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## Environmental Assessment Document

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### E.CONSTRUCTION OF VARIOUS ROADS IN SONEPAT DISTRICT

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

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## I. INTRODUCTION

### A. Background

1. The Project aims to promote growth and balanced development of the whole National Capital Region through providing economic base in the identified major settlements (Metro Centres/Regional Centres) for absorbing economic development impulse of Delhi, efficient transport network, development of physical infrastructure, rational land use pattern, improved environment and quality of life. In line with the objectives of the Regional Plan, the primary objective of this project are to improve quality of life and well-being of urban residents in the National Capital Region (NCR): This will be achieved by way of support to various agencies in the constituent States through NCRPB a line of credit to compliment the ongoing efforts of NCRPB in financing the regional Plan priorities and technical assistance to improve quality of planning, design and management interventions in the region. To address the twin business propositions of the National Capital Region Planning Board (NCRPB), – planner of relevance and a strategic financier, - the ADB line of credit comprises of both an investment loan USD 140 million and a TA component of USD 10 million. The projects to be taken up are typical of regions needs –small town water and sanitation, connectivity investments and transport infrastructure which provides multi modal transport linkages.
2. This Initial Environmental Examination (IEE) assesses the environmental impacts due to the proposed improvements to the following roads in Sonapat district in Haryana:
  - Gohana-Sisana Road ( 28.563 km)
  - Sonapat-Mehlana-Farmana Road, (21.883 km)
  - Kharkhauda-Assaudha Road, (18.045 km).
3. The IEE specifies measures towards addressal of the impacts. The IEE has been prepared based on a review of sub-project designs; field visits, and secondary data to characterize the environment and identify potential impacts; and consultations with stakeholders. An Environmental management plan (EMP) outlining the specific environmental measures to be adhered to during implementation of the sub-project has been prepared.

### B. Compliance to ESMS of NCRPB

4. Recognizing the environmental and social issues that can arise in infrastructure projects, NCRPB has prepared a Draft Environmental and Social Management Systems (ESMS) in line with ADBs safeguard requirements for Financial Intermediaries (FIs). The ESMS provides an overall management system to NCRPB to identify, assess, and mitigate environmental and social issues that are likely to arise in projects financed by NCRPB and implemented by Implementing Agencies (IAs). The ESMS outlines the policies, methods of assessments and procedures that will enable NCRPB to ensure that a project that it funds is developed in accordance with ESMS and is adequately protected from associated risks. IAs will have to comply with the ESMS conditions while submitting their loan application. This IEE has been prepared in line with the ESMS of NCRPB.

### C. Purpose of the IEE

5. The proposed components will result in positive environmental impacts. The alignments are proposed along the existing routes and widening /strengthening is envisaged within the available RoW. In case of stretches within settlements, resettlement impacts have been avoided through design of constricted cross-sections and provision of appropriate traffic management measures. Design of the alignment adopting this approach has enabled avoidance of impacts related to land acquisition, and impacts on agriculture lands.

6. Given the magnitude of civil works, there would be typical construction related impacts, and could be mitigated by appropriate mitigation measures and adoption of good construction practices. Further, these will be of limited intensity and of short duration. None of the project interventions as part of these proposed road improvements are proposed within locations in or near sensitive and valuable ecosystems, including protected areas and forests. Therefore, as per the ESMS, the sub-projects are categorized as 'B' and an IEE carried out. This IEE provides mitigation measures for impacts related to construction, operation, and maintenance.

**D. Environmental Regulatory Compliance**

7. The realm of environmental regulations and mandatory requirements for the proposed sub-project is shown in Table 1. The Environmental Impact Assessment (EIA) notification, 2006 by the Ministry of Environment and Forests (MoEF, GoI) specifies the mandatory environmental clearance requirements. Accordingly, all projects and activities are broadly categorized in to two categories - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and man-made resources. This project does not require any environmental clearances under the Environmental Protection Act 1986. However, the project will require consent from Competent Authorities such as the Haryana State Pollution Control Board.

Sub-Component	Applicability of Acts/Guidelines	Compliance Criteria
Roads and highways	Environmental (Protection) Act, 1986 (and as amended subsequently in 2006), and in 2009 The EIA notification, 2006 categorization of projects into category A and B, based on extent of impacts. All new state highway projects and state highway expansion projects in hilly terrain or in ecologically sensitive areas are categorized as category B projects.	According to the notification, the project roads do not fall under either category A or Category B. The roads included are district roads and are not state highways. Therefore, environment clearance is not required for the project. However, permission for felling of road side trees will be required. Consent for Establishment and Consent for Operation from the State Pollution Control Board will be required.

8. The ADB guidelines, stipulate addressing environmental concerns, if any, of a proposed activity in the initial stages of Project preparation. For this, the ADB Guidelines categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment<sup>1</sup> required to address the potential impacts. None of the project interventions are proposed within locations in or near sensitive and valuable ecosystems, including protected areas and forests. The sub-project has been categorized as B. Accordingly this IEE is prepared to address the potential impacts, in line with the recommended IEE content and structure for Category B projects. The IEE was based mainly on secondary sources of information and field reconnaissance surveys. Stakeholder consultation was an integral part of the IEE.

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<sup>1</sup> Level of environmental assessment required for each category of Project, as per ADB's Safeguards Policy Statement, 2009 and Environmental Assessment Guidelines 2003 is as follows: (i) Category A. Sub-project components with potential for significant adverse environmental impacts. An environmental impact assessment (EIA) is required to address significant impacts; (ii) Category B. Sub-project components judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for Category A projects. An initial environmental examination (IEE) is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. (iii) Category C. Sub-components unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.

E. Report Structure

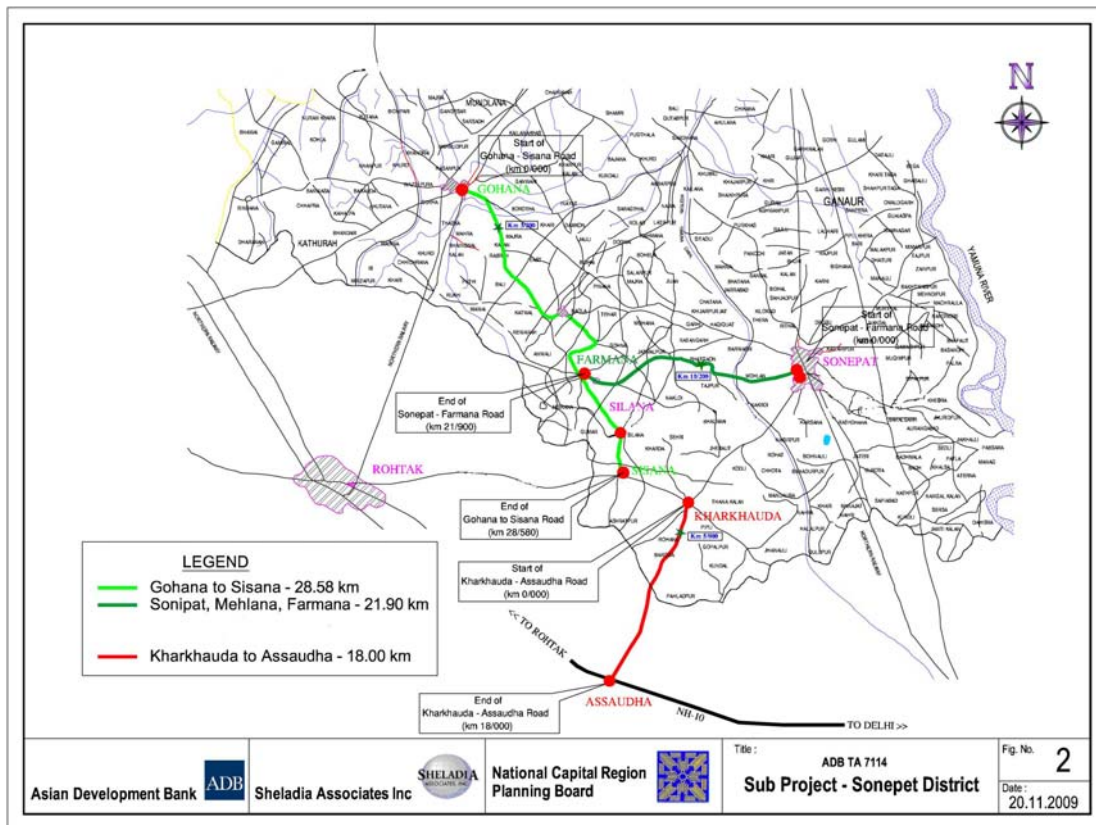
9. This Report contains 8 sections including this introductory section: (i) introduction; (ii) description of project components; (iii) description of the environment; (iv) environmental impacts and mitigation measures; (v) institutional requirements; (vi) public consultation and information disclosure; (vii) finding and recommendation; and (viii) conclusions. An Environmental management plan (EMP) outlining the specific environmental measures to be adhered to during implementation of the sub-project has been prepared.

II. DESCRIPTION OF PROJECT COMPONENTS

A. Project Description

10. The five roads proposed for rehabilitation and widening is shown in table below. Location map of the project roads is provided in the Figure below.

