SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

Supplementary Appendix to the
Report and Recommendation of the President
To the Board of Directors

On the

NATIONAL HIGHWAY SECTOR II PROJECT

INDIA

April 2005

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

Introduction

1. The Project involves upgrading of about 600–700 kilometers (km) of selected national highways (NHs), particularly the North-South Corridor along NH26 and NH7. It is classified as a category B Project in accordance with ADB's Environmental Assessment Requirements of 2003. The Jhansi-Lakhnadon road (400 km) will be implemented in the first phase. Out of it, under sector loan modality, the Sagar-Rajmarg Chouraha section (98 km) has been selected as a sample project road as it represents typical technical, environmental, and social conditions along the Project roads. An initial environmental examination (IEE) for this section was carried out from February to May 2004. In addition, a sector environmental assessment was also undertaken. This summary is based on these reports.

I. Description of the Project

2. In general, the existing roads have a double-lane standard with about 15 m carriageway and up to 1.5 m shoulder in each side. The Project will involve (i) widening the existing road to 4-lanes standard, with about 60 m right-of-way (ROW); (ii) improving drainage; (iii) replace bridges and culverts, (iii) construct underpasses, flyovers, and railroad over bridges and other supporting facilities. Realignment, including bypasses, will be carried out to avoid impacts to cities, settlements and forests, and to improve road configuration. The civil works is expected to complete by the end of 2007.

3. The existing alignment passes through urban areas, towns, settlements, and also passes close to surface water resources and through open scrublands and forest areas. Critical areas have been avoided by the use of environmentally sensitive alignment design to minimize unnecessary disturbance. About 30% of the original road alignment has been significantly modified in response to environmental, social, economic, technical considerations in line with established sustainability principles. The improvement of alignment is expected to reduce social, economic and environmental impacts as well as travel time and vehicle operating costs.

II. Description of the Environment

A. Physical Environment

4. The project area has a semiarid climate with temperature ranges from 5^0C to 45^0C. The summer season is from April to June. July, August and September are the rainy season. Cold season prevails from mid November to February. The yearly average rainfall varies between 800 and 1,500 millimeters but rainfall patterns are not reliable. Drought is not uncommon. Mean relative humidity is about 46%.

5. The altitude of the most of the project area is higher than 400 m above sea level. Much of the land along the road (60%) is flat agriculture land. Less than 10% of the project area is reserved forest (RF) and the rest is split almost equally between uncultivated open scrub and settlements. There are several river tributaries where wetland areas have been created. The geological formations are predominantly Vindhayan (sedimentary) and Deccan (volcanic). On hills and eroded areas there is shallow sandy to clay loam. On the valleys and plains there is fertile from sandy loam to clay loam to clay. Along the rivers, deep alluvial deposits of yellowish clay loam are also found. Black cotton soils also present in some places.

6. Groundwater table varies in depth. Areas overlying compact Vindhyan and Deccan trap have little water bearing capacity, in areas with alluvial and limestone deposits good aquifers are found, whereas, wells in hard rock areas go dry in summer. Ground water quality generally meets India's 1991 drinking water standard, (without conventional treatment). Rivers and lakes

also met India's 1991 water standard for outdoor bathing. The water quality of rivers is also suitable for propagation of wildlife and fisheries.

7. All measured parameters for the ambient air quality were acceptable according to the criteria stipulated India's Ambient Air Quality Standard for residential areas, except at one forest site where the suspended particular matter in sensitive areas was exceeded. The noise level at all residential areas near the road was higher than the standards for the applicable land uses.

B. Ecological Environment

8. The Jhansi-Lakhnadon (NH26) road runs through agricultural land and in many areas the edges of the existing carriageway are fringed with mature specimens of common species. There are also mature plantations and RFs (22 km of the existing highway). The dominant species are *Tectona grandis* (teak) *Terminalia tomentosa* (almond), *Diospyros melanoxylon*, *Butea monosperma* (flame of the forest), *Gardenia latifolia* and *Buchnania lanzen*. No rare, protected or endangered species were identified.

9. Wildlife is frequently encountered in the forested sections. Information from government censuses and other secondary sources indicates that several common species are present in the RFs. No rare, protected or endangered species were identified. Birds are also common in the study areas and there are several wetland habitats near each section where birdlife is abundant. There is no National Park near NH26 but the edge of the buffer zone Noradehi Wildlife Sanctuary (NWLS) comes to approximately 1.3 km of the road (between km286-289). A river (a tributary of Sonar river) separates the NWLS boundary and NH26. Near the sanctuary there is mountainous forest terrain. The local communities made no particular comment about wild animals in the area as the sanctuary is quite far from NH26, but very rarely wild animals stray and are seen in the Jhiraghati Reserve Forest. There are potential future accidents of stray animals, due to higher speed vehicles after project completion. The road design has included structures such as underpasses for movement of animals as necessary.

C. Social-Culture Environment

10. The project corridor passes predominantly agricultural land and several market towns. The road will be realigned to avoid small temples and places of worship. The traffic consists of mainly busses, passenger jeeps and a few tractors. Police records included only few accidents but may be more unrecorded accidents. In addition, NH-26 is frequently used for transporting hazardous substances. Environmental risk due to accidents involving vehicle(s) carrying hazardous cargo resulting in spillage of chemicals cannot be ruled out.

III. Potential Environmental Impacts and Mitigation Measures

A. Environmental Impact Associated with the Project Location

11. The environmental impacts associated with the location will not be significant because most of road will either follow the existing alignment or pass through uninhabited areas. None of the road sections pass through environmentally sensitive areas. The roads will be realigned to avoid impacts and carriageways are widened to the left or right to avoid the majority of sensitive receivers. In RF, significant construction impacts can be managed and the movement of wildlife within the forests will not be disrupted by the traffic due to the incorporation of wildlife mitigation measures such as providing road underpasses. Fencing, which is provided to prevent trespassers from entering the forest, will also serve to prevent wild animals to access the road. Where noise sensitive receivers remain close enough to the new alignment, measures at source, such as solid noise barriers and earth berms, will be built to provide noise attenuation.

B. Environmental Impact Associated with Construction Activities

12. Construction impacts, particularly those activities due to earthwork and the use of mechanical equipment are potentially significant. To reduce noise impact, mitigation measures at source will be adopted in line with Government's noise standards, and portable noise barriers will be used. Proper maintenance and storage of the equipment will be done to minimize emission impacts and to facilitate dispersion. Materials during transporting and stockpiling will be covered to minimize dust. Rock crushers, and batching plants will be installed only after receiving permissions from the concerned State Pollution Control Board. Hot mix plants will be licensed and controlled in line with state pollution board requirements.

13. Potential soil erosion and landslide will be controlled by minimizing cut-and-fill, and provision of slope drains, stone pitching and turfing. Aggregates and other quarried material will be obtained from licensed sites and new quarries or borrow pits will only be excavated after obtaining Government clearance and with prior permission from local/district authorities. Borrow pits will be rehabilitated after use. Cement batching and aggregate mixing plant shall be located away from settlements.

