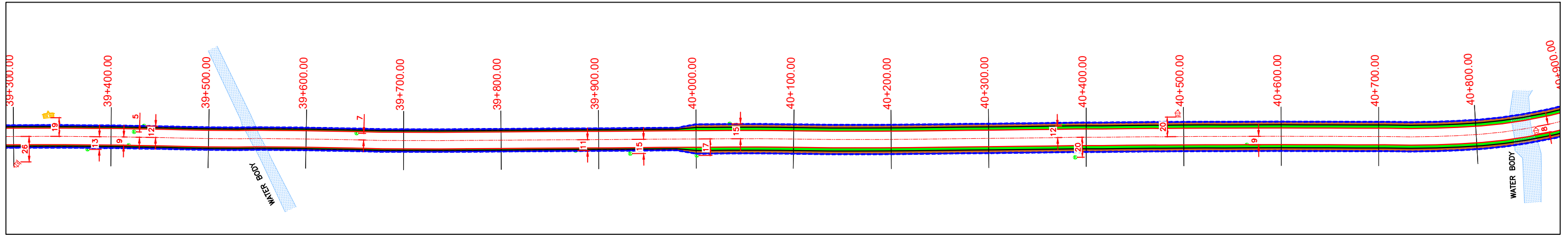
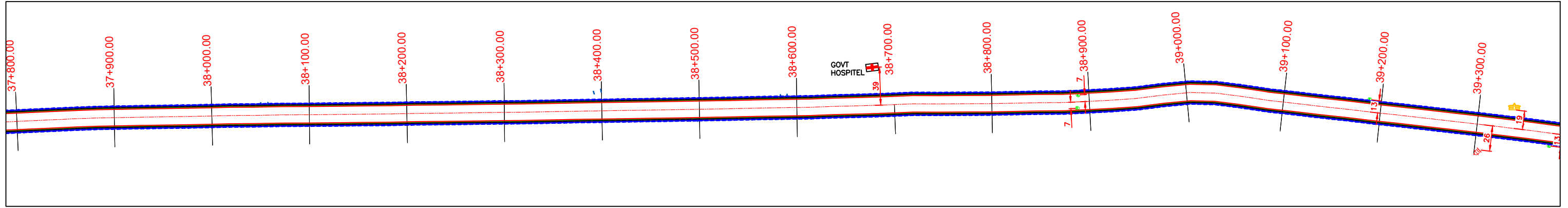
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LEGEND:-

ROAD CENTER LINE	TEMPLE	MOSQUE	POND	PROTECTED FOREST	WELL
EROW	HAND PUMP	SCHOOL	RIVER/CANAL/NALA	NON FOREST LAND	BOREWELL
PROW	HOSPITAL	WATER TANK (W/T)	BALANCE LAND		

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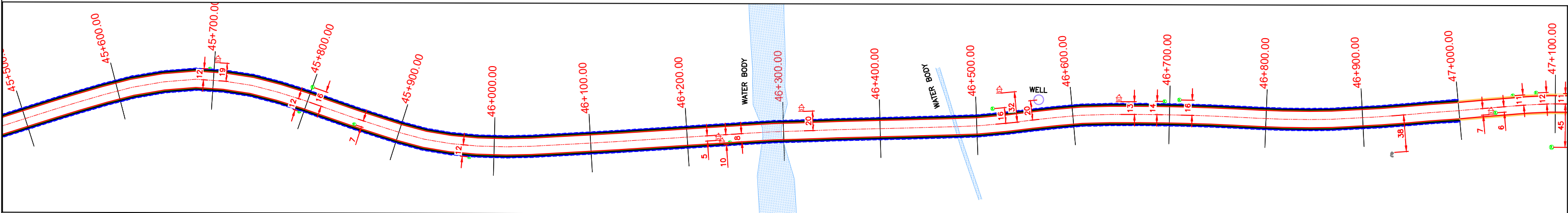
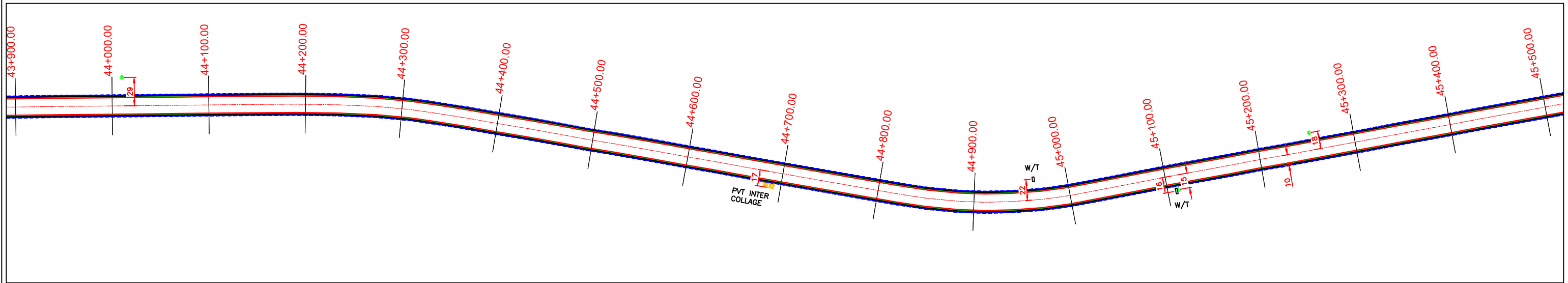
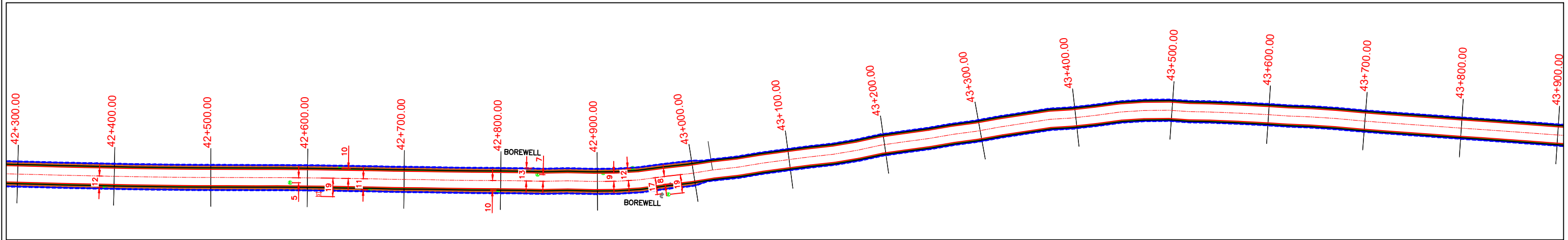
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LEGEND:-

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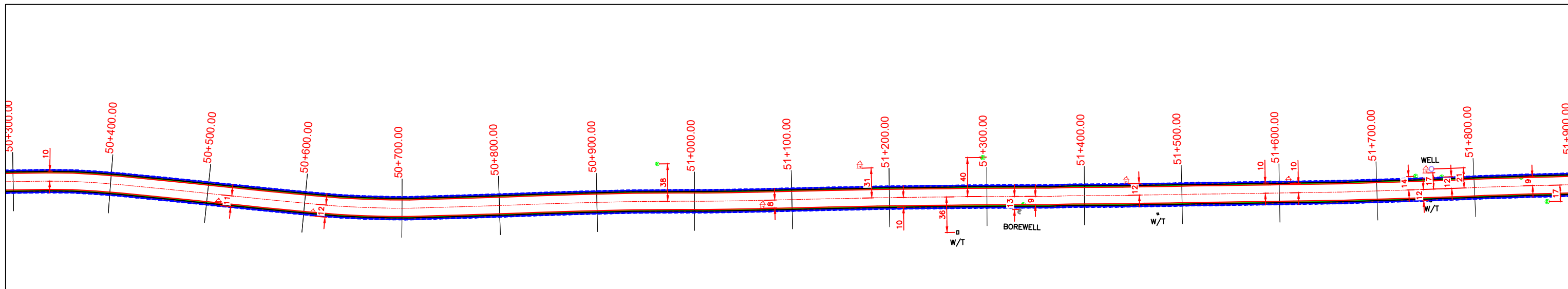
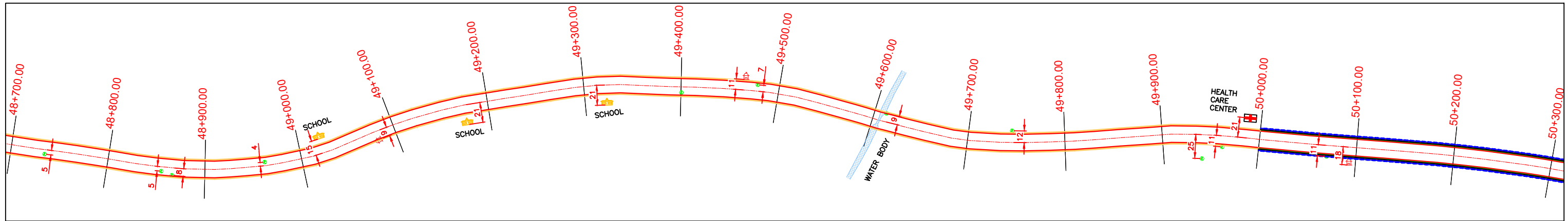
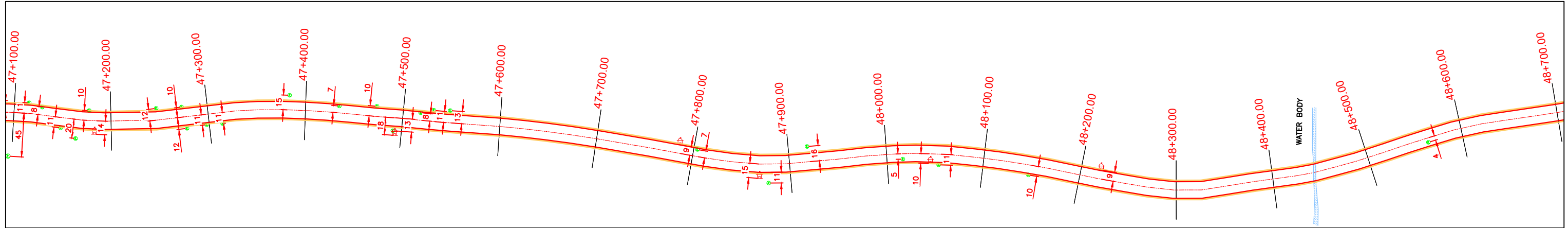
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LEGEND:-

	ROAD CENTER LINE		TEMPLE		MOSQUE		POND		PROTECTED FOREST		WELL
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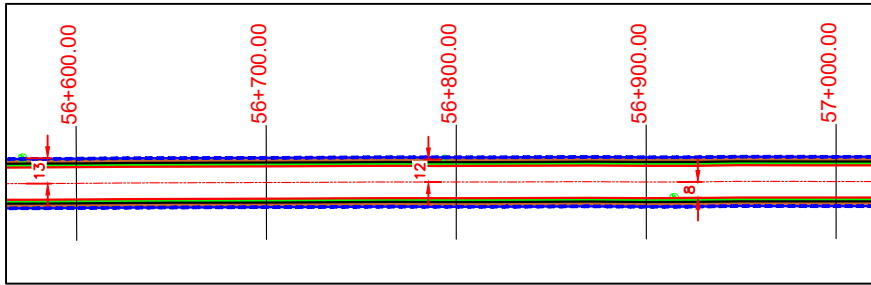
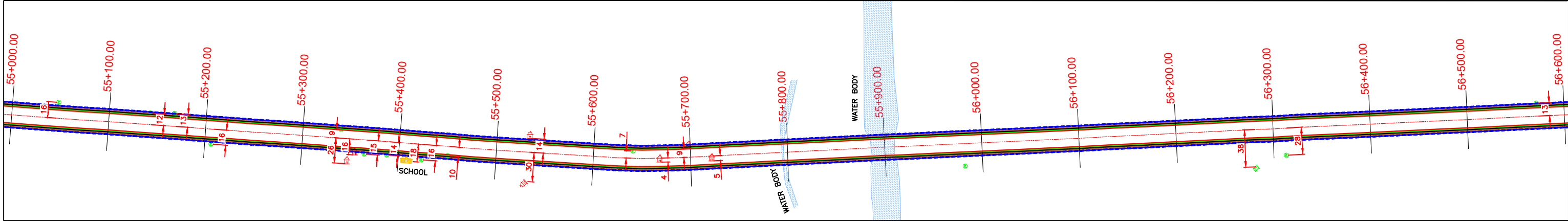
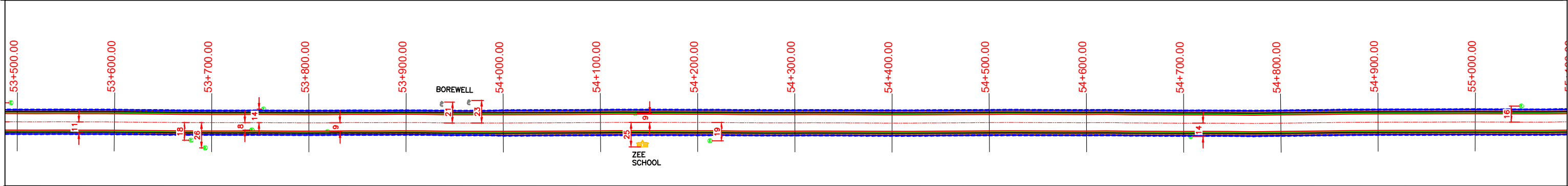
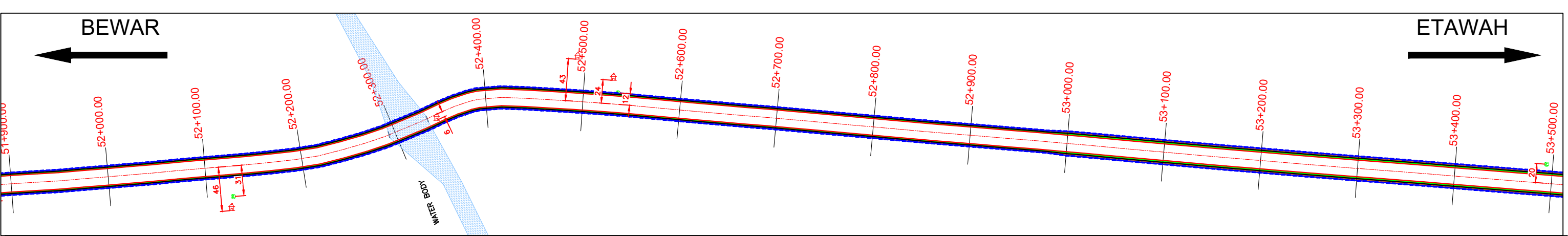
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ROAD CENTER LINE	TEMPLE	MOSQUE	POND	PROTECTED FOREST	WELL
EROW	HAND PUMP	SCHOOL	RIVER/CANAL/NALA	NON FOREST LAND	BOREWELL
PROW	HOSPITAL	WATER TANK (W/T)	BALANCE LAND		

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Environmental, Health, and Safety Guidelines for Toll Roads

Introduction

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP)¹. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the **General EHS Guidelines** document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary. A complete list of industry-sector guidelines can be found at:

www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines

The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new projects / facilities by existing technology at reasonable costs. Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment,

and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

Applicability

The EHS Guidelines for Toll Roads include information relevant to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses.² Issues associated with the construction and operation of maintenance facilities are addressed in the **General EHS Guidelines**. Issues associated with sourcing of construction materials are presented in the EHS Guidelines for Construction Materials Extraction, while those related to vehicle service areas are included in the EHS Guidelines for Retail Petroleum. This document is organized according to the following sections:

Section 1.0 — Industry-Specific Impacts and Management
Section 2.0 — Performance Indicators and Monitoring
Section 3.0 — References and Additional Sources
Annex A — General Description of Industry Activities

¹ Defined as the exercise of professional skill, diligence, prudence and foresight that would be reasonably expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally. The circumstances that skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project may include, but are not limited to, varying levels of environmental degradation and environmental assimilative capacity as well as varying levels of financial and technical feasibility.

² Elements of this Guideline document apply to smaller scale and / or unsealed road projects.

1.0 Industry-Specific Impacts and Management

The following section provides a summary of EHS issues associated with road projects, which occur during the construction and operation phase, along with recommendations for their management. Recommendations for the management of EHS issues during the decommissioning phase are provided in the **General EHS Guidelines**.

1.1 Environment

Environmental issues during the construction and operation of roads are similar to those of other large infrastructure projects involving significant earth moving and civil works and their prevention and control recommendations are presented in the **General EHS Guidelines**. These impacts include, among others, construction site waste generation; soil erosion and sediment control from materials sourcing areas and site preparation activities; fugitive dust and other emissions (e.g. from vehicle traffic, land clearing and movement, and materials stockpiles); noise from heavy equipment and truck traffic; and potential hazardous materials and oil spills associated with heavy equipment operation and fuelling activities.

Environmental issues specific to construction and operation of roads include the following:

- Habitat alteration and fragmentation
- Stormwater
- Waste
- Noise
- Air emissions
- Wastewater

Habitat Alteration and Fragmentation

Disruption of terrestrial and aquatic habitats can occur both during construction of a road and during maintenance of the right-of-way.

Road Construction

Construction activities along a road alignment may adversely affect wildlife habitats, depending on the characteristics of existing vegetation, topographic features, and waterways. Examples of habitat alteration from these activities include fragmentation of forested habitat; loss of nesting sites of listed rare, threatened, or endangered species and / or high biodiversity / sensitive habitat; disruption of watercourses; creation of barriers to wildlife movement; and visual and auditory disturbance due to the presence of machinery, construction workers, and associated equipment. In addition, sediment and erosion from construction activities and stormwater runoff may increase turbidity of surface waters.

Management practices to prevent and control impacts to terrestrial and aquatic habitats include:

- Siting roads and support facilities to avoid critical terrestrial and aquatic habitat (e.g. old-growth forests, wetlands, and fish spawning habitat) utilizing existing transport corridors whenever possible;
- Design and construction of wildlife access to avoid or minimize habitat fragmentation, taking into account motorist safety and the behavior and prevalence of existing species. Possible techniques for terrestrial species may include wildlife underpasses, overpasses, bridge extensions, viaducts, enlarged culverts, and fencing. Possible techniques for aquatic species include bridges, fords, open-bottom or arch culverts, box and pipe culverts;³

³ Additional information on the design of wildlife crossing and passage structures is available in "Chapter 3: Designing for Environmental Stewardship in

- Avoidance or modification of construction activities during the breeding season and other sensitive seasons or times of day to account for potentially negative effects;
- Preventing short and long term impacts to the quality of aquatic habitats by minimizing clearing and disruption of riparian vegetation; providing adequate protection against scour and erosion; and giving consideration to the onset of the rainy season with respect to construction schedules;⁴
- Minimizing removal of native plant species, and replanting of native plant species in disturbed areas;
- Exploring opportunities for habitat enhancement through such practices as the placement of nesting boxes in rights-of-way, bat boxes underneath bridges, and reduced mowing to conserve or restore native species;⁵
- Management of construction site activities as described in relevant sections of the **General EHS Guidelines**.

Right-of-Way⁶ Maintenance

Regular maintenance of vegetation within road rights-of-way is necessary to avoid interference with vehicle travel and road maintenance. Unchecked growth of trees and plants can cover signals and signs, restrict motorist visibility, and fall onto the road and overhead power lines.

Regular maintenance of rights-of-way to control vegetation may involve the use of mechanical methods (e.g. mowing), manual methods (e.g. hand pruning), and the use of herbicides.

Vegetation maintenance beyond that which is necessary for

safety may, by removing unnecessary amounts of vegetation, result in the continual replacement of successional species and an increased likelihood of the establishment of invasive species.

Management practices to prevent, minimize, and control impacts from rights-of-way maintenance include:

- Implementation of integrated vegetation management (IVM).
 - From the edge of the road area to the boundary of the right-of-way, vegetation is structured with smaller plants near the road and larger trees further away to provide habitats for a wide variety of plants and animals⁷
 - Planting of native species and removal of invasive plant species⁸
 - Use of biological, mechanical, and thermal vegetation control measures where practical, and avoiding use of chemical herbicides

An integrated approach to vegetation management may indicate that use of herbicides is the preferred approach to control fast-growing vegetation within road rights-of-way. In this case, users (e.g. road owners or contractors) should take the following precautions:

- Training of personnel to apply herbicides and ensure that personnel have received applicable certifications or

Construction and Maintenance" of Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance, National Cooperative Highway Research Program (NCHRP) Project 25-25 (04) and Evink, G. (2002)

⁴ Additional information on techniques for the protection of riparian and wetland areas is provided in Chapter 3 and Chapter 4, NCHRP Project 25-25 (04) and Nova Scotia Department of Transportation and Public Works Environmental Protection Plan (<http://www.gov.ns.ca/tran/enviroservices>)

⁵ Examples of additional habitat restoration strategies are presented in Chapter 3 and Chapter 10, NCHRP Project 25-25 (04)

⁶ Also known as a "wayleave" or "easement" in some countries, but referred to as right-of-way for the purposes of these Guidelines.

⁷ Mowing can be used to control growth of ground covers, minimize propagation of plants in the track area, and prevent the establishment of trees and shrubs in rights-of-way. Herbicides, in combination with mowing, can control fast-growing weedy species that have a potential to mature to heights over those permitted within the right-of-way. Trimming and pruning can be utilized at the boundaries of rights-of-way to maintain corridor breadth and prevent the encroachment of tree branches. Hand removal or removal of vegetation, while labor intensive, can be used in the vicinity of structures, streams, fences, and other obstructions that make the use of machinery difficult or dangerous.

⁸ Dense, thorny native shrubs can be used to help deter trespassers. Native plants can also help to stabilize soils, reducing erosion. Waste from removal of invasive species should be disposed of (e.g. by incineration or at a landfill) to avoid accidental spreading of the weeds to new sites. Invasive species should be removed during flowering periods to avoid dispersal of seeds.

equivalent training where such certifications are not required;⁹

- Compliance with international restrictions on pesticide use;¹⁰
- Restriction of herbicide use to those that are manufactured under license, and registered / approved by the appropriate authority and in accordance with the Food and Agriculture Organization's (FAO) International Code of Conduct on the Distribution and Use of Pesticides;¹¹
- Use only of herbicides that are labeled in accordance with international standards and norms, such as the FAO Revised Guidelines for Good Labeling Practice for Pesticides;¹²
- Review of manufacturer's directions on maximum recommended dosage or treatment, as well as published reports on reduced rate of herbicide application without loss of effect,¹³ and application of the minimum effective dose;
- Application of herbicides based on criteria (e.g. field observations, weather data, time of treatment, and dosage) and maintenance of a pesticide logbook to record such information;
- Selection of application technologies and practices designed to reduce unintentional drift or runoff;
- Maintenance and calibration of herbicide application equipment in accordance with manufacturer's recommendations;
- Establishment of untreated buffer zones or strips along water sources, rivers, streams, ponds, lakes, and ditches to help protect water resources;

- Contamination of soils, groundwater, or surface water resources, due to accidental spills during transfer, mixing, and storage of herbicides, should be prevented by following the hazardous materials storage and handling management practices in the **General EHS Guidelines**.

Stormwater

Construction or widening of sealed roads increases the amount of impermeable surface area, which increases the rate of surface water runoff. High stormwater flow rates can lead to stream erosion and flooding. Stormwater may be contaminated with oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate matter and other pollutants released by vehicles on the roadway, in addition to deicing salts (e.g. sodium chloride and magnesium chloride) and their substitutes (e.g. calcium magnesium acetate and potassium acetate) from road maintenance facilities in colder climates. Stormwater may also contain nutrients and herbicides used for management of vegetation in the rights-of-way.

In addition to the management practices for stormwater during construction and operations presented in the **General EHS Guidelines**, practices applicable to roadways include the following:¹⁴

General Stormwater Management

- Use of stormwater management practices that slow peak runoff flow, reduce sediment load, and increase infiltration, including vegetated swales (planted with salt-resistant vegetation); filter strips; terracing; check dams; detention ponds or basins; infiltration trenches; infiltration basins; and constructed wetlands;
- Where significant oil and grease is expected, using oil / water separators in the treatment activities;

⁹ Examples of certification schemes are provided by the US EPA Certification of Pesticide Applicators (40 CFR 171), which categorizes pesticides as either "unclassified" or "restricted" and requires workers that apply unclassified pesticides to be trained according to the Worker Protection Standard (40 CFR Part 170) for Agricultural Pesticides. It further requires restricted pesticides to be applied by or in the presence of a certified pesticide applicator.

¹⁰ Stockholm Convention on Persistent Organic Pollutants (2001).

¹¹ FAO (2002a)

¹² FAO (2002b)

¹³ Danish Agricultural Advisory Service (DAAS) (2000)

- Regular inspection and maintenance of permanent erosion and runoff control features;

Road Paving¹⁵

- Paving in dry weather to prevent runoff of asphalt or cement materials;
- Use of proper staging techniques to reduce the spillage of paving materials during the repair of potholes and worn pavement. This may include covering storm drain inlets and manholes during paving operations; using erosion and sediment control measures to decrease runoff from repair sites; and utilizing pollution prevention materials (e.g. drip pans and absorbent material on paving machines) to limit leaks and spills of paving materials and fluids;
- Reducing the amount of water used to control dust, and using sweeping practices rather than washing. Collecting and returning swept material to aggregate base or disposing as solid waste, as described in the **General EHS Guidelines**;
- Avoiding the generation of contaminated runoff from cleaning of asphalt equipment by substituting diesel with vegetable oil as a release and cleaning agent; containing cleaning products and contaminated asphalt residues; scraping before cleaning; and conducting cleaning activities away from surface water features or drainage structures.

Road Deicing

Colder climates may require the clearing of snow and ice from road surfaces during winter months. Stormwater management recommendations in this context include:¹⁶

- Primary use of mechanical deicing methods (e.g. sweepers and plows) complemented by chemical means if necessary;
- Pre-treating of pavement surfaces with anti-icing methods prior to the onset of snow or ice to reduce the need for subsequent applications and allow for easy removal;
- Selectively applying anti-icing and deicing agents based on expected pavement temperatures and the use of road weather information systems;
- Training employees in the application of anti-icing and deicing agents at optimum rates and times, and routinely calibrating deicer application equipment;
- Selecting the type of anti-icing and deicing agents based on the location of environmentally sensitive areas and the potential impacts of the particular agent;¹⁷
- Designing roads and bridges to minimize the accumulation of drifting snow on the roadway;¹⁸
- Designing drainage and site reinstatement to minimize impacts of anti-icing and deicing agent runoff to surface water and vegetation.¹⁹

Waste

Solid waste may be generated during construction and maintenance of roads and associated structures. Significant quantities of rock and soil materials may be generated from earth moving during construction activities. Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material);

¹⁴ The adoption of specific recommendations should be based on an identification of environmentally sensitive areas along the transport corridor.

¹⁵ Additional recommendations on paving activities management are presented in "Chapter 5: Pavement Materials and Recycling" of NCHRP Project 25-25 (04)

¹⁶ Additional recommendations on the management of road de-icing methods provided in "Source Water Protection Practices Bulletin: Managing Highway Deicing to Prevent Contamination of Drinking Water" USEPA 816-F-02-019

(2002) and Chapter 8: Winter Operations and Salt, Sand, and Chemical Management of NCHRP Project 25-25 (04)

¹⁷ Salts and acetates can create potentially negative consequences to soil and aquatic environments and should be carefully selected based on site specific circumstances, such as distance to receiving water bodies and the type of local aquatic habitat.

¹⁸ Specific design recommendations applicable to roadway and bridge structures, the use of structural or living fences, and other methods are provided in numerous sources including "Chapter 3: Designing for Environmental Stewardship in Construction and Maintenance" of NCHRP Project 25-25 (04)

¹⁹ Specific stormwater management design recommendations for roads are available in numerous sources including Chapter 3 of NCHRP Project 25-25 (04)

road litter, illegally dumped waste, or general solid waste from rest areas; animal carcasses; vegetation waste from right-of-way maintenance; and sediment and sludge from stormwater drainage system maintenance (including sediment traps and oil / water separation systems). Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting). Waste management strategies include:

Construction Phase

- Management of construction site excavation materials according to the recommendations of the **EHS Guidelines for Construction Materials Extraction** and the **General EHS Guidelines**;

Road Resurfacing

- Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base;
- Incorporating recyclable materials (e.g. glass, scrap tires, certain types of slag and ashes) to reduce the volume and cost of new asphalt and concrete mixes.²⁰

Miscellaneous Wastes

- Collecting road litter or illegally dumped waste and managing it according to the recommendations in the **General EHS Guidelines**. Provision of bottle and can recycling and trash disposal receptacles at parking lots to avoid littering along the road;
- Manage herbicide and paint inventories to avoid having to dispose of large quantities of unused product. Obsolete

product should be managed as a hazardous waste as described in the **General EHS Guidelines**;

- Collecting animal carcasses in a timely manner and disposing through prompt burial or other environmentally safe methods;
- Composting of vegetation waste for reuse as a landscaping fertilizer;
- Managing sediment and sludge removed from storm drainage systems maintenance activities as a hazardous or non-hazardous waste (see **General EHS Guidelines**) based on an assessment of its characteristics.

