E4647 V1 REV

TAMILNADU ROAD SECTOR PROJECT-II

Environmental Management Framework (EMF)

March 2015

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Chapter 1: Introduction

1.1 Overview

1. The objective of this Environmental Management Framework (EMF) is to assist the Tamil Nadu Road Sector Project-II, a wing of Highways Department in the preparation of a quality Environmental and Social Assessment (ESA) Report for the corridors, which under goes up-gradation (strengthening and widening) through preparation of Detailed Project Reports (DPR's). This environmental management framework is prepared based on the existing environmental rules and regulations adopted by the Ministry of Environmental, Forests and Climate Change (MoEF&CC), India and World Bank operational policies. This EMF contains concepts and good practices for roads under Tamil Nadu Road Sector Project-II, Highways Department to adopt while preparing the ESA report. This EMF has been structured in such a way to act as a self-explanatory guide with separate procedures for conducting ESA with Impact prediction, mitigation and management measures.

1.2 Rationale and Background

2. The Government of Tamil Nadu (GoTN), through the Highways Department, has taken up up-gradation, maintenance and improvement of identified core road network in the length of approx. 2079 km in the state. The roads selected for up-gradation are shown in **Error! Reference source not found.**. The GoTN has proposed to take up upgrading of about 575 km with financial assistance from the World Bank. In line with the prioritization exercise, total fourteen corridors have been selected, aggregating to about 575 km length under TNRSP- II, where there is no sensitive environmental issue involved. The Environmental Screening (ES), Environmental Assessment (EA) and Environmental Management plans (EMP) for roads under Phase I (i.e. a total road length of about 430 km) have been prepared and finalised.. Environmental Screening, Environmental Assessment and Environmental Management Plans for roads of Phase II of TNRSP-II (i.e. a total road length of about 145 km) are under preparation stage. The EMF for TNRSP –II has been prepared based on the information analysed from environmental screening, environmental assessment and environmental management plans. The environmental screening, environmental assessment and environmental management plans for some of the roads are enclosed for ready reference. To ensure implementation of mitigation measures during up-gradation of roads under TNRSP-II, necessary environmental safeguards have been incorporated in the EMF and road specific EMPs, The improvement of 575 km under TNRSP –II involves the strengthening and upgrading of non-standard two-lane roads to 2-lane-with-paved-shoulders / 4-lanes. EAs and EMPs have been prepared for Phase I corridors which are listed in Table **1-1**. The EA summary and EMPs for each of these corridors have been disclosed.

Table 1-1: Details of Roads under Tamil Nadu Road Sector Project II

S. No.	Component	Length (Km)	Existing Configuration	Proposed Treatment
I	**Road Up-gradation Works under EPC Contracts – Phase I**			
	Road Name			
1	Upgrading Kanchipuram - Vandavasi Road (SH116) Km 14/500-Km 36/900	22.30	2L + ES	2L + PS
2	Upgrading Sadras - Chengalpattu - Kancheepuram - Arakkonam - Thiruthani Road (SH58) Km 0/000 to Km 26/800	26.100	2L + ES	2L + PS
3	Upgrading Arcot - Villupuram Road (SH4) Km 29/800 to Km 110/200 and Km 113/200 to Km 114/600	82.40	2L + ES	2L + PS