S.No.	Name of the Road	District	Length(km)
1	Gohana-Sisana Road	Sonepat	28.563
2	Sonepat-Mehlana-Farmana Road	Sonepat	21.883
3	Kharkhauda-Assaudha Road	Sonepat and Jhajjar	18.045



11. The project roads consists of three separate roads having carriageway width varying from 3.5m to 5.5m and with 1m to 1.5 wide earthen shoulders on both sides. The design service volume (DSV) of single lane carriage way is 2000PCU and the current traffic in almost all the project roads exceeds the DSV. This indicates the immediate requirement of capacity augmentation in form of widening to 2 lane carriageway. Sections of the roads pass through a few built-up areas with inadequate road geometry. Between the built-up areas, alignment is fairly straight. The project road passes through plain terrain with mild gradients. The present condition of the pavement is very poor and the existing bituminous layer has no residual strength and hence scarification of existing pavement and reconstruction from the base or sub base level is required. The improvement

- proposal is generally restricted within the available ROW. There are 7 minor bridges and 56 culverts proposed for replacement/improvement.
12. The three roads selected for improvements are linking various villages to the main transport network consisting of National Highways and State Highways. In addition to the requirement for widening, the conditions of the existing road are very poor and needs rehabilitation.
  13. The HSRDC has taken up project preparation for upgrading roads in many districts. The sub-project under consideration forms part of Package 7 and links many villages to major arterial roads of Sonapat district. The upgrading proposal is for strengthening and capacity augmentation. The HSRDC has retained the service of M/s SAI Consulting Engineers Private Ltd for carrying out detailed engineering design report for proposed improvement of roads in Sonapat district. Most of the roads in this package are having single to intermediate lane width with bituminous pavement. The drainage conditions of the project roads especially in the village area are very poor. Concrete pavements are generally provided in the village areas. The horizontal geometry of the project roads is reasonable except at village sections where many sharp curves are observed. As the project area is in flat terrain, smooth vertical profile which meets the required design standards are generally observed on all the roads. There are no protected areas, wildlife sanctuaries or forests in the area.
  14. The available ROW varies between 8 m-25 m and HSRDC expressed their intention that land acquisition should be used as last resort. In other words, improvement to road geometrics is to be within the available land width. As such, there is no need to design the road links for high speed as most of the road users have their prime concern to reduce wear and tear to their vehicle by plying over good surface instead of present poor road. Therefore, the scope of geometric improvement can be considered fairly limited for this project.

#### B. Project Components

15. The improvements proposed are as follows.
16. **Realignment and curvature improvement:** Improvements to the existing sub-standard geometrics at several locations especially the sharp curves with poor geometrics have been proposed, to enhance the safety along the road. These designs have been worked out within the available RoW to the extent possible. There are no bypasses / major realignments proposed. However, on tight locations (locations with potential land acquisition impacts and along stretches within the settlements where structures would be impacted), the design speeds has been kept as low as 15 km/hr.
17. **Road widening:** The present traffic has exceeded the design service volumes of the existing single / intermediate lane carriageway traffic warrants widening only to two lanes. Therefore, a 2 lane carriageway is planned.
18. **Profile improvement:** Some locations have been identified for improvement of either the longitudinal or vertical profile as required at the various stretches.
19. **Junction improvement:** Improvement to allow a safe connection to the corridor and minimum interference to the through traffic at all intersections is planned. If required, realignment is also suggested.
20. **Drainage:** Drainage is considered an important part of the project design and a proper drainage network has been considered is considered. This will consist of
  - Covered lined drain in RCC M 20 grade in built-up areas as side drain.
  - Open chute drain in Brick masonry in cement mortar 1: 3 on slopes of high embankment.
  - No drains have been provided in open areas.
21. **Improvement of bridges and drainage structures:** The project road is proposed to be widened to 2-lane carriageway with paved shoulder. Most of the bridges have many common deficiencies/defects, which are proposed to be repaired. Improvement of 6 bridges and 119 culverts is proposed along the project roads.

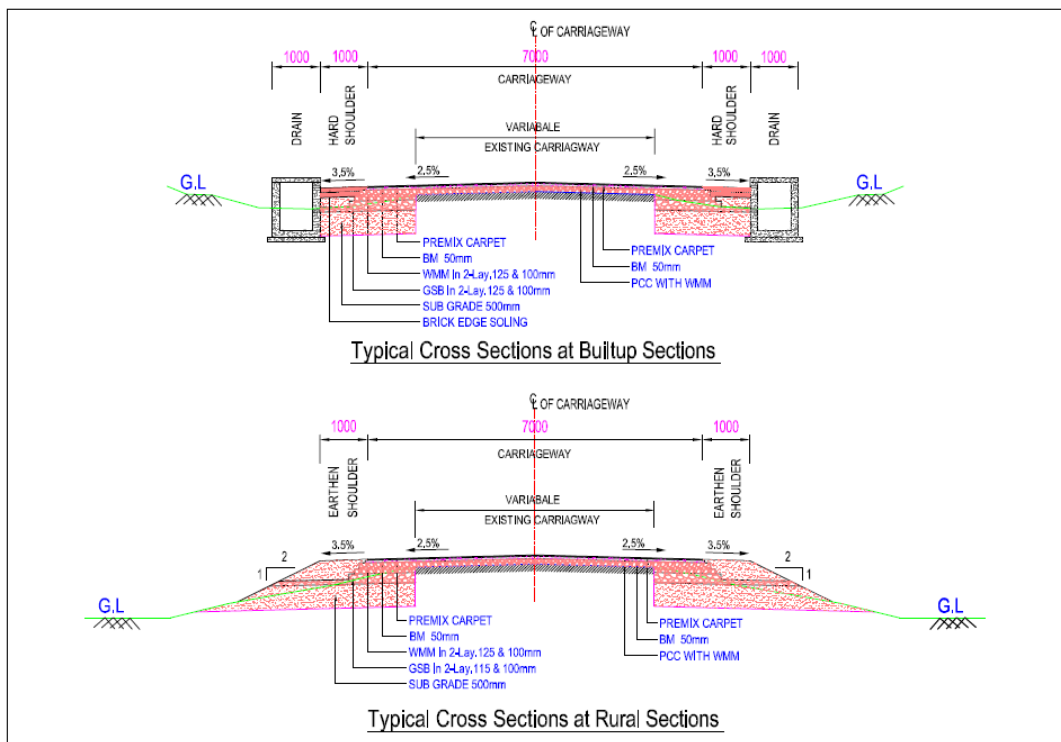


22. Superstructures: Repair and reinforcement of superstructures will be considered for all structures on the identified roads. These will include,
- Waterways: Cleaning of waterways will be undertaken if found choked with vegetative growth or silted. If required, spurs and dykes will also be provided to reduce excessive scouring and change flow of direction.
  - Improvement of culverts: In areas where improve design culverts will be recast, lengthened, cleaned of vegetation, or reconstructed or repaired, as required.
- C. Design cross-sections

23. Designs are based on IRC codes - and typical cross section is presented In Figure 3. While these are the typical cross-sections, modifications to these have been worked out at locations with RoW constraints, either in rural areas or within built up stretches to minimize land acquisition and resettlement. Various typical cross sections are adopted for the project improvement proposal depending upon the lane width and drain type. Typical section generally adopted are listed below:

- Two Lane rural section
- Two Lane urban section

The proposed sections consist of 7m wide carriageways and 1m wide gravel shoulder on either side of the carriageway. The proposed sections meet the IRC requirements of ODR.



D. Design Standards

24. The project roads are proposed to be designed as per the standards of Other Districts Roads. Accordingly IRC 73 “Geometric Design Standards for Rural Highways-1980” published by the Indian Road Congress is referred for finalizing project design standards. The design parameters considered for the project road improvements are summarized in the Table 6.10.

Table 6.10 Design Parameters

S. No	Description	IRC Standards		
1	Design speed Plain and Rolling	Max – Min	65 - 50 km/hr	
2	Lane width		3.5 m	
3	Paved shoulder width		1.5 m	
4	Earthen Shoulder		1.0	
5	Road Way Width	Single Lane Two Lane	7.5 m 9.0 m	
6	Right of Way		15 m	
7	Cross-slopes	Carriageway Paved shoulder Unpaved shoulder	2.5 % 2.5 % 3.5 %	
8	Maximum super elevation		7.0 %	
9	Minimum horizontal curve radius	For 65 Km/hr For 50 Km/hr	150 m 90 m	
10	Radii beyond which super elevation not required	For 65 Km/hr For 50 Km/hr	750 m 450 m	
11	Super elevation runoff rate	For Plain and rolling For mountainous & steep	<1 in 150 <1 in 60	
12	Transition curves to be used with length of spiral more than or equal to length of super elevation runoff			
13	Extra widening of carriageway on curves	For curve radius >300m 101 to 300m	Nil 0.6m	
14	Gradient	Ruling Gradient Limiting Gradient Exceptional Gradient	3.3 % 5 % 6.7%	
15	Minimum Length of Vertical Curves / Grade change not requiring vertical curve	Design Speed	min. curve length	max. grade change
		65 km/hr 50 km/hr	40m 30m	0.8% 1.0%
16	Vertical curve 'K' values Crest vertical curve/Sag vertical curve	For design Speed	Crest	Sag
		65 km/hr 50 km/hr	18.4 8.1	10 17.4
17	Vertical clearance	Road over road Road over railway Electrical lines H.T.Electrical lines Telecommunication Lines	5.5 m 6.525 m 6.0m (Up to 650 V) 6.5m (More than 650 V) 5.5m (Up to 110 V)	

25. The traffic projection for the design period of 10 years indicate that the projected traffic is within the design service volume of two lane road and therefore two lane road cross section is proposed for the project roads.