Painting Activities

- Management of all removed paint materials suspected or confirmed of containing lead as a hazardous waste;
- Use of a system to collect paint waste when removing old paint containing lead. For a simple scraping operation, ground-covering tarps may be sufficient. For a blasting operation, an enclosure with a negative pressure ventilation system may be necessary;
- Grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. Old, removed asphalt may contain tar and polycyclic aromatic hydrocarbons and may require management as a hazardous waste.

Noise

Traffic noise is generated by vehicle engines, emission of exhaust, aerodynamic sources, and tire / pavement interaction. For vehicle speeds over 90 kilometers per hour (km/h), the noise from the tire / pavement interaction predominates.²¹ Traffic noise can be a significant nuisance and may be loud enough to

²⁰ Additional information on the reuse of reclaimed concrete or asphalt and the use of recyclable materials in the aggregate is provided in numerous sources including "Chapter 5: Pavement, Materials, and Recycling" of NCHRP Project 25-25 (04)

²¹ The noise level is influenced by the type, volume, and speed of traffic (e.g. one five-axle truck sounds about as loud as 28 cars when traveling at 90 km/hr). US Department of Transportation, Federal Highway Administration. Highway Traffic Noise. <http://www.fhwa.dot.gov/environment/htnoise.htm>.

interfere with normal conversation²² and can cause stress in children and raise blood pressure, heart rates, and levels of stress hormones.²³ Traffic noise levels are reduced by distance, terrain, vegetation, and natural and manmade obstacles.

Management practices to prevent, minimize, and control noise include:

- Consideration of noise impacts during road design to prevent adverse impacts at nearby properties through the placement of the road right-of-way and / or through the design and implementation of noise control measures discussed below.^{24, 25}
- Design and implementation of noise control measures may include the following:
 - o Construction of the road below the level of the surrounding land
 - o Noise barriers along the border of the right-of way (e.g. earthen mounds, walls, and vegetation)²⁶
 - o Insulation of nearby building structures (typically consisting of window replacements)
 - o Use of road surfaces that generate less pavement / tire noise such as stone-matrix asphalt²⁷

²² At a distance of 50 ft, traffic noise ranges from about 70 dBA for cars to 90 dBA for heavy trucks.

²³ Evans, Gary W. et al. (2001)

²⁴ For example, the U.S. Federal Highway administration has established noise impact criteria, such as L_{10} (sound level exceeded 10 percent of the time) = 70 dBA for residential land use. A new road project should not cause a significant increase in existing noise levels at nearby properties.

²⁵ Traffic noise is generally not perceived as a nuisance for people who live more than 150 meters from heavily traveled highways or more than 30 to 60 meters from lightly traveled roads.

²⁶ The most effective noise abatement measures include noise barriers and mounds, which can reduce noise by 5 dBA or more. The cost of noise walls in the US has been estimated at \$1.3 million per mile (NCHRP Project 25-25 (04))

²⁷ Stone-matrix asphalt (SMA) is one of several alternative surfaces that can be used in new roads or as surface treatment in existing roads to provide a quieter surface. A double-layered porous asphalt construction results in a further reduction of traffic noise, from 3 to 4 dBA at 50 km/h up to 5.5 dBA at 100 km/h compared with regular asphalt and 7 to 12 dBA quieter than concrete pavements (NSW Roads and Traffic Authority (RTA), 2005).

Air Emissions

Air emissions are typically related to dust during construction and exhaust from vehicles. Management practices for air emissions include:

- Prevention and control of dust emissions during construction and maintenance activities as described in the **General EHS Guidelines**;
- Operation and maintenance of maintenance vehicle fleets according to the recommendations in the **General EHS Guidelines**;
- Consideration of design options for the reduction of traffic congestion, including:
 - o Automated toll charging systems
 - o Availability of high-occupancy vehicle lanes
 - o Minimizing grade changes, at-grade crossings, and sharp curves which can promote congestion
 - o Design of roadway to shed water, and prompt removal of snow to minimize rolling resistance, as well as to enhance safety
 - o Maintenance of the road surface to preserve surface characteristics (e.g. texture and roughness)

Wastewater

Wastewater discharges from maintenance facilities and from rest areas should be managed according to the recommendations provided in the **General EHS Guidelines**, and may include connection to centralized wastewater collection and treatment systems and / or use of properly designed and operated septic systems.

1.2 Occupational Health and Safety

Guidance on the prevention and control of physical, chemical, and biological hazards common to most projects and facilities is presented in the **General EHS Guidelines**.

Occupational health and safety issues associated with the construction and operation of roads primarily include the following:

- Physical hazards
- Chemical hazards
- Noise

Physical Hazards

Road construction and maintenance personnel, as well as landscaping workers maintaining vegetation in the rights-of-way, can be exposed to a variety of physical hazards, principally from operating machinery and moving vehicles but also working at elevation on bridges and overpasses. Other physical hazards (e.g. exposure to weather elements, noise, work in confined spaces, trenching, contact with overhead power lines, falls from machinery or structures, and risk of falling objects) are discussed in the **General EHS Guidelines**.

Management practices to prevent and control physical hazards include:

Moving Equipment and Traffic Safety

- Development of a transportation management plan for road repairs that includes measures to ensure work zone safety for construction workers and the traveling public;
- Establishment of work zones to separate workers on foot from traffic and equipment by:
 - o Routing of traffic to alternative roads when possible
 - o Closure of lanes and diversion of traffic to the remaining lanes if the road is wide enough (e.g. rerouting of all traffic to one side of a multi-lane highway)
 - o Where worker exposure to traffic cannot be completely eliminated, use of protective barriers to shield workers

from traffic vehicles, or installation of channeling devices(e.g. traffic cones and barrels) to delineate the work zone

- o Regulation of traffic flow by warning lights, avoiding the use of flaggers if possible
 - o Design of the work space to eliminate or decrease blind spots
- Reduction of maximum vehicle speeds in work zones;
 - Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles; and safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists).

Elevated and Overhead Work

- The area around which elevated work is taking place should be barricaded to prevent unauthorized access. Working under personnel on elevated structures should be avoided;
- Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use. Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings); equipment movement protocols (e.g. movement only when the lift is in a retracted position); repair by qualified individuals; and installation of locks to avoid unauthorized use by untrained individuals;
- Ladders should be used according to pre-established safety procedures for proper placement, climbing, standing, as well as the use of extensions.

Fall Protection

- Implementation of a fall protection program that includes training in climbing techniques and use of fall protection

measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others;

- Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the structure and necessary movements, including ascent, descent, and moving from point to point;
- Installation of fixtures on bridge components to facilitate the use of fall protection systems;
- Safety belts should be not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident;
- When operating power tools at height, workers should use a second (backup) safety strap.

Chemical Hazards

Chemical hazards in road construction, operations, and maintenance activities may be principally associated with exposures to dust during construction and paving activities; exhaust emissions from heavy equipment and motor vehicles during all construction and maintenance activities (including during work in tunnels or in toll collection booths); potentially hazardous dust generated during bridge paint removal; herbicide use during vegetation management; and diesel fuel used as a release and cleaning agent for paving equipment. General recommendations for hazardous materials management and chemicals hazard management are provided in the **General EHS Guidelines**.

Recommendations specific to road projects include:

- Use of millers and pavers with exhaust ventilation systems and proper maintenance of such systems to maintain worker exposure to crystalline silica (millers and grinders) and asphalt fumes (pavers) below applicable occupational exposure levels;
- Use of the correct asphalt product for each specific application, and ensuring application at the correct temperature to reduce the fuming of bitumen during normal handling;
- Maintenance of work vehicles and machinery to minimize air emissions;
- Reduction of engine idling time in construction sites;
- Use of extenders or other means to direct diesel exhaust away from the operator;
- Ventilation of indoor areas where vehicles or engines are operated, or use of exhaust extractor hose attachments to divert exhaust outside;
- Provision of adequate ventilation in tunnels or other areas with limited natural air circulation;
- Installation of tollbooth ventilation and air filtration systems;
- Use of protective clothing when working with cutbacks (a mixture of asphalt and solvents for the repair of pavement), diesel fuel, or other solvents;
- Use of dustless sanding and blasting equipment and special containment measures for paint removal activities²⁸.
Avoiding the use of lead-containing paint and using appropriate respiratory protection when removing paints (including those containing lead in older installations) or when cutting galvanized steel.

²⁸ Examples of enclosures used in paint removal activities include total enclosures with dust collector systems (for abrasive blasting), impermeable curtains (for wet abrasive blasting), or vacuum equipped power and blasting tools (Minnesota Pollution Control Agency <http://www.pca.state.mn.us/air/lead-class.html>)

Noise

Construction and maintenance personnel may be potentially exposed to extremely high levels of noise from heavy equipment operation and from working in proximity to vehicular traffic. As most of these noise sources cannot be prevented, control measures should include the use of personal hearing protection by exposed personnel and implementation of work rotation programs to reduce cumulative exposure. Additional recommendations on the management of occupational noise are provided in the **General EHS Guidelines**.

1.3 Community Health and Safety

Community health and safety issues during the construction of roads are common to those at most large construction sites, and are discussed in the **General EHS Guidelines**. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable disease associated with the influx of temporary construction labor. Significant community health and safety issues associated with road projects may also include:

- Pedestrian safety
- Traffic safety
- Emergency preparedness

Pedestrian Safety

Pedestrians and bicyclists are at greatest risk of serious injury from collisions with moving vehicles. Children are generally the most vulnerable due to lack of experience and knowledge of traffic related hazards, their behavior while at play, and their small size making them less visible to motorists. Recommended pedestrian safety management strategies include the following:

- Provision of safe corridors along the road alignment and construction areas, including tunnels and bridges (e.g. paths

separated from the roadway), and safe crossings (preferably over or under the roadway) for pedestrians and bicyclists during construction and operation. Crossing locations should take into account community preferences, including those related to convenience or personal safety (e.g. the prevalence of crime at potential crossing point locations).

- Installation of barriers (e.g. fencing, plantings) to deter pedestrian access to the roadway except at designated crossing points;
- Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas;
- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways.²⁹

Traffic Safety

Collisions and accidents can involve a single or multiple vehicles, pedestrians or bicyclists, and animals. Many factors contribute to traffic accidents. Some are associated with the behavior of the driver or the quality of the vehicle, while others are linked to the road design, or construction and maintenance issues.

Recommendations to prevent, minimize, and control risks to the community from traffic accidents include:

- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions;³⁰
- Setting of speed limits appropriate to the road and traffic conditions;

²⁹ As required by public agencies with jurisdiction over the project site. In their absence, project developers and operators should refer to sources from well developed regulatory frameworks such as the US Code of Federal Regulations (CFR) Part 655, Subpart F and the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD, 2003)

³⁰ Based on local regulatory requirements or, in their absence, sources such as the US Code of Federal Regulations (CFR) Part 655, Subpart F and the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD, 2003)

- Design of roadways to accommodate anticipated traffic volume and flow;
- Maintenance of the road to prevent mechanical failure of vehicles due to road conditions;
- Construction of roadside rest areas at strategic locations to minimize driver fatigue;
- Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross; construction of animal crossing structures; installation of fencing along the roadway to direct animals toward crossing structures; and use of reflectors along the roadside to deter animal crossings at night when vehicles are approaching);
- Targeting elimination of at-grade rail crossings;
- Targeting the use of a real-time warning system with signage to warn drivers of congestion, accidents, adverse weather or road conditions, and other potential hazards ahead.

Emergency Preparedness

Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and / or the release of oil or hazardous materials. Road operators should prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.

2.0 Performance Indicators and Monitoring

2.1 Environment

Emissions and Effluent Guidelines

Roads do not typically give rise to significant point source air emissions or effluents. Instead, operators should apply the principles and guidelines described above and in the **General EHS Guidelines**, especially with regard to emissions or effluents from road maintenance facilities.

Environmental Monitoring

Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment, during normal operations and upset conditions. Monitoring frequency should be sufficient to provide representative data for the parameter being monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Additional guidance on applicable sampling and analytical methods for emissions and effluents is provided in the **General EHS Guidelines**.

2.1 Occupational Health and Safety

Occupational Health and Safety Guidelines

Occupational health and safety performance should be evaluated against internationally published exposure guidelines, of which examples include the Threshold Limit Value (TLV®)

occupational exposure guidelines and Biological Exposure Indices (BEIs®) published by American Conference of Governmental Industrial Hygienists (ACGIH),³¹ the Pocket Guide to Chemical Hazards published by the United States National Institute for Occupational Health and Safety (NIOSH),³² Permissible Exposure Limits (PELs) published by the Occupational Safety and Health Administration of the United States (OSHA),³³ Indicative Occupational Exposure Limit Values published by European Union member states,³⁴ or other similar sources

guidance on occupational health and safety monitoring programs is provided in the **General EHS Guidelines**.

Accident and Fatality Rates

Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive)³⁵.

Occupational Health and Safety Monitoring

The working environment should be occupational hazards relevant to the specific project. Monitoring should be designed and implemented by accredited professionals³⁶ as part of an occupational health and safety monitoring program. Facilities should also maintain a record of occupational accidents and diseases and dangerous occurrences and accidents. Additional

³¹ Available at: <http://www.acgih.org/TLV/> and <http://www.acgih.org/store/>

³² Available at: <http://www.cdc.gov/niosh/npg/>

³³ Available at:
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992

³⁴ Available at: http://europe.osha.eu.int/good_practice/risks/ds/oel/

³⁵ Available at: <http://www.bls.gov/iif/> and
<http://www.hse.gov.uk/statistics/index.htm>

³⁶ Accredited professionals may include Certified Industrial Hygienists, Registered Occupational Hygienists, or Certified Safety Professionals or their equivalent.

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Annex A: General Description of Industry Activities

Road project infrastructure typically includes the rights-of-way, the roadway, junctions, tunnels, bridges, maintenance facilities, parking lots, and toll plazas in the case of toll roads. Road projects may include provisions for bicycles and pedestrians, such as designated bicycle lanes or shared-use paths separated from the roadway. Some road projects may also involve the construction and operation of vehicle service areas.

Direct land requirements for roads typically range from about 9 hectares (ha) per kilometer (km) for two lanes in each direction to 12 ha / km for four lanes in each direction.³⁷ The width of the rights-of-way may need to be sufficient to include traffic lanes, shoulders, grass strips, sidewalks and cycle lanes, public utility facilities, and outer slopes. In hilly terrain, the required right-of-way varies considerably as the roadway passes areas that require landscapes to be cut and filled, however tunnels are often preferred to avoid steep up and down sections on roads.

Design and Construction

Generally, modern roads are constructed as all-weather roads with a hard surface pavement, usually asphalt or concrete. A paved roadway typically consists of three layers above the sub-grade: the sub-base, base course, and wearing course. Each layer is compacted by a roller before proceeding with the next course.

Sub-grade, Sub-base, and Base layers

The sub-grade is earth that has been graded to the desired elevation. The soil may need to be amended with stabilizing additives (e.g. lime, portland cement, or fly ash) to provide adequate, uniform support to the overlying road structure.

The sub-base layer is designed to evenly spread the load of the pavement and the traffic to the ground below. Both bound and unbound materials are used for construction of sub-base. Unbound materials consist of aggregates which are loose and do not bind or adhere to neighboring particles when laid and compacted. The material is typically crushed stone, slag, or concrete. For bound materials, a binder, usually cement, is added to bind the aggregates together, thus allowing heavier loads but also reducing drainage. Crushed stone, slag, and building material can be used as components in bound materials.

The base course is the strengthening layer of the pavement. The material used is similar to that of the sub-base, but the size of particles is more uniform. Asphalt or concrete can be used as a binding medium.

Wearing layer

The wearing course is the top layer of asphalt or concrete. The top layer needs to be even to provide a smooth ride for cars and trucks. Asphalt is the most common material for the wearing course. The basic input materials used in asphalt preparation are hot liquid bitumen and aggregates (e.g. sand and crushed stone).

Asphalt

Hot mix asphalt is a highly technical mixture of strictly specified materials (e.g. the tolerance for the aggregates is often less than 5 percent for the shape, size, hardness, and wear index) The variety of mix types is practically limitless, depending on its position in the road structure (e.g. base or wearing course), on its particular function (e.g. intensity of traffic, anti-skid properties, noise reduction), on climatic conditions (e.g. from freezing to high temperatures), and on the nature of raw materials locally available (e.g. limestone or granite quarries, types of bitumen).

³⁷ EEA, 1998.

Other materials, such as broken asphalt (taken from a road that has been ripped up), sulphur, rubber, and foundry sands can be added to the basic mix without compromising the final asphalt quality.

Asphalts are grouped by their content and the size of stones (aggregates). Many types of asphalts have been developed to satisfy desired requirements depending on climate conditions, traffic loads, and other specific parameters. Two types of asphalt that are common in modern road work are stone mastic asphalt (SMA) and porous asphalt.

SMA consists of a coarse aggregate skeleton bound with mastic consisting of crushed rock fines, filler, and bitumen. The stone to stone contact of the coarse aggregate ensures a very durable matrix that is resistant to age hardening, and capable of high resistance to deformation. Consequently, it is resistant to cracking, ravelling, and damage by moisture.

Increasing traffic volumes, particularly in countries with wet climates, have led to the development of porous asphalt (PA). PA consists primarily of gap-graded aggregates bound together by a polymer modified binder to form a matrix with interconnecting voids through which water can pass.

The main difference between SMA and PA is in the percentage of voids in the mix. PA has a void content of at least 20 percent compared with 3 to 6 percent for SMA. This higher void content means that the PA greatly improves the rate of surface water drainage, thereby reducing spray and headlight glare in wet weather, improving skid resistance, and reducing the tendency for hydroplaning. PA typically also generates lower tire / pavement noise than other wearing course materials.

Asphalt is normally applied within 30-50 km of the mixing plant, however transport up to 100 km may be necessary in some cases.

Concrete

Concrete may be chosen for the wearing course, especially for roads carrying high traffic volume and heavy truck traffic, principally because of its durability, long life (usually 20 – 30 years), and generally lower maintenance needs compared to asphalt paving. Concrete typically generates higher levels of tire / pavement noise and is more expensive to install than asphalt.

The sub-grade, sub-base, and base layers supporting concrete paving are similar to those described above for asphalt paving. Because of the rigidity of concrete pavement, loads are spread over a large area and pressures on the subgrade are relatively low. A sub-base may be omitted when constructing concrete roads designed for light traffic. For large road projects, the concrete slab is usually laid down by slip-form paving equipment, which form and consolidate fresh concrete as they move along the right-of-way. The pavement surface is textured to enhance wet and dry weather traction. Contraction and expansion joints are included at regular intervals to relieve stresses and prevent cracking of the concrete slab.

Pavement Marking

Pavement striping is used for lane stripes and other pavement markings to guide motorists. Other pavement markers are used to supplement traffic signs. Markers may either be surface mounted (raised) or placed in recessed slots in the pavement. Markers are applied using bitumen / epoxy adhesives.

Toll stations

Toll stations may be manually or electronically operated or a mixture of both. To avoid prolonged stops at the tollgates, the roadway expands into a toll plaza with several lanes. The plaza design allows for traffic to safely separate and decelerate to the collection point and then accelerate and merge with the traffic flow again. Manual collection of tolls is relatively slow, and

therefore requires more toll booths / lanes than are required for electronic systems to process the same number of vehicles.

Operation and Maintenance

Operation and maintenance activities are numerous but mainly include road repair, snow and ice removal, bridge maintenance, and vegetation maintenance.

Asphalt pavement is susceptible to cracking and other breakdowns that have to be repaired. Asphalt emulsions are usually used to fill up small cracks. Cutbacks, which are a mixture of asphalt and petroleum solvents, are not used as frequently because of potential environmental effects of the solvents. Repair tasks include equipment operation, sweeping, application of asphalt, and compaction rolling.

The most common location for repairs of concrete roadways is at the longitudinal joints, where moisture has the opportunity to enter the pavement system. Repairs are typically conducted by sawing through and removing the deteriorated concrete. The existing base material is compacted, and additional material added if necessary. Load transfer is re-established in the patched area by means of reinforcement (e.g. tiebars and dowels). The new concrete is textured to match the surface of the existing roadway. Diamond grinding is also used to restore surface properties (e.g. reducing bumps and dips and restoring surface roughness).

When the road surface deteriorates to the extent that spot repairs and surface treatments are not useful, resurfacing is necessary. For asphalt pavement, resurfacing is most often accomplished by use of milling machines, which remove the top layer of pavement. The removed pavement can be transported off site and crushed or otherwise processed to make it useable as sub-base or other material.

Often, the removed pavement is ground at the job site, mixed with beneficiating additives (e.g. virgin aggregate, binder, and / or softening or rejuvenating agents to improve binder properties), and then used for re-paving the roadway. Milling and paving of asphalt roads is often completed in a single pass. Resurfacing of a concrete roadway entails breaking and removal of the concrete, compacting and amending the base material as necessary, and then re-paving. Removed concrete is usually crushed and recycled as sub-base material.

Snow / ice removal consists of plowing snow and ice from bridges, roadways, and shoulders. Wide ditches facilitate storage for plowed snow, which otherwise would be piled along the edge of the roadway or require removal. De-icing with chemicals (e.g. common salt [sodium chloride] or magnesium chloride) is used to facilitate safe driving. Alternatives to chloride salts include calcium magnesium acetate and potassium acetate. Spreading of sand or crushed stone is also used for increasing traffic safety. However, sanding is less effective on highways because the sand can be displaced by vehicles traveling at high speeds.³⁸

Steel bridges are generally painted with a multi-coat paint system to resist corrosion. In order to keep a high-quality protection against deterioration, new paint has to be applied regularly. If the old paint is in good condition it can be overcoated, otherwise it has to be removed before the new paint can be applied. Old paints may contain lead.

Vegetation in the rights of way requires periodic maintenance to enhance aesthetics and to prevent potential safety hazards (e.g. reduced visibility, obstruction of signs, and debris in the roadway). Vegetation maintenance typically includes mechanical mowing, trimming, removal of brush, cleanup, and removal of trees when necessary.

³⁸ University of New Hampshire, 2001.



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TEST CERTIFICATE

Test Report of Ambient Air	Report Code AAQ-01032021 -01	Date of Issue 05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 02/02/2021 to 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Air
Sampling Time	: 24 hrs
Analysis Duration	: 01/03/2021 TO 05/03/2021

Ambient Air Quality Data February 2021				Location: AAQ1 (Bewar) near Ch. 0+000		
S. No.	Date	PM2.5, $\mu\text{g}/\text{m}^3$	PM10, $\mu\text{g}/\text{m}^3$	SO ₂ , $\mu\text{g}/\text{m}^3$	Nox, $\mu\text{g}/\text{m}^3$	CO, $\mu\text{g}/\text{m}^3$
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	02.02.21	40.4	95.0	8.2	16.2	820
2	04.02.21	44.2	87.8	7.4	17.5	810
3	10.02.21	38.2	91.5	8.9	16.8	740
4	12.02.21	32.6	83.5	7.9	15.2	750
5	16.02.21	37.5	70.8	7.1	16.6	790
6	18.02.21	44.2	85.5	7.9	17.0	750
7	24.02.21	40.8	90.4	7.8	16.2	800
8	26.02.21	32.6	84.4	7.5	15.5	810
NAAQS, For 24 hourly monitoring (except CO for One hour)		60	100	80	80	4000

CHECKED BY:

AUTHORIZED SIGNATORY:



Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Air	AAQ-01032021 -02	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 02/02/2021 to 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Air
Sampling Time	: 24 hrs
Analysis Duration	: 01/03/2021 TO 05/03/2021

Ambient Air Quality Data February 2021				Location: AAQ2 (Kishni) near Ch. 24+200		
S. No.	Date	PM2.5, $\mu\text{g}/\text{m}^3$	PM10, $\mu\text{g}/\text{m}^3$	SO ₂ , $\mu\text{g}/\text{m}^3$	Nox, $\mu\text{g}/\text{m}^3$	CO, $\mu\text{g}/\text{m}^3$
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	02.02.21	32.4	75.0	8.2	16.4	510
2	04.02.21	28.2	68.2	7.7	13.2	480
3	10.02.21	30.6	70.5	7.9	14.2	350
4	12.02.21	24.5	66.2	8.1	15.5	500
5	16.02.21	29.8	60.6	7.5	14.3	440
6	18.02.21	26.6	69.2	8.0	13.2	450
7	24.02.21	22.4	72.6	7.2	14.8	410
8	26.02.21	25.6	74.6	7.9	12.6	380
NAAQS, For 24 hourly monitoring (except CO for One hour)		60	100	80	80	4000

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Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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Test Report of	Report Code	Date of Issue
Ambient Air	AAQ-01032021 -03	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 03/02/2021 to 27/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Air
Sampling Time	: 24 hrs
Analysis Duration	: 01/03/2021 TO 05/03/2021

Ambient Air Quality Data February 2021				Location: AAQ3 (Barlokpur) near Ch. 38+000		
S. No.	Date	PM2.5, $\mu\text{g}/\text{m}^3$	PM10, $\mu\text{g}/\text{m}^3$	SO ₂ , $\mu\text{g}/\text{m}^3$	Nox, $\mu\text{g}/\text{m}^3$	CO, $\mu\text{g}/\text{m}^3$
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	03.02.21	34.0	78.6	8.8	17.5	620
2	05.02.21	30.2	70.6	7.6	13.2	580
3	11.02.21	28.8	68.2	8.8	14.8	550
4	13.02.21	33.2	72.6	8.3	15.5	600
5	17.02.21	31.6	75.5	7.8	15.8	610
6	19.02.21	30.8	70.9	8.1	16.0	550
7	25.02.21	27.6	69.2	7.9	14.6	520
8	27.02.21	28.9	67.2	8.5	16.4	560
NAAQS, For 24 hourly monitoring (except CO for One hour)		60	100	80	80	4000

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Test Report of	Report Code	Date of Issue
Ambient Air	AAQ-01032021 -04	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name : Bewar to Etawah Section of NH-92
 Sample Drawn On : 03/02/2021 to 27/02/2021
 Sample Drawn By : Mr. Ajay Sharma & Ashu Saxena
 Sample Received On : 01/03/2021
 Sample description : Ambient Air
 Sampling Time : 24 hrs
 Analysis Duration : 01/03/2021 TO 05/03/2021

Ambient Air Quality Data February 2021				Location: AAQ4 (Shekpur Saraiya) near Ch. 48+000		
S.No	Date	PM2.5, $\mu\text{g}/\text{m}^3$	PM10, $\mu\text{g}/\text{m}^3$	SO ₂ $\mu\text{g}/\text{m}^3$	Nox $\mu\text{g}/\text{m}^3$	CO, $\mu\text{g}/\text{m}^3$
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	03.02.21	38.2	90.8	8.2	16.2	820
2	05.02.21	35.6	87.8	8.0	17.5	810
3	11.02.21	38.2	91.5	7.3	16.8	740
4	13.02.21	32.6	83.5	7.5	15.2	750
5	17.02.21	37.5	70.8	8.2	16.6	790
6	19.02.21	25.8	85.5	8.3	17.0	750
7	25.02.21	30.6	90.4	8.5	16.2	800
8	27.02.21	32.6	84.4	7.9	15.5	810
NAAQS, For 24 hourly monitoring (except CO for One hour)		60	100	80	80	4000

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Test Report of	Report Code	Date of Issue
Ambient Air	AAQ-01032021 -05	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name : Bewar to Etawah Section of NH-92
 Sample Drawn On : 01/02/2021 to 25/02/2021
 Sample Drawn By : Mr. Ajay Sharma & Ashu Saxena
 Sample Received On : 01/03/2021
 Sample description : Ambient Air
 Sampling Time : 24 hrs
 Analysis Duration : 01/03/2021 TO 05/03/2021

Ambient Air Quality Data February 2021				Location: AAQ45 (Harharpur) near Ch. 55+000		
S.No	Date	PM2.5, $\mu\text{g}/\text{m}^3$	PM10, $\mu\text{g}/\text{m}^3$	SO ₂ $\mu\text{g}/\text{m}^3$	Nox $\mu\text{g}/\text{m}^3$	CO, $\mu\text{g}/\text{m}^3$
		Gravimetric	IS:5182:Pt-23	IS:5182:Pt-2	IS:5182:Pt-6	IS:5182:Pt-10
1	01.02.21	22.6	95.0	6.0	14.2	380
2	03.02.21	30.8	87.8	7.1	15.5	360
3	09.02.21	25.5	91.5	8.4	16.8	520
4	11.02.21	21.2	83.5	7.2	15.2	480
5	15.02.21	24.4	70.8	7.1	16.6	360
6	17.02.21	25.5	85.5	7.9	14.2	500
7	23.02.21	26.7	90.4	7.8	11.0	440
8	25.02.21	30.2	84.4	7.5	12.5	450
NAAQS, For 24 hourly monitoring (except CO for One hour)		60	100	80	80	4000