S. No.	Component	Length (Km)	Existing Configuration	Proposed Treatment
4	Upgrading Cuddalore - Chittoor Road (SH9) Km 41/700 to Km 44/000 and Km 45/000 to Km 66+190 and construction of a new link road between SH9 and SH137 (Km 66+190 to Km 71+147)	28.45	2L + ES	2L+PS
5	Upgrading Vridhachalam - Parangipettai Road (SH70) Km 0/000 to Km 35/800	35.80	2L + ES	2L +PS;
6	Upgrading Omalur - Sankari - Thiruchengode - Paramathy road (SH86) Km 54/800 to Km 81/000	26.20	2L + ES	2L + PS
7	Upgrading Malliyakarai - Rasipuram - Trichengode - Erode Road (SH79) Km 0/000 to Km 30/600 and Km 51/400 to Km 71/300	50.50	2L + ES	2L + PS
8	Upgrading Mohanur – Namakkal – Senthamangalam - Rasipuram Road (SH95) Km 0/000 to Km 13/100	13.10	2L + ES	2L + PS
9	Upgrading Paruvakudi - Kovilpatti - Ettayapuram -Vilathikulam - Vembar Road (SH44) Km 22/500 to Km 38/750 and Km 41/300 to Km 56/700	31.65	2L+ES	2L+PS
10	Upgrading Nanguneri - Bharatavaram - Ovari Road (SH89) upto ECR junction Km 0/000 to Km 35/200	35.20	2L+ES	2L+PS
11	Upgrading Rajapalayam - Sankarankoil - Tirunelveli Road (SH41) Km 1/800 to Km 28/000 and Km 33/800 to Km 82/800	75.20	2L+ES	2L+PS
	Total	**426.900**		
II	**Road Upgradation works under PPP contracts – Phase II**			
1	Four laning and strengthening of Mettupalayam - Sathy - Gobi - Erode road (SH15) Km 123/000 to Km 153/400	30.40	2 L+ES	4 lane+ PS+ ES
2	Four laning and strengthening of Oddanchatram - Dharapuram - Tiruppur road (SH37) Km 37/400 to Km 106/300	68.90	2 L+ES	4 lane+PS+ES
3	Strengthening and widening of Tirunelveli – Tenkasi road (SH39) Km 5/000 to Km 50/600	45.60	2L+ES	4 lane+ PS+ ES
	Total	**145**		
	Grand Total	**572**		