**E. Implementation Schedule**

26. The project is proposed to be implemented over a period of 18 months and as a single construction package. Consultations with the communities along the project roads indicated that the agriculture activities shall be impacted if the construction activities are taken up in the harvesting and sowing periods. The implementation schedule shall be worked out to ensure minimum disruption to the communities, due to the construction activities.

### III. Description of the Environment

27. Sonipat district is located in the south-east of the State of Haryana. The district lies between 28°48'30" to 29°17'54" N latitude and 76° 28' 30" to 77° 13'40"E longitude.

#### A. Physical Environment

##### 1. Topography

28. Sonipat district forms a part of the Indo-Gangetic plains and exhibit flat terrain with slope from north to south. This area is devoid of any prominent topographic features, except a natural depression in north and northwest of Gohana. Altitude of the plains in the district varies from 212 m to 230 m above mean sea level (MSL). The quaternary sediments of the area are composed of recent and fresh matter deposits of clay, silt and sand which are of loose to semi-consolidated nature of recent to sub-recent age. Topographically the district can be divided into three units, viz., (i) active flood plains along the present day course of the river Yamuna in eastern part of the district; (ii) abandoned flood plains of recent past, bordering the active flood plains and are wider, low lying flat tracts; and (iii) upland plains aligned along the western Yamuna canal representing the relatively older river deposits.
29. All the project roads pass through plain terrain with mild gradients. The Sonipat district, is part of the alluvial plain formed by the Yamuna and the Ganga rivers that occupies a major portion of NCR. In Jhajjar district most of the area is covered by Quaternary alluvium. The adjoining areas around the project roads mainly consist of flat agricultural fields and brick kilns. In addition to the few scattered water bodies and village ponds existing along the roads, borrowing of earth for brick kilns has resulted in depressions adjoining the identified roads.

##### 2. Climate

30. The climate is characterized by an intensely hot summer and a cold winter. November to March is winter; summer season prevails during May and June. Temperature during January reaches 7.3°C, while in May and June reaches 47° C. Southwest monsoon fetches about 75% of rainfall between July to September, during this period weather is mild. Annual average rainfall in the district was 511.4 mm. During the monsoon period the district experiences high humidity; while in April and May it goes below 20%. Similarly, in the monsoon periods winds are strong, and in post-monsoon and winter months it is light. Thunder storm and dust storm, often accompanied with squalls (andhis) experienced during the period April to June.

##### 3. Soils

31. Soils along the project roads vary from sandy to clayey loam, because of its presence in the banks of the Yamuna river and being a part of Indo-Gangetic alluvial plain. About 67 per cent soil in the district is sandy loam, 25.5 per cent sandy and 7.25 per cent clay. The soil is deficient in organic matter, salinity and alkalinity. Soil parameters observed for cultivation in the district show fertility of the land (pH – 6.5 to 8.6, Conductivity – below 2.5µmho/cm, Organic Carbon – below 0.4%, P – below 10 kg/ac, K – above 135 kg/ac, Zn – above 0.6 ppm, Mn – above 2.00 ppm, Iron – above 4.5 ppm). Soils in Gohana area of the district show pH of 8.0 to 8.9; conductivity (µmho/cm) – 0.13 to 1.14; Zn (ppm) – 0.68 to 3.04; Cu (ppm) – 0.48 to 1.66; Fe (ppm) – 5.30 to 23.98; Mn (ppm) – 4.36 to 11.61 (*Source: Soil Testing Register, 2009- KRIBHCO*).

##### 4. Geology

32. The geological classification of the project area has been broadly divided into two formations viz. the older alluvial formation and the Jamuna older alluvial formation. The older alluvial formation, occurs at higher level arid, and consists of silt, silty clay and clay, accompanying 'kankar' at certain places.

Jamuna older alluvial formation, consists of grayish silt, silty sand with sporadic pebbles of quartzites basic rock fragments and clay pockets, occurs concomitant to the Jamuna channel in the form of recent flood plain and low lying terrace deposits. Sand occurring in abundance in this district is useful for construction. Brick clays from silty clays used for brick making and salt peter in Gohana and Sonipat taluks are mineral resources in this district.

5. Water systems

33. There are no perennial rivers in this part of the NCR. However, there are some water bodies adjoining the identified roads, in form of village ponds and lakes. The water quality in the district varies with some areas showing excess levels (beyond permissible limits of Gol guidelines) of nitrates, fluorides, and fluoride. The water table is shallow and within 5 m depths in the northern parts of Jhajjar district. In the remaining parts of the district the water table is between 5 and 20 meters. In Jhajjar district fresh water aquifers of limited thickness are underlain by saline water aquifers, and have limited yielding potential. However, freshwater is available up to a depth of 30 meters in most parts of the district. At present, the water table in Jhajjar District, though is not overexploited, there are areas wherein the water is brackish.

6. Surface Water

34. The River Yamuna in the eastern side and Western Yamuna Canal passing through the district are the major sources of surface water. The drains constructed in the district take out excess monsoon water to Yamuna River. The water quality near National Highway No. 1 in Yamuna River is presented in Table below. Cadmium, Nickel, Chromium, Zinc and Iron are the heavy metals observed in the Yamuna river near the Sonipat district.

Parameter	Location along NH1 in Sonipat district	Permissible Standard
Temperature (°C)	14.0 to 32.0	
Dissolved Oxygen (mg/l)	5.7 to 12.0	> 4
pH	7.04 to 8.42	6.5 to 8.5
Free Ammonia (mg/l)	BDL to 1.77	
Total Kjeldhal Nitrogen(mg/l)	0.28 to 3.05	
COD (mg/l)	4 to 49	
BOD (mg/l)	1 to 6	< 3
Conductivity (µmho/cm)	192 to 619	
Total Coliform (Nos./100ml)	2900 to 8100	< 5000
Faecal Coliform (Nos./100ml)	560 to 110000	
Source: Water Quality Status of Yamuna River (1999-2005), CPCB		

35.

36. There are 7 minor bridges and 56 culverts existing along the project roads. There are no major river crossings, and the minor bridges are across the irrigation canals. Following Table summarizes the cross-drainage structures in the various sections along the project roads.

Table 1: Surface water crossings along the project roads

S.No.	Name of the Road	Chainage (m)		Minor Bridges across irrigation canals	Culvert
		From	To		
1	Gohana-Sisana Road	0+000	18+000	4	17
		18+000	18+800	-	1
		18+800	19+200	-	1

S.No.	Name of the Road	Chainage (m)		Minor Bridges across irrigation canals	Culvert
		From	To		
		19+200	25+200	-	9
		25+200	25+600	1	-
		25+600	28+500	-	4
2	Sonepat-Mehlana-Farmana Road	0+000	0+500	-	-
		0+500	1+600	-	-
		1+600	5+300	-	-
		5+300	5+800	-	-
		5+800	11+600	2	5
		11+600	12+600	-	5
		12+600	15+900	1	2
		15+900	16+500	-	1
		16+500	21+450	1	10
		21+450	22+000	-	-
3	Kharkhauda-Assaudha Road	1+000	6+000	1	2
		0+000	0+600	-	-
		0+600	2+700	-	1
		2+700	3+450	-	-
		3+450	7+500	-	8
		7+500	8+600	-	2
		8+600	11+200	-	1
		11+200	11+700	-	-
		11+700	12+400	-	-
		12+400	14+200	1	3
14+200	15+600	1	1		
15+600	18+000	-	2		
<b>Total</b>				<b>7</b>	<b>56</b>

7. Ground water

37. Ground water occurs in depths of 10-25m in the district. The quality of ground water in shallow dug wells is fresh in the eastern and north, northwest parts and gradually gets deteriorated in the western and southwestern parts. The total replenishable ground water resource in the district is 449.58 mcm, while the total existing ground water draft by all means is 511.10 mcm. The shallow ground water of the district is alkaline in nature and with moderate to high mineral content with EC ranging from 597 to 6710µS/cm at 25°C. Ground water occurring in the southern and north-western parts of the district is more saline as compared to ground water occurring in the rest of the district. 68% of the ground waters are not suitable for drinking due to salinity, fluoride (13 mg/l) contents

above permissible limits. The concentration of Arsenic (2 mg/l) and Iron (6 mg/l) are observed more than permissible limits in few areas.