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NOISE MONITORING REPORT

Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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Test Report of	Report Code	Date of Issue
Ambient Noise	N-01032021 -01	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 25/02/2021 to 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Noise
Sampling Time	: 24 hrs
Analysis Duration	: 04/03/2021 TO 05/03/2021

Noise Monitoring February 2021

S.No.	PROJECT SITE	ZONE	LIMIT as per CPCB Guidelines Leq, dB(A)		Observed value Leq, dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	(NQ1) Bewar Near Ch. 0+000	Commerical	65	55	60.2	51.6
*	Day time	Leq(6.00AM TO 10.00PM)				
*	Night time	Leq(10.00PM TO 6.00AM)				

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Test Report of Ambient Noise	Report Code N-01032021 -02	Date of Issue 05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 24/02/2021 to 25/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Noise
Sampling Time	: 24 hrs
Analysis Duration	: 04/03/2021 TO 05/03/2021

Noise Monitoring February 2021

S.No.	PROJECT SITE	ZONE	LIMIT as per CPCB Guidelines Leq, dB(A)		Observed value Leq, dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	(NQ2) Kishni Near Ch. 24+200	Commerical	65	55	58.2	44.7
	* Day time	Leq(6.00AM TO 10.00PM)				
	* Night time	Leq(10.00PM TO 6.00AM)				

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Noise	N-01032021 -03	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 23/02/2021 to 24/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Noise
Sampling Time	: 24 hrs
Analysis Duration	: 04/03/2021 TO 05/03/2021

Noise Monitoring February 2021						
S. No.	PROJECT SITE	ZONE	LIMIT as per CPCB Guidelines Leq, dB(A)		Observed value Leq, dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	(NQ3 Barlokpur) near Ch. 38+000	Residential Zone	55	45	50.6	38.2
	* Day time	Leq(6.00AM TO 10.00PM)				
	* Night time	Leq(10.00PM TO 6.00AM)				

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Test Report of	Report Code	Date of Issue
Ambient Noise	N-01032021 -04	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 22/02/2021 to 23/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Noise
Sampling Time	: 24 hrs
Analysis Duration	: 04/03/2021 TO 05/03/2021

Noise Monitoring February 2021

S.No.	PROJECT SITE	ZONE	LIMIT as per CPCB Guidelines Leq, dB(A)		Observed value Leq, dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	(NQ4) Shekpur Saraiya Near Ch. 48+000	Residential Zone	55	45	48.7	39.4
*	Day time	Leq(6.00AM TO 10.00PM)				
*	Night time	Leq(10.00PM TO 6.00AM)				

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ambient Noise	N-01032021 -05	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 21/02/2021 to 22/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ambient Noise
Sampling Time	: 24 hrs
Analysis Duration	: 04/03/2021 TO 05/03/2021

Noise Monitoring February 2021						
S. No.	PROJECT SITE	ZONE	LIMIT as per CPCB Guidelines Leq, dB(A)		Observed value Leq, dB(A)	
			DAY*	NIGHT*	DAY*	NIGHT*
1	(NQ5) Harharpur Near Ch. 55+000	Residential Zone	55	45	51.8	40.2
*	Day time	Leq(6.00AM TO 10.00PM)				
*	Night time	Leq(10.00PM TO 6.00AM)				

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GROUND WATER MONITORING REPORT

Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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Test Report of	Report Code	Date of Issue
Ground Water	GW-01032021 -01	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ground Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

S. No.	Parameter	Unit	Limit (IS-10500:2012)		GW1
			Desirable	Permissible	Bewar Near Ch. 0+000
1	Temperature ($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	-	-	15
2	pH	-	6.5-8.5	No Relaxation	7.86
3	Electrical Conductivity	Micromhos/cm	-	-	755.16
4	TDS	mg/l	500	2000	413.34
5	TSS	Mg/l	-	-	BDL
6	Dissolved Oxygen	mg/l	-	-	4.8
7	Alkalinity as (CaCO_3)	mg/l	200	600	389.24
8	Total Hardness (as CaCO_3)	mg/l	200	600	288.2
9	BOD (at 27°C 3-Days)	mg/l	-	-	BDL
10	COD	mg/l	-	-	BDL
11	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.24
12	Chloride (as Cl)	mg/l	250	1000	28
13	Phosphates	mg/l	-	-	0.04
14	Sulphate (as SO_4)	mg/l	200	400	58.7
15	Sodium (as Na)	mg/l	-	-	42.7
16	Potassium (as K)	mg/l	-	-	2.5
17	Calcium (as CaCO_3)	mg/l	75	200	56.8
18	Magnesium (as CaCO_3)	mg/l	30	100	227
19	Silica	mg/l	-	-	33.2
20	Oil & Grease	mg/l	-	-	<1.0
21	Residual Sodium Carbonate	mg/l	-	-	116

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TEST CERTIFICATE

22	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01
23	Arsenic (as As)	mg/l	0.01	0.05	<0.01
24	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001
26	Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.001
27	Total Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.01
28	Copper (as Cu)	mg/l	0.05	1.5	<0.05
29	Zinc (as Zn)	mg/l	5	15	0.18
30	Iron (as Fe)	mg/l	0.3	1	0.86
Bacteriological Parameter					
1	Total Coliform	MPN/100ml	Absent	-	Absent
2	E.coli	E.coli /100ml	Absent	-	Absent

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ground Water	GW-01032021 -02	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ground Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

S. No.	Parameter	Unit	Limit (IS-10500:2012)		GW2 Kishni Near Ch. 24+200
			Desirable	Permissible	
1	Temperature ($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	-	-	16
2	pH	-	6.5-8.5	No Relaxation	7.66
3	Electrical Conductivity	Micromhos/cm	-	-	762.26
4	TDS	mg/l	500	2000	395.24
5	TSS	Mg/l	-	-	BDL
6	Dissolved Oxygen	mg/l	-	-	3.8
7	Alkalinity as (CaCO_3)	mg/l	200	600	386.12
8	Total Hardness (as CaCO_3)	mg/l	200	600	245.56
9	BOD (at 27°C 3-Days)	mg/l	-	-	BDL
10	COD	mg/l	-	-	BDL
11	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.12
12	Chloride (as Cl)	mg/l	250	1000	48
13	Phosphates	mg/l	-	-	0.05
14	Sulphate (as SO_4)	mg/l	200	400	62.6
15	Sodium (as Na)	mg/l	-	-	62.5
16	Potassium (as K)	mg/l	-	-	3.8
17	Calcium (as CaCO_3)	mg/l	75	200	52.3
18	Magnesium (as CaCO_3)	mg/l	30	100	41.2
19	Silica	mg/l	-	-	28.6
20	Oil & Grease	mg/l	-	-	<1.00

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TEST CERTIFICATE

21	Residual Sodium Carbonate	mg/l	-	-	86
22	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01
23	Arsenic (as As)	mg/l	0.01	0.05	<0.01
24	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001
26	Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.01
27	Total Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.05
28	Copper (as Cu)	mg/l	0.05	1.5	<0.05
29	Zinc (as Zn)	mg/l	5	15	0.19
30	Iron (as Fe)	mg/l	0.3	1	0.78
Bacteriological Parameter					
1	Total Coliform	MPN/100ml	Absent	-	Absent
2	E.coli	E.coli /100ml	Absent	-	Absent

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ground Water	GW-01032021 -03	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ground Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

S. No.	Parameter	Unit	Limit (IS-10500:2012)		GW3 Barlokpur Near Ch. 38+000
			Desirable	Permissible	
1	Temperature (°C)	(°C)	-	-	15
2	pH	-	6.5-8.5	No Relaxation	7.36
3	Electrical Conductivity	Micromhos/cm	-	-	412.36
4	TDS	mg/l	500	2000	205.16
5	TSS	Mg/l	-	-	0.41
6	Dissolved Oxygen	mg/l	-	-	5.6
7	Alkalinity as (CaCO ₃)	mg/l	200	600	216.16
8	Total Hardness as CaCO ₃	mg/l	200	600	182.44
9	BOD (at 27°C 3-Days)	mg/l	-	-	BDL
10	COD	mg/l	-	-	5.5
11	Nitrate (as NO ₃)	mg/l	45	No Relaxation	0.66
12	Chloride (as Cl)	mg/l	250	1000	12.6
13	Phosphates	mg/l	-	-	0.03
14	Sulphate (as SO ₄)	mg/l	200	400	42.3
15	Sodium (as Na)	mg/l	-	-	42.5
16	Potassium (as K)	mg/l	-	-	2.7
17	Calcium (as CaCO ₃)	mg/l	75	200	55.4
18	Magnesium (as CaCO ₃)	mg/l	30	100	32.6
19	Silica	mg/l	-	-	32.5
20	Oil & Grease	mg/l	-	-	<1.00

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21	Residual Sodium Carbonate	mg/l	-	-	72
22	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01
23	Arsenic (as As)	mg/l	0.01	0.05	<0.01
24	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001
26	Chromium (as Cr ⁶⁺)	mg/l	0.05	No Relaxation	<0.01
27	Total Chromium (as Cr ⁶⁺)	mg/l	0.05	No Relaxation	<0.05
28	Copper (as Cu)	mg/l	0.05	1.5	<0.05
29	Zinc (as Zn)	mg/l	5	15	0.003
30	Iron (as Fe)	mg/l	0.3	1	0.03
Bacteriological Parameter					
1	Total Coliform	MPN/100ml	Absent	-	Absent
2	E.coli	E.coli /100ml	Absent	-	Absent

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AUTHORIZED SIGNATORY:



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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ground Water	GW-01032021 -04	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ground Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

S. No.	Parameter	Unit	Limit (IS-10500:2012)		GW4 Shekpur Saraiya Near Ch. 48+000
			Desirable	Permissible	
1	Temperature ($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	-	-	15
2	pH	-	6.5-8.5	No Relaxation	7.44
3	Electrical Conductivity	Micromhos/cm	-	-	425.22
4	TDS	mg/l	500	2000	210.22
5	TSS	Mg/l	-	-	BDL
6	Dissolved Oxygen	mg/l	-	-	4.2
7	Alkalinity as (CaCO_3)	mg/l	200	600	208.14
8	Total Hardness (as CaCO_3)	mg/l	200	600	205.32
9	BOD (at 27°C 3-Days)	mg/l	-	-	BDL
10	COD	mg/l	-	-	BDL
11	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.12
12	Chloride (as Cl)	mg/l	250	1000	20.5
13	Phosphates	mg/l	-	-	0.06
14	Sulphate (as SO_4)	mg/l	200	400	38.6
15	Sodium (as Na)	mg/l	-	-	40.2
16	Potassium (as K)	mg/l	-	-	3
17	Calcium (as CaCO_3)	mg/l	75	200	48.2
18	Magnesium (as CaCO_3)	mg/l	30	100	38.6
19	Silica	mg/l	-	-	30.5
20	Oil & Grease	mg/l	-	-	<1.00

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21	Residual Sodium Carbonate	mg/l	-	-	78
22	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01
23	Arsenic (as As)	mg/l	0.01	0.05	<0.01
24	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001
26	Chromium (as Cr ⁶⁺)	mg/l	0.05	No Relaxation	<0.01
27	Total Chromium (as Cr ⁶⁺)	mg/l	0.05	No Relaxation	<0.05
28	Copper (as Cu)	mg/l	0.05	1.5	<0.05
29	Zinc (as Zn)	mg/l	5	15	0.12
30	Iron (as Fe)	mg/l	0.3	1	0.78
Bacteriological Parameter					
1	Total Coliform	MPN/100ml	Absent	-	Absent
2	E.coli	E.coli /100ml	Absent	-	Absent

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Ground Water	GW-01032021 -05	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Ground Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

S. No.	Parameter	Unit	Limit (IS-10500:2012)		GW5 Harharpur Near Ch. 55+000
			Desirable	Permissible	
1	Temperature ($^{\circ}\text{C}$)	($^{\circ}\text{C}$)	-	-	16
2	pH	-	6.5-8.5	No Relaxation	7.32
3	Electrical Conductivity	Micromhos/cm	-	-	395.85
4	TDS	mg/l	500	2000	198.6
5	TSS	Mg/l	-	-	BDL
6	Dissolved Oxygen	mg/l			3.9
7	Alkalinity as (CaCO_3)	mg/l	200	600	205.23
8	Total Hardness (as CaCO_3)	mg/l	200	600	195.25
9	BOD (at 27°C 3-Days)	mg/l	-	-	BDL
10	COD	mg/l	-	-	BDL
11	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.24
12	Chloride (as Cl)	mg/l	250	1000	18.4
13	Phosphates	mg/l	-	-	0.08
14	Sulphate (as SO_4)	mg/l	200	400	40.5
15	Sodium (as Na)	mg/l	-	-	38.6
16	Potassium (as K)	mg/l	-	-	2.6
17	Calcium (as CaCO_3)	mg/l	75	200	47.3
18	Magnesium (as CaCO_3)	mg/l	30	100	32.5
19	Silica	mg/l	-	-	37.5
20	Oil & Grease	mg/l	-	-	<1.01

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21	Residual Sodium Carbonate	mg/l	-	-	65
22	Lead (as Pb)	mg/l	0.01	No Relaxation	<0.01
23	Arsenic (as As)	mg/l	0.01	0.05	<0.01
24	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.001
26	Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.01
27	Total Chromium (as Cr6+)	mg/l	0.05	No Relaxation	<0.05
28	Copper (as Cu)	mg/l	0.05	1.5	<0.05
29	Zinc (as Zn)	mg/l	5	15	0.16
30	Iron (as Fe)	mg/l	0.3	1	0.76
Bacteriological Parameter					
1	Total Coliform	MPN/100ml	Absent	-	Absent
2	E.coli	E.coli /100ml	Absent	-	Absent

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SOIL MONITORING REPORT

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TEST CERTIFICATE

Test Report	Report Code	Date of Issue
Soil	S-01032021 -01	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Soil
Analysis Duration	: 01/03/2021 TO 05/03/2021

SOIL QUALITY RESULT

S. No.	Parameter	Test Method	Unit	SQ-1
				Bewar Near Ch. 0+000
1	pH(1:5 suspension)	IS:2720(Part-26)		7.82
2	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	µmhos/cm	340.26
3	Calcium (as Ca)	STP/SOIL	mg/kg	480.1
4	Magnesium(as Mg)	STP/SOIL	mg/kg	28.2
5	Organic Matter	IS:2720(Part-22)	% by mass	0.46
6	Potassium(as K)	STP/SOIL	mg/kg	90.2
7	Water holding Capacity	STP/SOIL	% by mass	26.5
8	Porosity	STP/SOIL	Mg/100/gm	40.24
9	Texture	STP/SOIL	-	Sandy loam
10	Sand	STP/SOIL	% by mass	57.6
11	Clay	STP/SOIL	% by mass	22.8
12	Silt	STP/SOIL	% by mass	19.6
13	Sodium	STP/SOIL	mg/100g	190.2
14	Sodium Absorption Ratio	STP/SOIL	%By mass	1.22
15	Nitrogen	STP/SOIL	mg/100g	0.05
16	Phosphorus	STP/SOIL	mg/kg	0.8
17	Bulk Density	STP/SOIL	gm/cc	1.3
18	Infiltration Rate	STP/SOIL	mm/hr	13
19	Moisture	STP/SOIL	%	15.3
20	Sulphates	STP/SOIL	mg/1000g	55.2
21	Available Sulphur(as S)	STP/SOIL	mg/kg	22.6
22	Available Manganese (as Mn)	STP/SOIL	mg/100g	2.14
23	Available Iron (as Fe)	STP/SOIL	mg/kg	46.4
24	Sodium as Na	STP/SOIL	mg/kg	55.68

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TEST CERTIFICATE

Soil Test Report	Report Code	Date of Issue
	S-01032021 -02	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Soil
Analysis Duration	: 01/03/2021 TO 05/03/2021

SOIL QUALITY RESULT

S. No.	Parameter	Test Method	Unit	SQ-2
				Kishni Near Ch. 24+200
1	pH(1:5 suspension)	IS:2720(Part-26)		7.54
2	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)		250.46
3	Calcium (as Ca)	STP/SOIL	µmhos/cm	410.6
4	Magnesium(as Mg)	STP/SOIL	mg/kg	32.4
5	Organic Matter	IS:2720(Part-22)	mg/kg	0.64
6	Potassium(as K)	STP/SOIL	% by mass	88.82
7	Water holding Capacity	STP/SOIL	mg/kg	19.5
8	Porosity	STP/SOIL	% by mass	37.82
9	Texture	STP/SOIL	Mq/100/gm	Sandy loam
10	Sand	STP/SOIL	-	55.4
11	Clay	STP/SOIL	% by mass	26.6
12	Silt	STP/SOIL	% by mass	18
13	Sodium	STP/SOIL	% by mass	206.1
14	Sodium Absorption Ratio	STP/SOIL	mg/100g	1.09
15	Nitrogen	STP/SOIL	%By mass	0.03
16	Phosphorus	STP/SOIL	mg/100g	0.42
17	Bulk Density	STP/SOIL	mg/kg	1.44
18	Infiltration Rate	STP/SOIL	grm/cc	15
19	Moisture	STP/SOIL	mm/hr	18
20	Sulphates	STP/SOIL	%	63.4
21	Available Sulphur(as S)	STP/SOIL	mg/1000g	25.4
22	Available Manganese (as Mn)	STP/SOIL	mg/kg	1.86
23	Available Iron (as Fe)	STP/SOIL	mg/100g	38.26
24	Sodium as Na	STP/SOIL	mg/kg	62.5

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Test Report	Report Code	Date of Issue
Soil	S-01032021 -03	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Soil
Analysis Duration	: 01/03/2021 TO 05/03/2021

SOIL QUALITY RESULT

S. No.	Parameter	Test Method	Unit	SQ-3
				Barlokpur Near Ch. 38+000
1	pH(1:5 suspension)	IS:2720(Part-26)		7.7
2	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	µmhos/cm	220.12
3	Calcium (as Ca)	STP/SOIL	mg/kg	400.3
4	Magnesium(as Mg)	STP/SOIL	mg/kg	35.42
5	Organic Matter	IS:2720(Part-22)	% by mass	0.38
6	Potassium(as K)	STP/SOIL	mg/kg	94.62
7	Water holding Capacity	STP/SOIL	% by mass	28.7
8	Porosity	STP/SOIL	Mq/100/gm	37.6
9	Texture	STP/SOIL	-	Sandy loam
10	Sand	STP/SOIL	% by mass	60
11	Clay	STP/SOIL	% by mass	24.1
12	Silt	STP/SOIL	% by mass	15.9
13	Sodium	STP/SOIL	mg/100g	180.1
14	Sodium Absorption Ratio	STP/SOIL	%By mass	1.34
15	Nitrogen	STP/SOIL	mg/100g	0.08
16	Phosphorus	STP/SOIL	mg/kg	0.64
17	Bulk Density	STP/SOIL	grm/cc	1.58
18	Infiltration Rate	STP/SOIL	mm/hr	9
19	Moisture	STP/SOIL	%	22.4
20	Sulphates	STP/SOIL	mg/1000g	48.6
21	Available Sulphur(as S)	STP/SOIL	mg/kg	28.36
22	Available Manganese (as Mn)	STP/SOIL	mg/100g	1.74
23	Available Iron (as Fe)	STP/SOIL	mg/kg	36.28
24	Sodium as Na	STP/SOIL	mg/kg	71.22

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TEST CERTIFICATE

Test Report	Report Code	Date of Issue
Soil	S-01032021 -04	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name : Bewar to Etawah Section of NH-92
 Sample Drawn On : 26/02/2021
 Sample Drawn By : Mr. Ajay Sharma & Ashu Saxena
 Sample Received On : 01/03/2021
 Sample description : Soil
 Analysis Duration : 01/03/2021 TO 05/03/2021

SOIL QUALITY RESULT

S. No.	Parameter	Test Method	Unit	SQ-4
				Shekpur Saraiya Near Ch. 48+000
1	pH(1:5 suspension)	IS:2720(Part-26)		7.88
2	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	µmhos/cm	280.4
3	Calcium (as Ca)	STP/SOIL	mg/kg	390.8
4	Magnesium(as Mg)	STP/SOIL	mg/kg	38.1
5	Organic Matter	IS:2720(Part-22)	% by mass	0.26
6	Potassium(as K)	STP/SOIL	mg/kg	83.1
7	Water holding Capacity	STP/SOIL	% by mass	25.6
8	Porosity	STP/SOIL	Mq/100/gm	34.5
9	Texture	STP/SOIL	-	Sandy loam
10	Sand	STP/SOIL	% by mass	65.6
11	Clay	STP/SOIL	% by mass	18
12	Silt	STP/SOIL	% by mass	16.4
13	Sodium	STP/SOIL	mg/100g	200.06
14	Sodium Absorption Ratio	STP/SOIL	%By mass	1.14
15	Nitrogen	STP/SOIL	mg/100g	0.09
16	Phosphorus	STP/SOIL	mg/kg	0.86
17	Bulk Density	STP/SOIL	gm/cc	1.2
18	Infiltration Rate	STP/SOIL	mm/hr	12
19	Moisture	STP/SOIL	%	17.1
20	Sulphates	STP/SOIL	mg/1000g	51.6
21	Available Sulphur(as S)	STP/SOIL	mg/kg	25.78
22	Available Manganese (as Mn)	STP/SOIL	mg/100g	1.06
23	Available Iron (as Fe)	STP/SOIL	mg/kg	41.26
24	Sodium as Na	STP/SOIL	mg/kg	80.3

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TEST CERTIFICATE

Test Report	Report Code	Date of Issue
Soil	S-01032021 -05	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Soil
Analysis Duration	: 01/03/2021 TO 05/03/2021

SOIL QUALITY RESULT

S. No.	Parameter	Test Method	Unit	(SQ-5)
				Harharpur Near Ch. 55+000
1	pH(1:5 suspension)	IS:2720(Part-26)		7.88
2	Electrical Conductivity at 25°C (1:5suspension.)	IS:2720(Part-21)	µmhos/cm	223.5
3	Calcium (as Ca)	STP/SOIL	mg/kg	390.8
4	Magnesium(as Mg)	STP/SOIL	mg/kg	38.1
5	Organic Matter	IS:2720(Part-22)	% by mass	0.27
6	Potassium(as K)	STP/SOIL	mg/kg	90.4
7	Water holding Capacity	STP/SOIL	% by mass	24.6
8	Porosity	STP/SOIL	Mq/100/gm	34.5
9	Texture	STP/SOIL	-	Sandy loam
10	Sand	STP/SOIL	% by mass	60
11	Clay	STP/SOIL	% by mass	20
12	Silt	STP/SOIL	% by mass	20
13	Sodium	STP/SOIL	mg/100g	190.5
14	Sodium Absorption Ratio	STP/SOIL	%By mass	1.12
15	Nitrogen	STP/SOIL	mg/100g	0.09
16	Phosphorus	STP/SOIL	mg/kg	0.86
17	Bulk Density	STP/SOIL	gm/cc	1.2
18	Infiltration Rate	STP/SOIL	mm/hr	12
19	Moisture	STP/SOIL	%	17.1
20	Sulphates	STP/SOIL	mg/1000g	57.4
21	Available Sulphur(as S)	STP/SOIL	mg/kg	24.62
22	Available Manganese (as Mn)	STP/SOIL	mg/100g	2.56
23	Available Iron (as Fe)	STP/SOIL	mg/kg	40.8
24	Sodium as Na	STP/SOIL	mg/kg	66.8

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AUTHORIZED SIGNATORY:



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SURFACE WATER MONITORING

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Test Report of	Report Code	Date of Issue
Surface Water	SW-01032021-01	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Surface Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

Surface Water Quality

S. No.	Parameter	Test Method	Unit	SW1 Majhola Canal near Ch. 2+200
1	pH	IS:3025 part 11 1983 RA-2012	-	8.44
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	532.8
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	2.5
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	346.32
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	213.75
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	235
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	22.5
8	C.O. D	-	mg/L	66.7
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	44.62
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	1.42
11	Sulphate as SO ₄ ²⁻	IS: 3025 Part 24 1986, RA-2003	mg/L	35.2
12	Nitrates as NO ₃	IS: 3025 Part 34 1988, RA-2003	mg/L	5.75
13	Phosphate as PO ₄	IS: 3025 Part 31 1988, RA-2003	mg/L	0.48
14	Bi-carbonate as HCO ₃	IS: 3025 Part 51	mg/L	110.22

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15	Iron as Fe	IS: 3025 Part 53	mg/L	0.05
16	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
17	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
18	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
19	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
20	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
21	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001
22	Phenolic Compound as C ₆ H ₅ OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
23	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.42
24	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	41
25	Potassium	IS: 3025 Part 45 1993, RA-2009	mg/L	5.5
26	Calcium	IS: 3025 Part 40	mg/L	55.65
27	Magnesium	IS: 3025 Part 46	mg/L	18.2
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1
30	SAR			0.35
31	Coliform	--	MPN/	240
32	Total Coliform	IS 15185: 2002	MPN/	510

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Test Report of	Report Code	Date of Issue
Surface Water	SW-01032021 - 02	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Surface Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

Surface Water Quality Result

S. No.	Parameter	Test Method	Unit	SW2 Nagia Khon Canal near Ch. 15+450
1	pH	IS:3025 part 11 1983 RA-2012	-	8.40
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	531.5
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	4.4
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	345.29
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	211.68
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	234.8
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	22.4
8	C.O. D	-	mg/L	66.2
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	45.86
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	1.35
11	Sulphate as SO ₄ ²⁻	IS: 3025 Part 24 1986, RA-2003	mg/L	34.7
12	Nitrates as NO ₃	IS: 3025 Part 34 1988, RA-2003	mg/L	5.68
13	Phosphate as PO ₄	IS: 3025 Part 31 1988, RA-2003	mg/L	0.44
14	Bi-carbonate as HCO ₃	IS: 3025 Part 51	mg/L	109.54
15	Iron as Fe	IS: 3025 Part 53	mg/L	0.05

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16	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
17	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
18	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
19	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
20	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
21	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001
22	Phenolic Compound as C ₆ H ₅ OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
23	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.41
24	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	40.5
25	Potassium	IS: 3025 Part 45 1993, RA-2009	mg/L	5.2
26	Calcium	IS: 3025 Part 40	mg/L	54.4
27	Magnesium	IS: 3025 Part 46	mg/L	
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	18
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1
30	SAR			0.34
31	Coliform	--	MPN/	320
32	Total Coliform	IS 15185: 2002	MPN/	630

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Surface Water	SW-01032021 - 03	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Surface Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

Surface Water Quality Result

S. No.	Parameter	Test Method	Unit	SW3 Saral Nawar Canal near Ch. 30+000
1	pH	IS:3025 part 11 1983 RA-2012	-	7.58
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	596.65
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	2.8
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	387.92
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	182
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	224.5
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	35.5
8	C.O. D	-	mg/L	62.2
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	50.16
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.35
11	Sulphate as SO ₄ ²⁻	IS: 3025 Part 24 1986, RA-2003	mg/L	44.8
12	Nitrates as NO ₃	IS: 3025 Part 34 1988, RA-2003	mg/L	0.78
13	Phosphate as PO ₄	IS: 3025 Part 31 1988, RA-2003	mg/L	0.55
14	Bi-carbonate as HCO ₃	IS: 3025 Part 51	mg/L	114.2

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15	Iron as Fe	IS: 3025 Part 53	mg/L	0.053
16	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
17	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
18	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
19	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
20	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
21	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001
22	Phenolic Compound as C ₆ H ₅ OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
23	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.48
24	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	60.26
25	Potassium	IS: 3025 Part 45 1993, RA-2009	mg/L	2.8
26	Calcium	IS: 3025 Part 40	mg/L	48.1
27	Magnesium	IS: 3025 Part 46	mg/L	12
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1
30	SAR			0.32
31	Coliform	—	MPN/	270
32	Total Coliform	IS 15185: 2002	MPN/	480

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Surface Water	SW-01032021 -04	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Surface Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

Surface Water Quality Result

S. No.	Parameter	Test Method	Unit	SW4 Rura Safai Canal near Ch. 45+850
1	pH	IS:3025 part 11 1983 RA-2012	-	7.55
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	μs/cm.	595.45
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	2.7
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	387.48
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	181.24
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	225.1
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	35.2
8	C.O. D	-	mg/L	61.86
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	50.12
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.34
11	Sulphate as SO ₄ ²⁻	IS: 3025 Part 24 1986, RA-2003	mg/L	44.2
12	Nitrates as NO ₃	IS: 3025 Part 34 1988, RA-2003	mg/L	0.67
13	Phosphate as PO ₄	IS: 3025 Part 31 1988, RA-2003	mg/L	0.51
14	BI-carbonate as HCO ₃	IS: 3025 Part 51	mg/L	113.15