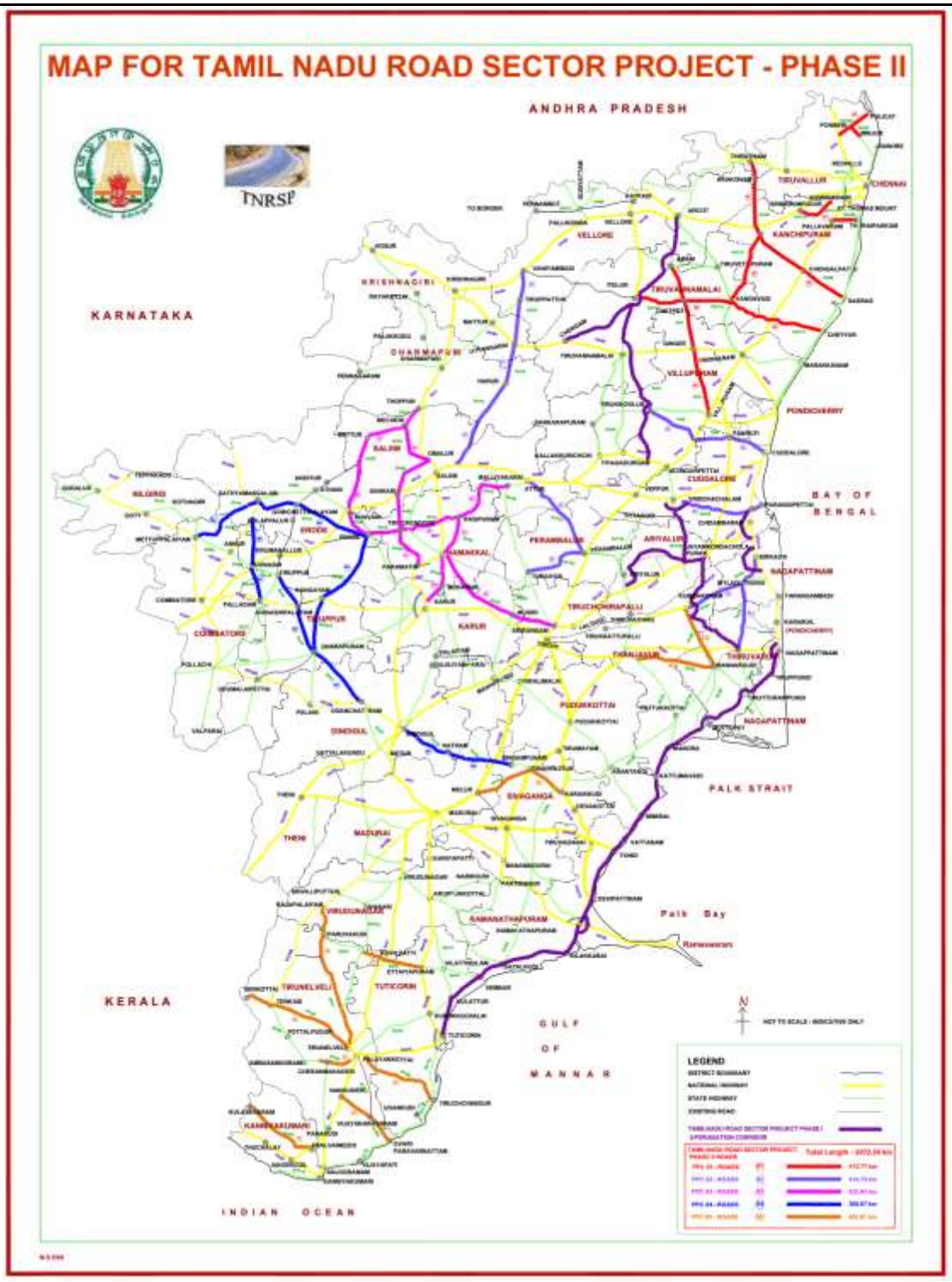


Figure 1-1: Roads Selected for Upgrading (includes TNRSP II roads and others)

1.3 TNRSP-II Proposed Improvements

1.3.1 Design Intervention for Upgradation Corridors

3. The up-gradation (strengthening and widening) proposal incorporating the various cross sections to accommodate with in the rural and urban stretches has been suggested based on the traffic projections estimated till the year 2042. The typical cross sections that are being adopted are depicted in the **Error! Reference source not found.** to **Error! Reference source not found.**. The proposed road cross sections are designed keeping in view of the following (i) to minimise additional land acquisition, (ii) to minimise the felling of avenue trees for the proposed widening, (iii) for the provision of economically feasible safety interventions and (iv) to minimise the environmental degradation to the surroundings.

4. In addition to the improvement of road cross section by widening, strengthening and/or reconstruction of the pavement, other design measures undertaken are presented below:

- Improvement of horizontal alignment and vertical profile of the roads with minimum land acquisition and through avoidance of obstructions such as trees, utilities, road side building structures, etc. to the extent possible,
- Improvement of intersections and junctions,
- Provision of road side appurtenances such as signage, delineators, guard rails, street lighting, etc., and
- Provision of road side facilities such as road side drains, pedestrian footpaths, pedestrian and cattle crossings, bus bays, bus shelters, parking bays, etc.

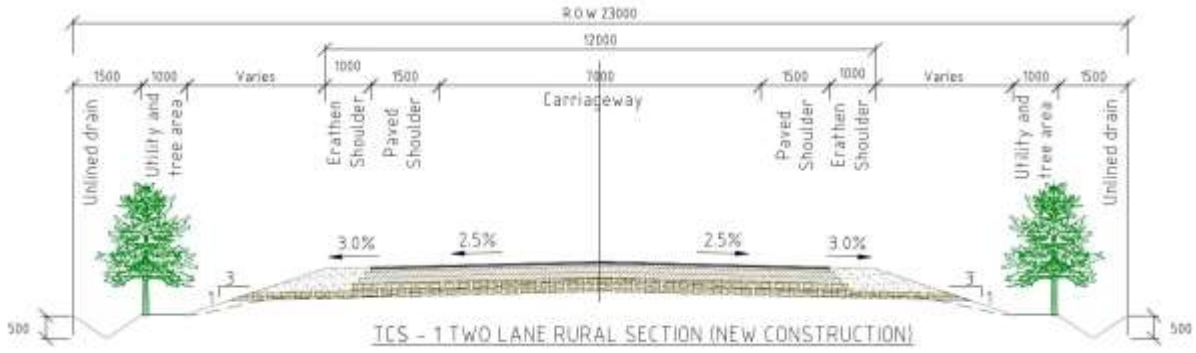


Figure 1-2: Two Lane Rural Section (New Construction)