8. **Ambient Air quality**

38. TSPM and PM<sub>10</sub> observed in Sonipat were above the standard limits. Concentrations of SO<sub>2</sub> and NO<sub>2</sub> were found below the permissible limits. Higher concentration of TSPM and SO<sub>2</sub> observed during winter seasons causes respiratory diseases. Ambient air quality observed in Sonipat is depicted in the table

Parameter	Observed in Sonipat	Standards
TSPM (µ/m <sup>3</sup> )	158.3 – 1756.6	50 – 100
PM <sub>10</sub> (µ/m <sup>3</sup> )	74.2 – 430	--
NO <sub>2</sub>	19.7 – 78.4	30 – 120
SO <sub>2</sub>	4.8 – 87	30 – 120

9. **Ambient Noise Levels**

39. Average noise levels monitored in Jhajjar district in rural and residential areas varied from 46.8 to 54.4 dB(A) during the day and 40.1 to 43.6 dB(A) at night, and are within the prescribed limits. Day time noise levels near the Jharli Railway station averaged 60 dB(A), exceeding the limit of 55 dB(A); while night time noise levels averaged 46.1 dB(A), exceeding the limit of 45 dB(A). The monitored noise levels for residential areas were within the prescribed limits.

10. **Agriculture**

40. Paddy, wheat, sugarcane and bajra contribute major crops in the project area due to good water holding capacity of the soil. Other crops include jawar, maize, cotton, moong gram, barley, oil seeds (such as Sarson, toria and tarmira/tira), robi pulses, and vegetables (such as tar or kakri, ghia, kadoo, tori, Petha, tinda, karela, brinjal, tomato, Bhindi (lady finger) and sweet potato in summer and radish, turnip, carrot, Palak, methi, cabbage in winter). Fruits grown include malta-orange, sweetlime, kaghzi lime, mango, guava and ber, pomegranate, grape and phalsa.

11. **Ecological Resources**

There are no reserved or protected forests or areas near and around the project roads. The Bhindawas Bird Sanctuary, situated about 50 km from the Kharkhauda-Assaudha Road, is the only protected area in the project districts. There are no impacts envisaged on this sanctuary due to the proposed road developments. Given that there are no major protected areas, and that the alluvial plains, and especially the project roads, are largely inhabited, there is hardly any wildlife existing, with exception of nilgai (blue bull). Flora and fauna in the district are not unique. No endangered flora and fauna is noted.

12. **Fisheries**

41. Surface waters in the form of river, drains, canals and ponds in the district facilitate growth of fisheries. Fish species noted in the district include Parri (Notopterus chitala (Hamilton)) and N.notopterus (Pallas) Parri Family Cyprinidae (Tne Carps), Katla, Theil (Catla catla (Hamilton)), Kalabans, Dhai ( Labeo calbasu (Hamilton)), Rohu ( L. rohita (Hamilton)), Akhrot (L. Pangusia (Hamilton)), Puntius sarana sarana (Hamilton) Family Bagridae (Catfishes), Aorichthys seenghala (Sykes), Mystus vittatus (Bloch), Rita rita (Hamilton) Family Heteropneustidae (Catfishes), Heteropneustes fossilis (Bloch) Family Schilbeidae (Catfishes), Clupisoma garva (Hamilton), Silonia silondia (Hamilton) Family Siluridae (Catfishes), Wallago attu (Schneider) Family Sisoridae (Catfishes), Bagarius varrelli (Sykes) Family Channidae thurrels), Channa gaehua (Hamilton),

C.marulius (Hamilton), C.Punctatus (Bloch), C.striatus (Bloch), Hurdwabra (Rhinomugil Corsula (Hamilton)).

13. Land use

42. Existence of fertile soil conditions and irrigation facilities favour utilisation of major portion of the land in the district for agricultural purposes; only a lesser portion is put to use for non-agricultural purposes. In the recent past several industries have been established and development induced by the growth of the National capital of Delhi led to more residential settlements in this district. Only 10 sq.km is under forest cover in this district.

14. Disasters

43. According to the Vulnerability Atlas of India the NCR falls in the,
- High damage risk zone (MSK VIII) for earthquakes
  - Very high damage risk zone B (Vb = 50m/s) for wind and cyclone hazards
  - Areas liable to floods, which are more site specific and consist of low-lying areas and the flood plain.
44. There are a number of faults and other tectonic features that trigger earthquakes in the NCR. The major ones are, Sohna fault, Aravalli fault, Hidden Moradabad fault in the Indo-Gangetic basin, Sonapat-Delhi-Sohna fault, Junction of Aravalli and Sohna fault, and the Delhi-Haridwar ridge. Earthquakes of intensity lower than four on the Richter scale have originated from 14 epicentres located in the NCR. Two major lineaments, namely Delhi-Hardwar ridge and Delhi- Moradabad fault, pass through the NCR, both having potential of generating earthquakes of magnitude up to 6.5 to 6.7 and normal depth of 30 kms. The NCR lies in the earthquake zone IV, the second highest vulnerable zones with respect to seismic impacts. The proposed design integrates the risks of seismic activities on the project roads, through adoption of the IRC codes and standards.

B. Economic Development

1. Population Characteristics

45. Total population of Sonipat district was 1,279,175 in Census 2001, representing 6.05% of Haryana State. About seventy five percent of total population lives in rural areas (74.88%) and 25.12% in urban areas (Urbanization of the state-28.9%). Sex-ratio of the district stood at 839 (rural-836, urban-847), when it was 860 for the State. Scheduled castes population is 18.09% (rural-18.91%; urban-15.62%); while no Scheduled Tribe has been notified. Population below 6 years of age in Sonipat district is 15.36% (rural-15.87%; urban-13.85%), having sex-ratio of 788 (rural-792; urban-775). Total literacy rate (TLR) of the district was 72.79% as against 69.79% of Haryana, in rural areas it was 70.09% (State-63.19%) and in urban 80.64% (State-79.16%). Female literacy rate (FLR) in the district was 60.68% (rural-56.59%; urban-72.50%).

46. Workers participation rate (WPR) of the district was 40.89% of the total population; it was 44.59% in rural areas and 29.84% in urban. Sex-ratio of the total work force was 514 (rural-605; urban-207). Majority of the work force are main workers; 73.31% of the total workers are main workers (in rural-69.90%; in urban-88.53%). 52.97% of the total workers are engaged in cultivation and agricultural sector; it was 63.22% in rural and 7.31% in urban areas.

2. Industries

47. Agriculture is the major activity in the district. The village and cottage sector industries include pottery, carpentry, stone-dressing, leather-tanning, handloom weaving and utensil-making. Industries in this district are involved in manufacturing wooden products, agro products, chemical and rubber wares, engineering goods, sports and leather goods, mineral based products, textiles, pharmaceuticals, and chemicals. Most of the existing industrial units are concentrated at Sonapat



and Kundli. Proximity to the National Capital of Delhi and other important industrial towns, and its connectivity by road and railway, growth of industries in this district shows a positive trend. This area has a number of quarries, stone crushers and brick kilns that provide building material to Delhi and Gurgaon.

3. **Health Facilities**

48. Health services of the Government is rendered through 100 bedded hospital at Sonapat town, 7 community health centres (CHC) including one at Gohana town with 50 beds, and 29 primary health centres (PHC). Intestinal diseases are the major illness recorded throughout the district.

#### IV. Identification of Environmental Impacts and their Mitigation Measures

##### A. Land acquisition and resettlement impacts

49. The rehabilitation proposed road corridors in Sonipat Division does not involve any land acquisition as all improvement works are proposed within the existing Right-of-Way (RoW).

50. However, the project will impact two encroachers who have encroached upon the RoW and few community assets (bus shelters, places of worship, water tank, community buildings etc) that have been built encroaching upon the RoW. There are no impacts to indigenous peoples.

51. In built-up stretches no widening is proposed in order to minimise involuntary resettlement and it has been proposed to only strengthen the existing road with proper drainage facility. Necessary traffic arrangement measures with proper signage have been proposed to ensure smooth flow of traffic in these constricted stretches.

52. In line with the Draft ESMS of NCRPB, projects funded by NCRPB will require a resettlement plan and/or an indigenous peoples plan commensurate with the significance<sup>2</sup> of impact. Rehabilitation of 5 roads in Sonipat Division will come under S-2 category for involuntary resettlement and S-3 category for indigenous peoples as per NCRPB's social categorization.

53. A short resettlement plan has been prepared in line with the ESMS requirements.

##### B. Environmental Impacts

54. The assessment for each physical component proposed for this project has been carried out with respect to the potential impacts during the following stages of the project planning and implementation:

- Location impacts. Impacts associated with site selection, including impacts on environment and resettlement or livelihood related impacts on communities
- Design impacts. Impacts arising from project design, including the type of designs, design standards etc
- Construction impacts. Impacts resulting from construction activities including site clearance, earthworks, civil works, etc.
- O&M impacts. Impacts associated with the operation and maintenance of the infrastructure built in the project.