14. Construction works should not use the groundwater without prior permission from the local water board. The main concerns about surface water conditions are related to bridge construction works. The mitigation measures for these aspects, especially to prevent pollution of ground and surface water resources are comprehensively covered in the environmental management plan (EMP). Tree cutting will be minimized, but if unavoidable, the trees will be restored immediately and compensatory planting will be applied as a statutory requirement, particularly in RF areas. Specimen and religious trees will be retained. No worker camps, asphalt plants, mixing plants, or rock crushers will be allowed within forest area.

C. Environmental Impacts Associated with Operation

15. The impacts during operation of the road involve noise, air pollution and water pollution. The improved road will increase traffic but all air sensitive receivers will be located more than 15 m from carriageway, which is farther than the present situation, resulting in adequate dispersion of traffic fumes. Accordingly, ambient air quality will not significantly deteriorate. Enforcement of vehicle emission standards will contribute minimizing solid particles. Noise at sensitive receivers is minimized by realigning/bypassing and other measures to control noise at source (barriers).

16. Hazards associated with road accidents at main settlements will be reduced by provision of bypasses. Road accidents should also be reduced due to carriageways separation and smoother flowing of traffic. The most significant environmental risk would be an accident involving vehicle(s) carrying hazardous cargo due to spillage of chemicals and run-off to a water-body. Therefore, drainage channels and collection sumps will be provided to intercept runoff of accidentally spilled chemicals. An emergency response mechanism shall be coordinated to ensure safe removal of hazardous chemicals in line with guidance on off-site emergency planning the Manufacture Storage and Import of Hazardous Chemicals Rules 1989.

17. No long term ecological impact is expected, however, it is important to maintain trees planted along the roadside. Long-term tree planting will compensate the loss of trees due to road widening and target areas should include degraded forest areas. The inclusion of animal passing tunnels will reduce the number of road kill accidents affecting wildlife. The culverts and bridges along the road in forest areas should be designed to facilitate passage of animals. Whereas vehicles should not generally be permitted to stop along the road near reserve forests stopping facilities should only be provided outside reserve forests. Nevertheless the provision of some off road stopping facilities for emergencies, with the acceptance of the Commissioner for Forests, would reduce the chances of collision or fire in the event of vehicle breakdown.

D. Sector Impacts Assessment

18. The existing road conditions vary from acceptable to very substandard, and traffic volume exceeds the road capacity in many places, creating transportation bottlenecks in the movement of goods across the country and has affected the economic development of many states. Due to the poor condition of roads, goods transport takes twice as long as it could, and spoilage of perishables can be significant. Alternatively, vehicles may take longer routes over better roads. In both cases there is a cost and this results in millions of rupees of lost revenues.

17. Large companies, requiring a reliable transportation network, hesitate to invest in states where the road network is poorly developed. It is noted where massive road upgrading was done, the state economy has improved. The Project will be beneficial and add to the developing road network in the country, facilitating the movement of goods and services, and thereby generating business. This will have knock on beneficial effects for the environment. Producers will not need to extract as much natural resource to balance out spoilage or damaged cargo and less energy will be consumed in production and transportation. However, efficient transportation will also enable producers to supply goods on a timely basis, and could thus increase repeat orders and demand, which will increase the exploitation of natural resources.

IV. Institutional Requirements, Management and Monitoring Program

A. Institutional Requirements

18. Prior to implementation of the Project, NHAI will comply with Ministry of Environment and Forest clearances and obtain state pollution control board clearances. NHAI will also need to confirm that contractors have complied with all statutory requirements and have appropriate and valid permits for all powered mechanical equipment, permissions for use of local water supplies and to construct and operate al plant in appropriate areas.

19. The EMP was prepared taking into account the capacity of the NHAI Environmental Unit. The general manager Environment, Social and Administrative, with its fulltime environmental staff, will be responsible for implementing, monitoring, and auditing the EMP. In addition, each contract package will have an environmental specialist to supervise contractors in implementing the EMP. Training/workshops will be conducted at least once each year, for the first 3 years, to share monitoring, lessons learned and remedial actions for unexpected environmental impacts. Monitoring will focus on checking the contractor's bidding documents, to ensure that all necessary environmental requirements have been included and references to environmental mitigation measures are incorporated. During construction, monitoring activities will focus on ensuring implementation mitigation measures, performance indicators, and remedial action to address unexpected impacts. During operation, it will focus on recording environmental performance and proposing remedial actions to address unexpected impacts.

B. Environmental Assessment of Subsequent Subprojects

20. The subsequent subprojects are being prepared. The roads pass through a range of terrain similar to the section considered above. The roads will not pass through or near any sensitive areas as described in the ADB's Environmental Assessment Requirements of 2003, or otherwise they will not be eligible to be funded under this Project. Alignment selection should be based on internationally accepted guidelines[1]. Subsequent subprojects will be prepared and implemented in accordance with ADB Environmental Guidelines and relevant Government's statutory requirements including: (i) obtain Ministry of Environment and Forest clearance for civil works in forest areas, and secure a tree removal and replanting permit from the Department of

[1] Environmental, Health and Safety Guidelines, Roads and Highways, International Finance Corporation 1998.

Forest; (ii) obtain state pollution control board clearances for potentially polluting activities; and (iii) ensure that contractors have complied with all environmental requirements and have appropriate and valid permits for the use of mechanical equipment, local water supplies, and to construct and operate plants and facilities.

22. IEEs and summary IEE for the sub-projects will be prepared. NHAI will ensure that environmental mitigation measures are incorporated in detailed designs and followed during construction, operation, and maintenance of the roads. EMPs will be prepared and implemented. NHAI will monitor, audit, and report the implementation of the EMPs to ADB. All environmental assessment documents shall be properly kept and made available in a timely manner for inspection by ADB and the public.

C. Public Consultation and Disclosure

23. Public consultations were conducted in March to May 2004 through village meetings and meetings with other relevant local government agencies. There was general support for the project as villagers recognized existing road conditions are deterrent to travel and they looked forward for better connectivity. Townspeople were concerned over the acquisition of land and impacts on property and houses, particularly in the market area, but there was general acceptance of the proposed compensation as mitigation. Concerns were also expressed on shortage of water in the area. These concerns have been taken into account in the design and by providing mitigation measures such as water harvesting features in the road design and modifying rehabilitated borrow areas for water collection.

V. Findings, Recommendations and Conclusion

24. The IEE and SEA reports present all potential environmental impacts associated with the Project, and recommended suitable mitigation measures. The improvement and widening of Project roads with several bypasses is the best option from the environmental, legal, and socioeconomic points of view. Mitigation of environmental impacts needs to be properly implemented, and the existing institutional arrangements, including staff and financial resources, are available. Therefore, the proposed mitigation and management plans are practicable.

25. The IEE and SEA reports have thoroughly assessed all potential environmental impacts associated with the Project. The environmental impacts identified by the study are manageable, and NHAI will implement the mitigation measures stated in the EMP and IEE reports. Therefore, no further EIA is needed. However, continued monitoring of the implementation of EMP needs to be properly carried out and annual report on EMP implementation should be submitted to ADB and relevant Government Agencies.

ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN FOR SAGAR – RAJMARG CHAURAHA SECTION

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
Design / Pre-construction Stage							
1. Alignment							
General	The alignment selection criteria used for selecting the final alignment included social, environmental, engineering and economic aspects. The points considered for the same are given below: • Minimize interference to reserve forests, human settlements, and centres of commercial and industrial activity (Social and Environmental). • Bypass National Parks and Wildlife Sanctuaries or realign road to avoid National Park (NP) and Wild Life Sanctuary (WLS) by the largest distances practicable (Environmental). • Avoiding interference to schools, hospitals, primary health clinics, places of worship, archaeological sites and cultural centres, playgrounds, and other public facilities (Environmental and Social). • Avoiding Reserved / Protected Forest areas by bypass or choose left or right side widening to avoid land acquisition in large stretches of RF and PF on either side (Environmental). • Facilitating compliance with highway alignments standards for curvature and grading (Technical). • Avoiding utility services, reservoirs, water pipe lines, electricity supply telecommunications and waste disposal infrastructure (Technical). • Following major river crossings and adjusting position of large bridges to facilitate compliance with alignment criteria for curvature and grading, avoiding interference to sensitive receivers and preventing increased siltation (Technical, Social and Environmental). • Redesigning of small culverts and bridges in to widened structures on the downstream	Design requirement	The location of bypasses and realignment selected using alignment selection criteria for the project are as follows : Sagar Bypass, Km 195.5 on NH86 to km 211 on NH 26 Surkhi Bypass, km 227 to 232 on NH26 Gaurjhamar Bypass, km 244 to km 250 on NH26 Deori Bypass, Km 262.5 to 269 on NH 26 Split Alignment on Jhiraghati Hilly Terrain to improve geometry, km 268 to 288 on NH 26	During the design stage	Project preparation cost	Design Consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
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	side to prevent increased siltation (Technical and Environmental). • Choosing realignment to facilitate release of flood flows after heavy rains, but with water harvesting structures and features to facilitate retention of water to recharge groundwater, at other times (Technical and Social). • Realigning along edge of property boundaries and with left or right side widening to minimize impacts to trees and agricultural, commercial or industrial activities (Environmental, Economic and Social). • Designing of curvilinear realignments to optimize sub-base conditions, to minimize cut and fill requirements and to reduce visual impacts and driver fatigue (Social, Technical and Environmental). • Realigning road to move away from low-lying areas to avoid localized areas of poor drainage, wetland areas, reservoirs and areas of ecological interest, water holes (within forests) and avoiding specimen trees (Technical and Environmental). • Realigning in wet land areas to facilitate creation of sufficient space for meaningful buffer tree planting (over and above statutory requirements) where alignment passes within 500m of the high water mark for water bodies. • Realigning to facilitate design of small culverts and bridges to permit underpass for wildlife particularly in wetland and forest areas. • Choosing alignment, which offers balance between shortest distance between two points effecting economies in construction, operation and maintenance (Economic).						
a. Constricted sections/ settlements	Sagar Bypass Surkhi Bypass	Design requirement	Sagar Bypass Km 195.75 on NH86 to 211 on NH26	During the design stage	Project preparation cost	Design Consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	Gaurjhamar Bypass Deori Bypass Split Alignment on Hilly Terrain Split Alignment in Hilly Terrain at Jhiraghati in Forest Area 1000 m service roads along the existing alignment and 3.0 m & 5.0 m underpass have been suggested in the new alignment. Suitable length and size of Service road and Underpasses / Over Bridges through out the existing project road and in the proposed new alignments where other road (State Highway / Major District Road / Ordinary District Road / Village Road) crosses the Project road will be provided as per IRC Specifications.		Surkhi Bypass Km 227 to 232 on NH26 Gaurjhamar Bypass Km 244.0 to 250.0 on NH26 Deori Bypass Km 262.5 to 269.0 on NH26 Jhiraghati in Forest Area, Km 286.0 to 288 Km286 to 288.2 Km211, 213.6, 217.2, 220.3, 220.9, 225.8, 234.4, 234.5, 236.4, 237.5, 238.5, 241.3, 242.4, 270.6, 275.5, 277.8, 281, 283.1, 283.4, 291.5, 293, 294 and 295.8 on NH 26 and at road crossings enroute of the new alignments				
b. Land and Property Losses	To avoid social disruption and damage to religious structures, the road centerline has been adjusted. The Bridge on River Bewas between km215.8 and 216 will be reconstructed 50m downstream of the river to avoid the Religious structure and a specimen champion Ficus tree	Project/Design requirement	Throughout project corridor Between Km 215.8 and km216	During the design stage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	and to improve the present kink in the existing NH road alignment. Adopting suitable cross-sections and adjustment of median width. Retaining walls have been proposed to limit the extent of widening. Compensation will be given to PAPs based on the RAP's entitlement policy.		Reduced median width within settlement area Retaining walls will be provided where required				
2. Land							
a. Embankment slopes	At all critical slopes along the roadsides throughout the project, turfing will be done as per the recommended practice for treatment of embankment slopes for erosion control, IRC: 56-1974. Especially the slopes across / along : River / Rivulets crossings and in Hilly Terrain	Project / Design requirement	Based on existing pavement Location of moderate slopes: Sagar Bypass; Km 215.8 to 216 Km 232.6 to 232.8 Km 234.2 to 234.3 Km 235.9 to 236.1 Km 237.5 to 237.6 Km 241.5 to 241.6 Km 244.8 to 244.9 Km 246.9 to 247.0 Km 248.4 to 248.6 Km 251.3 to 251.5 Km 256.8 to 256.9 Km 259.8 to 260.1 Km 262.9 to 263.1 Km 264.9 to 265.0 Km 265.7 to 265.8 Km268 to km 268.1 Km 270.0 to 270.1 Km 275.3 to 275.4 Km 275.6 to 275.7 Km 277 to km 277.1 Km 281.5 to 281.6 Km 288.7 to 288.8 Km 291.1to 291.2 Km 293.2 to 293.3 Km 295 to km 295.1 Km 237 to 238 Km 240 to 242	During the design stage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
			Km 251.7 to 255.0 Km 285 to 289				
b. Road inundation	The planned 0.6-1.5 m increase in the vertical elevation from the existing roadway, with suitable sizes of cross drainage structures e.g., Culverts, Bridges will avoid inundation.	Design requirement	Since the project area is primarily hilly with sloping terrain, water logging due to heavy rains during rainy season some of Bridges like the Bridges at km 215.8, 232.65, 234.21, 235.95, 286.7 get submerged	During the design stage	Project preparation cost	Design consultant	PIU, NHAI
c. Quarries and borrow areas	Existing licensed quarries that are already in operation have been recommended. Nonproductive lands, barren lands, raised lands, riverbeds, wastelands have been recommended for borrowing earth materials; no productive land will be used for this purpose. Through community consultation with the villagers and interactions with state Department of Fisheries, low lying areas and wastelands that could be developed into fish ponds have been recommended for borrow areas.	Legal Requirement	All selected borrow pits located at : Village Sironja 1.5 from NH26 (km209); Bamori Quarry 200m from NH26 (km213); Makolpur Junction on NH26 (km226); Umrari Quarry on NH26 (km234); Barkoti near NH26 (km241); Chimadhara Quarry 200m from NH26 (km258);	During the design stage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
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			and all proposed quarry sites located at For sand : Gulganj, District Chatarpura 135km from NH 36 (km203); Sonar River, Gourjhamar, 1km fron NH26 (km 249); For Aggregate : At km 209 on NH26; Baghkhejra Quarry, Pamakheri Village Within 200m of the proposed alignment for Sagar Bypass; Chiwla Quarry, Deori adjacent to NH 26 (km258);				
d. Modification of landform	Minor modifications of the present landuse will take place due to the proposed project. However, against the total environmental setting this change is so small that it is insignificant and will not necessitate any special remedial measures. In case of forestland, the changing land use will follow the guidelines of Forest Conservation Act (1980) Government of India.	Project Requirement	All along the project corridor All forest land through which the proposed alignment passes	During design stage During design stage	Project preparation cost	Design consultant	PIU, NHAI