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15	Iron as Fe	IS: 3025 Part 53	mg/L	0.04
16	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
17	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
18	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
19	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
20	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
21	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001
22	Phenolic Compound as C ₆ H ₅ OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
23	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.46
24	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	59.8
25	Potassium	IS: 3025 Part 45 1993, RA-2009	mg/L	2.7
26	Calcium	IS: 3025 Part 40	mg/L	47.68
27	Magnesium	IS: 3025 Part 46	mg/L	11.8
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1
30	SAR			0.31
31	Coliform	--	MPN/	310
32	Total Coliform	IS 15185: 2002	MPN/	440

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AUTHORIZED SIGNATORY:



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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Surface Water	SW-01032021 -05	05/03/2021

ISSUED TO: M/S Competent Engineering Solution

SAMPLING & ANALYSIS DATA

Project Name	: Bewar to Etawah Section of NH-92
Sample Drawn On	: 26/02/2021
Sample Drawn By	: Mr. Ajay Sharma & Ashu Saxena
Sample Received On	: 01/03/2021
Sample description	: Surface Water
Analysis Duration	: 01/03/2021 TO 05/03/2021

Surface Water Quality Result

S. No.	Parameter	Test Method	Unit	SW5 Hariharpur Canal near Ch. 55+600
1	pH	IS:3025 part 11 1983 RA-2012	-	7.42
2	E. Conductivity	IS: 3025 Part 10 1984 RA-2002	µs/cm.	263.91
3	Dissolved Oxygen	IS: 3025 Part 38 1989 RA-2003	mg/L	6.0
4	Total Dissolved Solids	IS: 3025 Part 16 1984 RA-2006	mg/L	171.54
5	Total Hardness	IS: 3025 Part 21 2009	mg/L	131.08
6	Total Alkalinity	IS: 3025 Part 23 1986, RA-2003	mg/L	132
7	B.O.D (3 days at 27°C)	IS: 3025 Part 44 1993 RA-2009	mg/L	5.5
8	C.O. D	-	mg/L	12.2
9	Chloride as Cl	IS: 3025 Part 32 1988, RA-2009	mg/L	18
10	Fluorides as F-	IS: 3025 Part 60 2008	mg/L	0.15
11	Sulphate as SO ₄ ²⁻	IS: 3025 Part 24 1986, RA-2003	mg/L	12.62
12	Nitrates as NO ₃	IS: 3025 Part 34 1988, RA-2003	mg/L	3.82
13	Phosphate as PO ₄	IS: 3025 Part 31 1988, RA-2003	mg/L	0.42
14	Bi-carbonate as HCO ₃	IS: 3025 Part 51	mg/L	130
15	Iron as Fe	IS: 3025 Part 53	mg/L	0.042

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16	Chromium as Cr	IS 3025 Part 52 2003	mg/L	<0.001
17	Cadmium as Cd	IS 3025 Part 41 1992	mg/L	<0.001
18	Lead as Pb	IS 3025 Part 47 1994	mg/L	<0.001
19	Copper as Cu	IS 3025 Part 42 1992	mg/L	<0.001
20	Arsenic as	IS: 3025 Part 37 1988, RA-2003	mg/L	<0.01
21	Selenium as Se	IS: 3025 Part 56 2003	mg/L	<0.001
22	Phenolic Compound as C ₆ H ₅ OH	IS: 3025 Part 43 1992, RA-2003	mg/L	<0.001
23	Zinc as Zn	IS 3025 Part 49 1994	mg/L	0.46
24	Sodium	IS: 3025 Part 45 1993, RA-2009	mg/L	8.5
25	Potassium	IS: 3025 Part 45 1993, RA-2009	mg/L	2.6
26	Calcium	IS: 3025 Part 40	mg/L	38
27	Magnesium	IS: 3025 Part 46	mg/L	8.8
28	Anionic detergents as MBAS	Annex K of IS 13428:2005	mg/L	<0.01
29	Oil and grease	IS 3025 Part 39 1991	mg/L	<0.1
30	SAR			0.36
31	Coliform	--	MPN/	250
32	Total Coliform	IS 15185: 2002	MPN/	430

CHECKED BY:

AUTHORIZED SIGNATORY:



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Project Name: Bewar to Etawah Section of NH-92 in the State of Uttar Pradesh

Land Use

The Land Use/ Land Cover map of the study area of the project road (Bewar to Etawah Section of NH-92 in the State of Uttar Pradesh) is prepared using Resourcesat-2 ortho rectified LISS-III data derived from Bhuvan. Interpretation of satellite imagery is done using visual interpretation technique and individual classes were interpreted using their visual characteristics. Ground truth has been carried out to validate the interpretation accuracy and reliability of remotely sensed data, by enabling verification of the interpreted details and by supplementing with the information, which cannot be obtained directly on satellite imagery. Digital image processing techniques like classification of False Color Composite (FCC) image, were applied for the mapping of the land use land cover classes of the provided area from the satellite data. The LULC database is prepared with 5 class LULC Classification Scheme. Output is in GIS vector file format, prepared using LCC projection and WGS84 as datum.

The existing land use around the project road primarily comprises of agricultural land followed by Built-up area. The land use map for a buffer length of 500m around the project road centerline has been prepared to a scale of 1:25000 based on recent satellite imagery (LISS-III). Below table describes the land use / land cover of the study area. The land use land cover map based on satellite imagery within 500m buffer area around the project road is shown in below figures.

Table-: Land use / Land Cover of the Study Area (500m)

S. No	LU/LC Classes	Area in ha	Area Percentage (%)
1	Agriculture Land	5090.96	87.59
2	Built Up Area	535.94	9.22
3	Vegetationn & Plantation	112.19	1.93
4	Waterbodies	61.41	1.06
5	Waste Land	11.86	0.20
Total		5812.36	100.00

79°16'30"E

79°18'0"E

79°19'30"E



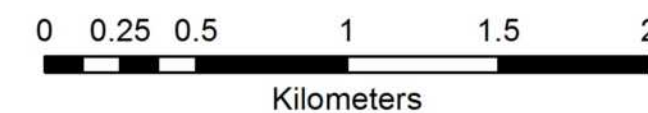
LAND USE/LAND COVER MAP

Legend

- 500Meter Buffer Study Area
- Proposed RoW
- Road Centrelines
- Agriculture Land
- Built Up Area
- Vegetationn & Plantation
- Waste Land
- Waterbodies

**Reference:- Liss-III Satellite Imagery*

Scale:- 1:25,000



0+000

1+000

2+000

3+000

4+000

5+000

6+000

7+000

Km 0+000 (Project Road - Package 1 Start)

27°12'0"N

27°12'0"N

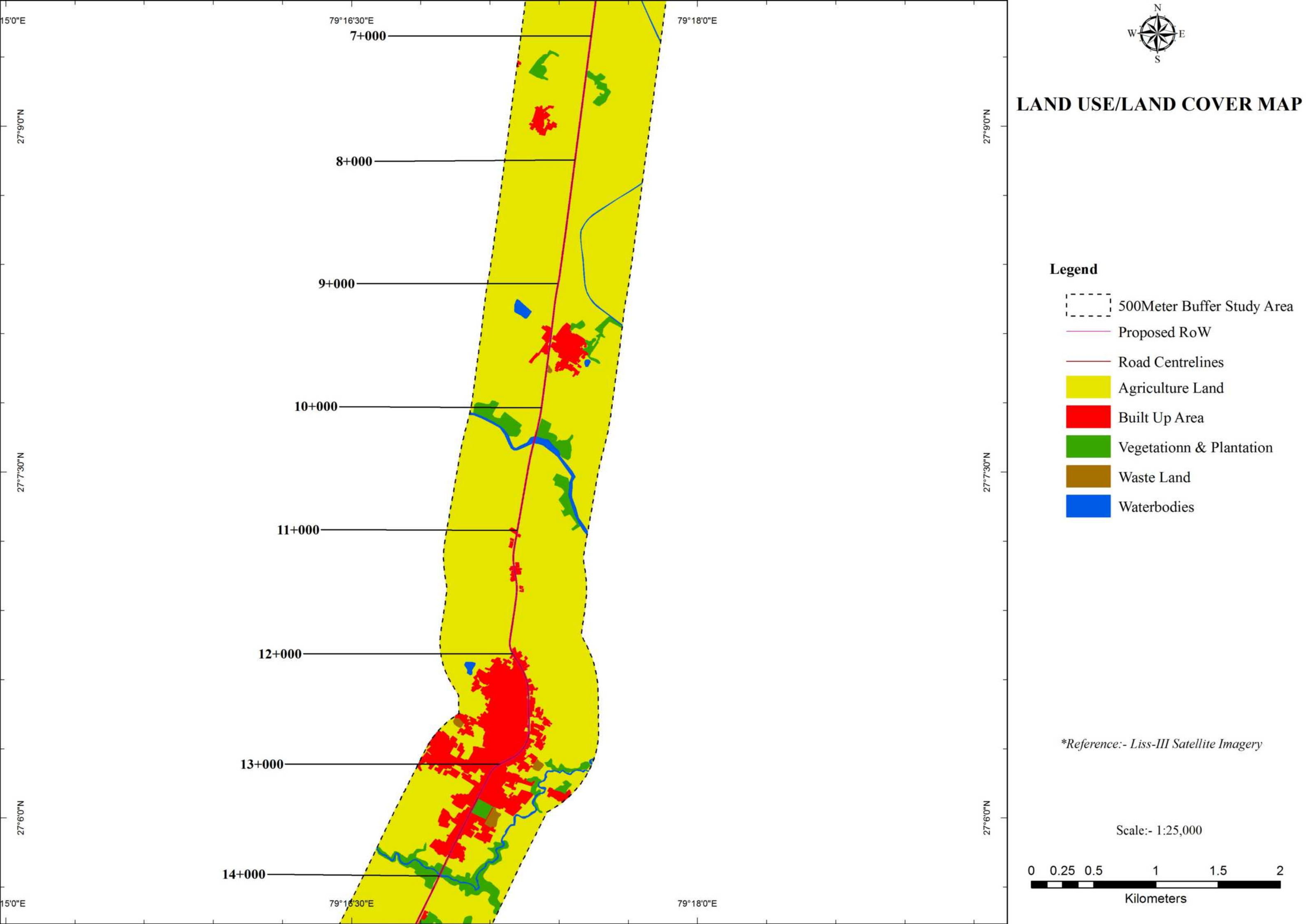
27°10'30"N

27°10'30"N

79°16'30"E

79°18'0"E

79°19'30"E





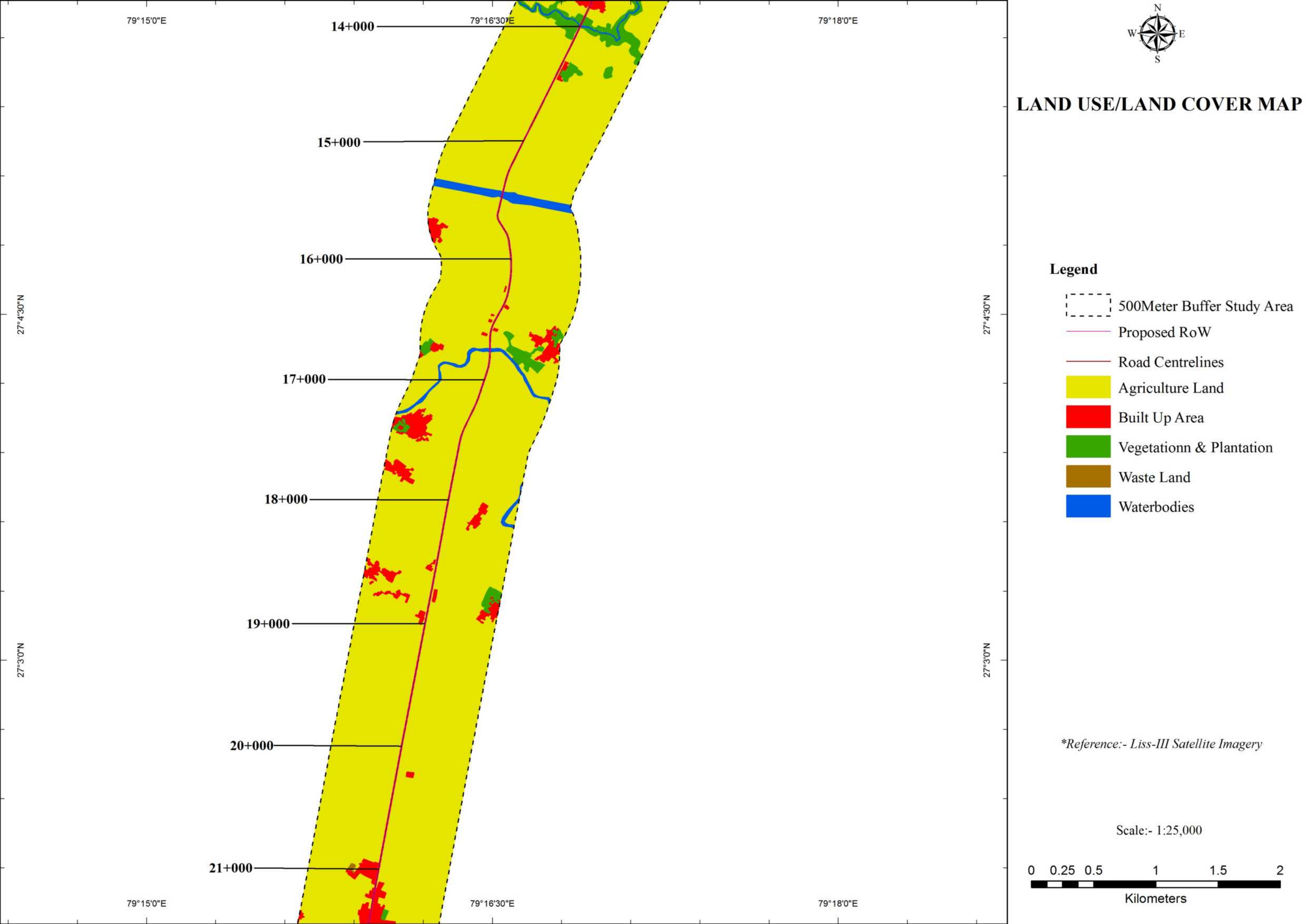
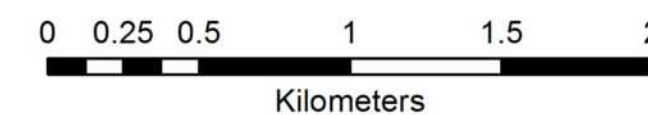
LAND USE/LAND COVER MAP

Legend

-  500Meter Buffer Study Area
-  Proposed RoW
-  Road Centrelines
-  Agriculture Land
-  Built Up Area
-  Vegetationn & Plantation
-  Waste Land
-  Waterbodies

**Reference:- Liss-III Satellite Imagery*

Scale:- 1:25,000





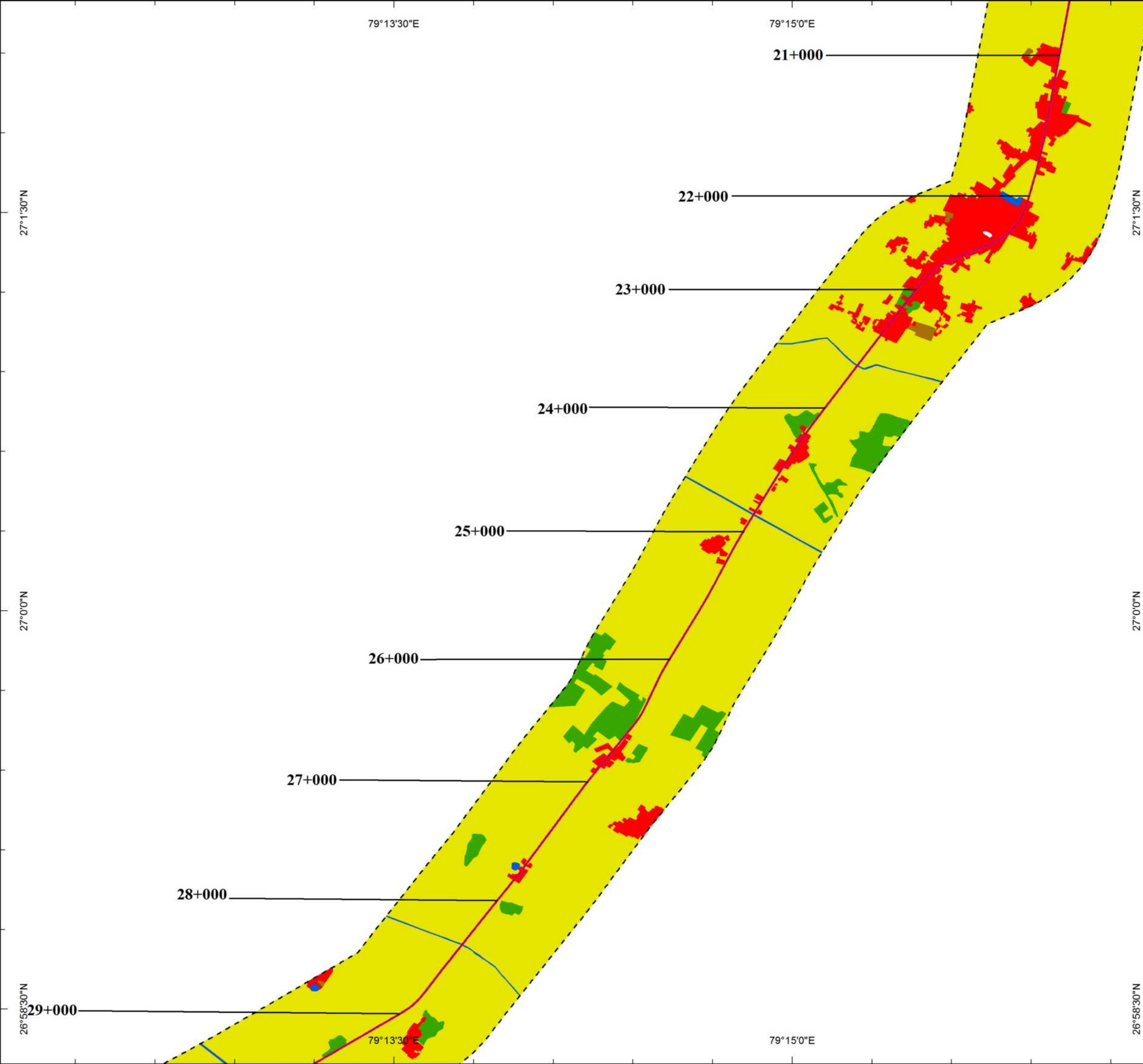
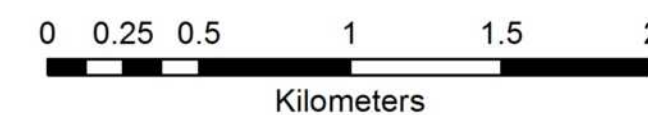
LAND USE/LAND COVER MAP

Legend

- 500Meter Buffer Study Area
- Proposed RoW
- Road Centrelines
- Agriculture Land
- Built Up Area
- Vegetationn & Plantation
- Waste Land
- Waterbodies

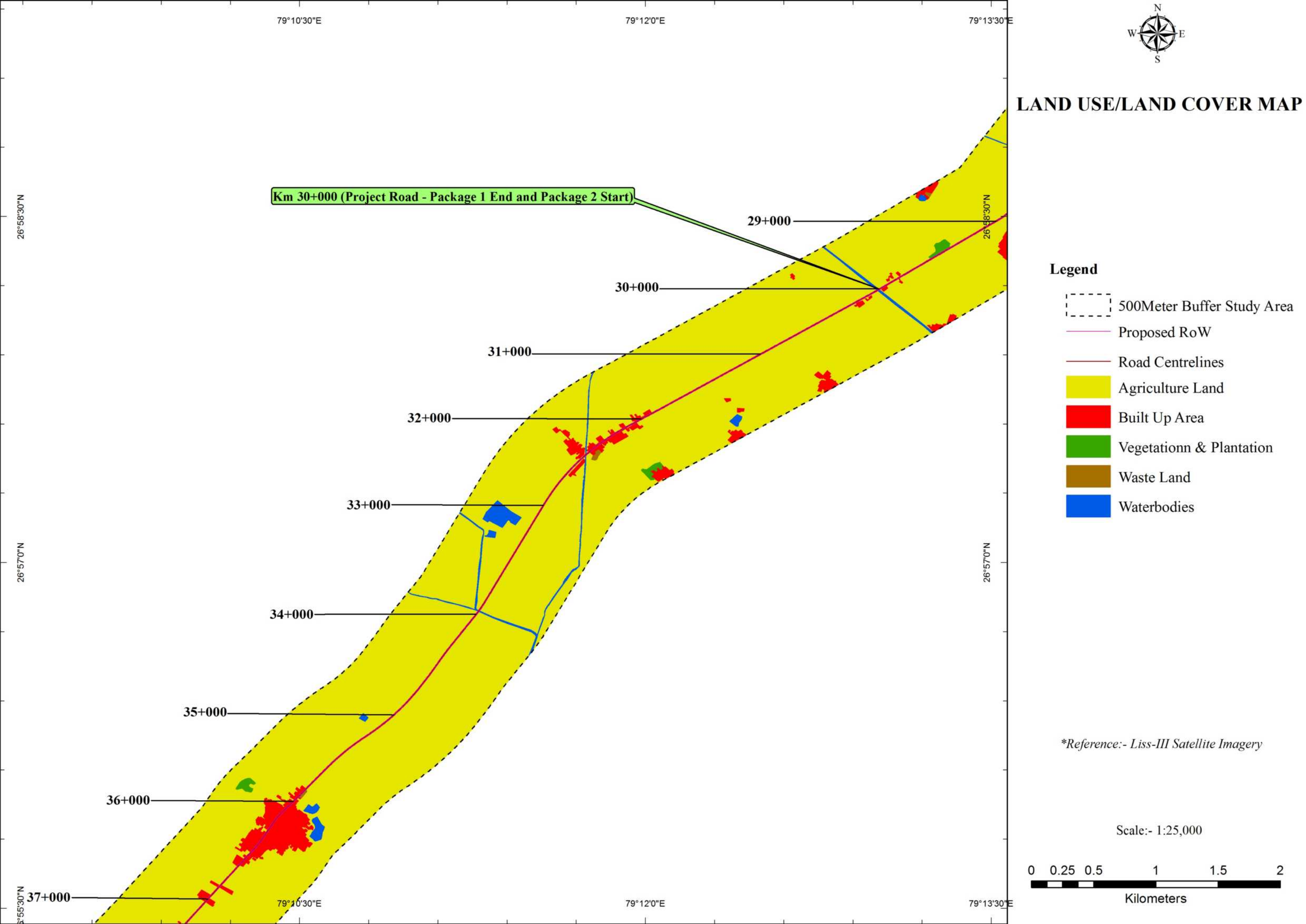
**Reference:- Liss-III Satellite Imagery*

Scale:- 1:25,000





LAND USE/LAND COVER MAP





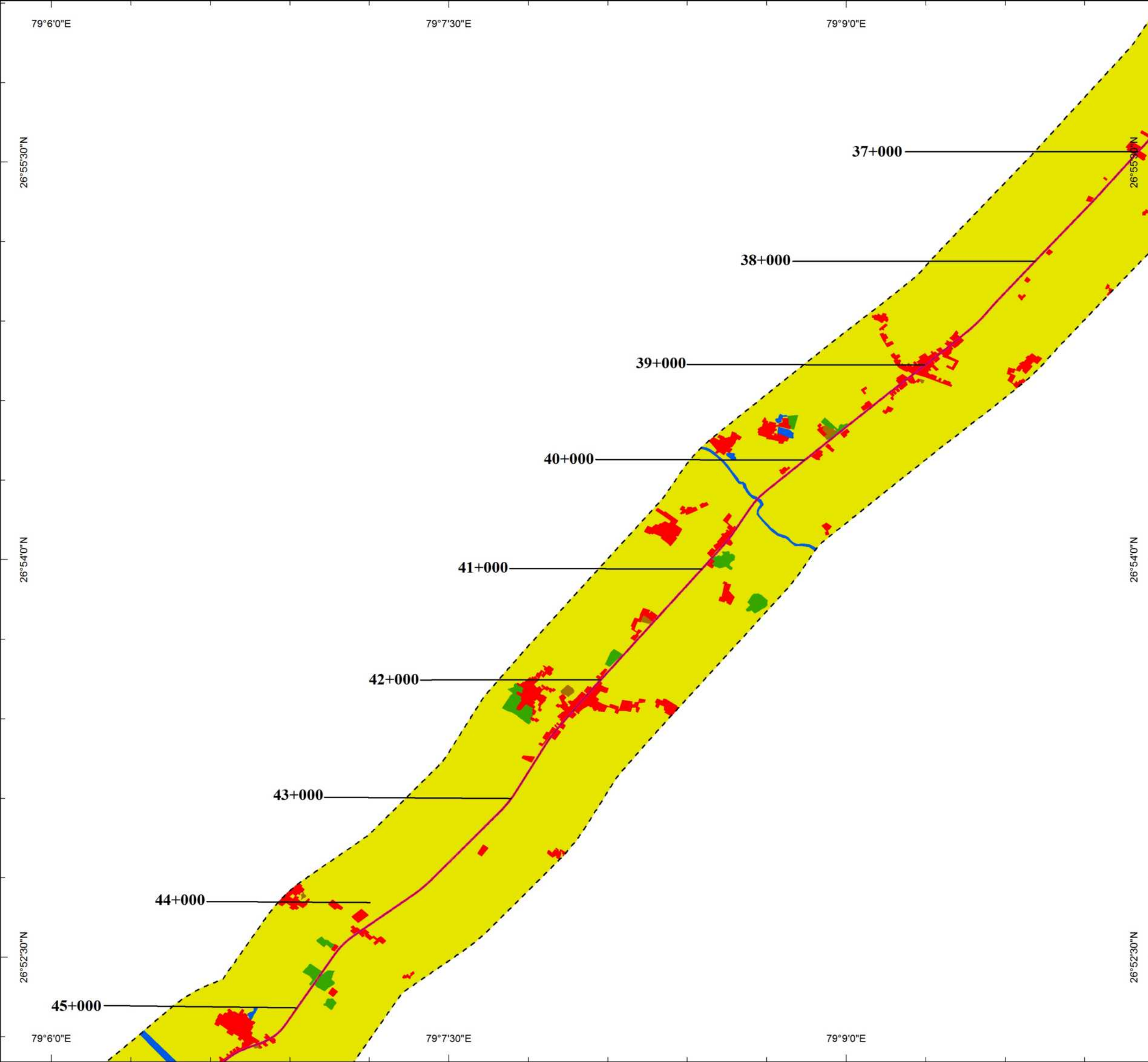
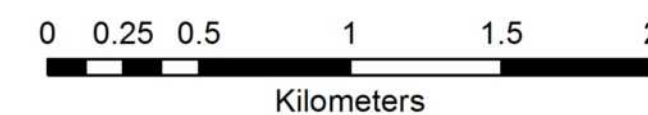
LAND USE/LAND COVER MAP