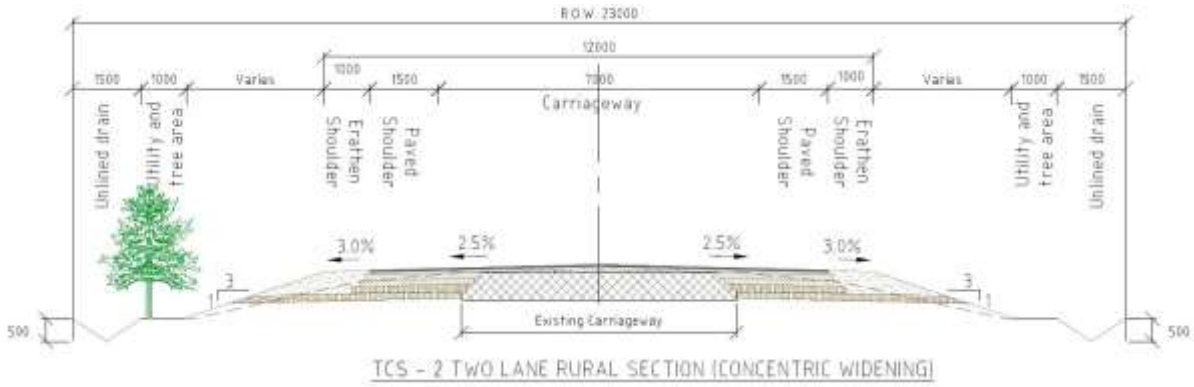


Figure 1-3: Two Lane Rural Section (Concentric Widening)

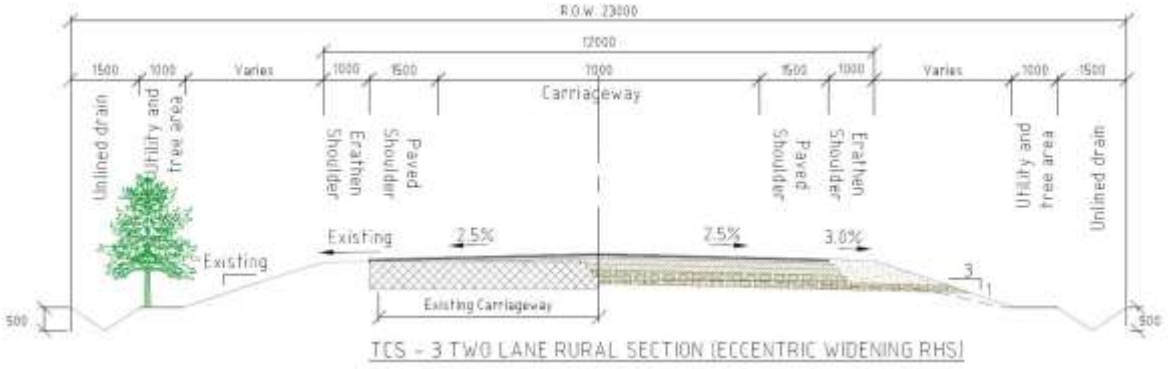


Figure 1-4: Two Lane Rural Section (Eccentric Widening)

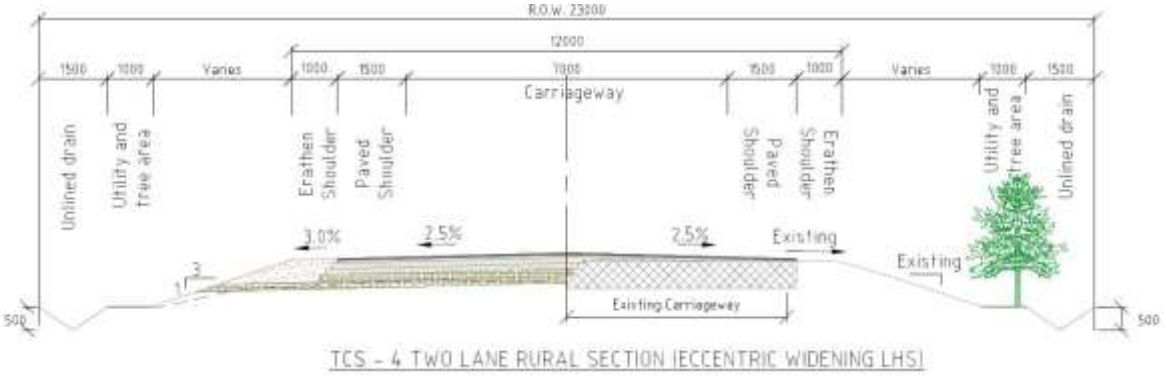


Figure 1-5: 4 Lane Rural Section (Eccentric Widening)