3. Water							
a. Water sources	The existing courses of the river and canals or streams have been maintained at all the locations. Most of the bridges have been retained and widening has been proposed on the downstream side to prevent increased	Design requirement	All the River / Rivulets will be impacted along the project corridor at	During the design stage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	siltation. **Protection of Water Bodies** There is no Perennial community ponds en-route of the proposed project. Suitable sizes of Bridges and cross drainage structures will be provided on all river / rivulets crossing the project road.		Km 215.8 to 216 Km 232.6 to 232.8 Km 234.2 to 234.3 Km 235.9 to 236.1 Km 237.5 to 237.6 Km 241.5 to 241.6 Km 244.8 to 244.9 Km 246.9 to 247.0 Km 248.4 to 248.6 Km 251.3 to 251.5 Km 256.8 to 256.9 Km 259.8 to 260.1 Km 262.9 to 263.1 Km 264.9 to 265.0 Km 265.7 to 265.8 Km268 to km 268.1 Km 270.0 to 270.1 Km 275.3 to 275.4 Km 275.6 to 275.7 Km 277 to km 277.1 Km 281.5 to 281.6 Km 288.7 to 288.8 Km 291.1to 291.2 Km 293.2 to 293.3 Km 295 to km 295.1				Local ground water authority, PIU, NHAI
	Rain Water Harvesting Since the project area does not have sufficient perennial surface water bodies, groundwater will have to be extracted for construction works. To minimize stress on groundwater, recharging through water harvesting structures along the project corridor will be considered. As a long-term benefit of the project, water-harvesting structures like check dams, and underground tanks are recommended.	Project / Legal Requirement	Locations will be decided in consultation with local ground water authority				
b. Drainage	Natural drains will be suitably modified so that the proposed highway does not obstruct them. Provision of adequate size and number of cross drainage structures. Sections of the corridor have been proposed to be raised suitably along with the cross drainage structures and adequate side drains	Design requirement	All through the project corridor Raised section: All through the project corridor the	During the design stage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	have been proposed. The proposed project alignment has been adequately provided with necessary engineering solution. This has been done on the basis of the highest flood level data for the past 50 years.		road level has been raised 800 millimeters on an average.				
4. Flora and Fauna							
a. Roadside plantation	Trees have been saved by constructing / expanding the road on one side in inhabited stretches and in bypass sections care have been taken (as far as possible) to avoid planted areas. Even then substantial quantity of trees are to be cut. The estimated number of trees to be cut is 13159. Roadside trees will be removed with prior approval of DFO. Suitable number of trees will be planted for each tree felled as per regulatory compliance. In case of acquisition of Forestland for the project, Compensatory afforestation as per Forest conservation Act (1980) will be adopted. A new split alignment has been proposed in Jhiraghat Reserve Forest passing through fire lines / area not having much tree density. Erection of proper signboard at the beginning of the forest areas indicating precautions • for not blowing horn in forest areas, • for not throwing burning match sticks / fire sticks in forest areas, and • for not stopping vehicles in forest areas.	Legal Requirement	Throughout project corridor within ROW	During the design stage	Cost of felling of trees Rs1.3 million Roadside plantation cost Rs6.45 million. Total cost of Forest acquisition including compensatory cost Rs. 56.98 million Project preparation cost	DFO, Design consultant, PIU, NHAI	PIU, NHAI
b. Wildlife migration	To mitigate accidents with wildlife animal underpasses 15X15 feet high will be installed below the present embankment levels with proper drainage facilities and gradual slope away from the road towards the forest.	Legal requirement	Bridge over Nala at km 287 in Jhiraghati, Chauki Reserve Forest, three under passes in the new alignment section	During the design stage	Engineering cost	DFO, Design consultant, PIU, NHAI	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
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	Fencing of NH in Reserve Forest Areas		between km 287 and 288 in Jhiraghati Chauki Reserve Forest. Fencing of NH in Gourjhamar and Jhiraghati RF				
c. Trespassing into reserve forest	Also both the split of the realignment will be fenced in the Reserve Forest area this will prevent wild accidents on the NH and also prevent trespassers from entering the reserve forest. Prohibition of stopping of vehicles in RF areas.	 Legal Requirement	Between km 251.7 - 256 and between km 285.5 - 288.5 - do -	During the design stage	Engineering cost	DFO, Design consultant, PIU, NHAI	PIU, NHAI DFO
5. Environmental Quality							
a. Air quality	Improving road geometry, curves, slopes, etc and widening of road to smoothen traffic flow. Pavement roughness will be improved to a level less than 2000 mm. This will be done through appropriate pavement designs and resurfacing. Trees will be planted on both sides of the road and in the median verges. These areas will be planted with shrubs of suitable species to reduce the air pollutant concentrations and to attenuate noise.	Design requirement	Throughout project corridor, especially at sensitive locations	During the design stage	Project preparation cost Included in afforestation cost, Road side plantation and environmental enhancement cost	Design consultant	PIU, NHAI
b. Solid waste	Solid waste disposal sites will be properly designed and must be at least 250 m away from the ROW.	Legal requirement	Near the construction sites	During the design stage	Project preparation cost	Design consultant	PIU, NHAI
c. Noise levels	The required noise mitigation measures will be included based on accepted acoustic principles. Solid noise barrier walls and or earth berms will be included such that the noise standards can be met at all sensitive receivers with particular focus on residential, schools, hospitals and places of worship.	Legal requirement	Throughout project corridor, especially at sensitive locations	During the design sage	Project preparation cost	Design consultant	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
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	Removal of bottlenecks and relieving congestion in built-up stretches through improved design. Improvement of junctions / intersections. Segregation of slow and fast moving traffic. A proper mix of indigenous species comprising of broad-leaved evergreen and deciduous species will be planted along roadside. The deciduous species will be planted on slopes.						
Noise levels contd.	The inhabited locations shall be bypassed as far as possible such that the road does not pass through any critical areas. In bypass sections the bypass alignment shall be chosen to be more than 0.5 to 1.0 km away from habitation wherever possible. Places where the road crosses minor human habitation, will be treated as follows: 3 m from the edge of the pavement, shrubs will be planted; 1 m further, trees will be planted. Noise barriers will be provided (above) in line with acoustic calculations.	Legal requirement	Through out the project corridor where minor habitation is within 50m of the proposed road	During the design sage	Project preparation cost	Design consultant	PIU, NHAI
6. Utilities							
a. Utility lines community utilities	All utilities likely to be impacted will be relocated with prior approval of the concerned agencies. All community utilities likely to be impacted, such as wells shall be reprovisioned at locations with access acceptable to the end.	RAP Requirement	To be identified based on community needs	During the design and construction stage	Project preparation cost	PIU, NHAI, concerned government departments	PIU, NHAI
7. Cultural Heritage							
a. Cultural properties	The major human habitation and hilly terrain in Jhiraghati shall be bypassed and thus impact on cultural properties has been avoided. Alignment shall be suitably routed to avoid/minimize impact to cultural property as	RAP / Project Requirement	Major Religious structures in congested human habitations and in Hilly terrain of Jhiraghati have been avoided A small Temple at	During the design stage	Project preparation cost	PIU, NHAI, NGOs and R&R unit	PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	shifting the bridge on Bewas River at km 215.8 to 216, 100m downstream of the river. Moving of religious structures shall be done based on the results of Public consultation carried out to obtain opinions of the end users.		km 215.95 by the side of the road on left while moving from Sagar to Rajmarg Chowraha Small Temples located between Km 240.95 and km 241.05, 241.95 and 242.05, km 250.95 and 251.05, km260.95 and 261.05 and km 295.95 and 296.05.				
8. Environmental Safety							