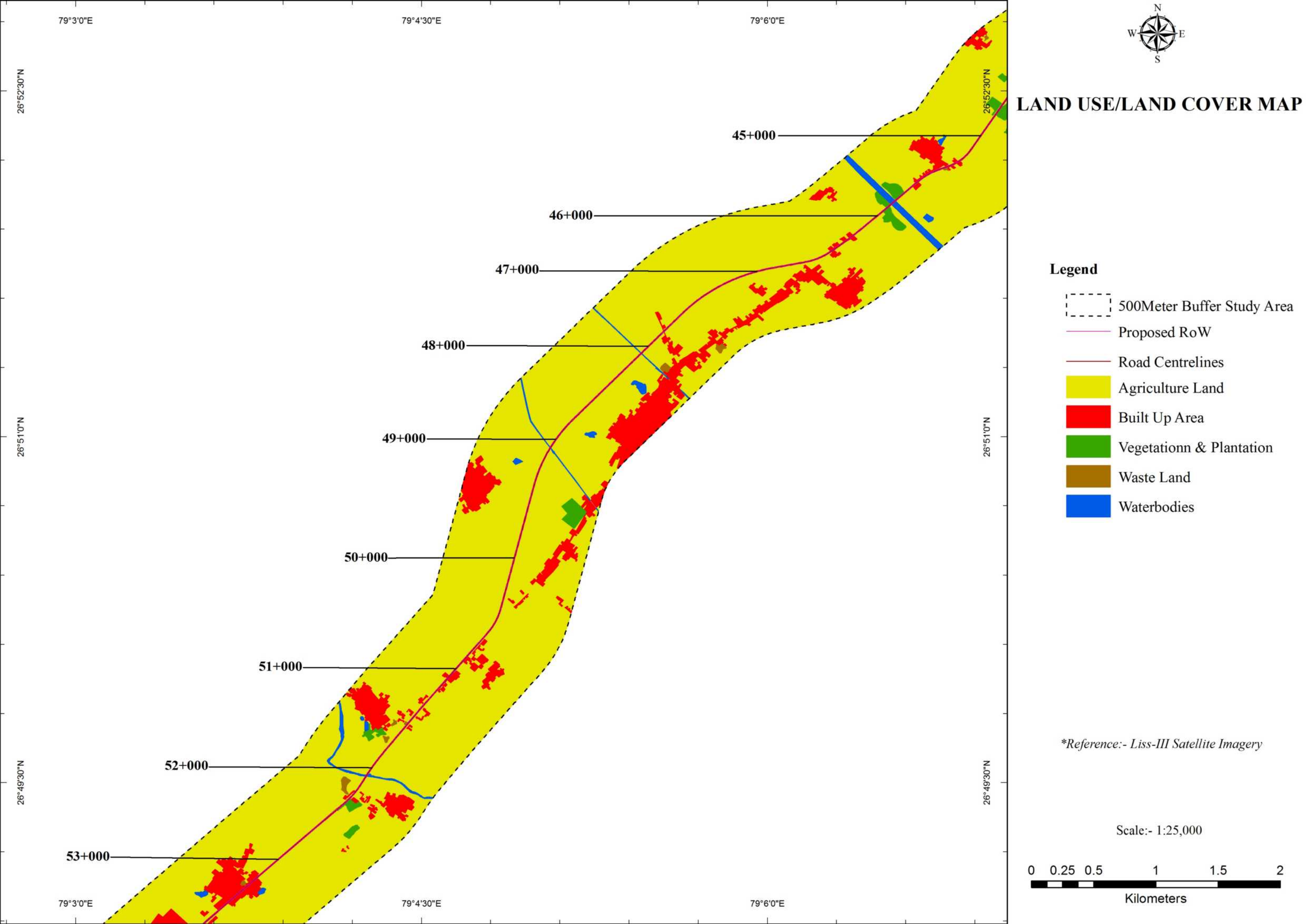
Legend

- 500Meter Buffer Study Area
- Proposed RoW
- Road Centrelines
- Agriculture Land
- Built Up Area
- Vegetationn & Plantation
- Waste Land
- Waterbodies

**Reference:- Liss-III Satellite Imagery*

Scale:- 1:25,000





79°0'0"E

79°1'30"E

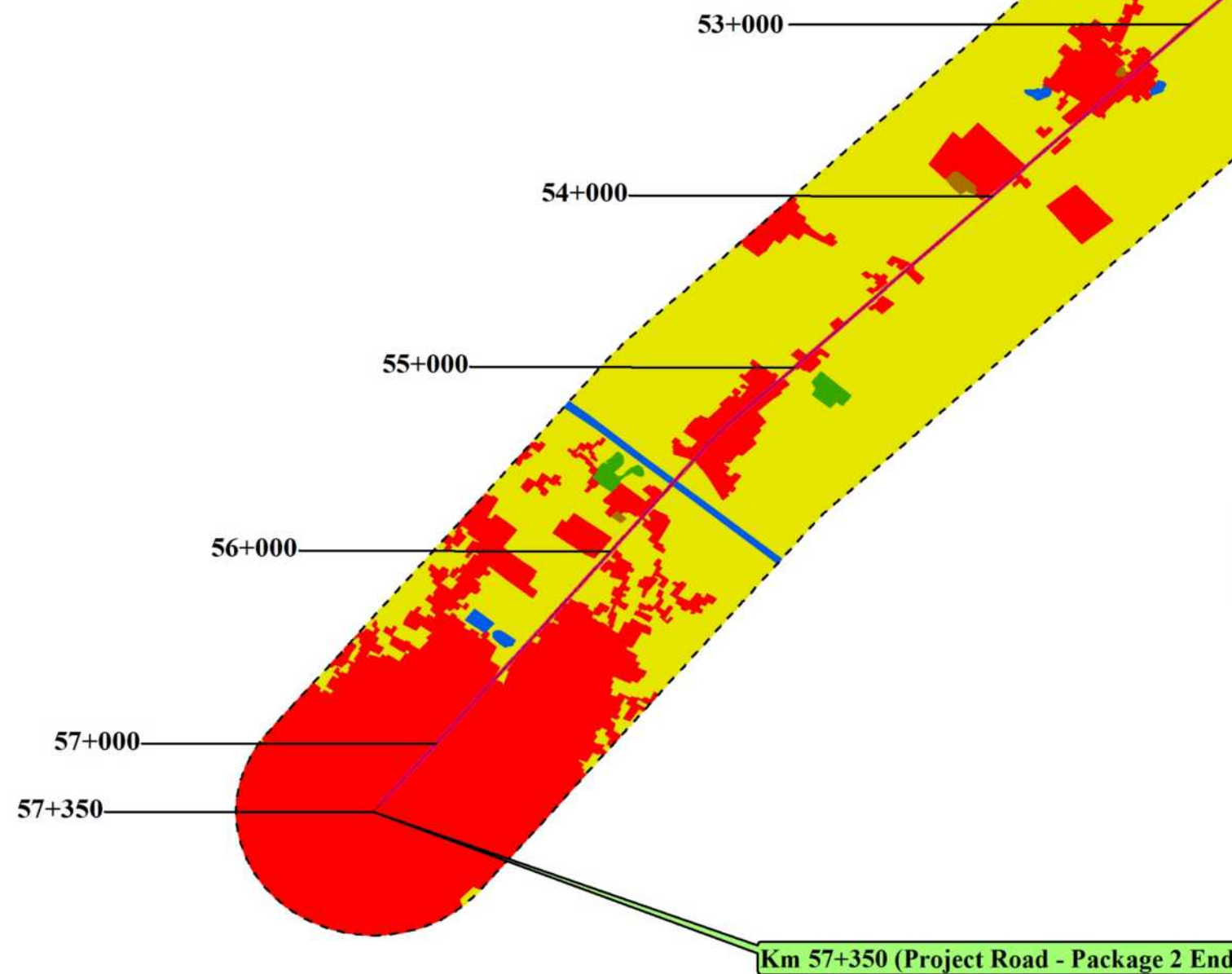
79°3'0"E



LAND USE/LAND COVER MAP

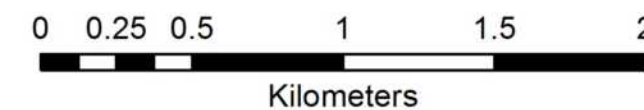
Legend

- 500Meter Buffer Study Area
- Proposed RoW
- Road Centrelines
- Agriculture Land
- Built Up Area
- Vegetationn & Plantation
- Waste Land
- Waterbodies



**Reference:- Liss-III Satellite Imagery*

Scale:- 1:25,000



79°0'0"E

79°1'30"E

79°3'0"E

26°49'30"N

26°48'0"N

26°46'30"N

26°49'30"N

26°48'0"N

26°46'30"N

Annexure 4.3

**Grith Wise Details Trees to be fell
in the Project Road.**

RHS Trees Brief Summary of NH-92 Package 1A												
Sr. No.	Road Side	Chainage	Division	Forest Range	Local Name	Diameter in cm						
						(0-30)	(31-60)	(61-90)	(91-120)	(121-150)	(>150) cm	Total
1	RHS	KM- 0+000 TO 29.100	Mainpuri	Bewar Range	Aam	0	1	0	0	0	2	3
2	RHS		Mainpuri		Arjun	0	1	0	0	0	0	1
3	RHS		Mainpuri		Ashok	0	0	0	1	0	0	1
4	RHS		Mainpuri		Bakayan	0	3	5	1	0	0	9
5	RHS		Mainpuri		Bargad	0	0	0	0	0	1	1
6	RHS		Mainpuri		Kadam	0	0	0	1	0	0	1
7	RHS		Mainpuri		Ber	0	3	0	0	0	0	3
8	RHS		Mainpuri		Chhitvan	0	10	7	4	1	1	23
9	RHS		Mainpuri		Jangal Jalebi	0	0	2	0	1	0	3
10	RHS		Mainpuri		Gold Mohar	0	0	5	5	1	0	11
11	RHS		Mainpuri		Gular	0	0	0	1	0	0	1
12	RHS		Mainpuri		Imli	0	0	0	0	0	1	1
13	RHS		Mainpuri		Jamun	0	0	2	5	8	4	19
14	RHS		Mainpuri		Juli Flora	0	1	2	0	2	0	5
15	RHS		Mainpuri		Kanji	0	5	5	1	0	2	13
16	RHS		Mainpuri		Kesia	0	0	3	3	2	0	8
17	RHS		Mainpuri		Laveda	0	0	2	0	0	0	2
18	RHS		Mainpuri		Neem	1	2	5	3	0	10	21
19	RHS		Mainpuri		Pakhar	0	0	1	2	4	7	14
20	RHS		Mainpuri		Papdi	0	4	6	2	0	2	14
21	RHS		Mainpuri		Peepal	0	0	0	3	0	0	3
22	RHS		Mainpuri		Shaitoot	0	1	4	0	0	8	13
23	RHS		Mainpuri		Sheesham	0	8	8	1	0	0	17
24	RHS		Mainpuri		Siras	0	0	2	1	1	5	9
25	RHS		Mainpuri		Astonia	0	0	1	0	0	0	1
26	RHS		Mainpuri		Aaru	0	0	0	0	0	0	0
27	RHS		Mainpuri		Eucalyptus	0	2	0	0	0	0	2
28	RHS		Mainpuri		Aam	0	0	0	0	0	0	0
29	RHS		Mainpuri		Arjun	0	0	6	4	4	2	16
30	RHS		Mainpuri		Ashok	1	3	0	0	0	0	4
31	RHS		Mainpuri		Bakayan	0	4	1	0	0	0	5
32	RHS		Mainpuri		Balam Kheera	0	0	0	3	0	0	3
33	RHS		Mainpuri		Bargad	0	1	0	1	0	1	3
34	RHS		Mainpuri		Benja Ber	0	1	0	1	0	1	3

35	RHS		Mainpuri		Ber	0	2	1	0	0	0	3
36	RHS		Mainpuri		Botal Brush	0	3	4	0	0	0	7
37	RHS		Mainpuri		Chhitvan	0	3	0	1	0	0	4
38	RHS		Mainpuri		Deshi Babul	0	0	2	2	1	0	5
39	RHS		Mainpuri		Gold Mohar	0	2	1	2	0	0	5
40	RHS		Mainpuri		Gular	0	0	1	0	0	0	1
41	RHS		Mainpuri		Imli	0	0	0	0	0	1	1
42	RHS		Mainpuri	Kisni Range	Jamun	0	4	5	4	3	1	17
43	RHS		Mainpuri		Juli Flora	1	10	4	6	3	0	24
44	RHS		Mainpuri		Kaith	0	0	0	0	0	5	5
45	RHS		Mainpuri		Kanji	5	29	23	18	4	7	86
46	RHS		Mainpuri		Cassia	0	0	0	0	1	25	26
47	RHS		Mainpuri		Neem	0	23	28	18	4	3	76
48	RHS		Mainpuri		Pakhar	0	10	5	9	3	0	27
49	RHS		Mainpuri		Papdi	0	14	12	3	5	7	41
50	RHS		Mainpuri		Peepal	0	1	5	4	1	0	11
51	RHS		Mainpuri		Sagwan	0	0	0	1	0	0	1
52	RHS		Mainpuri		sahjan	0	0	1	0	0	0	1
53	RHS		Mainpuri		Shahtoot	0	1	0	0	0	11	12
54	RHS		Mainpuri		Sheesham	0	29	15	10	7	0	61
55	RHS		Mainpuri		Siris	0	1	7	2	0	0	10
56	RHS		Etawah		Aam	0	0	0	0	0	1	1
57	RHS		Etawah		Arjun	0	0	0	1	0	0	1
58	RHS		Etawah		Pakad	0	0	1	0	0	0	1
59	RHS		Etawah		Gold Mohar	0	1	0	0	0	0	1
60	RHS	KM- 29+100 TO 30.000	Etawah	Sirsai Range	Jamun	0	0	0	2	6	25	33
61	RHS		Etawah		Kanji	0	2	1	1	2	2	8
62	RHS		Etawah		Kesiya	0	0	0	2	0	0	2
63	RHS		Etawah		Laveda	0	0	1	0	0	0	1
64	RHS		Etawah		Sheesham	0	5	0	0	0	2	7
				Total		8	190	184	129	64	137	712

LHS Trees Brief Summary of NH-92 Package 1A												
Sr. No.	Road Side	Chainage	Division	Forest Range	Local Name	Diameter in cm						
						(0-30)	(31-60)	(61-90)	(91-120)	(121-150)	(>150) cm	Total
1	LHS	KM- 0+000 TO 29.100	Mainpuri	Bewar Range	Aam	0	1	0	0	0	0	1
2	LHS		Mainpuri		Arjun	0	1	0	0	0	1	2
3	LHS		Mainpuri		Ashok	0	0	0	1	0	0	1
4	LHS		Mainpuri		Bakayan	0	3	5	1	0	0	9
5	LHS		Mainpuri		Bargad	0	0	0	0	0	1	1
6	LHS		Mainpuri		Kadam	0	0	0	1	0	0	1
7	LHS		Mainpuri		Ber	0	3	0	0	0	0	3
8	LHS		Mainpuri		Chhitvan	0	10	7	4	1	1	23
9	LHS		Mainpuri		Jangal Jalebi	0	0	2	0	1	0	3
10	LHS		Mainpuri		Gold Mohar	0	0	5	5	1	0	11
11	LHS		Mainpuri		Gular	0	0	0	1	0	1	2
12	LHS		Mainpuri		Imli	0	0	0	0	0	1	1
13	LHS		Mainpuri		Jamun	0	0	2	5	8	2	17
14	LHS		Mainpuri		Juli Flora	0	1	2	0	2	0	5
15	LHS		Mainpuri		Kanji	0	5	5	1	0	0	11
16	LHS		Mainpuri		Kesia	0	0	3	3	2	0	8
17	LHS		Mainpuri		Laveda	0	0	2	0	0	0	2
18	LHS		Mainpuri		Neem	1	2	5	3	0	7	18
19	LHS		Mainpuri		Pakhar	0	0	1	2	4	5	12
20	LHS		Mainpuri		Papdi	0	4	6	2	0	1	13
21	LHS		Mainpuri		Peepal	0	0	0	3	0	3	6
22	LHS		Mainpuri		Shaitoot	0	1	4	0	0	0	5
23	LHS		Mainpuri		Sheesham	0	8	8	1	0	3	20
24	LHS		Mainpuri		Siras	0	0	2	1	1	0	4
25	LHS		Mainpuri		Astonia	0	0	1	0	0	0	1
26	LHS		Mainpuri		Aaru	0	0	0	0	0	2	2
27	LHS		Mainpuri		Aam	0	0	0	0	0	1	1
28	LHS		Mainpuri		Arjun	0	0	6	4	4	1	15
29	LHS		Mainpuri		Ashok	1	3	0	0	0	0	4
30	LHS		Mainpuri		Bakayan	0	4	1	0	0	0	5
31	LHS		Mainpuri		Balam Kheera	0	0	0	3	0	0	3
32	LHS		Mainpuri		Bargad	0	1	0	1	0	0	2
33	LHS		Mainpuri		Benja Ber	0	1	0	1	0	0	2
34	LHS		Mainpuri		Ber	0	2	1	0	0	0	3

35	LHS		Mainpuri		Botal Brush	0	3	4	0	0	0	7
36	LHS		Mainpuri		Chhitvan	0	3	0	1	0	1	5
37	LHS		Mainpuri		Deshi Babul	0	0	2	2	1	1	6
38	LHS		Mainpuri		Gold Mohar	0	2	1	2	0	0	5
39	LHS		Mainpuri		Gular	0	0	1	0	0	0	1
40	LHS		Mainpuri		Imli	0	0	0	0	0	1	1
41	LHS		Mainpuri	Kisni Range	Jamun	0	4	5	4	3	3	19
42	LHS		Mainpuri		Juli Flora	1	10	4	6	3	5	29
43	LHS		Mainpuri		Kaith	0	0	0	0	0	1	1
44	LHS		Mainpuri		Kanji	5	29	23	18	4	8	87
45	LHS		Mainpuri		Cassia	0	0	0	0	1	0	1
46	LHS		Mainpuri		Neem	0	23	28	18	4	28	101
47	LHS		Mainpuri		Pakhar	0	10	5	9	3	10	37
48	LHS		Mainpuri		Papdi	0	14	12	3	5	1	35
49	LHS		Mainpuri		Peepal	0	1	5	4	1	6	17
50	LHS		Mainpuri		Sagwan	0	0	0	1	0	0	1
51	LHS		Mainpuri		sahjan	0	0	1	0	0	0	1
52	LHS		Mainpuri		Shahtoot	0	1	0	0	0	0	1
53	LHS		Mainpuri		Sheesham	0	29	15	10	7	8	69
54	LHS		Mainpuri		Siris	0	1	7	2	0	1	11
54	LHS		Mainpuri		Eucalyptus	1	1	0	0	0	0	2
55	LHS	KM- 29+100 TO 30.000	Etawah	Sirsai Range	Jamun	0	0	0	4	5	17	26
56	LHS		Etawah		Kanji	0	2	0	3	4	5	14
57	LHS		Etawah		Kesiya	0	0	0	0	2	0	2
58	LHS		Etawah		Sheesham	0	2	0	0	0	1	3
				Total		9	185	181	130	67	127	699

RHS Trees Brief Summary of NH-92 Package 1B												
Sr. No.	Road Side	Chainage	Division	Forest Range	Local Name	Diameter in cm						
						(0-30)	(31-60)	(61-90)	(91-120)	(121-150)	(>150) cm	Total
1	RHS	KM- 30+000 TO 33.000	Etawah	Sirsai	Ber	0	0	1	0	0	0	1
2	RHS		Etawah		Jamun	0	0	0	1	0	5	6
3	RHS		Etawah		Juli Flora	0	0	1	1	0	0	2
4	RHS		Etawah		Kanji	5	18	3	0	0	2	28
5	RHS		Etawah		Neem	0	2	0	2	0	0	4
6	RHS		Etawah		Papdi	0	0	2	1	0	0	3
7	RHS		Etawah		Sheesham	0	0	0	2	1	2	5
8	RHS	km- 34+000 to 38+000	Etawah		Arjun	0	0	2	0	0	0	2
9	RHS		Etawah		Babul	0	9	2	0	0	0	11
10	RHS		Etawah		Bargad	0	0	1	0	1	0	2
11	RHS		Etawah		Ber	1	0	0	0	0	0	1
12	RHS		Etawah		Deshi Babul	0	26	18	3	0	0	47
13	RHS		Etawah		Jamun	0	1	1	1	0	4	7
14	RHS		Etawah		Juli Flora	5	47	16	2	0	0	70
15	RHS		Etawah		Kanji	6	30	0	0	0	4	40
16	RHS		Etawah		Lameda	0	1	0	0	0	0	1
17	RHS		Etawah		Neem	1	3	1	1	3	1	10
18	RHS		Etawah		Pakhar	0	1	0	1	0	0	2
19	RHS		Etawah		Pipal	0	0	1	0	1	1	3
20	RHS		Etawah		Shahtoot	0	0	1	0	0	0	1
21	RHS		Etawah		Sheesham	0	6	3	0	1	8	18
22	RHS		Etawah		So Babul	0	4	0	0	0	0	4
23	RHS	KM- 39+000 TO 43+000	Etawah		Babul	0	1	0	0	0	0	1
24	RHS		Etawah		Bargad	0	0	1	0	1	0	2
25	RHS		Etawah		Ber	0	2	0	0	0	0	2
26	RHS		Etawah		Deshi Babul	0	0	3	1	0	0	4
27	RHS		Etawah		Gold Mohar	0	0	1	0	1	0	2
28	RHS		Etawah		Imli	1	0	0	0	0	0	1
29	RHS		Etawah		Jamun	0	0	1	1	2	6	10
30	RHS		Etawah		Jungle Jalebi	0	0	0	1	0	0	1
31	RHS		Etawah		Kadam	0	1	0	0	2	15	18
32	RHS		Etawah		Kanji	0	9	1	0	0	1	11
33	RHS		Etawah		Mahua	0	0	0	0	0	1	1

34	RHS	KM- 44+000 TO 48+000	Etawah
35	RHS		Etawah
36	RHS		Etawah
37	RHS		Etawah
38	RHS		Etawah
39	RHS		Etawah
40	RHS		Etawah
41	RHS		Etawah
42	RHS		Etawah
43	RHS		Etawah
44	RHS		Etawah
45	RHS		Etawah
46	RHS		Etawah
47	RHS		Etawah
48	RHS		Etawah
49	RHS		Etawah
50	RHS		Etawah
51	RHS		Etawah
52	RHS		Etawah
53	RHS		Etawah
54	RHS		Etawah
55	RHS		Etawah
56	RHS		Etawah
57	RHS		Etawah
58	RHS		Etawah
59	RHS	KM- 49+000 TO 53+000	Etawah
60	RHS		Etawah
61	RHS		Etawah
62	RHS		Etawah
63	RHS		Etawah
64	RHS		Etawah
65	RHS		Etawah
66	RHS		Etawah
67	RHS		Etawah
68	RHS		Etawah
69	RHS		Etawah

Basrehar

Neem	0	4	1	2	1	7	15
Pakhar	0	0	0	2	2	4	8
Papdi	0	0	0	1	0	0	1
Pipal	0	0	1	0	0	0	1
Sheesham	2	26	5	0	1	11	45
Sholems	0	0	1	0	1	0	2
So Babul	0	1	0	0	0	0	1
Aam	0	0	0	0	1	1	2
Arjun	0	0	0	0	1	0	1
Bakayan	0	3	3	3	3	1	13
Ber	0	1	0	0	0	0	1
Deshi Babul	0	0	2	1	1	0	4
Gold Mohar	0	0	0	1	0	0	1
Gular	0	0	0	0	0	1	1
Jamun	0	1	3	3	3	34	44
Juli Flora	0	0	1	0	0	1	2
Kadam	0	0	1	1	0	0	2
Kanji	0	2	2	0	0	1	5
Kesiya	0	0	0	1	1	0	2
Mahua	0	0	0	0	0	1	1
Neem	1	3	4	3	2	3	16
Pakhar	0	0	2	0	0	3	5
Papdi	0	0	1	0	0	0	1
Pipal	0	0	0	0	0	8	8
Sheesham	2	7	4	5	7	26	51
Aajua	0	0	0	0	0	1	1
Aam	0	0	0	0	0	1	1
arjun (t.g.)	3	0	0	0	0	0	3
Bakayan	0	0	0	1	1	1	3
Ber	0	2	0	0	0	0	2
Chhitvan	0	0	0	1	0	0	1
Chhitvan (Tree Gaurd)	0	1	0	0	0	0	1
Deshi Babul	0	0	1	0	0	0	1
Eucalyptus	0	0	0	0	1	0	1
Gold Mohar	0	0	0	0	1	0	1
Gular	0	0	1	0	0	0	1

70	RHS	KM- 49+000 TO 53+000	Etawah	Total	Jamun	0	0	0	0	0	1	1
71	RHS		Etawah		Juli Flora	0	0	2	2	2	0	6
72	RHS		Etawah		kanji (tree gaurd)	16	1	0	0	0	0	17
73	RHS		Etawah		Kesiya	0	2	3	5	6	2	18
74	RHS		Etawah		laveda	0	0	1	0	0	0	1
75	RHS		Etawah		Neem	0	2	4	2	2	2	12
76	RHS		Etawah		pakhar (t.g.)	4	1	1	0	0	0	6
77	RHS		Etawah		Papdi	1	5	4	0	0	0	10
78	RHS		Etawah		Pipal	0	0	0	0	0	2	2
79	RHS		Etawah		Sheesham	5	17	5	2	1	3	33
80	RHS		Etawah		Siras	0	0	0	1	1	1	3
81	RHS	KM- 54+000 TO 57.346	Etawah		kanji	0	0	0	11	2	0	13
82	RHS		Etawah		Arjun	0	0	1	1	2	0	4
83	RHS		Etawah		ashok	0	0	2	2	0	0	4
84	RHS		Etawah		Bakayan	0	0	1	0	0	0	1
85	RHS		Etawah		bargad	0	0	0	0	0	1	1
86	RHS		Etawah		Bel Jamun	0	0	1	0	0	0	1
87	RHS		Etawah		Chhitvan	1	0	6	3	0	0	10
88	RHS		Etawah		Eucalyptus	0	0	0	1	0	1	2
89	RHS		Etawah		farenda	0	0	0	0	0	1	1
90	RHS		Etawah		Gold Mohar	0	0	1	2	1	0	4
91	RHS		Etawah		Gular	0	1	1	2	0	0	4
92	RHS		Etawah		Jamun	0	0	3	4	3	28	38
93	RHS		Etawah		Juli Flora	0	0	1	0	0	1	2
94	RHS		Etawah		kadam	0	1	1	0	0	0	2
95	RHS		Etawah		kanji	0	0	0	1	0	0	1
96	RHS		Etawah		Kesiya	0	1	1	3	2	0	7
97	RHS		Etawah		laila majnu	0	1	2	0	0	0	3
98	RHS		Etawah		Neem	1	0	1	2	2	4	10
99	RHS		Etawah		Pakhar	0	4	3	0	0	2	9
100	RHS		Etawah		Pipal	0	0	0	1	0	2	3
101	RHS		Etawah		Sheesham	0	1	2	1	6	7	17
102	RHS		Etawah		siras	0	1	0	0	0	0	1
103	RHS		Etawah		So Babul	0	0	2	0	0	0	2
						55	250	142	89	70	213	819

LHS Trees Brief Summary of NH-92 Package 1B												
Sr. No.	Road Side	Chainage	Division	Forest Range	Local Name	Diameter in cm						
						(0-30)	(31-60)	(61-90)	(91-120)	(121-150)	(>150) cm	Total
1	LHS	KM- 30+000 TO 33.000	Etawah	Sirsai	Arjun	0	0	3	1	0	0	4
2	LHS		Etawah		Deshi Babul	0	0	1	0	1	0	2
3	LHS		Etawah		Jamun	0	0	0	0	0	17	17
4	LHS		Etawah		Juli Flora	0	2	1	0	0	0	3
5	LHS		Etawah		Kanji	0	4	0	0	0	0	4
6	LHS		Etawah		Kesiya	0	0	1	7	12	1	21
7	LHS		Etawah		Neem	1	0	2	0	0	0	3
8	LHS		Etawah		Sheesham	0	1	1	0	1	0	3
9	LHS		Etawah		SO Babul	0	1	0	0	0	0	1
10	LHS		Etawah		Mahua	0	0	0	0	1	0	1
11	LHS	km- 33+000 to 38+000	Etawah		Arjun	0	2	0	0	0	0	2
12	LHS		Etawah		Bakaan	0	0	1	0	0	0	1
13	LHS		Etawah		Ber	1	2	0	0	0	0	3
14	LHS		Etawah		Deshi Babul	2	41	23	3	0	0	69
15	LHS		Etawah		Gold Moher	1	0	0	0	0	0	1
16	LHS		Etawah		Imali	0	0	0	0	0	1	1
17	LHS		Etawah		Jamun	0	3	2	1	3	5	14
18	LHS		Etawah		Juli Flora	1	26	13	0	0	0	40
19	LHS		Etawah		Kanji	3	9	3	1	0	0	16
20	LHS		Etawah		Neem	1	4	1	4	3	0	13
21	LHS		Etawah		Pakhar	0	0	0	3	1	2	6
22	LHS		Etawah		Papdi	0	1	0	0	0	0	1
23	LHS		Etawah		Peepal	0	0	0	0	0	2	2
24	LHS		Etawah		Shaileks	0	0	0	0	1	0	1
25	LHS		Etawah		Sheesham	0	8	2	0	1	2	13
26	LHS		Etawah		So Babul	0	1	0	0	0	0	1
27	LHS		Etawah		Aaduaa	0	0	0	3	0	0	3
28	LHS		Etawah		Aam	0	1	0	0	0	1	2
29	LHS		Etawah		Arjun	0	1	1	0	0	2	4
30	LHS		Etawah		Babul	0	0	0	0	0	1	1
31	LHS		Etawah		Ber	0	0	0	0	1	0	1
32	LHS		Etawah		Deshi Babul	0	6	8	3	2	0	19
33	LHS		Etawah		Farenda	0	0	0	0	0	2	2