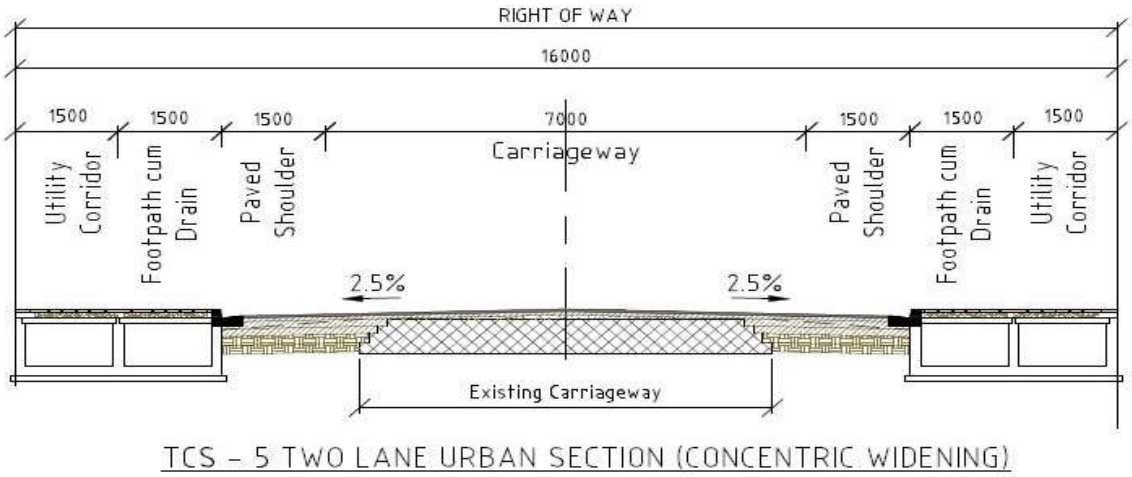


Figure 1-6: Two Lane Urban Section (Concentric Widening)

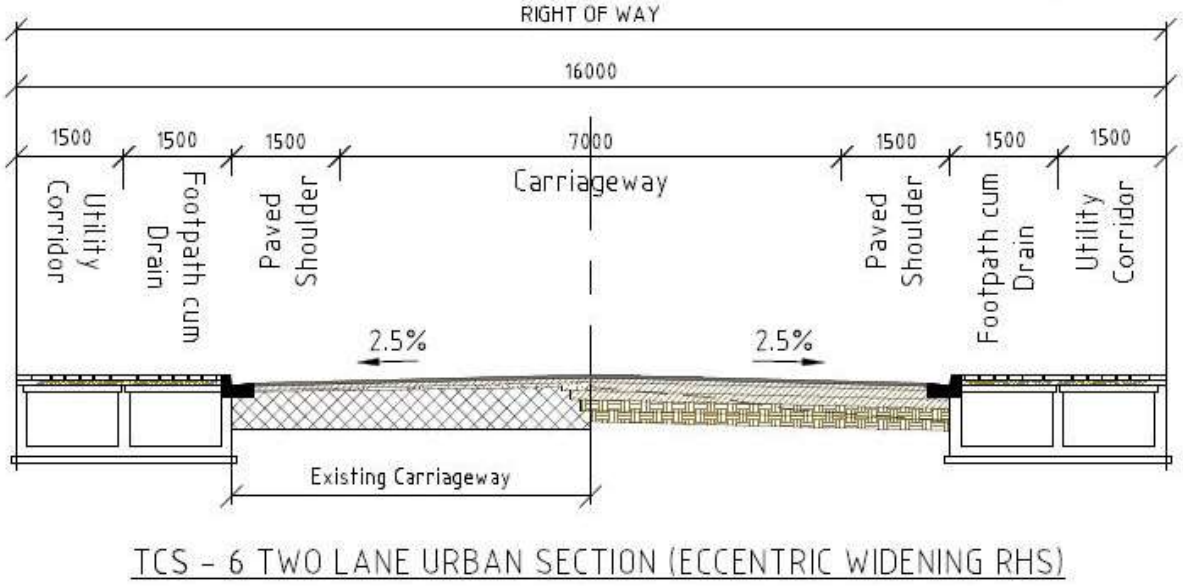


Figure 1-7: Two Lane Urban Section (Eccentric Widening)

1.4 Need for the EMF

5. The aim of this EMF is to guide the Tamil Nadu Road Sector Project (TNRSP-II), Highways Department, in subproject selection, screening and categorization, environmental assessment, social assessment and preparation and implementation, monitoring, and preparation of environmental management plans for the project roads to facilitate compliance with the requirements specified in the World Bank Operational Policies and Government of India (GoI) rules and regulations. This EMF shall be applicable to all up-gradation components proposed to be taken up under TNRSP-II.