Construction Stage							
1. Soil							
a. Soil erosion	Steep embankment will be provided with chutes and drains to minimize soil erosion. Stone pitching and retaining walls will be made on steep embankments in critical areas. Turfing of low embankments and planting of grasses and shrubs will be done to protect slopes. The depths In borrow pits will be regulated so that the sides will not be steeper than 25%, from the edge of the final section of bank.	Design Requirement	Throughout Project corridor, borrow pits (location given above) and service roads, and at bridges on Rivers / rivulets from Km 215.8 to 216 Km 232.6 to 232.8 Km 234.2 to 234.3 Km 235.9 to 236.1 Km 237.5 to 237.6 Km 241.5 to 241.6 Km 244.8 to 244.9 Km 246.9 to 247.0 Km 248.4 to 248.6 Km 251.3 to 251.5 Km 256.8 to 256.9 Km 259.8 to 260.1 Km 262.9 to 263.1 Km 264.9 to 265.0 Km 265.7 to 265.8 Km268 to km 268.1 Km 270.0 to 270.1 Km 275.3 to 275.4 Km 275.6 to 275.7 Km 277 to km 277.1 Km 281.5 to 281.6	During construction	Engineering stage	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
			Km 288.7 to 288.8 Km 291.1to 291.2 Km 293.2 to 293.3 Km 295 to km 295.1 And in Hilly areas from Km 237 to 238 Km 240 to 242 Km 251.7 to 255.0 Km 285 to 289km				
Soil erosion contd.	Soil erosion will be checked by measures such as the formation of sediment basins and slope drains. If earth will be cut for the road alignment and the slope exceeds 25%, the cut side of the earth will have a gentle slope.	Design Requirement		During construction	Engineering stage	Contractor	SC, PIU, NHAI
b. Loss of topsoil	Agricultural areas will not be used for borrowing of materials, unless requested by the landowner for making ponds or for lowering the land for making it irrigable.	Legal Requirement	All selected borrow pits located at : Village Sironja 1.5 from NH26 (km209); Bamori Quarry 200m from NH26 (km213); Makolpur Junction on NH26 (km226); Umrari Quarry on NH26 (km234); Barkoti near NH26 (km241); Chimadhara Quarry 200m from NH26 (km258); and all proposed quarry sites located at For sand : Gulganj, District	During construction	Engineering cost	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
			Chatarpura 135km from NH 36 (km203); Sonar River, Gourjhamar, 1km fron NH26 (km 249); For Aggregate : At km 209 on NH26; Baghkhejra Quarry, Pamakheri Village Within 200m of the proposed alignment for Sagar Bypass; Chiwla Quarry, Deori adjacent to NH 26 (km258);				
c. Compaction of soil	Construction vehicles, machinery, and equipment will move, or be stationed in the designated ROW, to avoid unnecessary compaction of soil.	Design Requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
d. Borrowing of earth	Topsoil will be stockpiled and protected for use at the rehabilitation stage. No earth will be borrowed from within the ROW. Non productive lands, barren lands, raised lands, waste lands will be used for borrowing earth with the necessary permissions. Riverbeds will not be used for borrow areas without first presenting hydrological studies to the acceptance of the authorities If new borrow areas are to be selected, then measures will be taken so that there will be no loss of productive soil, and all environmental considerations will be met.	Legal Requirement	All selected borrow pits located at : Village Sironja 1.5 from NH26 (km209); Bamori Quarry 200m from NH26 (km213); Makolpur Junction on NH26 (km226); Umrari Quarry on NH26 (km234); Barkoti near NH26 (km241); Chimadhara Quarry 200m from NH26 (km258);	During construction	Engineering cost	Contractor	SC, PIU,NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	Unpaved surfaces used for the haulage of borrow materials will be maintained properly. Precautionary measures such as covering vehicles will be taken to minimise dust avoid spilling of borrow materials. To avoid any embankment slippage, borrow areas will not be dug continuously. In borrow areas, two trees will be replaced for every one felled.		and all proposed quarry sites located at For sand : Gulganj, District Chatarpura 135km from NH 36 (km203); Sonar River, Gourjhamar, 1km fron NH26 (km 249); For Aggregate : At km 209 on NH26; Baghkhejra Quarry, Pamakheri Village Within 200m of the proposed alignment for Sagar Bypass; Chiwla Quarry, Deori adjacent to NH 26 (km258);				
e. Quarry	The aggregates and other quarried material will be obtained from licensed sites with proper environmental clearances, including clearances under the Air Act. New quarries will only be opened with prior permission from local/district authorities.	Legal Requirement	All proposed quarry sites located at For sand : Gulganj, District Chatarpura 135km from NH 36 (km203); Sonar River, Gourjhamar, 1km fron NH26 (km 249); For Aggregate : At km 209 on	During construction	Engineering cost	Contractor	Local/ district authority, SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
			NH26; Baghkhejra Quarry, Pamakheri Village Within 200m of the proposed alignment for Sagar Bypass; Chiwla Quarry, Deori adjacent to NH 26 (km258);				
f. Contamination of soil from fuel and lubricants	Construction vehicles and equipment will be maintained and refueled so that spillage does not contaminate the soil. Fuel storage and refueling sites will be kept away from drainage channels and Rivers / Rivulets crossing the proposed NH.	Legal Requirement	Throughout project corridor and borrow areas	During construction	Engineering cost	Contractor	SC, PIU, NHAI
g. Contamination of soil from construction wastes and quarry materials	Earth, if required, will be dumped in areas selected and approved area by the supervision consultant. All spoils will be disposed of as desired and the site will be fully cleaned before handing over. Non-bituminous wastes from construction activities will be dumped in borrow pits and covered with a layer of topsoil conserved from opening the pit. Bituminous wastes will be disposed of in a dumping site approved by the supervision consultant.	Legal Requirement	All construction sites throughout project Corridor	During construction	Engineering cost plus Rs0.5 million toward maintenance cost for soil conservation	Contractor	SC, PIU, NHAI
2. Water							
a. Water bodies	Only Rivers / Rivulets are getting impacted due to the proposed project during construction stage. No ponds / lakes are getting impacted. Measures will be taken to prevent temporary or permanent damage to water bodies.	RAP / Project Requirement	At water bodies or cross drainage	During construction	Engineering cost	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
b. Other water sources	Any community water source, such as wells, tube-wells, etc., lost incidentally will be replaced with alternate sources.	RAP / Project Requirement	Along the project corridor	During construction Before and during construction	Engineering cost plus Rs0.30 million for relocation of hand pumps and wells (in addition to RAP provision).	Contractor	SC, PIU, NHAI
c. Drainage and run-off	At cross drainage structures, the earth, stone or any other construction material will be properly disposed of, so as not to block the flow of water.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
d. Contamination of water from construction waste	Construction work close to streams or other water bodies will be avoided, especially during the monsoon period. Temporary drainage measures will be constructed. All necessary precautions (sandbagging etc.) will be taken to construct temporary or permanent devices to prevent run - off and water pollution due to increased siltation and turbidity.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
Contamination of water from construction waste contd.	All necessary measures will be taken to prevent earthworks and stone works from impeding rivers, streams, water canals, or drainage system. Wastes must be collected, stored, and taken to disposal sites approved by the authorities.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
e. Contamination of water from fuel and lubricants	To avoid contamination from fuel and lubricants, the vehicles and equipment will be properly maintained and refueled in dedicated locations and not over open ground. Fuel and lubricants will be stored in bunded areas with a capacity of 110% the maximum fuel storage capacity. Oil and grease traps will be provided at re-fuelling locations, to prevent contamination of water. The slopes of embankments leading to water bodies will be modified and screened so that contaminants do not enter the water body.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
Contamination of water from fuel and lubricants contd.	Side drains provided in the settlement areas will discharge through a primary settling tank Waste petroleum products will be collected, stored, and disposed of at the sites approved by the authorities and as per Indian Hazardous Waste Management and Handling Rules, 2002. Water quality will be monitored as envisaged in the EMP in all water bodies. The River Bewas River is the only perennial River and rest all dries up during summer season. However the water quality for such rivers will be monitored when water is present during non-summer season.	Legal requirement	Throughout project corridor At km 215.8–216, Bewas River At km 236–236.1, Dehar River At km 248.4–248.5, Sonar River At km 264.9–265, Banner River (Sukhchain Nala)	During construction	Rs0.072 million has been allocated for water quality monitoring at 4 sampling locations.	Contractor	SC, PIU, NHAI