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<sup>2</sup> As per the Draft ESMS projects are categorized based on the significance of involuntary resettlement and impact to indigenous peoples. Involuntary resettlement categories are (a) Category S-1 (Significant Impact): means 200 or more people will experience major impacts, which are defined as (i) being physically displaced from housing, or (ii) losing 10% or more of their productive assets (income generating). Category S-1 projects require a full resettlement plan; (b) Category S-2 (Not Significant). Category S-2 projects include involuntary resettlement impacts that are not deemed significant and require a short resettlement plan; and (c) Involuntary Resettlement Category S-3: There is no involuntary resettlement impacts and hence does not require any action. Indigenous Peoples categories are (a) S-1 Significant impacts are those projects that directly or indirectly affect the dignity, human rights, livelihood systems, or culture of indigenous peoples or affect the territories or natural or cultural resources that Indigenous peoples own, use, occupy or claim as their ancestral domain. Category S-1 projects will require a indigenous peoples plan; (b) S-2 Not Significant are projects where the indigenous peoples are the sole or the overwhelming majority of project beneficiaries, and when only positive impacts are identified. Category S-2 projects will require a summary note on IP in project document; and (c) S-3 are projects where no impacts on indigenous peoples are envisaged and hence does not require any action.

55. The potential impacts occurring from this project have been identified below.

1. **Location and design impacts**

56. Location impacts are not likely to be significant as there are no major environmentally sensitive areas along the project roads. Impacts on water bodies along the project roads have been minimized through careful design of the alignments to avoid encroachment onto the water bodies. Impacts pertaining to cutting of roadside (including eucalyptus and acacia species) have been unavoidable and will be compensated through compensatory plantation. The impacts pertaining to road safety, especially for stretches in urban areas have been addressed through incorporation of appropriate safety measures in designs.

2. **Construction impacts**

57. The impacts during the construction stage shall include impacts associated with road construction activities and can be addressed through adoption of good engineering practices and undertaking specific mitigation measures towards minimization of construction impacts on the sensitive receptors and communities in the vicinity of the project roads. The mitigation measures for the various impacts are outlined in the Table xx, and are summarized in the following sub-sections.

58. Drainage: Construction activities in the vicinity of natural drainage channels and water bodies, if drainage is not adequately provided, would cause change in the drainage character of the site and lead to water logging.

59. Soil: Construction of road increases the paved surface and permanent loss of top soil under these civil construction works. Excavation for forming the drains and borrowing also involves loss of top soil as well as scarifying the surface with construction machinery and equipment. Spillage of fuel, lubricants, other oils and chemicals will contaminate the soil in the area.

60. Sourcing of materials. While material such as bitumen may be acquired from local hot-mix plants and aggregate from already identified quarries, procurement of soil will still need to be carried out. Considering that the brick kilns have already used the top soil in many areas, sites for the procurement of soil may have to be carefully identified.

61. Water Bodies: Stockpiles of construction debris if left unattended near water bodies as in Jasor Khari will be washed off as runoff into nearby water bodies causing siltation. Spillage of oil, lubricants and other chemicals also mix with the runoff and contaminate the water bodies.

62. Air Pollution: Emission from Construction Vehicles, Equipment and Machinery used for excavation and construction would induce impacts on the air pollution in the construction site as well as on the surrounding settlements. Construction activities generate dust in the surrounding area causing increase in particulate matter. Hot-mix plants installed for road construction will lead to generation of fugitive dust and exhaust emissions. Adequate siting criteria for the hot mix plants to be adopted based on the environmental sensitivity of surrounding land uses.

63. Noise and Vibration Impacts: Generation of noise from construction equipments is a major concern during construction stage. Use of heavy construction machinery in the construction site would generate vibrations and affect the adjacent structures in the settlements. Noise generated during construction is however intermittent and would be of limited duration but would affect the construction workers in case of unprotected prolonged exposure.

64. Material Handling: Storage of Bitumen and other hazardous material if stored near drainage channels would induce hazardous situations to the environment from possibility of leaching into ground and flow as runoff. Spillage of debris and construction material to surface water bodies may lead to surface water quality deterioration. Stockpiling of materials along the edge of the road will obstruct the drainage and restrict the free movement of vehicles.

65. Safety during construction: Appropriate measures during construction shall be worked out to address safety issues during construction. Prolonged exposure of workers to consistently high decibel noise levels above 90 dB(A) also induces hearing losses. Similarly, prolonged exposure of

the workers to dusty environment of the construction site induces respiratory problems and loss of man days. Traffic diversions have to be notified sufficiently in advance and where necessary temporary diversions have to be provided for safe crossing of the traffic.

66. Site clearance and Restoration of Construction Camps: Post construction clearance if not adequate, would create unsightly conditions and affect aesthetics of the area. Campsites if not removed usually become a refuge for unscrupulous activities and sometimes develop as another settlement putting strain on the resources. Sanitary pits may cause contamination of surface and ground water.

3. **Operational impacts**

67. Impacts on environmental conditions associated with the operation stage of the project are identified to be due to increased of air and noise pollution from the increased vehicular traffic along the route. The proposed improvements and safety provisions, in areas such as Assoda would reduce accidents and congestion and result in more public and private transport vehicles also plying in the area. Improved drainage provision within the settlements shall ensure avoidance of water logging and poor drainage conditions along the project roads.

V. Environmental Management Plan

68. Potential environmental impacts identified in the IEE due to implementation of the project components are to be minimized or avoided through appropriate mitigation and avoidance measures mentioned in Table 2. The agencies that are responsible for implementing the measures that are required to be undertaken have been identified.

Table 2: Environmental Impacts and mitigation measures

SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
1	Location Impacts				
1.1	Land acquisition and resettlement impacts required due to widening of roads at certain locations, where required.	Permanent	Major	Land acquisition impacts to be minimal as the proposed strengthening of the road will be restricted to the existing RoW. Affected Persons, if any, will be relocated and compensated in accordance to the RP	HSRDC & Design Consultants
2	Design and pre-construction Impacts				
2.1	Alterations of drainage pattern of the site	Permanent	Major	Design of cross drainage structures would be carried out so as to avoid alteration of drainage pattern. Design would be done considering 50 year return flood level to avoid overtopping of the roads and maintain natural drainage	HSRDC, Design Consultants
2.2	Damage to roadside trees	Permanent	Severe	If removal of any tree is unavoidable, obtain tree clearance approval from Forest Department. Identify each tree along the proposed route and adequately mark each tree within proposed construction areas. For trees not proposed to be cut, but within the construction area, take all precautions to protect trees not impacted from any damage including placement of tree guards	HSRDC & Design Consultants
2.3	Impact on cultural properties, shrines, temples etc	Permanent	Temporary	The designs shall be worked out to minimize impacts on cultural properties, shrines etc. All precautionary measures to address impacts on structures including protection measures required shall be provided in the designs.	HSRDC & Design Consultants
3	Pre-construction Activities by Contractor				
3.1	Construction Camps – Location, Selection, Design and Layout	Temporary	Moderate	The construction camps will be located at least 500m away from habitations at identified sites.	Contractor Management Consultant /
3.2	Drinking water availability and water arrangement	Temporary	Severe	The contractor will be responsible for arrangement of water in every workplace at suitable and easily accessible place for the whole construction period. Sufficient supply of cold potable water (as per IS: 10500) to be provided and maintained. If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided.	Contractor Management Consultant /
	Establishment of construction camps and / or hot mix plants, if required	Temporary	Moderate	Obtain the consent-to-establish and consent-to-operate from the Pollution Control Board  Adhere to the air pollution and water pollution standards prescribed.	HSRDC, PMC & Contractors
3.3	Identification of disposal sites	Permanent	Major	Location of disposal sites will be finalized based on consultations with the Engineer. The Engineer will certify these are not located within designated environmentally sensitive areas and confirm that: Disposal of the material does not impact natural drainage courses No endangered / rare flora is impacted by such material Settlements are located at least 1000m away from the	Contractor Management Consultant /

SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
				site	
3.4	Quarry Operations	Permanent	Major	It has to be ensured that materials are obtained from licensed quarries having environmental clearance. Quality and legality to be examined by the Contractor and copies of environmental clearances for these needs to be submitted prior to sourcing of material.	Contractor Management Consultant /
3.5	Batching Plants	Temporary	Moderate	Batching plants will be located sufficiently away from habitation, where possible such plants will be located at least 1000m away from the nearest habitation. The contractor will obtain the consent to operate the plants from the SPCB.	Contractor Management Consultant /
4	Construction Impacts				
4.1	Improper stockpiling of construction materials can cause impacts starting from obstruction of drainage, disturbance/ safety hazard to local population, traffic blockage, etc.	Temporary	Moderate	Due consideration will be given for material storage and construction sites such that it doesn't cause any hindrance to daily traffic movement. Stockpiles will be covered to protect from dust and erosion.	Contractor Management Consultant /
4.2	Quarry / Borrow pits Operations	Permanent	Moderate	Adequate safety precautions will be ensured during transportation of quarry material from quarries to the construction site. Vehicles transporting the material will be covered to prevent spillage. Operations to be undertaken by the contractor as per the direction and satisfaction of the Engineer.	Contractor Management Consultant /
4.3	Stripping, stocking and preservation of top soil	Permanent	Moderate	The topsoil from borrow areas, areas of cutting and areas to be permanently covered will be stripped to a specified depth of 150mm and stored in stockpiles. The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is to be restricted to 2m. 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 will be covered with gunny bags or tarpaulin. 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 returned to cover the disturbed area and cut slopes.	Contractor Management Consultant /
4.4	Soil Erosion	Permanent	Moderate	At the outfall of each culvert, erosion prevention measure will be undertaken, as per the direction and satisfaction of the Engineer The work will consist of measures as per design, or as directed by the Engineer to control soil erosion, sedimentation and water pollution. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earthwork or other items of work.	Contractor Management Consultant /
4.5	Compaction of Soil	Temporary	Minor	To minimize soil compaction construction vehicle, machinery and equipment will move or be stationed in designated area (RoW or CoI, haul roads as applicable) only. The haul roads for construction materials will be routed to avoid agricultural areas	Contractor Management Consultant /
4.6	Blasting	Permanent	Moderate	Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will not use explosives. Where the use of explosives is so provided or ordered or	Contractor Management Consultant /

SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
				<p>authorized, the Contractor will comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land as applicable.</p> <p>The Contractor will at all times take every possible precaution and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives and will, at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer.</p> <p>The Contractor will at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations. Blasting will be carried out only with permission of the Engineer. All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives will be strictly followed.</p> <p>all directions at least 10 minutes before the blasting.</p>	
4.8	Loss of Access	Temporary	Moderate	<p>The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property access connecting the project road. Construction activities that will affect the use of side roads and existing access to individual properties will not be undertaken without providing adequate access.</p> <p>The construction works will not interfere with the convenience of the public or the access to, use and occupation of public or private roads, or any other access to properties, whether public or private.</p>	Contractor / Management Consultant
4.9	Soil and Water Pollution due to fuel and lubricants, construction waste	Temporary	Moderate	<p>The fuel storage and vehicle cleaning area will be stationed such that runoff from the site does not drain into the water body.</p> <p>Oil interceptor will be provided at construction vehicle parking area, vehicle repair area and workshops ensuring that all wastewater flows into the interceptor prior to its discharge.</p>	Contractor / Management Consultant
4.10	Siltation of Rivers and streams due to spillage of construction wastes	Temporary	Moderate	<p>Silt fencing to be provided at all water bodies near construction sites to prevent sediments from the construction site to enter into the watercourses. The number of units of silt fencing to be installed is to be decided by the engineer.</p> <p>Discharge standards promulgated under the Environmental Protection Act, 1986 for surface water bodies will be strictly adhered to. No disposal of construction wastes will be carried out into the river.</p>	Contractor / Management Consultant
4.11	Generation of Dust	Temporary	Moderate	<p>The contractor will take every precaution to reduce the levels of dust at construction sites to the satisfaction of the Engineer. All earthwork to be protected/covered in a manner acceptable to the satisfaction of the engineer to minimise dust generation.</p>	Contractor / Management Consultant
4.12	Emissions from batching plants	Temporary	Moderate	<p>Batching plants will be located atleast 500m away from environmentally sensitive areas as Reserved Forests / National Parks and sensitive receptors i.e., hospital and college. The exhaust gases will comply with the requirements of the relevant current emission control legislation. All operations at plants will be undertaken in accordance with all current rules and regulations protecting the environment. Monitoring of air and noise</p>	Contractor / Management Consultant

SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
				parameters will be as per monitoring plan	
4.13	Emission from Construction Vehicles, Equipment and Machinery	Temporary	Moderate	The discharge standards promulgated under the Environmental Protection Act, 1986 will be strictly adhered to. All vehicles, equipment and machinery used for construction will conform to the relevant Bureau of Indian Standard (BIS) norms. All vehicles, equipments and machinery used for construction will be regularly maintained to ensure that pollution emission levels comply with the relevant requirements of SPCB and the Engineer. 'PUC' certificates will be obtained regularly for all vehicles used for the project. Copies will be submitted regularly to the Engineer.	Contractor / Management Consultant
4.14	Dust Pollution from Crushers	Temporary	Minor	All crushers will obtain siting clearance from SPCB or only those crushers that have already have obtained license from SPCB will be used.	Contractor / Management Consultant
4.15	Noise from construction Equipments	Temporary	Moderate	Maintenance of vehicles, equipment and machinery will be regular and to the satisfaction of the Engineer, to keep noise from these at a minimum. All vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked and if found to be defective will be replaced. Noise limits for construction equipment used in this project (measured at one metre from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), as specified in the Environment (Protection) Rules, 1986 Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of noise emission.	Contractor / Management Consultant
4.16	Traffic Control and Safety	Temporary	Moderate	The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking flags, lights and flagmen as per Engineer's direction and satisfaction, for the information and protection of traffic approaching or passing through the section under improvement. Before taking up any construction, detailed Traffic Control Plans will be prepared and submitted to the Engineer for approval, 5 days prior to commencement of work on any section of road. The traffic control plans shall contain details of arrangements for construction under traffic and details of traffic arrangement after cessation of work each day. The Contractor will ensure that the running surface is always maintained in good condition, particularly during the monsoon so that no disruption to traffic flow occurs	Contractor / Management Consultant
4.17	Road furniture	Temporary	Minor	All roadside structures / furniture, protection, intersections, traffic islands, rotaries, facilities and amenities etc. will be constructed as per engineering design and to the satisfaction of the engineer. Similarly restoration of bus shelters including bus bays complete with seating arrangement, other infrastructure etc. will be carried out as per design and to the satisfaction of the engineer.	Contractor / Management Consultant
4.18	Material Handling at Site	Temporary	Minor	All workers employed on mixing asphaltic material, cement, concrete etc., will be provided with protective	Contractor / Management



SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
				<p>footwear and protective goggles.</p> <p>Workers, who are engaged in welding works, would be provided with welder's protective eye-shields.</p> <p>Workers engaged in stone breaking activities will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.</p> <p>The use of any toxic chemical will be strictly in accordance with the manufacturer's instructions.</p>	Consultant
4.19	Disposal of Bituminous wastes / Construction Waste / Debris / Cut Material	Temporary	Moderate	<p>The bituminous waste generated will be reused in road construction based on its suitability of reuse to the maximum extent possible. Safe disposal of the extraneous material will be ensured in the pre-identified disposal locations. In no case, any construction waste will be disposed around the project road indiscriminately.</p> <p>Cut material generated because of construction will be utilized for as filling material. Remaining material if any will be disposed off safely at the disposal sites.</p>	Contractor / Management / Consultant
4.20	Safety Measures During Construction	Temporary	Moderate	<p>All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to.</p> <p>Adequate safety measures for workers during handling of materials at site will be taken up.</p> <p>The contractor has to comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.</p> <p>The Personal Protective Equipment for workers on the project will conform to respective IS codes.</p>	Contractor / Management / Consultant
4.21	Risk caused by Force Majeure	Temporary	Minor	<p>All reasonable precaution will be taken to prevent danger of the workers and the public from fire, flood, drowning, etc. All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.</p>	Contractor / Management / Consultant
4.22	Malaria Risk	Temporary	Minor	<p>The Contractor will, at his own expense, conform to all anti-malaria instructions given to him by the Engineer.</p>	Contractor / Management / Consultant
4.23	First Aid	Temporary	Minor	<p>At every workplace, a readily available first aid unit including an adequate supply of sterilized dressing material and appliances will be provided as per the Factory Rules. Suitable transport will be provided to facilitate transfer of injured or ill person(s) to the nearest hospital. At every workplace and construction camp, equipment and nursing staff will be provided.</p>	Contractor / Management / Consultant
4.24	Hygiene	Temporary	Minor	<p>All latrines will be provided with dry-earth system (receptacles), which will be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles will be tarred inside and outside at least once a year.</p> <p>All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing.</p> <p>Garbage bins must be provided in the camps and regularly emptied and the garbage disposed off in a hygienic manner.</p> <p>Adequate health care is to be provided for the work force. Unless otherwise arranged for by the local sanitary authority, the local medical health or municipal authorities will make arrangement for disposal of excreta.</p>	Contractor / Management / Consultant

SI No	Environmental Issues	Duration / Extent	Magnitude	Mitigation Measures	Responsibility
				On completion of the works, all such temporary structures will be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.	
4.25	Archaeological Property chance find	Temporary	Minor	The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and will, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work will be stopped 100 m all directions from the site of discovery. The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence work on the site.	Contractor Management Consultant /
4.26	Clearing of Construction of Camps & Restoration	Temporary	Major	Contractor to prepare site restoration plans for approval by the Engineer. The plan is to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer.	Contractor Management Consultant /
5	O&M Impacts				
5.1	Environmental Conditions	Permanent	Moderate	The HSRDC will undertake seasonal monitoring of air, water, noise and soil quality through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared.	HSRDC
	Survival of trees planted	Permanent	Moderate	Proper care shall be taken to increase survival rate of saplings like regular watering, pruning, provision of tree guards, manure for better nourishment, etc. including timely replacement of perished saplings.	HSRDC
5.2	Increased air and noise pollution due to increased traffic using the improved roads	Permanent	Moderate	Smooth and better road surface will reduce generation of noise. Provision of vegetative barriers where ever possible. Other measures such as improved transport fuel quality, more stringent environmental norms, installation of no horn signages at educational institutes and at hospitals	HSRDC
5.3	Drainage of roadsides	Permanent	Moderate	To ensure efficient flow of surface water and to prevent water logging along the side of the roads adequate size and number of cross-drainage structures and longitudinal drains are provided in the design. These will be adequately maintained by cleaning and avoiding clogging of openings.	HSRDC
5.4	Traffic and Accident Safety	Permanent Risk	Major	Depending on the level of Congestion and traffic hazards, traffic management plans will be prepared. Traffic control measures including speed limits to be enforced strictly. Road control width to be enforced. Local government bodies and development authorities will be encouraged to control building development along the highway.	HSRDC

## VI. Institutional Requirements

### A. Institutional Arrangements

69. Haryana State Roads Development Corporation (HSRDC), as the Implementing Agency (IA) will undertake all actions for the implementation of the project. HSRDC will have one specialist identified to overseeing the implementation of the EMP, and will be outsourced. An Environmental Officer (consultant) shall be inducted within the HSRDC to address the environmental impacts due to the project. The identified officer should be a Civil Engineer specializing in Environment or a related field with experience in the management of infrastructure projects. S/he should be similar with Indian legislation and the implementation of multi/bilateral loan projects.