6. The proposed development envisaged in TNRSP-II pertains mostly to improvements/ strengthening/widening/ maintenance of existing State Highways (SH). The proposed road improvement work

would be concentrated along the existing alignments; there is no road which passes through or would be adjacent to the environmentally sensitive areas. This EMF shall assist Highways Department (TNRSP -II), in identification, assessment and management of environmental and social concerns at all stages of the project.

1.5 Purpose and use of EMF

7. The EMF is prepared in-line with the MOEF&CC's EIA Guidance Manual for Highways and World Bank operational policies. It also provides a framework for managing environmental responsibilities efficiently by integrating the overall operations. It helps in the management of environmental programs in a comprehensive, systematic, planned and documented manner. The EMF addresses environmental concerns through allocation of resources, assignment of responsibilities, procedures and processes, and focuses on continual improvement of the system.

8. It also highlights the importance of the environmental screening and scoping exercises detailing the procedures to be followed for the better understanding of the project impacts to the environment at the initial stage of the project itself. The EMF also helps to categorise the sub - project based on the environmental severity. For the identified environmental impacts and issues arising during planning, designing, construction and operation phase, a generic environmental management plan is also developed. The EMF will be used to define the criteria required to determine the level of EA required (either detailed or limited EA) for the project and the processes involved, determines their sequence to conduct the EA studies for various components/phases of road projects considering the legal requirements and its implications.

9. This EMF is a living document, and thus it needs to be updated and revised as necessary in order to incorporate the changes based on the status of the prevailing laws, as well as revisions that might arise due to TNRSP-II project development process. The EMF shall be reviewed by the PIU (TNRSP-II) staff annually. For further updates and modifications of the EMF, a check list shall be prepared, with dates detailing each revision status. A data sheet shall be maintained in order to show that records are maintained for all the changes that have been carried out.

10. The recommended approach for TNRSP -II stakeholders especially project implementing agency and other the end users of the EMF are detailed, as follows:

- Read through the environmental and socioeconomic subjects described in the EIA projects, bid documents, environment monitoring during the various phases of project implementation. An appreciation of these issues will help to understand the significance of the guidelines set out in subsequent sections of the manual.
- The effective implementation of environmental protection and mitigation measures requires the coordinated effort of all those involved with a project. PIU (TNRSP-II) shall appraise the issues and concerns involved in each stage of a project. It is also important that PIU (TNRSP-II) shall take personal and collective responsibility for the stewarding of the environment in discharging their tasks.

11. This EMF is intended to guide its users in:

- Undertaking / understanding environmental and social issues in road projects
- Standardizing work efforts and environmental documents;
- Improving the quality of the documents and the analysis;
- Facilitating the development and review of documents by PIU (TNRSP-II) staff; and
- Providing technical guidance on impact assessment

Chapter 2: Legal Frame work

2.1 Environmental Rules and Regulations

12. In order to understand the extent of the environmental and social assessment for the proposed improvement works, applicable laws, legislation and policies have been reviewed. A summary of environmental legislations / regulations relevant to TNRSP II is furnished in Table 2-1.

Table 2-1: Environmental Legislations / Regulations applicable to TNRSP – II

Policy/Act/Rule	Year	Purpose	Responsible Institution	Applicability (Yes/No)
Environment (Protection) Act.	1986	To protect and improve the overall environment	MoEF & CC	Yes
Environment Impact Assessment Notification and amendments	2006 2009 2013	To provide environmental clearance to new development activities following environmental impact assessment.	MoEF & CC	No[1]
Notification on use of fly ash	2007	To mandate reuse of large quantities of fly ash from thermal power plants for development projects within 100km radius.	MoEF & CC	Yes
Wildlife Protection Act	1972	To protect wild animals and birds through the creation of National Parks and Sanctuaries	MoEF & CC	No[2]
The Forest (Conservation) Act	1980	To protect and manage forests, to check deforestation by restricting conversion of forest areas into non-forest areas	Forest Department, GoTN/ MoEF & CC	Yes
The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act	2006	To recognise and vest the forest rights and occupation in forest land in forest dwelling STs and other traditional forest dwellers	Forest Department, GoTN & Dept of Tribal Development, GoTN	Yes
Biological Diversity Act	2000	Disclosure of species survey or collection activities to the National Biodiversity Authority	MoEF & CC	Yes
Water (Prevention and Control of Pollution) Act (and Subsequent Amendments)	1974	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	TNPCB	Yes
Air (Prevention and Control of Pollution) Act (and subsequent	1981	To provide for the prevention, control and	TNPCB	Yes