f. Sanitation and waste disposal in construction camps	The construction camps will be located away from the habitation. The sewage system for such camps will be properly designed and built so that no water pollution takes place. If necessary, temporary effluent treatment plants will be installed in the construction camps. The workplace will have	Legal requirement	At construction camp locations, wherever located along the project corridor	During construction	Engineering cost plus Rs0.01 million for maintenance of hygienic condition at work place and Rs0.035 million	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	proper medical facilities.				for maintenance of hygienic condition at construction camps.		
g. Use of water for construction	The contractor will arrange for water required for construction so that nearby communities remains unaffected. Since the project area does not have enough perennial surface bodies, ground water will have to be extracted during construction in summer season, however, over exploitation of groundwater will be avoided by proper water management techniques. Water will not be wasted during the construction.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
3. Air							
a. Emission from construction vehicles and machinery	All the machinery and plants will be downwind of human settlements. The pollution emission levels of all vehicles, equipment and machinery used for construction will conform to the standards prescribed in India Central Motor Vehicles Rules, 1989. Air pollutant parameters will be monitored regularly during construction, as envisaged in the EMP. The asphalt plants, crushers, and the batching plants will be at least 1 km in the downwind of the nearest human settlement.	Legal requirement	Construction sites	During construction	Rs0.18 million for air quality monitoring at four construction sites	Contractor	SC, PIU, NHAI
b. Dust and its treatment	All precautions will be taken to reduce the level of dust emissions from the hot mix plants, crushers and batching plants. The hot-mix plants, crushers and batching plants will be at least 1 km downwind from the nearest habitation. The hot mix plant will be fitted with dust extraction units. Water will be sprayed in the lime, cement, and	Legal requirement	Throughout project corridor	During construction	Engineering cost plus Rs1.5 million	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	earth mixing sites; asphalt mixing site; and temporary service and access roads. After compacting works, water will be sprayed on the earthwork regularly to prevent dust.						
Dust and its treatment Contd.	Delivery vehicles will be covered. Mixing equipment will be well sealed and equipped as per existing standards.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
4. Noise Levels							
a. Noise from vehicles, asphalt plants and equipment	The plants and equipment used for construction will strictly conform to MoEF noise standards. Vehicles and equipment used will be fitted with silencer and maintained to keep noise at minimum levels.	Legal requirement	Throughout project corridor	During construction, till the closure of such sites	Rs0.162 million for four construction sites and other specified locations noise monitoring during construction.	Contractor	SC, PIU, NHAI
Noise from vehicles, asphalt plants and equipment Contd.	Noise standards for industrial enterprises will be strictly enforced to protect construction workers from severe noise impacts. Workers will be provided with appropriate ear muffs/plugs. The noise level will be monitored during the construction, as per the EMP. Noise barriers will be placed in urban locations.	Legal requirement	At hot mix plant, batching plants and Construction sites.	During construction, till the closure of such sites	Rs2.10 million for noise barriers, trees	Contractor	SC, PIU, NHAI
b. Noise from blasting operations	Blasting will be carried out as per Indian Explosives Act. People living near blasting sites will be informed of blasting times prior to the blasting. Blasting will not be undertaken at night. Materials haulage roads will be disposed in designated place. Workers at blasting sites will be provided with earplugs.	Legal requirement	Authorized quarry sites	During construction	Engineering cost	Contractor	SC, PIU, NHAI
c. Noise barriers	Solid, continuous high walls or earth mounding with vegetation will be installed at sensitive locations in line with acoustic principles and	Legal requirement	Sensitive locations such as educational	During construction	Rs3.1 million for wall per barriers against noise	Contractor	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	calculations to comply with statutory noise levels specified in MINAS standards.		institutions, hospitals etc.				
5. Flora							
a. Loss or damage to vegetation	Construction camps will not be allowed in areas of reserved forest or near rivers or water bodies. Areas cleared of trees will be replanted according to the Afforestation Policy under Forest Conservation Act-1980. Keeping in mind the survival rate 3 trees will be planted for each tree to be grown. Only trees clearly identified and conspicuously marked for felling will be cleared within the ROW.	Legal requirement	Throughout project corridor	Just before the beginning of the construction	Rs1.3 million for felling of trees plus Rs6.45 million for Road side Plantation and for plantation in the median	Contractor; SPCB	SC, PIU, NHAI
b. Compaction of soil	Construction vehicles, machinery, and equipment will move or be stationed in the designated area only, to prevent compaction of vegetation outside ROW. While operating on temporarily acquired land for traffic detours, storage, material handling, or any other construction-related or incidental activities, trampling of soil and damage to naturally occurring herbs and grasses will be kept to the minimum.	Legal requirement	Throughout project corridor	Just before commencement of construction	Engineering cost	Contractor; SPCB	SC, PIU, NHAI
6. Fauna							
a. Loss, damage or disruption to fauna	Construction workers will be directed not to disrupt or damage the fauna. State rules for hunting (Wildlife Protection) will be adhered to and rules for bird catching (Wildlife Protection) will be followed. Construction vehicles will ply specified access roads to avoid accidents with cattle.	Legal requirement	Throughout project corridor	During construction	No cost is involved	Contractor	SC, PIU, NHAI
7. Safety and Accident Risks							
a. Accident risks from construction activities	To ensure safe temporary accesses during construction, lighting and safety signal devices will be installed. Traffic rules and regulations will be strictly adhered to.	Legal requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
Accident	Cordons will be set 200m either side of the	Legal	Throughout project	During	Engineering cost	Contractor	NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
risks from construction activities Contd.	area to be blasted. The traffic will be halted and road will be temporarily closed at blasting time, signal, and guarding will be regulated. Prior to blasting, the site will be thoroughly inspected. Blasting will not be carried out during rush hours or with vehicles or any persons within 200m of the blasting area. Safety of workers during construction will be protected by providing helmets, masks, safety goggles, etc. The electrical equipment will be checked regularly. At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff, and doctor will be provided. Road safety education will be imparted to drivers of construction vehicles. Adequate signage, barriers and persons with flags to control traffic will be provided during construction. Communications through newspaper/ announcements/ radio / TV etc. about the time frame of the project and the activities causing disruption to road access and the temporary arrangements made to gave relief to the public will be undertaken.	requirement	corridor	construction			
b. Loss of access traffic jam	Temporary access will be built at interchanges of the highway and other roads. Since the present road is to be widened primarily on one side, the chances of severe congestion are minimal. However, temporary diversions will be provided wherever necessary, with proper drainage facilities.	Legal requirement	Along settlement stretches and at major intersections.	During construction	Engineering cost	Contractor	SC, PIU, NHAI
c. Health	The HIV/AIDS policy and strategy shall be	Legal / Project	Throughout project	During	Engineering cost	Contractor	SC,