34	LHS	KM- 39+000 TO 43+000	Etawah
35	LHS		Etawah
36	LHS		Etawah
37	LHS		Etawah
38	LHS		Etawah
39	LHS		Etawah
40	LHS		Etawah
41	LHS		Etawah
42	LHS		Etawah
43	LHS		Etawah
44	LHS		Etawah
45	LHS		Etawah
46	LHS		Etawah
47	LHS		Etawah
48	LHS	KM- 44+000 TO 48+000	Etawah
49	LHS		Etawah
50	LHS		Etawah
51	LHS		Etawah
52	LHS		Etawah
53	LHS		Etawah
54	LHS		Etawah
55	LHS		Etawah
56	LHS		Etawah
57	LHS		Etawah
58	LHS		Etawah
59	LHS		Etawah
60	LHS		Etawah
61	LHS		Etawah
62	LHS		Etawah
63	LHS		Etawah
64	LHS		Etawah
65	LHS		Etawah
66	LHS		Etawah
67	LHS		Etawah
68	LHS		Etawah
69	LHS		Etawah
70	LHS		Etawah

Basrehar

Gold Moher	0	1	0	0	0	0	1
Jamun	0	7	4	0	1	10	22
Juli Flora	0	4	0	2	1	1	8
Kadam	4	6	0	1	2	16	29
Kanji	2	17	1	2	3	0	25
Labeda	0	0	1	0	0	0	1
Mahua	0	0	0	0	0	2	2
Neem	0	3	9	6	0	3	21
Pakhar	0	1	0	1	2	5	9
Papdi	0	3	1	0	0	0	4
Pipal	0	0	0	0	1	2	3
Sheesham	5	39	14	1	1	15	75
shetus	0	0	0	1	0	0	1
Siras	0	0	0	2	1	0	3
Aaduaa	0	0	0	0	0	1	1
Bakayan	0	1	1	1	0	1	4
Ber	0	0	0	1	0	0	1
Chhitvan	0	0	1	0	0	0	1
Deshi Babul	0	0	0	1	0	0	1
Eucalyptus	0	0	0	1	0	0	1
Gold Moher	0	0	0	2	0	4	6
Gular	0	0	1	0	0	0	1
Jamun	0	0	5	3	1	23	32
Juli Flora	0	0	2	0	1	0	3
Kadam	2	4	0	1	0	0	7
Kanji	0	5	0	2	2	2	11
Kesiya	0	0	3	1	3	5	12
kunji	0	0	1	0	0	0	1
Laveda	0	0	0	1	0	0	1
Neem	0	3	0	6	3	5	17
Pakhar	0	0	1	0	0	0	1
Pipal	0	0	0	0	0	3	3
Sheesham	1	1	3	3	0	7	15
shetus	0	0	1	0	0	0	1
shish	0	1	0	0	0	0	1
So Babul	0	0	1	0	0	0	1
Arjun	0	0	0	0	1	0	1

71	LHS	KM- 49+000 TO 53+000	Etawah
72	LHS		Etawah
73	LHS		Etawah
74	LHS		Etawah
75	LHS		Etawah
76	LHS		Etawah
77	LHS		Etawah
78	LHS		Etawah
79	LHS		Etawah
80	LHS		Etawah
81	LHS		Etawah
82	LHS		Etawah
83	LHS		Etawah
84	LHS		Etawah
85	LHS		Etawah
86	LHS		Etawah
87	LHS		Etawah
88	LHS		Etawah
89	LHS		Etawah
90	LHS		Etawah
91	LHS		Etawah
92	LHS	KM- 54+000 TO 57.346	Etawah
93	LHS		Etawah
94	LHS		Etawah
95	LHS		Etawah
96	LHS		Etawah
97	LHS		Etawah
98	LHS		Etawah
99	LHS		Etawah
100	LHS		Etawah
101	LHS		Etawah
102	LHS		Etawah
103	LHS		Etawah
104	LHS		Etawah
105	LHS		Etawah
106	LHS		Etawah

Bakayan	0	1	0	1	0	0	2
Balam Khira (Tree Gaurd)	0	1	0	0	0	0	1
Bargad	0	0	0	0	0	1	1
Ber	0	0	0	1	0	0	1
Chhitvan	0	1	1	0	0	0	2
Deshi Babul	0	1	0	0	0	0	1
Gold Moher	0	0	1	1	0	1	3
Gular	0	0	2	1	0	1	4
Jamun	0	0	0	0	0	1	1
Juli Flora	0	1	0	1	2	0	4
Kanji	3	1	2	4	4	3	17
Kanji (Tree Gaurd)	20	12	0	0	0	0	32
Kesiya	0	1	2	10	26	5	44
kunj	0	0	0	3	0	0	3
Neem	1	1	0	0	1	4	7
Pakhar	0	0	0	0	0	1	1
Pakhar (Tree Gaurd)	1	0	0	0	0	0	1
Papdi	3	5	2	0	0	0	10
Papdi (Tree Gaurd)	1	0	0	0	0	0	1
Sheesham	0	12	4	2	2	6	26
Eucalyptus	0	0	0	0	3	10	13
Arjun	0	0	2	2	1	2	7
aruaa	0	0	0	0	0	2	2
Ashok	1	0	1	0	0	0	2
Bargad	0	0	0	0	0	1	1
Bel Jamun	0	0	1	0	0	0	1
ber	0	4	0	0	0	0	4
Chhitvan	0	4	5	1	0	0	10
Gular	0	2	0	2	1	1	6
imali	0	0	0	1	0	0	1
Jamun	0	3	2	4	8	21	38
Juli Flora	0	0	0	0	1	1	2
kanji	0	1	1	1	1	0	4
Kesiya	0	0	3	0	1	0	4
Neem	2	0	5	4	1	1	13
pakhar	0	0	2	3	1	1	7

107	LHS		Etawah		Pipal	0	0	1	0	0	1	2
108	LHS		Etawah		shaitut	0	2	0	0	0	0	2
109	LHS		Etawah		Sheesham	1	2	1	0	0	8	12
110	LHS		Etawah		Siras	0	0	2	1	0	0	3
111	LHS		Etawah		Eucalyptus	0	0	4	0	0	0	4
				Total		57	264	157	108	103	213	902

Attendance Sheet of Public Consultation Meeting

Name of the Project: Bower to Etawah section-(NH-92)

District	Meerut			
Village	Bower			
Place	Bower			
Date	10/12/2020			
Time	11:00 AM			
S. No.	Name of the Participant	Age	Gender	Signature
1	मोहित कुमार	35	मेल	Mohit Kumar
2	अमित कुमार	38	Male	अमित कुमार
3	तेजपाल शर्मा	30	"	तेजपाल
4	रामवन्धपुर	37	"	रामवन्धपुर
5	राजेश्वर गुप्ता	29	"	राजेश्वर गुप्ता
6	मोह रज़ी अहमद	35	"	Razi Ahmad.
7	रामेश्वर	33	"	रामेश्वर
8	पुष्प कुमार	26	"	पुष्प कुमार
9	पुष्प पाल शाह	32	"	पुष्प पाल शाह
10	मुनेन्द्र कुमार	38	"	मुनेन्द्र कुमार
11	रामेश्वर पांडव	42	"	रामेश्वर पांडव
12	महेन्द्र पांडव	39	"	महेन्द्र पांडव
13	पुष्प पांडव	46	"	Pushpal Pandav
14	मोहनी शर्मा	38	"	मोहनी शर्मा
15	कासना	49	"	कासना
16	अश्विन कुमार	47	"	अश्विन
17	शिवान शर्मा पांडव	52	"	शिवान शर्मा पांडव
18	मुमित कुमार	50	"	मुमित कुमार
19				
20				

Attendance Sheet of Public Consultation Meeting
Name of the Project: Bower to Etawah section-(NH-92)

District	Mainpuri			
Village	Kishni			
Place	Kishni			
Date	08/01/21			
Time	09:00 PM			
S. No.	Name of the Participant	Age	Gender	Signature
1	समीम खे	36	Male	
2	नवल किशोर	28	"	
3	नवीन यादव	24	"	
4	पुनोद यादव	42	"	
5	राजेश्वर जेठवा	54	"	
6	मुनीम राठी	27	"	
7	गुलाम सादत	36	"	
8	राम मनोहर प्रजापती	28	"	
9	नीलेश कुमार	47	"	
10	भारविंद कुमार	52	"	
11	भारविंद शर्मा वर्मा	39	"	
12	राममोहन राठी	34	"	
13	रामजीवन यादव	44	"	
14	शिवेंद्र सिंह	36	"	
15	मोहित मिश्रा	49	"	
16	राजीव कुमार कुशवाहा	42	"	
17	रामनाथ	28	"	
18	अनिल सिंह	39	"	
19	नीलेश अग्निवेश	36	"	
20				

Attendance Sheet of Public Consultation Meeting

Name of the Project: Bower to Etawah section-(NH-92)

District	Mainpuri			
Village	Kusumara			
Place	Kusumara			
Date	11/01/2021			
Time				
S. No.	Name of the Participant	Age	Gender	Signature
1	शम्भुवर	40	Male	शम्भुवर
2	शजवीर पाल	35	"	शजवीर पाल
3	नन्दि रवीर	30	"	नन्दि रवीर
4	रतन गंगवार	60	"	रतन गंगवार
5	अर्जुन यादव	58	"	अर्जुन यादव
6	वीरपाल यादव	25	"	Veerpall yadav
7	पुनमिर्षा कुमारी	28	"	पुनमिर्षा कुमारी
8	गजराज शर्मा	35	"	गजराज शर्मा
9	समेश्वर सिंह	38	"	समेश्वर सिंह
10	मुनेश कुमार सिंह	28	"	मुनेश कुमार सिंह
11	मोहित पाल	40	"	मोहित पाल
12	नरेश	30	"	नरेश
13	राहुल कश्यप	24	"	राहुल कश्यप
14	मोहित मिश्रा	25	"	मोहित मिश्रा
15	सोनी श्रीवास्तव	37	"	सोनी श्रीवास्तव
16	पुनमिर्षा कुमारी	40	"	पुनमिर्षा कुमारी
17	कमलेश शर्मा	24	"	कमलेश शर्मा
18	संजय ठाकुर	29	"	संजय ठाकुर
19	संतोष	30	"	Santosh
20	संतोष	36	"	संतोष

Attendance Sheet of Public Consultation Meeting

Name of the Project: Bewer to Etawah section-(NH-92)

District Etawah

Village

Place Etawah

Date 18/01/2021

Time 12:00 PM

S. No.	Name of the Participant	Age	Gender	Signature
1	तेजराज	45	Male	तेजराज
2	पटेलराज	63	"	पटेलराज
3	मो० ललीत लॉ	38	"	ललीत लॉ
4	मो० नफीस लॉ	40	"	नफीस लॉ
5	सोनपाल	60	"	सोनपाल
6	वेचेलाल पात्र	55	"	वेचेलाल पात्र
7	नरेश शर्मा	39	"	Narasharma
8	शशिभूषण शर्मा	30	"	Shashibhushan
9	शशीम कुमार मिश्रा	26	"	Shashimishra
10	राजू कर्णिक	40	"	Raju
11	उमराज प्रजापती	30	"	Umaraj
12	मो० दामिस	25	"	मो० दामिस
13	हरीश कुमार	28	"	Harish Kumar
14	सुनील गुप्ता	60	"	Sunil Gupta
15	पंकज मिश्रा	25	"	Pankaj
16	पुष्कर द्विवेदी	28	"	Pushkar Dwivedi
17	शिवानन्द द्विवेदी	30	"	Shivannand
18	राजेश्वर सिंह	35	"	Rajeshwar Singh
19	अमित कुमार सिंह	29	"	Amit Kumar
20	रोहित	24	"	Rohit

Attendance Sheet of Public Consultation Meeting

Name of the Project: Rehabilitation and Up-gradation to 2 Lane with shoulder Bawer-Karri-Etahwa section under Green National Highways Corridor Project (GNHCP) of NH-92 from Km 0.000 to km 57.346 in the State of Uttar Pradesh.

District:	Mainpuri			Date:	06/03/2021	
Village:	Kusmura			Time:	12:00	
Tehsil:	Kishani			Place of Meeting:	G.P. market	
Municipal Area/Block:	Kusmura			Chainage/KM:	11-12	
S. No.	Name of the Participant	Age	Gender	Occupation	Contact Details	Signature
1	अशीष मिश्रा	21	Male	Student	9105743070	Ashish
2	शिवर मिश्रा	18	Male	"	7417644001	Shivhar Mishra
3	अमित वीरसिंह	21	Male	"	7660621315	Amit
4	रमेश कुमार	29	M	"	9639090738	Ramesh
5	शमश शर्मा	30	M	"	9719767016	Shamsh
6	Mohit Sharma	35	M	Teacher	7078841172	Mohit
7	विकास मिश्रा	23	M	Student	9027291002	Vikas Mishra
8	जयसिंह	45	"	"	7310815312	Jaysingh
9	Shivanshu Shukla	23	M	"	9536194026	Shivanshu
10	Saurav Singh	25	M	"	8398182841	Saurav
11	हरिहर	37	"	"	9557500038	Harishar
12	शिवा कुमार	20	M	"	9084268142	Shiva Kumar
13	सहदेव सिंह	60	M	"	9456880591	Sahadev Singh
14	सुखि पांडेय	55	M	"	9536397610	Sukhi Pandey
15	राकेश	45	M	"	9675147085	Rakesh
16	शमश कुमार	40	M	"	"	Shamsh Kumar
17						
18						
19						
20						

Attendance Sheet of Public Consultation Meeting

Name of the Project: Rehabilitation and Up-gradation to 2 Lane with shoulder Bower-Karri-Etahwa section under Green National Highways Corridor Project (GNHCP) of NH-92 from Km 0.000 to km 57.346 in the State of Uttar Pradesh.

District:	Etawah	Date:	06/03/2021			
Village:	Basmechaur	Time:	03:00 Pm			
Tehsil:	Etawah	Place of Meeting:	Basmechaur (Shekhupur Saraiya)			
Municipal Area/Block:	Basmechaur	Chainage/KM:	48.49			
S. No.	Name of the Participant	Age	Gender	Occupation	Contact Details	Signature
1	Pradeep Kumar	34	male	खेती (जमीन)	9555899663	Pradeep Kumar
2	मिथिलेश कुमार	48		खेती	82794900916	मिथिलेश कुमार
3	Shul Kumar	24	m	खेती	8273938796	Shul Kumar
4	Sateesh Chandra	50	m	खेती		सतीश चंद्र
5	Bharat Singh	46	m	खेती	7037072186	CCF (NABARD)
6	Anoop Yadav	20	m	खेती	9027584957	अनूप यादव
7	रामेश ठाकुर	16	m	खेती	813091617	रमेश
8	रघुवीर सिंह	44	m	खेती	9410208800	Rajkumar
9	कपिल यादव	38	m	खेती	8445632371	कपिल यादव
10	सुरेन्द्र सिंह	75		खेती		सुरेन्द्र सिंह
11	रवींद्र कुमार	38	m	खेती	8171521652	रवींद्र
12	विकास यादव	20	m	खेती	9149030478	विकास यादव
13	अरवि कुमार	40	m	खेती	9520369710	Aravind
14	मरविंद्र कुमार	30	m	खेती	11	
15	राम किशोर	20	m	खेती	9520305038	Rajkishan
16	शिवशंकर	25	m	खेती	1	Shivanshu
17	Shameer	24	m	खेती	11	शमीर
18						
19						
20						

Annexure 9.1

GUIDELINES FOR TOP SOIL CONSERVATION AND REUSE

1. The top soil from all sites including road side widening and working area, cutting areas, quarry sites, borrow areas, construction camps, haul roads in agricultural fields (if any) and areas to be permanently covered shall be stripped to a specified depth of 15 cm and stored in stock piles for reuse.
2. At least 10% of the temporary acquired area for construction purposes shall be earmarked for stockpiling of fertile top soil
3. The locations for stacking will be pre-identified in consultation and with approval of Environmental Specialist of the Supervision Consultant.
4. The following precautionary measures will be taken by the contractor to preserve the stock piles till they are re-used:
 - Slop of the stockpiles should not exceed 1:2 (vertical to horizontal), and height is restricted to 2m to retain soil and allow percolation of water.
 - The edges of pile should be protected by silt fencing and allow percolation of water, which will help to retain soil
 - Multiple handling kept to a minimum to ensure that no compaction occurs.
 - Stockpiles shall be covered with empty gunny bags or will be planted with grasses to prevent the loss during rains.
5. Such stockpiled topsoil will be utilized for
 - Covering reclamation sites or other disturbed areas including borrow areas (not those in barren areas).
 - Top dressing and raising turfs in embankment slopes
 - Filling up of tree pits
 - For developing median plantation
 - In the agricultural fields of farmers, acquired temporarily that needs to be restored.
6. Residual top soil, if there is any, shall be utilized for the plantations works along the road corridor. The utilization as far as possible shall be in the same area from where top soil was removed. The stripping, preservation and reuse shall be carefully inspected, closely supervised and properly recorded by the Environmental Specialist of the Supervision Consultant.

Annexure 9.2

GUIDELINES FOR SITING AND LAYOUT OF CONSTRUCTION CAMP

A. Siting

The following guidelines shall be followed while siting the construction camps:

- The construction camps shall be located at least 500 m away from habitation. The living accommodation and ancillary facilities for labour shall be erected and maintained to approved standards and scales.
- Non-agricultural land should be used, as far as possible
- Not within 1,000 m of either side of locations of Forest areas.
- All sites used for camps must be adequately drained. They must not be subject to periodic flooding, nor located within 300 feet of pools, sink holes or other surface collections of water unless such water surface can be subjected to mosquito control measures.
- The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

B. Layout

Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for development and maintenance of construction camp. A conceptual layout of a typical construction site has been presented in **Figure-A**. The contractor during the progress of work shall provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scales approved by the Engineer of SC. The site must be graded and rendered free from depressions such that water does not get stagnant anywhere. The entire boundary of the site should be fenced all around with barbed wire so as to prevent the trespassing of humans and animals. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force. Vehicle parking area is to be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly slopped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor.

C. Drinking Water

The contractor should provide potable water within the precincts of every workplace in a cool and shaded area, which is easily accessible. All potable water storage facilities must be on a safely raised platform that is at least 1m above the surrounding ground level. Such facilities shall be regularly maintained from health and hygiene point of view. If necessary, water purifier units shall be installed for providing potable water. As far as possible, shallow wells should not be used as potable source of water. However, if water is drawn from any existing well, irrespective of its location from any polluting sources, regular disinfection of the water source (which may include application of lime, bleaching power and potassium permanganate solution) has to be ensured at weekly/fort nightly interval. All open wells will be entirely covered and will be provided with a trap door to prevent accidental fall and contamination from dust, litter etc. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. A reliable pump will be fitted to each covered well. A drain shall be constructed around the well to prevent flow of contaminated water into the well from road, camp or other sources.

Contractor's vehicles shall not be allowed to wash in the river / stream / pond. This is to avoid potential pollution from oil residues.

D. Sanitation Facilities

Construction camps shall be provided sanitary latrines and urinals. Adequate number of toilets shall be provided separately for men and women depending on their strength. Sewerage drains should be provided for the flow of used water outside the camp. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and be regularly emptied at designated disposal place in a hygienic manner.

Portable toilets may be brought to use and the night soil from such units has to be disposed through designated septic tanks so as to prevent pollution of the surrounding areas. All these facilities shall be inspected on a weekly basis to check the hygiene standards.

E. Shelter at Workplace

At every workplace, there shall be provided free of cost, four suitable shelter, two for meals and two others for rest, separately for use of men and women laborers. The height of shelter shall not be less than 3 m from floor level to lowest part of the roof. Sheds shall be kept clean and space provided shall be the basis of at least 0.5 m² per head.

F. Canteen Facilities

A cooked food canteen on a reasonable scale shall be provided for the benefit of workers wherever it is considered necessary and should generally conform to sanitary

requirements of local medical, health and municipal authorities including such precautionary measures as necessary to prevent soil pollution of the site.

G. First Aid Facilities

At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances shall be provided as per the Factory Rules. Workplaces in remote location and far away from regular hospital shall have indoor health units with one bed for every 250 workers. Suitable transport shall be provided to facilitate taking injured and ill persons to the nearest hospital. At every work place an ambulance room containing the prescribed equipment and nursing staff shall be provided.

H. Health Care Facilities

Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, duty staffs, medicines and minimum medical facilities to tackle first aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should have MCW (Mother & Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should provide with regular vaccinations required for children.

I. Day Care Facilities

At every construction site, provision of a day care shall be worked out so as to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a hut for use of children under the age of 6 years belonging to such women. Huts shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Hut shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provisions of sweepers to keep the places clean. There shall be two maid servants (or aayas) in the satisfaction of local medical, health, municipal or cantonment authorities. Where the number of women workers is more than 25 but less than 50, at least one hut and one maid servant should be provided to look after the children of women workers. Size of cares shall vary according to the number of women workers employed.

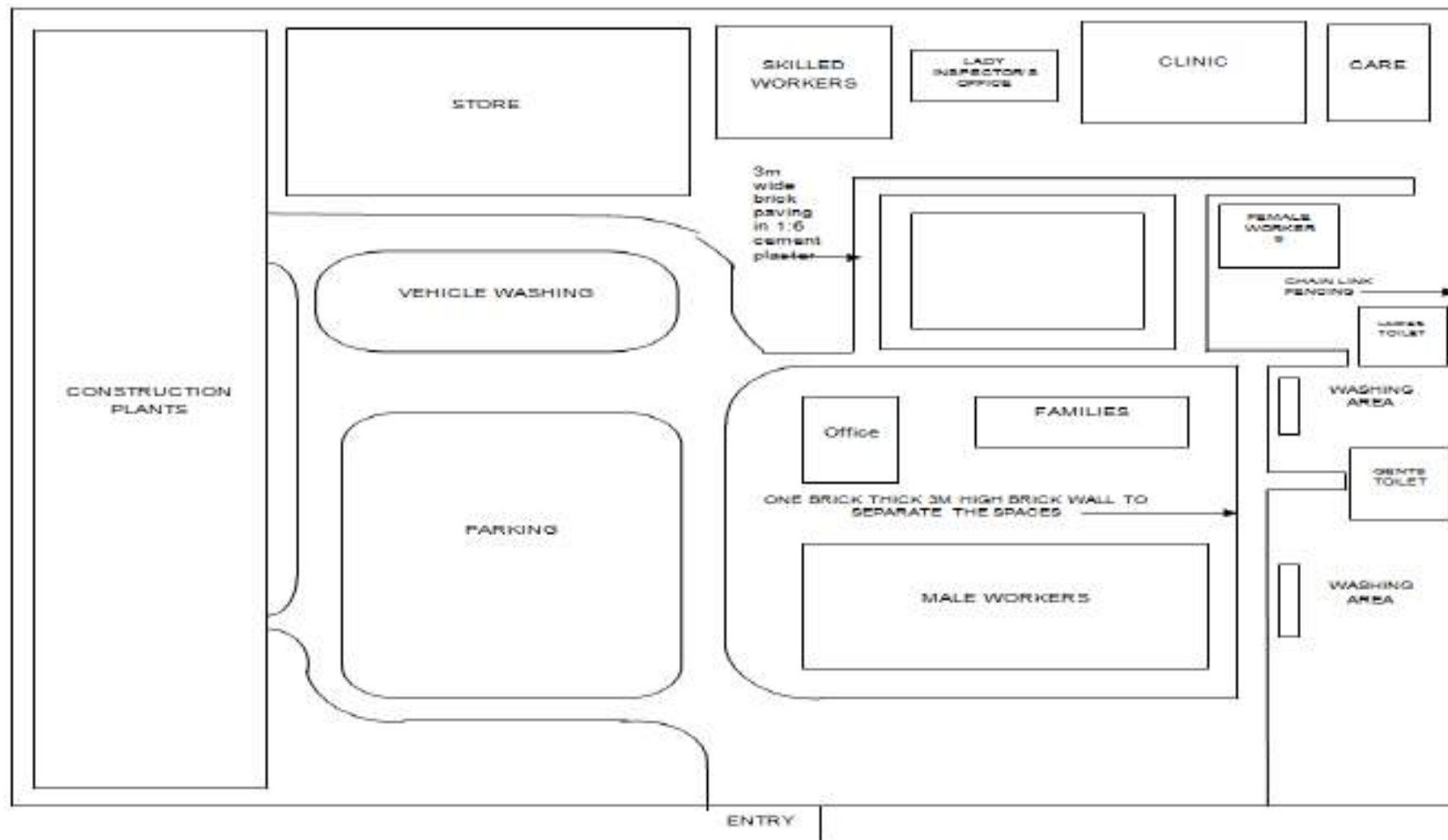


Figure-A Typical Layout of Construction Camp

ANNEXURE 9.3

GUIDELINES FOR SITING, OPERATION AND RE-DEVELOPMENT OF BORROW AREAS

A. Siting

The selection of borrow areas shall be based on environmental considerations apart from civil engineering considerations. Environmental considerations dictate that:

- Borrow areas should be located away from human habitation (1 km away) to avoid breeding of mosquitos and other organisms during monsoon when the borrow areas are flooded.
- Borrow areas should be at a distance of about 1.5 km from ecologically sensitive area i.e. Reserve Forest, Protected Forest, Sanctuary, National Park and any archaeological sites
- Borrow areas should be generally on degraded land unsuitable for any productive purpose. Government or community land should be preferred to private land. Productive agricultural land should not as far as possible, be used for borrowing earth and where it is used, the productive top soil must be stored and reuse.
- Borrow areas should not, as far as possible, obstruct the natural drainage of the ground and bunds and/or boundary drains should be created on their periphery to restore the flow of natural run off.
- Borrow areas should not be selected near sensitive locations such as banks or beds of rivers or channels, which can adversely affect the river hydrology and hydraulics, or along the road or rail embankment, which, apart from threatening the embankment may enhance the severity of accidents if these happen, or close to public structures such as transmission towers whose foundation can be endangered.
- Borrow area sites must be authorized sites. If located on private land, there should be written consent of the owner in the form of lease agreement permitting the use of the land for borrowing earth. If located on government or community land, the permission should be of the appropriate authority.

Avoid locating borrow area close to any road (maintain at least 30m distance from ROW and 10 m from toe of embankment, whichever is higher);

B. Borrow Area Operations

- Excavation in the areas should be planned keeping in view the end use of the borrow area land the shape and dimensions of the area to be excavated from (length, breadth and depth) should be accordingly decided. Generally the depth of excavation should not be deeper than 2 m from the consideration of safety of the humans or animals against accidental fell into the ditch.
- The eventual slope of the excavation should be 2 (H):1(V) from the consideration of safety of the slopes as well as humans.

- There should be safe access to the earth moving equipment and transport vehicles into the borrow areas
- The approach to the borrow areas from the public or private haul roads should have a reasonable design to withstand the movement of transport vehicles.
- Dust palliation measures should be taken to minimise dust pollution on the approach roads (e.g. watering, spraying of lime or cement slurry or bitumen emulsion, etc.)
- Spillage of materials under transit on to the haul roads or main roads through gaps in the transport vehicles should be guarded against by plugging such gaps. Similarly, Wind blowing of the materials in transit should be checked by suitable covers.
- Where productive agricultural land is used for borrow areas, the top soil in 150 mm thickness should be scrapped, stock piled and re-used for rehabilitation of borrow areas. At least 10% of the temporary land should be earmarked for stockpiling. The top soil should be seeded and mulched to cover the slopes, or any degraded area in thickness between 75 -150 mm.

C. Borrow Area Rehabilitation Plan

The borrow area must be rehabilitated after completion of the work and rehabilitation plan should be prepared in advance in consultation with the community. The area shall be restored to a safe and secure area usable to the public enabling safe access and entry to the restored site by filling the borrow pit floor to approximately the access road level. Some indicative rehabilitation measures could be community water storage facility, pisciculture ponds, recreational spots, landscape enhancement, or rehabilitation by re-vegetation of the borrow area. Where re-vegetation is done, it should be ensured that:

- Vegetative cover is established on all affected land
- Topsoil is placed, seeded and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the reclamation phase
- Selection and use of vegetative cover should take into account soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department.
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, sufficient to assure a 75% survival rate
- The planning results in 90% ground coverage
- The site should be inspected when the planting is completed and again at one year to ensure compliance with the reclamation plan

D. Borrow Area Documentation

- 1) Location reference and potential yield: The information as per the table below should

be contained in the documentation:

Sample No.	Name of Village	Material Type	Site identification		
			Nearest Chainage (Km)	Left / Right	Offset from nearest Chainage (m)
1	2	3	4	5	6

Approximate Quantity (Cum)				Available land / Terrain	Surrounding Land / Terrain	Remarks
Length (m)	Breadth (m)	Depth (m)	Total (cum)			
7	8	9	10	11	12	13

2) Land use and vegetative cover (existing)

- Existing land use (agricultural/barren/scrub/grazing/any other type)
- Vegetation /trees to be removed
- Erosion /degradation potential
- Distance and name of the nearest settlement
- Distance from the nearest surface water body
- Drainage pattern of the area
- Distance of the nearest reserve forest / eco-sensitive area (if any)
- Distance of the nearest sacred tree (if any)
- Distance from the nearest school/hospital/primary health center
- Daily / occasional or avenues for generation of income for adjoining community

3) Borrow area and community features

- Area (in Sq. m)
- Type of Access / width / kutcha / pucca etc. from carriageway
- Soil type
- Slope / drainage characteristics
- Water Table of the area or identify from nearest well etc. /ask people
- Land-use type such as barren / agricultural / grazing land
- Social features of settlement / community and its proximity to
- Present use of the borrow area by the community
- Identification of any other community facility in the vicinity of the borrow pit

4) Plans and photographs

- Borrow area site plans showing the land use, habitation, drainage pattern and structures and other physical features such as access roads, haul roads, existing community facilities (roads, schools, play grounds, community facilities, religious places etc.)
- Before and after photographs of the borrow areas.