[1] As per EIA Notification 2006 & subsequent amendments, Environmental clearance will be required if any State Highway project road under TNRSP –II is passing in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive area"

[2] If any State Highway project road under TNRSP –II is passing through ecologically sensitive area like Wildlife Sanctuary /National Park/Biosphere/Tiger Reserves/Bird Sanctuary, etc, prior Wildlife Clearance will be required from National Board for Wildlife and Hon,ble Supreme Court of India.

Policy/Act/Rule	Year	Purpose	Responsible Institution	Applicability (Yes/No)
amendments)		abatement of air pollution, and for the establishment of Boards to carry out these purposes.		
Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.	2008	Authorisation for handling, storage, transportation & disposal of hazardous wastes	TNPCB	Yes
Municipal Solid Waste (Management & Handling)Rules, 2000	2000	Segregation, Handling & safe disposal of domestic solid waste	Local Body	Yes
Batteries (Management and Handling) Rules, 2001	2001	Safe recycling of lead acid batteries	TNPCB	Yes
Public Liability and Insurance Act 1991	1991	Protection form hazardous materials and accidents.		Yes
Minor Minerals Conservation and Development Rules. 2010	2010	For opening new quarry	District Collector	Yes
Explosive Act 1984 Explosive Rule 2008	2008	Safe transportation, storage and use of explosive material and	Chief Controller of Explosives	Yes
Tamil Nadu Minor Mineral Concession Rules, 1956	1956	For opening new quarry	Mining & Geology Department	Yes
Coastal Regulation Zone (CRZ) Notification	2011	For construction of road in Coastal Regulation Zone Notification Area	MOEF	Yes, it road is falling in Coastal Regulation Zone Area
Noise Pollution (Regulation and Control) rules 2000	2000	Noise pollution regulation and controls	TNPCB	Yes
Central Motor Vehicle Act Central Motor Vehicle Rules	1988 1989	To control vehicular air and noise pollution. To regulate development of the transport sector, check and control vehicular air and noise pollution.	Transportation Department, GoTN	Yes, for all the vehicles used for construction purposes
The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act	2010	To amend the Ancient Monuments and Archaeological Sites and Remains Act, 1958, including declaration of regulated and prohibited areas around the monuments.	Department of Archaeology, GoTN, National Monuments authority	Yes, only If there are ASI identified sites along the TNRSP-II Corridor
The Land Acquisition Act	1894 1984	Set out procedures for acquisition of land by government	Revenue Department, GoTN	Yes
The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013	2013	Set out rule for fair compensation in land acquisition and Rehabilitation & Resettlement Plan for affected families	Revenue Department, GoTN	Yes

Source: GoI, MoEF&CC and GoTN

2.2 World Bank Safeguard Policies

13. In addition to the national and state policies, acts and rules, the World Bank policies and directives on environmental and social safeguards need to be adhered to in the present assignment. The applicability of the

relevant policies pertaining to the corridors that are undergoing upgradation (strengthening and widening) are summarized in Table 2-2.

Table 2-2: Applicability of WB Safeguard Policies

WB Safeguard Policy	Policy Objectives
OP 4.01 Environmental Assessment	Help to ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-making process
OP 4.04 Natural Habitats[3]	Assist in appropriate conservation and mitigation measures remove or reduce adverse impacts on natural habitats or their functions, keeping such impacts within socially defined limits of acceptable environmental change. Specific conservation measures depend on the ecological characteristics of the given site.
OP 4.36 Forests	Helps to protect forest areas. The policy is also meant to steer World Bank investments into forests in accordance with the World Bank's wider strategy related to forests. This strategy is principally aimed at expanding the area of tropical forests
OP 4.12 Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
OP 4.11 Physical cultural resources (PCR)	Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance.