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
issues	integrated with the above environmental mitigation measures where required, A health care system will be maintained at construction camps including regular visits by trained medical staff for routine check up of workers and avoidance of communicable disease. Adequate drainage, sanitation, and waste disposal facilities will be provided at work places. Proper drainage will be maintained around the sites to avoid water logging leading to disease. At least pit latrines will be constructed and provided at all minor work stations Adequate sanitation, washing, sewage and waste disposal facilities will be provided at construction camps by means of septic tanks, soakaway pits, etc. At every workplace, potable and sufficient drinking and washing water supply will be maintained to avoid water-related diseases and to secure the health of workers. Such pits and latrines will not be constructed within 80m of a water course or water body to avoid transmission of water-related diseases Adequate drainage, sanitation, and waste disposal will be provided at workplaces. Preventive medical care will be provided to workers.	requirement	corridor construction camps	constructi on			PIU, NHAI
8. Cultural Properties							
a. Damage or loss of religious /cultural	Relocation of cultural properties. If any valuable articles such as fabrics, coins, artifacts, structures, or other archaeological relics are discovered, the excavation will be	Legal requirement	Along the project corridor	Before constructi on starts	Rs5,000 lump sum per relocation (in addition to	Contractor and Archaeology Department of Madhya	SC, PIU, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
properties	stopped and the archaeology departments of Madhya Pradesh will be informed. Construction camps, blasting sites, and all allied construction activities will be away from cultural properties so they are not affected.			During construction.	provisions made in the resettlement action plan).	Pradesh.	
9. Environemntal Enhancements							
a. Roadside landscape development	Avenue plantation of shade trees mixed with flowering trees, shrubs, and aromatic plants as per detailed schemes prepared, will be carried out.	Legal requirement	Throughout project corridor	During construction	Rs0.3 million for additional tree plantation for environmental enhance-ment / roadside landscape development	Contractor	SC, PIU, NHAI
b. Roadside amenities	Restoration and improvement of bus shelters, bus bays, and truck stops as per detailed design will be carried out. Road furniture including footpaths, railings, traffic signs, speed zone signs, etc. will be erected as per design.	Project Requirement	Throughout project corridor	During construction	Engineering cost	Contractor	SC, PIU, NHAI
c. Cultural properties	Enhancement of all cultural properties and the access roads will be completed as per design.	Project / RAP Requirement	Throughout project corridor	During construction	Covered in damage or loss of cultural properties.	Contractor	SC, PIU, NHAI
Operating Stage							
a. Contami-nation from spills due to traffic and accidents	The accident sites will be cleared immediately. The soiled earth will be scraped into small lined confined pits nearby, with the ROW.	Legal requirement	Throughout project corridor	Operation period	Engineering cost	Local government bodies including State PWD, NHAI	NHAI
b. Dust Generation	Roadside tree plantations will be maintained. Afforestation will be taken up at new sites near the road.	Legal requirement	Throughout project corridor	Operation period	Covered in environmental enhancement–roadside landscape development	NHAI; State Forest Department	NHAI; State Forest Department
c. Air pollution	Vehicular emissions of critical pollutant parameters (SPM, RSPM, CO, SO_2, NO_x and Pb) will be monitored as per the EMP.	Legal requirement	Gura Village Surkhi Village, Gaurjhamar Village and Deori Village	Operation period	Rs0.06 for air quality management	Motor Vehicle Department, and SPCB, NHAI	NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
Air pollution Contd.	Vehicular air pollution will be managed and monitored at the toll plazas. Public awareness will be generated. The road will be regularly maintained done to ensure good surface conditions. Roadside tree plantation will be maintained.	Legal requirement	Throughout project corridor	Operation period	Included above	Motor Vehicle Department, and SPCB, NHAI	NHAI
d. Noise pollution	Noise will be monitored at schools and hospitals to determine the effectiveness of the noise barriers installed at the construction stage. According to monitoring results modifications and improvements to the designed and installed noise sound barriers/trees will be considered as a remedial measure if residual effects exceed accepted standards. Signs for sensitive zones (hospitals, educational institutions, Reserve Forest Areas, etc.) will be put up where horns will not be blown and traffic speed needs to be regulated. Public awareness program will be launched.	Legal requirement	Gura Village Surkhi Village, Gaurjhamar Village, Deori Village , on NH 86 and NH 26 crossing	Operating period	Rs0.03 million for noise manage-ment	Motor Vehicle Department and SPCB, NHAI	NHAI
e. Water	The drainage system will be cleaned periodically. Water quality will be monitored as per the monitoring plan.	Legal requirement	At km 215.8–216 Bewas River At km 236–236.1, Dehar River At km 248.4–248.5 Sonar River At km 264.9–265, Banner River (Sukhchain Nala)	Operating Stage	Rs0.024 million for water quality monitoring	Local government bodies, NHAI	NHAI
f. Flora and Fauna (key stone species)	The re-plantation scheme, containing key species, will be strictly monitored for the first 3 years. Efforts will be made for planted trees, shrubs, and grasses to be properly maintained. Efforts will be made to educate the villagers on the use of specified areas for cattle grazing.	Legal requirement	Throughout project corridor	Operating stage	Rs0.09 million	Forest department Madhya Pradesh	Forest departments of Madhya Pradesh, NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
g. Soil	Soil quality monitoring as per monitoring plan for Pb, Cr, and Cd.	Legal requirement	At congested locations near industries	Operating stage	Rs0.036 million	NHAI	NHAI
h. Accidents involving hazardous materials	The rules as defined in Environmental (Protection) Act, 1986 will be complied with. For delivery of hazardous substances, three certificates issued by the transportation department (the permit, driving, and guarding licenses) will be required. To take care of the accidental spills, side drainage channels and collection sump at landfall (sloping side) points shall be provided to intercept runoff of accidentally spilled chemicals. Runoff shall be collected in sumps and an emergency response mechanism shall be co-ordinated with District Administration / Local Police / Other parties to ensure safe removal of spilled hazardous chemicals from catchment (as per guidance on off site emergency planning, Section 14 and Schedule 12 of "Manufacture Storage and Import of Hazardous Chemicals Rules 1989").	Legal requirement	Throughout project corridor	Operating stage	No cost involved	Motor Vehicle Department and SPCB; District Administration	Motor Vehicle Department, NHAI; District administration
Accidents involving hazardous materials Contd.	Vehicles delivering hazardous substances will be printed with appropriate signs. Any spillage will be reported to relevant departments will be made and instructions followed in taking up the contingency measures. Efforts will be made to clean spills of oil, toxic chemicals, etc. as early as possible.	Legal requirement	Throughout project corridor	Operating stage	No cost involved	Motor Vehicle Department and SPCB; District Administration	Motor Vehicle Department, NHAI; District Administration
i. Safety measures	The traffic management plan will be developed, especially along congested locations. Traffic control measures, including speed limits, will be enforced strictly. Further encroachment and squatting within the ROW will be prevented. No school or hospital will be allowed to be	Legal requirement	Throughout project corridor	Operating stage	Engineering cost	Local government bodies	NHAI