#### 70. Roles and Responsibilities

- Review of IEE and other environment documents based upon ADB's Environmental Assessment Guidelines, or other multilateral or bilateral agency guidelines, as required.
- Liaise and obtain clearances from with required state and central departments for clearances and compliance to regulations.
- Monitor and oversee the implementation of the Environmental Management Plan
- Ensure inclusion of EMP in contractor's ToRs.
- Oversee implementation and monitor compliance to the EMP
- Undertaken required interactions with civil society groups and community for projects under implementation
- Ensure inclusion of public concerns and grievances in EMP and project implementation. Undertake dialogue with affected communities, as required.
- Review environmental performance of project through periodical environmental monitoring reviews. Where additional environmental safeguards are identified incorporate them in project design, construction or implementation or other follow-up actions, as required.
- Provide required support for the management of environmental concerns in the implementation of the project
- Develop, review and plan and implement training and capacity building for contractors and consultants involved in the project

71. A consultant shall be hired for supervising construction activities. This agency will need an officer identified for overseeing the implementation of the EMP. The roles and responsibilities of this individual will be,

- Work closely with Corporation's environmental specialist for the implementation of EMP and ensure compliance to environmental safeguards, support its implementation
- Work with Corporation's environmental specialist for getting environmental clearances for the project
- Review of EMP implementation and advice the Corporation's environmental specialist on the implementation status
- Review any changes in project design, identify environmental safeguards if required and work with the Corporation's environmental specialist to reflect identified safeguards in EMP
- Ensure all identified systems – safety, accident management and control, waste are in place, functioning and implementing personnel have adequate training to implement actions
- Ensure that all safety gear for workers and on the project location are in place
- Consultation with stakeholders and inclusion of their concerns in project implementation
- Incorporate additional environmental safeguards as required during project implementation

**B. Environmental Monitoring Plan**

72. Prior to developing a monitoring plan there is a need for the development of a baseline for some activities. This would help with the monitoring activities. The baseline is described below.

**1. Development of a baseline**

73. Prior to developing a monitoring plan there is a need for the development of a baseline for some activities. This would help with the monitoring activities. The baseline is described below.

Sl. No.	Attributes	Stage	Parameters to be Monitored	Location	Frequency	Responsibility	Cost estimates INR
1	Air Quality	Pre construction	SPM and RSPM, NOx, CO	Ten – two on each of the roads – for all 5 roads, near habitations.	In morning, rush hours or time of high traffic and late evening	DPR consultant	4000/sample
2	Noise	Pre construction	Decibels	Ten – two on each of the roads – for all 5 roads, near habitations.	In morning, rush hours or time of high traffic and late evening	DPR consultants	1000/sample
3	Water quality	Pre construction	Surface water quality	Sample waterbodies along with construction activities will be undertaken	Once, prior to construction	DPR consultants	2000/ sample
4	Site for quarries and borrow pits	Pre construction	The site situation – for rehabilitation, photographs	All sites identified for quarries, borrow pits, waste and construction labour camps and offices	Once prior to construction	DPR consultants/ agency identified to supervise construction	30,000 lump sum
5	Vegetation removal	Pre construction	Vegetative survey to identify type and amount of vegetation that requires to be replaced	Along paths that are to be cleared off trees for construction activities	Once prior to construction	DPR consultants	300000 lump sum

**2. Monitoring Actions**

Sl. No.	Attributes	Stage	Parameters to be Monitored	Location	Frequency	Responsibility	Cost estimates INR
1	Air Quality	Construction	SPM and RSPM, NOx, CO	Six – two on each of the roads – for all 3 roads, near habitations.	Thrice annually	Contractor	4000/sample
2	Noise	Construction	Decibels	Six – two on each of the roads – for all 3 roads, near habitations.	Thrice annually	Contractor	1000/sample
3	Water quality	Construction	Surface water quality	Sample waterbodies along with construction activities will be undertaken	Thrice annually	Contractor	2000/sample
4	Site for quarries and borrow pits	Construction	After construction activity over – if rehabilitated	All quarries, borrow pits, waste and construction labour camps and offices sites	Once prior to construction	Contractor	40,000 total
5	Tree/vegetation plantation	Construction	Ensure all vegetation/tree replacement activity undertaken	Based upon discussions with local community and Forest Department	During construction	Contractor	40,000 total

6	Air Quality at Residential area	Operation	RPM, SPM, SO <sub>2</sub> , NO <sub>x</sub> , CO and Hydrocarbons	At six locations, especially around sensitive receptors and settlements	Once in a season (except monsoons) for the first 3 years of operation	Contractor	100000 per year
7	Noise Levels at residential and silence zone	Operation	Equivalent Day & Night Time Noise Levels	At six locations, especially around sensitive receptors and settlements	Once in a season for the first 3 years of operation	Contractor	50000 per year

### C. Training & Capacity Building

74. The training programme will start with a Sensitization Workshop for officials of HSRDC and also the Contractor's personnel. Typical modules that would be present for the training session would be as follows:

- Sensitization
- Introduction to Environment Considerations in Urban Development Projects
- Review of IEE and Integration into Design
- Improved Co-ordination within Nodal Departments, on special issues, if any.
- Role during construction
- Monitoring & Reporting System

75. The proposed training program along with the frequency of sessions is presented in the table below.

Program	Description	Participants	Form of Training	Duration	Trainer / Agency
Introduction and sensitisation to environment issues	Sensitisation on environmental concerns <ul style="list-style-type: none"> <li>▪ Environmental impacts of road's projects</li> <li>▪ Gol environmental regulations</li> <li>▪ ADB/multilateral/bilateral environmental regulations</li> <li>▪ Coordination between departments for implementation of environmental safeguards</li> </ul>	Senior department engineers HSRDC officials responsible for implementing project and office in-charge of implementing environmental safeguards	Workshop	Half day workshop	External Consultants/ NCRPB
EMP implementation	Implementation of environment EMP <ul style="list-style-type: none"> <li>▪ Identification of environment impacts</li> <li>▪ Monitoring and reporting for EMP</li> <li>▪ Public interactions and consultations</li> <li>▪ Identification of various government</li> </ul>	Department head at Haryana PWD B&R and HSRDC in-charge of the project, officer in-charge of project implementation, identified officer in-charge of implementing EMP	Lectures and field visit		External Consultants/ NCRPB
EMP implementation	Implementation of EMP <ul style="list-style-type: none"> <li>▪ Identification of environment impacts</li> <li>▪ Monitoring and reporting for EMP</li> <li>▪ Public interactions and consultations</li> </ul>	Officer in charge of implementing this project activities at HSRDC, officer implementing EMP for agency/contractors	Lecture and field visit	One day session	External Consultants/ NCRPB
Implementation of EMP	Reporting and coordination	Officer in charge of implementing this project activities, officer	Lecture and interactive	Half day session	External Consultants/

	<ul style="list-style-type: none"> <li>▪ Coordination for consents and with various departments</li> <li>▪ Identification of environmental impacts</li> <li>▪ Monitoring formats filling and review of impacts</li> </ul>	implementing EMP for agency	session		NCRPB
Recurring training programmes	<ul style="list-style-type: none"> <li>Management of Environmental impacts</li> <li>Identification of Environmental impacts</li> <li>Environmental regulations</li> <li>Environmental monitoring and review</li> </ul>	Department head at Haryana PWD B&R and HSRDC in-charge of the project, officer in-charge of project implementation, identified officer in-charge of implementing EMP	Lecture and interactive session	One day session	External Consultants/ NCRPB

#### D. Environmental Budget

76. As part of good engineering practices in the project, there have been several measures as erosion prevention, rehabilitation of borrow areas, safety, signage, provision of temporary drains, etc the costs for which will be included in the design costs. Therefore, these items of costs have not been included in the IEE budget. Only those items not covered under budgets for construction and RP are costed in the IEE budget. The IEE costs include mitigation, monitoring and capacity building costs. The summary budget for the environmental management costs for the project is presented in the following table.