ANNEXURE 9.4

GUIDELINES FOR SITING, OPERATION AND RE-DEVELOPMENT OF QUARRYING AND STONE CRUSHING OPERATIONS

A. Overview

A quarry is a type of open-pit mine from which rock or minerals are extracted for building materials, such as dimension stone, construction aggregate, riprap, sand, and gravel. Quarrying causes environmental damages like air and noise pollution, water logging etc. and requires permission from regulatory authorities like mining department, state pollution control board etc. It requires a careful approach in the site selection process, scientific method of quarrying and appropriate measures to redevelop it.

B. Criteria for Locating the Site/s

The selection of a quarry is sole responsibility of the contractor and should be undertaken in adherence to the rules & regulations of the authorities. Following criteria should be followed while selecting a quarry site:

- To the extent possible barren land or waste lands shall be preferred during site selection and fertile land and agricultural land shall be avoided.
- There shall be no quarrying of sand in any river bed or adjoining area or any other area which is located within 500 meters radial distance from the location of any bridge, water supply system, infiltration well or pumping installation of any of the local bodies or Central or State Government
- Department or any area identified for locating water supply schemes by any of the Government Department or other bodies.
- Quarry site shall be located at a minimum distance of 1km from any human settlements and 100 meters from any surface water body / natural drainage channel.
- Locate the quarry and crusher at a min. distance of 1.5 km away from forests / wildlife habitats / ecologically sensitive areas
- Access roads to quarry sites must be wide enough for heavy vehicle movement without inconvenience to local traffic.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Sr. Environmental Specialist of the Authority Engineer without which any activity shouldn't be started on the site.

C. Finalization of Selected Site/s

The selected site/s shall be approved by AE and PIU, after considering the compliance with the EMP clauses. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the AE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

D. Setting up of quarrying and Stone Crusher

Quarrying involves not only extraction of material (rock) but also crushing and screening that makes the rock suitable for use as construction material. Following are the major parameters to be considered before the start of quarrying and stone crushing operations:

Site Preparation

The stripping, stacking and preservation of top soil will be mandatory and absolutely no activity should be allowed prior to the satisfactory completion of this conservation measure as per guidelines in EMP. The boundary of the quarry should be demarcated using barbed wire fencing in order to avoid the future dispute over land as well as to avoid accidental trespassing of people. There should be recorded documents of exact no of trees cut. Contour trenches should be dug along the quarry area boundary and at any other appropriate places considering the topography to reduce the surface run off and conserve soil and water. Side slopes shall be constructed with slope drains at applicable locations to provide drainage and avoid any landslides. All the drainage constructed should be linked to existing drainages in order to avoid flooding and water logging.

Setting up of a Quarry Site

The layout of a quarry should provide a gravity flow of material from the face to the crusher, from the crusher to the storage bin and from the bin to the hauling equipment. Adequate arrangements should be made for avoiding fugitive emissions from quarry and crusher premises. This will include:

- a) housing the noise and dust producing units of the crusher plant in a building with wall of minimum 23 cm thickness and with suitable roofing
- b) control of air pollution through provision of in-built dust extraction systems in the crusher unit and all transfer points
- c) a chimney of appropriate height for the DG set (as specified by SPCB)
- d) water sprinkling facilities for the camp premises
- e) facilities to store water required for 3 days use

Consent to Operate the crusher unit should be obtained from SPCB under Air (Prevention and Control of Pollution) Act, 1981 before starting the operation.

Safety Aspects

- Blasting timings in quarry should be fixed avoiding the rush hours and these timings should be adhered to in order to avoid the conflict between the surrounding communities or population. Provide warning sirens 10 minutes before each explosion as a warning alarm to people in and outside the quarry. Damaged explosives must be disposed-off in a safe manner away from the operational area. Speed of the vehicles around the quarry should be restricted to a low speed in order to reduce the noise pollution and dust generation. Workers should not be exposed to sound of more than 85 – 90 dB for more than eight hours a day and shall be provided with adequate safety wears and personal protective equipment like ear muffs / plugs etc. Fire extinguishers

should be provided in the site office.

- Traffic movements should be restricted along the access road around times that children walk to and from school. Proper first aid facilities should be provided within the site office and in case of an accident, quick access to nearby hospital /clinic should be provided.

Facilities for Workers

- Potable drinking water should be provided in the site office in a hygienic environment sufficient for all the people.
- Adequate no. of toilets shall be provided for the workers with adequate water supply, proper drainage and effluent treatment system like septic tank with soak pit. Soak pit should have a sealed bottom, honey comb wall and 75cm thick, 2mm sand envelope around that.
- The sewage system for the camp must be properly sited, designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.

Waste Disposal

- The Contractor should provide separate garbage bins for biodegradable, non-biodegradable and hazardous wastes in the camps and ensure that these are regularly emptied and disposed-off in a hygienic manner.
- No incineration or burning of wastes shall be carried out by the Contractor.
- The disposal of any biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site. Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipe scrubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or sold /given out for recycling.
- POL (petroleum, oil and lubricants) waste shall be disposed-off by transfer only to recycler/ re-refiners possessing valid authorization from the State Pollution Control Board and valid registration from the Central Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Quarry areas should be protected from illegal dumping of waste by third parties. The overburden should kept as minimum to maximize the commercial efficiency of the quarry, it can be utilized for creating earth bunds to mitigate the noise and visual impacts and also for the site rehabilitation process.
- No quarry waste shall be dumped within a 100 m either side of the road. The overburden should be reused or disposed properly. Site for overburden disposal should be planned within the quarry site or any other appropriate site.

Training to Workers

- Workers shall be trained in smooth and safe operation of plants and equipment, their regular maintenance and various safety measures to be followed as well as about the need and importance for adherence to these measures.
- All the drivers should be trained about safe driving and should be made aware about

the need to observe caution while plying through access roads, especially during the time when children walk to and from school.

- Conduct education programs with the locals regarding the potential impacts of blasting, blasting warning systems, schedules etc.

Information Dissemination

- There should be a sign board of size 6' x 4' mentioning the project details and contractor's details to disseminate the information to the public.
- There should be a second sign board displaying the latest air and noise monitoring data against the standards specified.
- Warning sign boards should be set up at the entrance gate for the public as well as at other required places for the workers to alert them about the nature of operation being undertaken.

Other Mitigation Measures

- The quarry should not damage any building, work, property or rights of other persons.
- The quarry should not alter any right of way, well or tank.
- Roads inside the crusher premises should be tarred or concreted.
- Water course, if any, from a higher slope should be properly drained out.
- Storm water drainage shall be provided to prevent water logging and flooding in and around the area.
- The possibility of collecting the storm water in a pit or a tank should be explored so that it can be reused for dust suppression and the dependence on other water sources could be reduced. If this is not possible, the water should be safely channeled out of the quarry without disturbing any nearby human settlement.
- A register should be provided in the camp site for public to record their grievances if any.
- Environmental monitoring (air, noise, surface & ground water) should be conducted on quarterly basis.
- The concerned authority – AE / PIU should regularly review the environmental, health and safety aspects. If any adverse effect on environment, habitat and concern of safety is noticed, appropriate measures should be taken as suggested by AE or should arrange an alternative for road construction materials.
- In the case of existing quarries and additional quarries, the contractor has to ensure that all actions in these quarries are in compliance with EMP.

E. Operation of Quarry Site and Stone Crushing Unit

- No quarrying operation shall be done without the approval from the concerned authority.
- The equipment used in quarry should be wear faced, which extends the equipment life and reduce the demand for spare parts.
- Adopt controlled blasting techniques and conduct quarrying in a skillful, scientific and systematic manner.
- All units should operate only between 6 am and 10 pm. or as specified by SPCB in the consent letter.
- Accessory facilities to be provided in the quarry includes sprinklers to spray water for

dousing the dust generation, noise suppressers and rubberized mounting to reduce noise and vibration and tarpaulins or covers over material transporting vehicles.

- Provide sufficient water storage facility for 2 days' use.
- Measures have to be taken to reduce the dust generation during drilling operation. Deep wetting of drilling zones also to be done by water sprinkling and drilling machine shall be fitted with dust suppression, collection and disposal arrangements.
- To avoid spillage of fuel and lubricants, the vehicles and equipment should be properly maintained and repaired. Maintenance should be carried out on impervious platforms with spill collection provisions.

Following conditions regarding sound generation should be complied with in a quarry / crusher unit:

- The sound level (L_{eq}) measured at a distance of 1 m from the boundary of the site shall not exceed 55 dB(A) during day time (6 a.m. to 6 p.m.) and 45 dB(A) during night time (6 p.m. to 6 a.m.).
- The DG set shall be provided with exhaust muffler /acoustic enclosure/acoustic treatment with an insertion loss of minimum 25 dB(A) and its emission levels should be within relevant SPCB guidelines.
- A proper, routine and preventive maintenance procedure for the DG set shall be set and followed in consultation with the DG set manufacturer.

F. Quarry Management Plan

Quarry Management Plan shall be documented as follows for each quarrying sites:

Sl. No.	Item	Unit	Details
1.	Name / identity of the location		
2.	Nearest project road Chainage		
3.	Name of the owner		
4.	Area involved	m ²	
5.	Existing land use (verification from land records with Revenue Dept.)		
6.	Land use of the area surrounding the proposed site including a Map		
7.	Access Roads – existing conditions, proposed development and maintenance		
8.	Tree cutting and vegetation clearance if any, along with compensation measures	Nos.	
9.	Arrangement with the owner (agreement with land owner should be attached as an annexure)		
10.	Quantity of material to be quarried	Cum	
11.	Machinery and equipment to be used		
12.	Copy of the Consents to Establish and Operate should be attached as an annexure		
13.	Copy of the license from Mining and Geology, Police and Fire Department		
14.	Conditions laid down in the clearances / licenses and plans to ensure compliance		

Sl. No.	Item	Unit	Details
15.	Information on whether or not the quarry shall be closed under this project. If yes, the proposed closure and restoration plan.		
16.	Concern of the local people living in the immediate / near vicinity (through dialogue / consultation)		
17.	Photographs showing before and after conditions as well as during operations at regular intervals		
18.	Quarry Site Plan		
19.	Quarry Operation Plan		
20.	Quality Plan		
21.	Safety Plan		
22.	Waste Management Plan		
23.	Restoration and Rehabilitation Plan		
24.	Monitoring Plan		

G. Redevelopment of Quarry Area

The main objective of the redevelopment of quarries is to make the area safe and secure place and adapt it to a suitable land use like leisure place or fishing place etc. which is suitable for the physical environment as well as for the community around. Along with the preparation of quarry and crusher management plan the contractor should also prepare a re-development plan, which will be submitted for approval to AE who in turn will be responsible for approving and monitoring these plans. The restoration plan should indicate following points:

- List of structures to be demolished and list of the cleanup activities that needs to be undertaken.
- Presence of facilities that could be put in use by the land owner if it is a leased out private land or community in case of a public property
- The proposed use of the quarry site with a layout plan showing the proposed facilities / improvement measures, list of local plant species that could be planted etc.
- Photographs of the site before and during the quarrying process

Possible re-development options include the following:

- Re-vegetation of the quarry to merge with surrounding landscape with reuse of top soil mixed together with farm yard manure.
- Development of exhausted quarries as water bodies, where the quarry pit is developed into pond or a rainwater harvesting structure
- Pits created as a result of blasting could be filled with over burden which are removed and stockpiled in other areas or with construction debris. Top soil should be spread back and trees should be planted along the boundary.
- Tree plantation where ever possible depending on the proposed use, erosion control measures etc. should be taken up as part of the redevelopment plan.

H. De-mobilization of the Site

- The contractor should clear all temporary structures; dispose all building debris, garbage, night soils and POL waste as per the approved debris management plan.
- All disposal pits or trenches should be filled in, disinfected and effectively sealed off.
- Once the re-development plan is implemented and the site is restored, the same should be intimated to AE by the contractor.
- The AE shall ensure that all clean-up and restoration operations are completed satisfactorily and written approval is given to the contractor before the 'works completion' certificate is issued / recommended.
- The PIU shall ensure through site inspection that the Contractor and AE have complied with all these provisions.
- The site can then be handed over to the concerned owner or local bodies or for local communities as the case may be.
- Certification / documentation pertaining to approval for clean-up and restoration operations and thereafter handing-over to the owner shall be properly maintained by the Contractor, Supervision Consultant and PIU.

ANNEXURE 9.5

GUIDELINES FOR SEDIMENT CONTROL

Right at the initial stage of the work, the operations such as clearing and grubbing, roadway and drainage excavation, embankment / sub-grade construction, bridges and other structures across, pavement courses and shoulders are undertaken. These activities generate huge wastes and debris, which should not find their way into drainage channels and water courses nor should remain exposed to wind at the site and allowed to erode and contaminate productive soils or generate windblown dust particles in the atmosphere.

Erosion and sediment control measures shall, therefore, be planned to prevent soil erosion and sedimentation. These measures may involve temporary measures at construction stage, such as of temporary berms, dikes, sediment basins, slope drains, use of temporary mulches, fabrics, mats, seeding or other control devices. Permanent erosion control measures aim at preventing erosion during the project life cycle and should be planned as a part of the project design. These may involve turfing or pitching the embankment Slopes, turfing / mulching / vegetating the exposed areas, vegetating or reinforcing the cut slopes by appropriate methods such as shot-creting, rock bolting, soil-nailing, gabions etc.

Sediment control, whether temporary or permanent, would be mostly project and site specific. However, some of the generic measures shall be as follows.

- Debris generated at construction site must be removed immediately and dumped at the designated dump sites after useful recyclable materials are sorted out, and properly stocked or stacked.
- The site cleared after removal of debris would usually be prone to erosion. These areas should be treated by mulching and other dust palliation measures.
- There could be many mulching options such as seeding top soil and spreading the mulch (organic) to permit growth of grass, or other methods like mulches of tiles, brick bats, stone chips, or any other non-erodible wastes, which cover the exposed soil, allow moisture to be retained within soil and prevent erosion.
- Dust palliation measures by any suitable commercially available dust palliatives, application of water, cement, lime or bitumen emulsion in thin application to bind the dust particles together.
- All slush at construction sites, which after drying up become erodible must be either dredged and removed or treated appropriately in-situ (say by mulching).
- Temporary drains combined with sedimentation tanks should be created at the periphery or edge of the work sites to arrest the sediments brought by rains or construction activities requiring water and discharge only sediment free water into the water courses.

ANNEXURE 9.6

GUIDELINES FOR SITING AND MANAGEMENT OF DEBRIS DISPOSAL SITE

A. Overview

Construction of highways generates huge quantity of building debris which needs to be disposed off in previously identified sites suitable for such an activity. This process entails close scrutiny of the sites with respect to their location and this section details out the criteria to be followed in doing so. Moreover, it also guides the contractor as to how to prepare the site without causing much impact on the surrounding environment.

B. Criteria for Locating the Site/s

The locations of debris disposal have to be selected such that:

- The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities.
- Debris disposal site should be at least 200 m away from surface water bodies.
- No residential areas should be located downwind side of the site.
- The site should be minimum 1000 m. away from ponds / lakes or other water bodies, protected areas, forests, wildlife habitats, ecologically sensitive areas, seasonal streams, rivers, canals, flood plains, educational institutions, medical centers, religious sites, cultural or heritage sites and play grounds.
- The local governing body and the community should be consulted while selecting the site.
- The selected site should meet with the local regulatory requirements (including those of SPCB, Municipalities etc.).
- The site should preferably be owned by government so that there is no need to acquire the land for the same.
- After identification of the site the Contractor should fill up the prescribed reporting format and submit the same for approval to the Sr. Environmental Specialist of the Authority Engineer. Any activity on the site can be initiated only after obtaining permission from the IE.

C. Finalization of Selected Site/s

The selected site/s shall be approved by Sr. Environmental Specialist of the Authority Engineer and PIU, after considering compliance with the EMP clauses and this guideline. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the AE and PIU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made good at his own cost.

D. Disposal Site Management Plan

The Contractor after getting approval from the competitive authority for the selected site should submit a detailed Debris Disposal Site Management Plan comprising the following details:

- **Details of site:** Copy of approved site identification report along with location plan on a village map showing the site, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use like residences, agricultural land, water bodies etc., photograph of the site showing the topography and other existing features.
- **Arrangements within the Camp:** A layout plan showing the existing trees, green belt, locations where contour trenches should be dug etc.
- **Mitigation Measures:** Measures will be undertaken as per the EMP while preparing the site and dumping the waste should be separately listed out.
- **Other details:** Any other relevant details like copy of approvals / clearances obtained, species wise no. of trees to be cut and the details of top soil to be removed and conserved like quantity, location of storing etc. shall also be provided. All the drawings should have north direction marked in it along with prevailing wind direction. Necessary dimensions and specifications should be provided where ever necessary. The debris site management plan should be submitted to the AE for a written approval before any physical work is undertaken. The AE will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary to the contractor who will implement it within the stipulated time period.

E. Setting up of Debris Disposal Site

Following steps have to be undertaken while setting up a debris disposal site:

- Top soil conservation has to be undertaken as per the guidelines given in EMP.
- Considering the topography of the site contour trenches should be made along the site boundary to prevent soil erosion.
- Fencing should be provided for the debris disposal site to prevent trespassing of humans and animals into the area as well as to prevent spread of the waste material through action of wind, water, scavengers or rag pickers.
- No of trees cut should be recorded and three times the same should be planted as green belt development or elsewhere as part of the project.
- Provide proper drainage facility so that the run off from the site doesn't contaminate any nearby surface water sources.

F. Redevelopment of Debris Disposal Site

Along with the format seeking permission / approval for the disposal site / location from the Engineer / Supervision Consultant, the contractor shall also submit a rehabilitation plan for the area. Following points have to be kept in view while undertaking the rehabilitation measure:

- The dump sites shall be suitably rehabilitated by planting local species of shrubs and other plants.
- Vegetative materials to be used are grasses, legumes, herbaceous or woody plants or a mixture thereof
- Plant material must be planted during the first growing season following the

reclamation phase

- Selection and use of vegetative cover should take into account soil and site characteristics such as drainage, pH, nutrient availability and climate to ensure permanent growth. Choice of plant species for the planting program shall be made in consultation with ecological consultant and local forest department.
- The vegetative cover is acceptable if within one growing season of seeding
- The planning of trees and shrubs results in a permanent stand or regeneration and succession rate, sufficient to assure a 75% survival rate
- The planning results in 90% ground coverage
- Rehabilitation can also include conversion into farm land, playground, parking area, block plantation area etc.
- Care should always be taken to maintain the hydrological flow in the area.

ANNEXURE 9.7

GUIDELINES FOR PREPARING COMPREHENSIVE WASTE MANAGEMENT PLAN

A. Overview

A comprehensive waste management plan shall be prepared by the contractor prior to initiation of any works. The purpose of the plan is to provide standardized procedures for the clearance, removal and disposal of waste generated during the construction work as well as to establish the most efficient and cost effective methods to resolve waste disposal issues.

B. Preparation of Comprehensive Waste Management Plan

The Contractor should prepare a Comprehensive Waste Management Plan to be submitted to Sr. Environmental Specialist of the Authority Engineer for approval prior to setting up of construction and labour camp and it should comprise the following details:

- Categorization of waste into degradable, biodegradable and hazardous categories and list out different types of waste that falls in each of these categories
- Estimates about the quantity of waste generated in each category and type of storage units required.
- Detail the provisions for storage and handling of waste until disposed. A plan of the respective camps / areas like construction camp, labour camp etc. to be attached indicating the space allocated for storage and handling of wastes.
- Detail the precautions to be taken while storing, handling and disposing each type of waste, trainings to be imparted to workers to create awareness about waste management.
- Details of each debris disposal site
- Copy of approved site identification report along with location plan on a village map showing the waste disposal sites, its survey no., access road, project stretch, distance from the project stretch, surrounding features and land use (like residences, agricultural land, water bodies etc.), photograph of the site showing the topography and other existing features.
- All staff and workers involved in the highway construction should be imparted training about comprehensive waste management plan including the need for such a plan, its components and measures adopted by the contractor for implementing it. In addition, all personnel involved should be made aware about various steps and measures each of them has to follow so as to ensure the compliance to the comprehensive waste management plan.
- Precautions to be adopted during disposal of waste material

The contractor shall take the following precautions during transportation and disposal of waste material:

- A register should be kept for recording the details of the waste generated and their disposal.

- The pre-designated disposal sites should be a part of Comprehensive Solid Waste Management Plan and should be identified prior to initiation of any work on a particular section of the road.
- The contractor will take full care to ensure that public or private properties are not damaged/ affected during the site clearance for disposal of debris and the traffic is not interrupted.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the contractor will immediately remove all such waste material/s and restore the affected area to its original state to the satisfaction of Sr. Environmental Specialist of the Authority Engineer.
- Contractor should ensure that any spoils / materials unsuitable for embankment fill shall not be disposed off near any water course; water body; agricultural land; flood plains, forests etc. pasture; eroded slopes; and in ditches, which may pollute the surrounding.
- Contractor should ensure effective water sprinkling during the handling and transportation of materials where dust is likely to be created.
- Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.

C. Waste Disposal in Construction Camp

- Concrete flooring and oil interceptors should be provided for hot mix plant area, workshops, vehicle washing and fuel handling area.
- POL (petroleum, oil and lubricants) waste shall be stored safely in separate containers and should be disposed-off by transfer only to recycler / re-refiners possessing valid authorization from the State Pollution Control Board.
- Used lead batteries, if any, should be disposed as per the Batteries (Management and Handling) Rules 2001.
- Water separated and collected from oil interceptor should be reused for dust suppression.
- There should be a register to record the details of the oil wastes generated at the workshops and oil storage areas.
- The Contractor will provide separate garbage bins in the camps and ensure that these are regularly emptied and disposed-off in safe and scientific manner as per the Comprehensive Solid Waste Management Plans approved by the AE.
- No incineration or burning of wastes shall be carried out.
- Discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, hessian, metal containers, strips and scraps of metal, PVC pipes, rubber and poly urethane foam, auto mobile spares, tubes, tires, belts, filters, waste oil, drums and other such materials shall be either reused or will be sold / given out for recycling.
- Septic tank must be provided for toilets and the sludge should be cleared by municipal exhausters.

D. Waste Disposal in Labour Camp

- The Contractor should provide separate garbage bins in the camps for bio-degradable, non-biodegradable and domestic hazardous waste and ensure that these are regularly emptied and disposed off in safe and scientific manner.

- The disposal of kitchen waste and other biodegradable matter shall be carried out in pits covered with a layer of earth within the camp site to avoid smell and pests. The contractor may use the compost from such wastes as manure in the plantation sites.
- Non-biodegradable waste like discarded plastic bags, paper and paper products, bottles, packaging material, gunny bags, metal containers, strips and scraps of metal etc. and other such materials shall be either reused or should be sold /given out for recycling.
- No incineration or burning of wastes should be carried out.
- Effluent treatment system like septic tank with soak pits provided for toilets should be sited, designed, built and operated in such a way that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place.
- Soak pits must be provided to collect waste water from bathrooms and kitchen.

E. Disposal of Bituminous Waste

- The bituminous waste should be used for development of roads inside the construction camps, haul roads or for filling pot holes in rural roads.
- Non reusable bituminous waste to be dumped in 30 cm thick clay lined pits with the top 30 cm layer covered with good earth for supporting vegetation growth over a period only after obtaining approval of Sr. Environmental Specialist of the Authority Engineer.
- The Contractor will suitably dispose-off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of Sr. Environmental Specialist of the Authority Engineer.
- Debris generated from pile driving or other construction activities along the rivers and streams drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies.

ANNEXURE 9.8

GUIDELINES FOR PREPARATION OF TRAFFIC MANAGEMENT PLAN

The Contractor shall at all times carry out work on the road in manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the Sr. Environmental Specialist of the Authority Engineer (AE), provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the AE regarding traffic arrangements during construction.

Traffic Safety and Roads Works

- Delineate advance warning zones, transition zones and construction zones at both ends of a work front. Use devices such as regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights, reflectors and signal men in appropriate manner round the clock.
- No work front should be 'touched' without putting appropriate safety measures in place. Sr. Environmental Specialist of the Authority Engineer will be responsible to ensure that the permission for any activity is not given without the required safety plan and practices in place.
- Put signage at appropriate locations as per the road construction activity plan to warn the road users, construction vehicles / equipment operators, pedestrians and local residents about the work in progress, speed controls, hindrances / blockages, diversions, depressions etc. in lines with contract requirements and IRC guidelines.
- Signage has to be: (i) simple, easy-to-understand and should convey only one message at a time; (ii) has florescent and reflective properties of the paints; (iii) broad, prominent and with appropriate size of letters and figures; (iv) placed at the appropriate 'point/s' as specified in the IRC guidelines to allow proper stoppage / reaction time to approaching vehicles.
- Express a regret signage for the inconvenience caused and alert about the dangers ahead on account of construction activity.



- Different sign boards shall have a mix of pictorial signs and messages in local language, Hindi and English.
- While using barricades, ensure that traffic is kept away from work areas and the road user is guided to the safe, alternative movement track.
- Ensure that excavation sites are provided with effective barriers and reflecting signage to prevent any accidental approach by vehicles during the day or night.
- Provide proper uniform (light reflecting garments) to flagmen engaged in traffic control at diversions so that they can be singled out from the moving traffic.
- Prevent entry of cattle and wildlife through proper fencing / barricading around the excavation sites.
- Provide wide red and green flags or red and green lights to flagmen for controlling traffic. In high traffic zones and congested areas, use of wireless communication devices with protective headgear and shoes by flagmen has to be ensured to prevent confusion and minimize the risk of accidents.



Ensuring Traffic Control

- Where the execution of the works requires temporary closure of road traffic use, the Contractor should provide and maintain temporary traffic diversions. The diversions should generally consist of 200 mm thickness of gravel laid directly upon natural ground and earthworks.
- Where the execution of the works requires single-lane operation on public road, the Contractor should provide and maintain all necessary barriers, warning signs and traffic control signals.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the Carriageway) the lane width path for traffic should be clearly marked with the aid of pavement markings and painted drums or a similar device. At night, the passage should be delineated with lanterns or other suitable light source.
- One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This should be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen should be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the AE shall be installed for the guidance of road users. On each approach, at least two signs shall be



put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs should be of design and of reflector type.

- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor should remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started.