Issue/ Component	Remedial Measure	Reference to Contract Documents	Approximate Location	Time frame	Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	established within 200m of the highway without permission from the planning authorities.						
Total Environmental Mitigation Cost (Excluding Items Coming Under Project Preparation / Engineering Cost)					**73.234 Million**		

Note: Data are given as per IEE report. But recent developments due to RAP and other engineering considerations may change these.

DFO = Department of Forest, IEE = initial environmental examination, EMP = environmental management plan, IRC = India Road Construction, km = kilometers, m = meters, MINAS = minimal national ambient standard, mm = millimeters, NHAI = National Highways Authority of India, PAP = project affected people, PIU = Project Implementation Unit, PWD = Public Works Department, RAP = resettlement action plan, ROW = right of way, SC = supervision consultant, SPCB = State Pollution Control Board, SPM = suspended particulate matter, RPM = respirable particulate matter, SO2 = sulpher di-oxide, NOx = nitrogen oxides, CO = carbon mono-oxide, HC = hydrocarbons, Pb = lead.

MONITORING PLAN FOR THE PERFORMANCE INDICATORS

Environmental Component	Project Stage	Parameters	Location	Frequency	Standards	Approximate cost (Rs)	Implementation	Supervision
Air Quality	Construction stage	SPM, RPM, NOx, CO	***Hot mix plant, concrete mixing plant at construction (four construction sites)***	24 hr continuous, 3/year for 3 years	Air quality standard by CPCB	4x5000x3x3 =Rs180,000	Contractor through approved monitoring agency	PIU, NHAI, SC

Environmental Component	Project Stage	Parameters	Location	Frequency	Standards	Approximate cost (Rs)	Implementation	Supervision
	Operation stage	SPM, RPM, NOx, CO, HC, Pb, SO_2	***Gura Village Surkhi Village, Gaurjhamar Village and Deori Village***	24 hr continuous, 3/year for 1 year	Air quality standard by CPCB	5,000x3X4 =Rs60,000	Contractor through approved monitoring agency	NHAI
Water Quality	Construction stage	All the parameters for inland surface water quality standard for class-D will be tested for groundwater as per IS 10500:1991	**At km 215.8–216 , Bewas River At km 236–236.1, Dehar River At km 248.4–248.5 Sonar River At km 264.9–265, Banner River (Sukhchain Nala)**	3/year for 3 years	Water quality standard by CPCB	4x3x2,000x3 =Rs72,000	NHAI	PIU, NHAI, SC
	Operation stage	All the parameters for inland surface water quality standard for class-D will be tested groundwater as per IS 10500:1991	**At km 215.8–216 , Bewas River At km 236–236.1, Dehar River At km 248.4–248.5 Sonar River At km 264.9–265, Banner River (Sukhchain Nala)**	3/year for 1 year	Water quality standard by CPCB	4X3x2,000 =Rs24,000	Contractor through approved monitoring agency	NHAI
Noise levels	Construction stage	As per National Ambient Noise Standard as per Environmental Protection Act, 1986 amended 2002	***All Construction sites and Gura Village Surkhi Village, Gaurjhamar Village, Deori Village , on NH 86 and NH 26 crossing***	24 hr continuous, 3*/year for 3 years	Noise level standard by CPCB	9x2000x3x3 =Rs162000	NHAI	PIU, NHAI, SC
	Operation stage	As per National Ambient Noise Standard as per Environmental Protection Act, 1986 amended 2002	***Gura Village Surkhi Village, Gaurjhamar Village, Deori Village , on NH 86 and NH 26 crossing***	3 / year for 1 year	Noise level standard by CPCB	5x2,000x3X1 =Rs30,000	Contractor through approved monitoring agency	NHAI
Flora	Operation stage	Maintain the species at 75% survival rate	***Entire stretch***	For 3 years after plantation	-	Rs. 90,000	NHAI	NHAI
Fauna	Design Stage	WLS Census	***Naoradehi WLS***	Once (baseline)		Rs. 30,000		
	Construction Stage	WLS Census	***Naoradehi WLS***	Once during construction of km 283-288		Rs30,000		
	Operation Stage	WLS Census	***Naoradehi WLS***			Rs. 30,000		
Soil	Operation stage	Monitoring of Pb, Cr, Cd	***Congested locations (4 locations)***	3 years, once in a year during winters	-	4X3,000X3= Rs36,000	NHAI	NHAI

otal Monitoring Costs = Rs744000 or Rs0.744 million

Cd -Cadmium; CO - Carbon Monoxide ; Cr - Chromium; HC - Hydrocarbon; IS - India Standard; NHAI - National Highway Authority of India; NOx - Nitrogen Oxide; Pb - Plumbum, (lead); PIU - Project Implementation Unit ; RPM - Respirable Particulate Matter; SO_2 - Sulfur Dioxide; SC – Supervision Consultant; SPM - Suspended Particulate Matter, RPM - Respirable Particulate Matter