Sl. No.	Particulars	Stages	Unit	Total number	Rate (INR)	Cost (INR)
A.	Mitigation Measures					
1	Management of dust and sand during construction activities – suppression etc	Construction	Lump sum			150,000
2	Ensuring occupational safety for workers at camps and construction sites	Construction	Lump sum			300,000
	Sub -Total (A)					450,000
B.	Monitoring Measures					
	Water quality	Pre-Construction / Construction	Per sample	12	4000	48,000
	Air	Pre-Construction / Construction	Per sample	18	2500	45,000
	Noise	Pre-Construction / Construction	Per sample	18	1000	18,000
	Borrow pits sites etc	Pre-Construction / Construction	Lump sum			50,000
	Vegetation/tree survey and monitoring implementation of tree plantation	Pre-construction / construction	Lump sum			50,000
	Sub -Total (B)					211,000
C	Capacity Building					

Sl. No.	Particulars	Stages	Unit	Total number	Rate (INR)	Cost (INR)
2	Sensitisation, awareness	Pre-construction	Lump sum			472000
3	Monitoring and management	Construction	Lump sum			187000
	Sub-Total (C)					659000
	Total (A+B+C), INR					1,320,000

## VII. Public Consultation and Information Disclosure

### A. Process of Consultation Followed

77. During the preparation of the project, consultations with stakeholders were held on environmental issues with HSRDC, communities along the project roads and affected persons. The general impression from the consultations was that all stakeholders were glad for the development as it would result in a better environment in the area, ease traffic and reduce travel time, and will also result in fewer accidents. Summary of the consultations undertaken is given in Table below.

Table 3: Summary of Consultations

S.No.	Place	Date	Number of participants	Participants	Issues discussed
1	Sonepat	October – November 2009	5	Divisional Engineer, HSRDC and Engineers, Sonipat Division	Design modifications to minimize environment, land acquisition impacts Clearance requirements, w.r.t tree cutting, no-objections from SPCB etc Overview of ESMS, ADB policies on environmental assessment etc Draft version of the IEE, identification of measures to address environment impacts.
1	Local restaurant Assoda	28 November, 2009	15	Village Communities, residents along the road	The road width is insufficient as the traffic is heavy in the area Some areas have very poor road design and therefore when overtaking heavy vehicles turn turtle and go off the road. Speed breakers are a must as there are a number of heavy vehicles that drive badly and can risk local users of the road A special area should be left for cycles, pedestrians etc
3	Assoda	28 November, 2009	10	Residents	Need for speed breakers in front of schools and where village roads meet the main road and in front of the bus stops There is a need for proper drainage to reduce the possibility of damage to the roads. Culverts are also required Heavy vehicles like trucks and tankers use the road therefore roads should be designed to keep this in mind
4	Borada	28 November, 2009	25	Residents	The traffic for present road width is very high. There is insufficient safety provisions – speed breakers and shoulders Roads quality should be good to reduce noise from moving vehicles Along with roads, drain improvement must be considered There is encroachment from residents on the area demarcated for roads, and may need to be removed to have wide roads

### B. Framework for continued public participation

78. A grievance redressal cell will be set up within the HSRDC to register grievances of the people regarding technical, social and environmental aspects. This participatory process will ensure that all views of the people are adequately reviewed and suitably incorporated in the design and implementation process. Further, to ensure an effective disclosure of the project proposals to the



stakeholders and the communities in the vicinity of the project locations, an extensive project awareness campaigns will be carried out.

79. For the benefit of the community the Summary IEE will be translated in the local language and made available at: (i) Office of the HSRDC Division at Sonipat; and, (ii) Office of the District Commissioners, Sonipat and Jhajjar districts. These copies will be made available free of cost to any person seeking information on the same. Hard copies of the IEE will be available in the HSRDC office as well as the local library, and accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. On demand, the person seeking information can obtain a hard copy of the complete IEE document at the cost of photocopy from the office of the Divisional office of the HSRDC at Sonipat, on a written request and payment for the same. Electronic version of the IEE will be placed in the official website of the HSRDC and the website of ADB after approval of the documents by Government and ADB. The HSRDC will issue notification on the disclosure mechanism in local newspapers, ahead of the initiation of implementation of the project, providing information on the project, as well as the start dates etc. The notice will be issued in local newspapers one month ahead of the implementation works. This will create awareness of the project implementation among the public. Posters designed to mass campaign the basic tenets of the IEE will be distributed to libraries in different localities that will be generating mass awareness.

### VIII. Findings and Recommendations

80. It is to be noted that as per the statutory requirements of Government of India (Environmental Impact Assessment Notification, September 2006, and its subsequent amendment 2009) Environmental Impact Assessments are not required for the proposed road improvements. The proposed development does not fall either in Category A or in Category B as per Gol EIA requirements. The significance of the environmental impacts will be more due to the construction related impacts than any impacts associated with areas of rich environmental sensitivity. It is to be noted that the resultant potential impacts from these proposals are already mitigated through provision of proven mitigation measures in the design and can further be offset by adoption of good engineering practices during construction and implementation. EMP prepared to this affect addresses these potential impacts through appropriate mitigation, management and monitoring measures. The effective implementation of the measures proposed will be ensured through the building up of capacity towards environmental management within the HSRDC supplemented with the technical expertise of an Environmental Specialist as part of the Management Consultants. Further, the environmental monitoring plans prepared as part of the EMP provide adequate opportunities towards course correction to address residual impacts during construction stages.

## IX. Conclusions

81. The project will have a number of benefits such as – reduced time taken to travel on the roads with reduced congestion, reduced accidents on the road and smoother flow of traffic. Also, considering the low levels of environmental impacts expected it will not require any major mitigation. The proposed components should proceed through to design and implementation, subject to mitigation measures and monitoring programs as per EMP for potential impacts identified in the IEE. It may be emphasized that the present IEE, which identifies potential impacts and EMP which presents appropriate mitigation measures, is sufficient enough to safeguard the environment. There are no significant adverse impacts, which are irreversible or may lead to considerable loss/destruction of environment, envisaged. All the impacts are generic and have proven mitigation measures to minimize/mitigate the same.

X. Appendix 1: REA Checklist

**ROADS AND HIGHWAYS**

**Instructions:**

- This checklist is to be prepared to support the environmental classification of a project. It is to be attached to the environmental categorization form that is to be prepared and submitted to the Chief Compliance Officer of the Regional and Sustainable Development Department.
- This checklist is to be completed with the assistance of an Environment Specialist in a Regional Department.
- This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.
- Answer the questions assuming the “without mitigation” case. The purpose is to identify potential impacts. Use the “remarks” section to discuss any anticipated mitigation measures.

Country/Project Title: Sonipat Roads, Haryana. NCRPB, India

Sector Division:

SCREENING QUESTIONS	Yes	No	REMARKS
<p><b>A. PROJECT SITING</b></p> <p>IS THE PROJECT AREA ADJACENT TO OR WITHIN ANY OF THE FOLLOWING ENVIRONMENTALLY SENSITIVE AREAS?</p>			There are no special or protected areas.
<ul style="list-style-type: none"> <li>▪ CULTURAL HERITAGE SITE</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<ul style="list-style-type: none"> <li>▪ PROTECTED AREA</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<ul style="list-style-type: none"> <li>▪ WETLAND</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

SCREENING QUESTIONS	Yes	No	REMARKS
▪ MANGROVE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ ESTUARINE	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ BUFFER ZONE OF PROTECTED AREA	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ SPECIAL AREA FOR PROTECTING BIODIVERSITY	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>B. POTENTIAL ENVIRONMENTAL IMPACTS</b>			
WILL THE PROJECT CAUSE...			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The topography of the area is relatively flat. There are a few village ponds near the roads as they pass through the villages. Surface runoff during rains could lead to stagnating water in the fields adjoining the roads or in the villages. The project design therefore needs to include culverts and road side drainage.
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Concerns may exist as there will be a need to get labour from outside, therefore requiring labour camps.
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	This would occur, however as it is planned to procure all material from the
▪ noise and vibration due to blasting and other civil works? ▪ dislocation or involuntary resettlement of people	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Increasing noise and vibrations during construction and civil works shall be an impact, to address which, construction timing therefore will need to ensure that disruptions are low.
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
▪ hazardous driving conditions where construction interferes with pre-existing roads?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

SCREENING QUESTIONS	Yes	No	REMARKS
<ul style="list-style-type: none"> <li>poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations?</li> </ul>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Local population do not work as construction labour, therefore workers from outside will be specially brought for the construction of the road, requiring labour camps and associated amenities.
<ul style="list-style-type: none"> <li>creation of temporary breeding habitats for mosquito vectors of disease?</li> </ul>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	At labour camps, quarries and borrow pits the possibility of temporary breeding habitats for mosquito vectors is possible.
<ul style="list-style-type: none"> <li>dislocation and compulsory resettlement of people living in right-of-way?</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There is nobody living in right of way. The identified land is mainly for agricultural
<ul style="list-style-type: none"> <li>accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials and loss of life?</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<ul style="list-style-type: none"> <li>increased noise and air pollution resulting from traffic volume?</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<ul style="list-style-type: none"> <li>increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?</li> </ul>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	