ANNEXURE 9.9

GUIDELINES TO ENSURE WORKER'S SAFETY DURING CONSTRUCTION

In order to ensure worker's safety while undertaking various operations / stages of construction many safety measures needs to be followed, which are listed down below:

A. Tree Felling

- Use hard hats during tree felling
- Ensure safe use and storage of tools such as axes, power chain saw, hand saw of different types, HDPE ropes of approved thickness to drag felled trees and logs.
- Keep the saw blades in proper lubrication and sharpened state for efficient workability.
- Determine proper foot and body position when using the implements for felling, cutting and dragging.
- Wear appropriate foot protection
- Avoid cutting overhead branches
- Keep first aid kits ready at the site.
- Determine possible hazards in the area, e.g. electrical or telephone or other utility lines, buildings, vehicles and domestic cattle that may create unsafe work situations.
- Prior to felling, determine the safest direction of fall and orient fixing of ropes and cutting positions accordingly.
- Determine the proper hinge size before directing the fall.
- Keep machineries and workers ready for speedy removal of the tree from the main traffic movement area.
- Keep flag men and warning signal signage at either end of felling area to control movement of traffic and warn passers-by

B. Plant Sites, Construction Camp and Quarry Areas

- Install perimeter fencing
- Ensure good visibility and safe access at site entrances
- Provide adequate warning signs at the entrance and exit, as necessary
- Provide adequate space / area for loading and unloading, storage of materials, plant and machinery
- Display emergency procedure and statutory notices at conspicuous locations
- Provide areas for collecting garbage and other waste material, and also arrange for their regular / periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities
- Provide defined access roads and movement areas within the site
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers
- Provide and enforce use of PPE at plant and quarry sites

C. House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water
- Keep all walkways and circulation areas clear and unobstructed at all times
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these should be collected immediately
- Use metal bins for collection of oily and greasy rags
- Stack raw materials and finished products out of walkways
- Do not leave tools on the floor or in any location where they can be easily dislodged
- Keep windows and light fittings clean
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people
- Store all flammable materials in appropriate bins, racks or cabinets with proper cover and labels as required for various products
- Make sure that hazardous / dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures.
- Display 'no smoking' signs in areas with high risks of fire, (e.g. near fuelling areas, diesel /oils / lubricant /paint storage area, hessians, rubber, wood and plastic etc.) in and around working area

D. Safety during Excavation

- The risk of accidents involving people and vehicles remains high in excavated sites. All pits or excavations shall to be barricaded to warn the road users and residents and to avoid any unauthorized entry of persons, children, domestic cattle or wildlife. For deep excavations and culvert construction sites, painted GI sheets, delineators, lamps (as required) and retro-reflective signage shall be used.
- Excavation more than 1.5 m is to be done in steps of minimum 500 mm offsets with plank and stuttering support, as required under contract clauses.
- For excavation in slippery or water logged area, try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping.
- For excavation for drain, the area should be properly barricaded with sign boards and illumination / lamps for night time safety. In congested stretches, watchmen / guards can also be placed for vigil.
- Snake bites or Scorpion stings during excavation - in areas with vegetation, tall grasses and forest cover, the contractor shall provide the labour with gum boots and gloves. He shall also make snake antidotes available on site. Emergency vehicles should also be kept ready to rush the patient to the nearest hospital.

E. Safety during Some Typical Construction Work

Centering and Scaffolding

- Many a times ballies joined together give away due to weak joints. Use of metal scaffolding and centering plates with metal fasteners are the safest and highly recommended materials for use in all road construction works for ensuring safety,

stability and casting of structures. All such scaffolding should be placed on a firm and a level base on the ground for ensuring stability. No wooden scaffolding or bamboo scaffolding is to be used for any casting of heavy (RCC) structural construction as the risk to safety of workers is higher.

- Railings are to be provided along working platforms and ladders for better safety. Nets shall be hung below the scaffolding or structures where work is on-going to prevent fall of debris, stones, bricks, equipment and other heavy to retain soil objects and even workmen, which could be fatal.

Form-work for small/light beams and slabs

- The collapse of bottom of the beam that may bring down the slab as well is a risk in such operations, which may injure the labour or supervision staff. Slender ballies without bracing are not be allowed for such works. No concreting should be allowed without bracing at 300 mm above ground and at midway for normal beams and slabs. The bracings should be for the support of beams as well as the slabs.
- Direct ballies support from the ground and the practice of tying planks with binding wire to the steel reinforcement shall not be allowed. A temporary railing and properly based working platforms along the periphery of slab reduces risk to the life of labour and supervision staff.

Dismantling of Scaffoldings

- Dismantled materials may fall on passer-by and workers. Workers could also get injured during the removal of such materials. Prior to dismantling of scaffoldings / working platforms, the area of operation should be closed for all outsiders. No one should be allowed within 50 m. from the place of demolition.
- Helmets, safety belts and other PPE must be worn by all the workers engaged in such a work. This work requires careful handling by an experienced supervisor / work force and should be executed with utmost caution. Gradual dislodging and use of PPE is required.

Column Reinforcements

- The tendency of bar-benders is to tie the vertical steel with coir rope or 8 mm steel rods as ties on all four sides of the column reinforcements. Reinforcement to columns shall be by welding MS rods with metal scaffolding to keep it in position till the final casting of RCC is done.

Falling of Objects or Debris from a Height

- At bridges construction sites (or in work areas at a height above ground level) thick nylon net or hessian barriers shall be used to prevent any splinter, debris, mortar or concrete from falling onto the passersby or workmen around.

Site Cleaning

- Throwing of waste materials, broken concrete pieces, brick bats, sand etc. straight from

the top of a structure onto the ground can injure a worker or a passerby. Such materials should be brought to the ground with the help of lift or the use of rope over pulley with a bucket.

Operation of Excavators

- Ensure that excavators are operated by authorized persons who have been adequately trained.
- Prevent any unauthorized use of the excavators.
- Ensure that only experienced and competent persons are engaged in supervising all excavations and leveling activity.
- Check and maintain as per the manufacturer's manual.
- Issue relevant information, including that related to instructions, training, supervision and safe system of work in writing and provides expert supervision for guidance.
- Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
- During tipping or running alongside the trenches, excavators must be provided with stop blocks.
- Excavators must be rested on firm ground after field operation away from the road
- Locate and identify underground services including telephone cables, OFC cables, sewerage and drainage lines, water supply, electrical cables etc. by checking with all concerned underground utility providers.
- When reversing or in cases where the operator's view is restricted, adequate supervision and signaling arrangements shall be provided.
- Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
- Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator and ensure replacement / repair to avoid mishap and break down.
- Check that all linkages / hinges are properly lubricated and linkage pins are secured. Never use improper linkage pins.

Operation of Trucks and Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer's requirements
- All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Follow safe driving principles including speed limits as per traffic signage.

- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

Manual Handling and Lifting

- Avoid manual handling of heavy and hazardous objects and chemicals.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- The hazardous and poisonous materials should not be manually handled without proper equipment /gears and prior declaration of the risks needs to be made to the involved workers.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control / supervise / guide movement of equipment and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects, which are dangerous.
- Loading and unloading from vehicles shall be under strict supervision.

Gas Welding

- The welders and welding units should follow all the basic principles of welding for safety and security
- Use face shield to protect the eyes
- Use goggles, particularly when chipping slag and cutting strips.
- Use gloves long enough to protect wrists and forearms against heat, sparks, molten metal and radiation hazards.
- Use high-top boots / gum boots to prevent sparks, splinters, sharp edges of metal and hot welded strips, welding rods, electric cables etc. from injuring the legs.
- Avoid inhaling the noxious fumes and gasses from burning electrodes by using gas masks and screen of the work area to prevent the glare moving outside it.
- Keep the key hung from the regulator control for split seconds operations to stop the valve in case of any accidental damage or leakage to supply pipeline that may catch fire and cause accidents in case acetylene or LPG cylinder.
- The welding area should have sufficient openings with fixed exhaust ventilators or adequate air flow openings to remove poisonous fumes and gases.
- Take precautions of wearing hard hats or fiber helmets to prevent injury due to fall of any object and accidental injury from projections while welding.
- Welders operating above ground should have adequate safety belt secured to stable platform to prevent accidental fall or injury from the scaffold. All electrical and gas

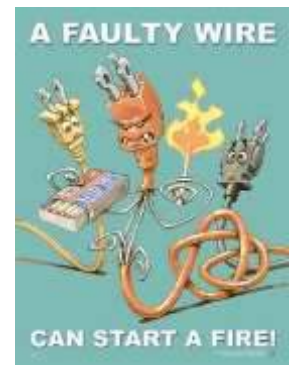


connection lines up to the welder should be sufficiently insulated and protected from sharp edges and sharp objects. These shall not come into contact with hot metal.

- Do not use gas cylinders for supporting work or as rollers. While using LPG or CNG cylinders for welding, follow all safety precautions as has been prescribed by the supplier company.
- Avoid fire hazards and accidents by posting safety supervisors to oversee the activities of workers.
- Do not store explosives, high inflammable materials, loose hanging overhead objects, hot welded strips etc. near gas cylinders.
- Close all valves, switches and circuits while leaving the work place under proper lock and key. In case of mobile units, proper carriage procedure have to be followed for safety and security of men and materials.

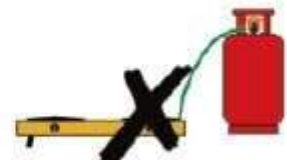
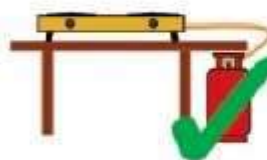
F. Electrical Hazards in Construction Areas

- Statutory warning leaflets / posters are to be distributed / displayed by the Contractor in the vicinity of work sites for the benefit of all workers, officers and supervisors as well as the public, indicating the do's and don'ts and warning related to electrical hazards associated with operations to be executed / in progress.
- All wires shall be treated as live wires
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
- Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines.
- Inform technical person/s for required maintenance.
- Never used damaged wires for electrical connection
- Demolition, tree felling and removal of overhead transmission lines shall be undertaken with strong, efficient and closely monitored arrangements to avoid accidents.



G. Use and Storage of Gas (LPG)

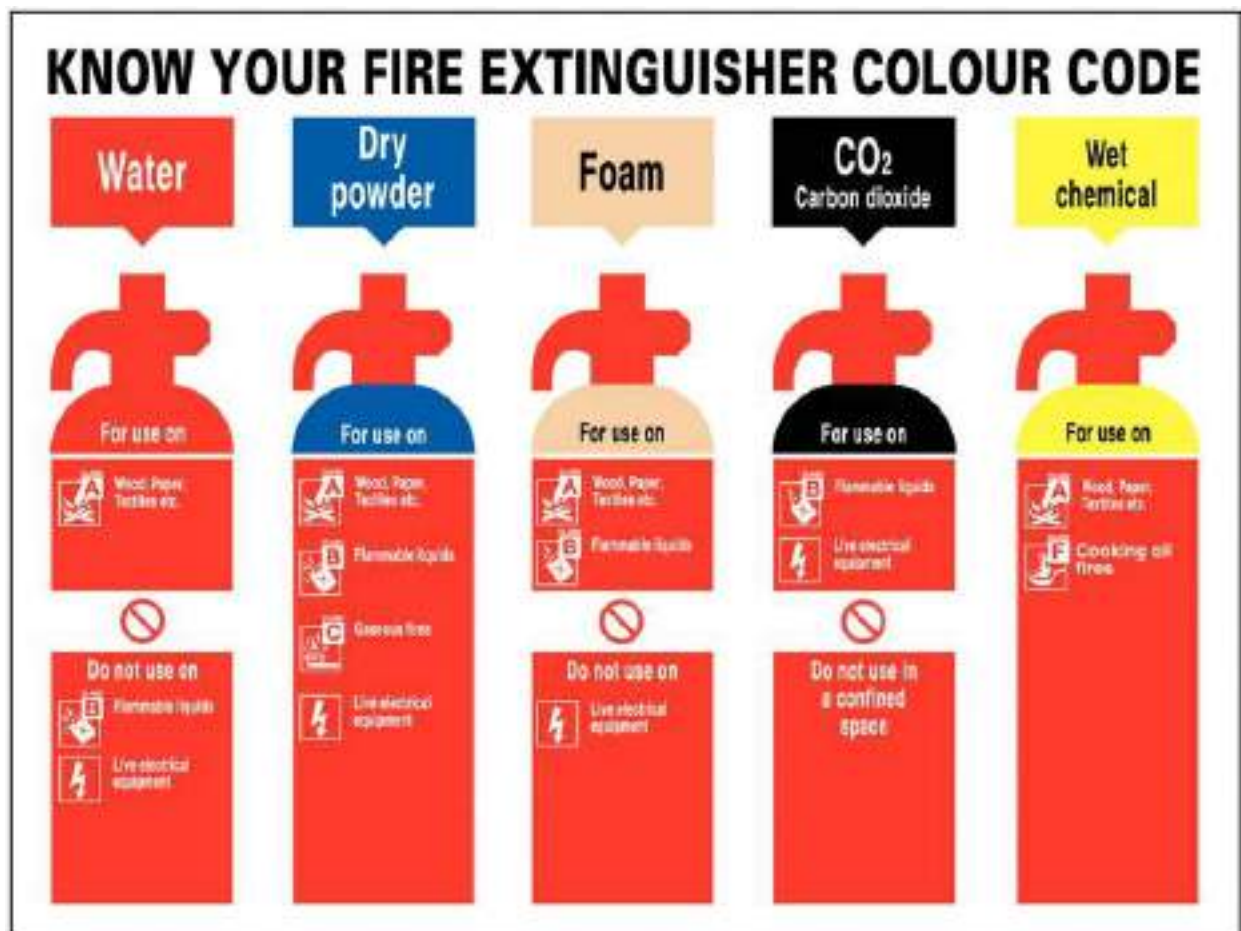
- Store filled LPG cylinder in a secure area – mark this as a no smoking area.
- Transport, store, use and secure cylinders in upright position
- Ensure proper ventilation at the ground level in locations where LPG is in use.
- Avoid physical damage to the cylinders
- Never weld near the cylinder
- Store empty cylinders secured and upright
- Make sure that the cylinder is closed immediately after use



- Investigate immediately if there is the smell of LPG or gas
- Make sure that there is no other unrelated fire in the vicinity of the cylinder.

H. Fire Safety Practices

- Store flammable material in proper areas having adequate fire protection systems
- Display sufficient warning signs
- Install fire alarm wherever required and test regularly.
- Inspect fire extinguishers regularly and replace as necessary.
- Train selected personal on use of fire extinguishers
- Fire escape route should be kept clear at all times and clearly indicated
- Train workers about the escape route and assembly point/s.
- Carryout fire drill periodically
- When fire breaks out alert all persons through fire alarms or other methods.
- Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
- Escape if you are in danger through the fire escape route to assembly point.
- Call-up Fire Service
- Fire officers to carryout head count at the assembly point.



I. Noise Hazards and its Control

- Plan camp lay-out in a manner that ensures barriers /buffers between residential / office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors / ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipment; regular and proper maintenance of the machinery as per the manufacturer's manual; by replacing rickety and noisy equipment and machineries.
- Screening locations with noise absorbing material; making changes in the process / equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipment with fasteners.
- Appoint a competent person to carryout a detailed noise assessment of the site; designate ear protection zone/s; give training / instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipment.

J. Personal Protective Equipment (General)

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipment are provided and that they are readily available for every person who may need to use them.
- The Contractor's Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipment is in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean. PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.



Eye Protection

- Road construction work sites, quarries and crushers are full of dust particles, sand, splinter, harmful gases, bright light and welding arc lights, which are injurious for the eyes. Therefore, eye protection and adequate lighting in work areas is required. All workers, supervisors and inspection officers and dignitaries coming over for study of works should be compelled to wear eye protecting glasses /goggles properly fitting the eye sockets to prevent damage due to dust, gases and other particles.

Head Protection

- Hard hats are compulsory for all workers, supervisors and managers /officials while working and / or inspecting a work sites. Hard hat areas shall be demarcated clearly.

Hearing Protection

- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently.
- Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive.
- Use earmuffs where a large attenuation of up to 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn't provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs. Use soap and water or the recommended solvent for cleaning ear muffs.

Respiratory (Protective) Equipment

- Wear suitable masks for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, working at crusher sites etc.
- Provide training to all persons using the masks / respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use
- Store respirators properly when not in use

Safety Footwear

- Wear suitable footwear for work
- Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.
- All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
- Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury and keep shoelace knots tight.

Hand Protection

- Wear suitable gloves for selected activities such as welding, cutting and manual handling of materials and equipment.
- Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.
- Wash hands properly with disinfectant soap and clean water before drinking or eating.
- Wash hands immediately after each operation on site when the situation warrants.

K. First Aid

- Provide first aid boxes at every work site in a cool and shaded place.
- Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.
- Display the list of persons along with their contact numbers who are trained on providing first aid.
- Ensure that every first aid box is marked "First Aid" in English and in local language.
- Check for expiry dates and replace the contents, as necessary.
- Maintain a register on health records including injuries / accidents.

L. Accident Investigations

- Carryout the investigation/s as quickly as possible
- Investigation should be carried out both internally as well as through third party.
- Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.
- Do not rely on any one / limited source of evidence.
- Check all the log books, stock registers, issue registers and movement registers on site
- Safety regulations, traffic signals and signal men activities, signage, as well as other field positions and keep a record of all investigations through audio-visual and electronic medium for presenting an evaluation of the incident/s.
- After completion of the investigation / enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipment and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.

ANNEXURE 9.10

GUIDELINES FOR STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS SUBSTANCES

A. Handling Hazardous Substances (including Chemicals)

- As far as practicable the hazardous materials will be stockpiled under proper mechanical loading, unloading and stacking aided by manual labour where necessary.
- Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
- Separate different chemicals physically and store accordingly after proper labeling.
- Stock taking of all hazardous will be mandatory together with enforcement of manufacturer's or supplier's safety standard/s and drill exercises.
- New and less known chemicals and building materials, for which toxicological studies are wanted, need to be properly evaluated prior to their inclusion in the materials list.
- All containers should be clearly labeled to indicate contents.
- Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
- Ensure use of correct personal protective equipment before allowing workers to handle chemicals.
- When opening containers, ensure holding of a rag over the cap / lid or use of safety gloves, as some volatile liquids tend to spurt up when released.
- Eye fountain, emergency shower and breathing apparatus should be available near the workplace.
- Ensure immediate medical attention in case of spill / splash of a chemical.
- Safety instructions for handling emergency situations shall be displayed prominently at both the storage and use locations.

B. Refueling / Maintenance procedure

- Truck or suitable containers will bring in all fuel and fluids. There will be no storage of fuel, oil or fluids within 200m of a water line.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal facilities;
- Following re-fueling and maintenance, the absorbent blankets (if any) and spill pans will be picked up and the fuel truck or container moved outside of the 200m wide area.

C. Emergency Spill Procedure

The applicable emergency spill procedure as outlined below and / or as directed by the manufacturer / supplier shall be followed:

Spill Procedure (inside the stream)

In the case of a spill, overflow or release of fluid into the stream waterway (whether water is flowing during the spill or not), do what is practical and safely possible to control the situation, then get help.

1) Stop the flow

- ✓ Stop the release into the stream waterway
- ✓ Shutdown equipment
- ✓ Close valves and pumps
- ✓ Plug hoses

2) Remove Ignition sources

- ✓ Shut off vehicles and other engines
- ✓ Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

3) Contact the Environmental Officer and initiate emergency response

- ✓ Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- ✓ The Environmental Officer will review the situation and decide if emergency services like fire brigade are required
- ✓ Appropriate parties to be notified of the spill are:
 - ❖ The contractor's Project Manager
 - ❖ The Engineer through his designated Environmental Officer
 - ❖ The Client
 - ❖ Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.
 - ❖ Site safety Officer

4) Cleanup and Disposal

- ✓ Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment.

5) Reporting

- ✓ The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the client and appropriate regulatory agencies like the Pollution Control Board.

6) Procedure Review

- ✓ The Engineer will review the report, determine if changes are required to be incorporated in the plan of activity under the revised guidelines and recommendation/s that have been suggested by the technicians / manufacturer / supplier / fire brigade / SPCB / Environment Expert of the PIU, as the case may be.

Spill Procedure (on Land)

In the case of a spill, overflow or release fluid onto land, do what is practical and safety possible to control the situation and then get help.

1) Stop the flow

- ✓ Stop the release into the water body
- ✓ Shutdown equipment
- ✓ Close valves and pumps
- ✓ Plug hoses

2) Remove Ignition sources

- ✓ Shut off vehicles and other engines
- ✓ Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible)

3) Contain the Spill

- ✓ Dike around the spill to contain the material
- ✓ Spread absorbent or place a spill blanket on the spill
- ✓ Enlist the help of personnel on site
- ✓ Notify your supervisor as soon as possible

4) Notification

Appropriate parties to be notified of the spill are

- ✓ The Contractor's Project Manager
- ✓ The Engineer through his designated Environmental officer
- ✓ The Client
- ✓ Regulatory Agencies like Pollution control Board, Municipal Authorities, as applicable
- ✓ Site Safety coordinator

5) Cleanup and Disposal

- ✓ The Engineer's Environmental officer will ensure that a proper cleanup and disposal method is determined. Absorbent pads will soak up the spilled material. The pads will be contained and removed from site for disposal at a licensed (authorized) facility.

6) Reporting

- ✓ The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution control Board(s)

7) Procedure Review

- ✓ The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes.

AANEXURE 9.11

Reporting Format for Identification of Construction Camp Site

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the Project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from nearest settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				
Submission Details		Submitted by Contractor		Approved by: Sr. Env. Specialist of AE
Signature				
Name				
Designation				

ANNEXURE 9.12

Reporting Format for Setting-up of Construction Camp

(Report to be prepared by the Contractor)

Name of Project Road: _____

Construction Stage Report: Date _____

Month: _____

Year: _____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before target date of establishing camps

Sl. No	Item	Unit	Details	Remarks, if any
1	Detail of item camp			
	Size of Camp	m x m		
	Area of Camp	Sq.m		
	Distance from nearest settlement			
	Distance from the nearest water source	Type / Size / Capacity / Present Use / Ownership		
	Date of camp being operational dd / mm / yy			
	Present land use			
	No of trees with girth > 0.3m			
	Details of Storage area (Availability of impervious surface)	m x m		
	Availability of separate waste disposal	Cum		
2	Details of topsoil stacking			
	Quantity of top soil removed	Sq.m		
	Detail of storage of topsoil	Describe stacking arrangement		
3	Details of workforce	Nos.		
	Total No of Laborers	Nos.		
	Total no of Male Workers	Nos.		
	No of Male Workers below 18 years of age	Nos.		
	Total No of Female Workers	Nos.		
	No of Female workers below 18 years of age	Nos.		
	No of children	Nos.		

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Sl. No	Item	Unit	Details	Remarks, if any
4	Details of dwelling units			
	No of dwellings/huts			
	Minimum Size of Dwelling	m x m		
	No. of openings per dwelling	Nos.		
	Minimum size of opening	m x m		
	Walls	Specifications		
	Roofing	Specifications		
	Flooring	Specifications		
	Drinking Water Tank	Specifications		
	Capacity of Drinking Water Tank	Cum		
	Size of Drinking Water Tank	m x m		
	Total no of WC	Nos.		
	No of WCs for female workers	Nos.		
	Minimum Size of WC	m x m		
	Total No of Bathrooms for female workers	Nos.		
	Size of septic tank for WC / Baths	m x m		
	Capacity of Water Tank for WCs / Bathrooms and general purpose			
	Fencing around camp	Yes / No		
5	Details of facilities			
	Availability of security guard 24 hrs. a day	Yes / No		
	Details of First Aid Facility	Yes / No		
	Availability of Dav Care Centre	Yes / No		
	Availability of dust bins (capacity 60ltr)	Nos.		

Remark

Submitted

Approved

Signature

Signature

Name

Name

Designation

Sr. Environmental Specialist

Contractor

Authority Engineer

ANNEXURE 9.13

Reporting Format for Establishment of Hot Mix Plant / Batch Mix Plant

(To be submitted by the Contractor for taking permission from AE)

Name of Project Road: _____

Date _____

Sl. No	Location Details					Area (m ²)
	Name of Village	Chainage (Km)	Side (LHS/RHS)	Latitude and Longitude	Haul Road Length (m)	

Distance from nearest Water Course (m)	Distance from nearest Settlement (m)	Existing Land Use	Prevalent Wind Direction	Whether in Up Wind Direction from Settlement (Y/N)	Approved by EO (Y/N)	Remarks, if any

Submitted

Signature

Name

Designation

Contractor

Approved

Signature

Name

Sr. Environmental Specialist

Authority Engineer

ANNEXURE 9.14

Reporting Format for Identification of Borrow Areas

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				
Submission Details		Submitted by Contractor		Approved by: Sr. Env. Specialist of AE
Signature				
Name				
Designation				

ANNEXURE 9.15

Reporting Format for Establishment of Borrow Area

(To be submitted by the Contractor for taking permission from AE)

Name of Project Road: _____

Date _____

Sl. No	Location Details					Area (m ²)	Land Use	
	Name of Village	Chainage (Km)	Side (LHS/RHS)	Latitude and Longitude	Haul Road Length (m)		Before	After

Distance from nearest Water Course (m)	Distance from nearest Settlement (m)	Quantity of available material (cum)	Type of material	No. of Trees to be felled	Approved by EO (Y/N)	Remarks, if any

Attach Photograph of proposed site, location map, agreement etc.

Re-development Plan:

Remarks

Submitted

Signature

Name

Designation

Contractor

Approved

Signature

Name

Sr. Environmental Specialist

Authority Engineer

ANNEXURE 9.16

Reporting format for Identification of Quarry and Stone Crusher Site

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				
Submission Details		Submitted by Contractor		Approved by: Sr. Env. Specialist of AE
Signature				
Name				
Designation				

ANNEXURE 9.17

Reporting format for Identification of Debris Disposal Site

(Report to be prepared by the Contractor)

Sl. No.	Project Details	Information		
1.	Name and address of the Contractor			
2.	Contact details of the Contractor			
3.	Name of Project Road			
4.	Stage of the project			
5.	Site Details	Information		
6.	Name of the Village		Panchayat	
7.	Name of the Taluk		District	
8.	Chainage (km)		Side	LHS/RHS
9.	Area of site		Current land use	
10.	Ownership of the land	Owned/Leased	Survey No.	
11.	If leased, name, address and contact details of owner			
12.	Distance from settlement			
13.	Distance from surface water course or body			
14.	Distance from Ecologically Sensitive Areas			
15.	Width of access road			
16.	No of trees with girth > 0.3m			
17.	No of trees to be cut			
18.	Is top soil conservation required (Yes/ No)			
List of Enclosure		Location Map		
Remarks				
Submission Details		Submitted by Contractor		Approved by: Sr. Env. Specialist of AE
Signature				
Name				

Designation		

ANNEXURE 9.18

Reporting Format for Safety Checklist

(Report to be prepared by the Contractor)

1. Name of the Project Road
2. Contract No.
3. Name of the Contractor
4. Name of Safety Officer
5. Date of Inspection
6. Location description: Location-1 _____; Location-2 _____

Particulars	Location-1			Location-2			Remarks
	A	B	C	A	B	C	
General							
House Keeping							
▪ Stacking of Material							
▪ Passageway							
▪ Lighting							
▪ Ventilation							
▪ Others							
Electrical							
▪ Switches							
▪ Wirings							
▪ Fixed Installation							
▪ Portable Lighting							
▪ Portable Tool							
▪ Welding Machine							
▪ Others							
Fire Prevention							
▪ Fire Fighting Appliance							
▪ Dangerous Goods Store							

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Particulars	Location-1			Location-2			Remarks
	A	B	C	A	B	C	
▪ Gas Welding Cylinders							
Others							
▪ Dust Control							
▪ Noise Control							
▪ First Aid Equipment							
▪ Washing Facility							
▪ Latrine							
▪ Canteen							
Provision of Personal Protective							
▪ Helmet							
▪ Eye Protector							
▪ Ear Protector							
▪ Respirator							
▪ Safety Shoes							
▪ Safety Belts							
▪ Others							

A = Adequate at the time of Inspection

B = Needs Improvement

C = Needs Immediate Attention

ANNEXURE 9.19

Reporting Format for Road Safety Measures during Construction

(Report to be prepared by the Contractor)

One time reporting before commencement of construction (zone wise)

1. Name of the Project Road
2. Contract No.
3. Name of the Contractor
4. Name of Safety Officer
5. Date of Inspection
6. Location description: Location-1_____ ; Location-2_____

Sl. No.	Item	Unit	Compliance	Remarks
Details of Construction Zone				
1.	Length of Construction Zone			
2.	Distance between this and next construction zone			
3.	Length of work sub zone in urban stretch (should be <2 km)			
4.	Length of work sub zone in rural stretch (5-10 km)			
5.	Distance between two work sub zones			
Signage's in Construction Zones				
1.	Sign saying 'Men at Work' 1 km ahead of transition sub zone			
2.	Supplementary sign saying diversion 1 km provided			
3.	Sign saying 'Road Closed ahead' provided			
4.	Compulsory Right Turn /Left sign provided			
5.	Detour sign placed			
6.	Sharp deviation sign placed at end of advance warning sub zone			
Signage in Transition Sub Work Zone				
1.	Signage saying 'Keep Right / Left' provided			
2.	Delineators placed along length of transition			

EIA including EMP Report for Two Lane Upgradation with Paved Shoulders of Bewar-Etawah Section (Km 0.000 to Km 57.346) of NH-92(Package 1A & 1B) in Uttar Pradesh under Green National Highway Corridor Project (GNHCP)

Sl. No.	Item	Unit	Compliance	Remarks
Signage in work sub zone				
1.	Hazard Marker placed where railing for CD structure on diversion starts			
2.	Barricade on either side of work sub zone			
Signage in Termination sub zone				
1.	Sign for indication of end of work zone 120 m from end of termination sub zone			
Road Delineator				
1.	Roadway indicators provided			
2.	Hazard Makers provided			
3.	Object Makers Provided			

Submitted

Approved

Signature

Signature

Name

Name

Designation

Sr. Environmental Specialist

Contractor

Authority Engineer