2.3 Other Legislations Applicable to TNRSP-II

14. Environmental issues during road construction stage generally involve equity, safety and public health issues. The road construction agencies require complying with laws of the land, which include inter alia, the following:

15. ***Workmen's Compensation Act 1923***: The Act provides for compensation in case of injury by accident arising out of and during the course of employment;

16. ***Contract Labour (Regulation and Abolition) Act, 1970***: The Act provides for certain welfare measures to be provided by the contractor to contract labour;

17. ***Minimum Wages Act, 1948***: The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act;

18. ***Payment of Wages Act, 1936***: It lays down as to by what date the wages are to be paid, when it will' be paid and what deductions can be made from the wages of the workers;

19. ***Equal Remuneration Act, 1979***: The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees;

20. ***Child Labour (Prohibition and Regulation) A; 1986***: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in

3 (a) **Natural habitats** are land and water areas where (i) the ecosystems' bio-logical communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area's primary ecological functions.
(b) **Critical natural habitats** are: (i) existing protected areas and areas officially proposed by governments as protected areas (e.g., reserves that meet the criteria of the World Conservation Union [IUCN] classifications, areas initially recognized as protected by traditional local communities (e.g., sacred groves), and sites that maintain conditions vital for the viability of these protected areas (as determined by the environmental assessment process).

all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry;

21. ***Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979***: The inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.;

22. ***The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996*** and the Cess Act of 1996: All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.;

2.4 Clearance Requirements

2.4.1 Environmental Clearance (EC)

23. EIA notification of the MoEF & CC dated 14th September 2006, categorizes all projects and activities into two categories[4] - Category A and Category B, based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources. Environmental Impact Assessment Notification, amendment in 2009, states that "all state highways and state highways undergoing expansion in hilly terrain (above 1000m AMSL) and / or ecological sensitive area" should obtain environmental clearance from State Environmental Impact Assessment Authority (SEIAA). The selected corridors under TNRSP-II are not passing through hilly terrain (above 1000m AMSL) and / or ecological sensitive area". Therefore, EIA Notification 2006 as amended in 2009 is not applicable and environmental clearance is not required for any selected corridors. In case environmental clearance is required for any corridor, procedure given in the EIA Notification 2006 and subsequent amendments shall be followed as shown in Figure 2.1.

2.4.2 Consents from Tamil Nadu Pollution Control Board

24. The project corridors shall require obtaining '***Consent to Establish***' and '***Consent to Operate***' from Tamil Nadu Pollution Control Board for establishment and operation of Hot Mix Plant (HMP), WMM, Crushers and Constructors Labour Camps (as per Schedule-I), under Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981) and authorization under Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008, as amended.

[4]All projects or activities included as ***Category 'A'*** in the Schedule, including expansion and modernization of existing projects or activities and change in product mix, shall require prior environmental clearance from the Central Government in the Ministry of Environment and Forests (MoEF) on the recommendations of an Expert Appraisal Committee (EAC) to be constituted by the Central Government for the purposes of this notification; All projects or activities included as ***Category 'B'*** in the Schedule, including expansion and modernization of existing projects or activities as specified in sub paragraph (ii) of paragraph 2, or change in product mix as specified in sub paragraph (iii) of paragraph 2, but excluding those which fulfill the General Conditions (GC) stipulated in the Schedule, will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The SEIAA shall base its decision on the recommendations of a State or Union territory level Expert Appraisal Committee (SEAC) as to be constituted for in this notification.

2.4.3 Forest Clearances

25. In Tamil Nadu state, road plantations along the MDR, ODR and State Highways (SH) are not declared as Notified Protected Forest (NPF), under Forest (conservation) Act 1980. Hence, in the identified corridors, including strengthening and widening activity would not attract Forest clearance for road side trees felling.

26. In some corridors, reserved/protected forest land is close to the road and diversion of forest land may be avoidable. Forest clearance will be required under The Forest (Conservation) Act, 1980 if diversion of forest land is necessary. As per the Forest (Conservation) Act, 1980, Form 'A' (refer **Appendix 2-1**) needs to be filled by the project proponent and has to be submitted along with the necessary enclosures to the District Forest Office, further stages of forest clearance (*as per IRC –SP-93-2011*) procedures is shown in the following Figure 2-.

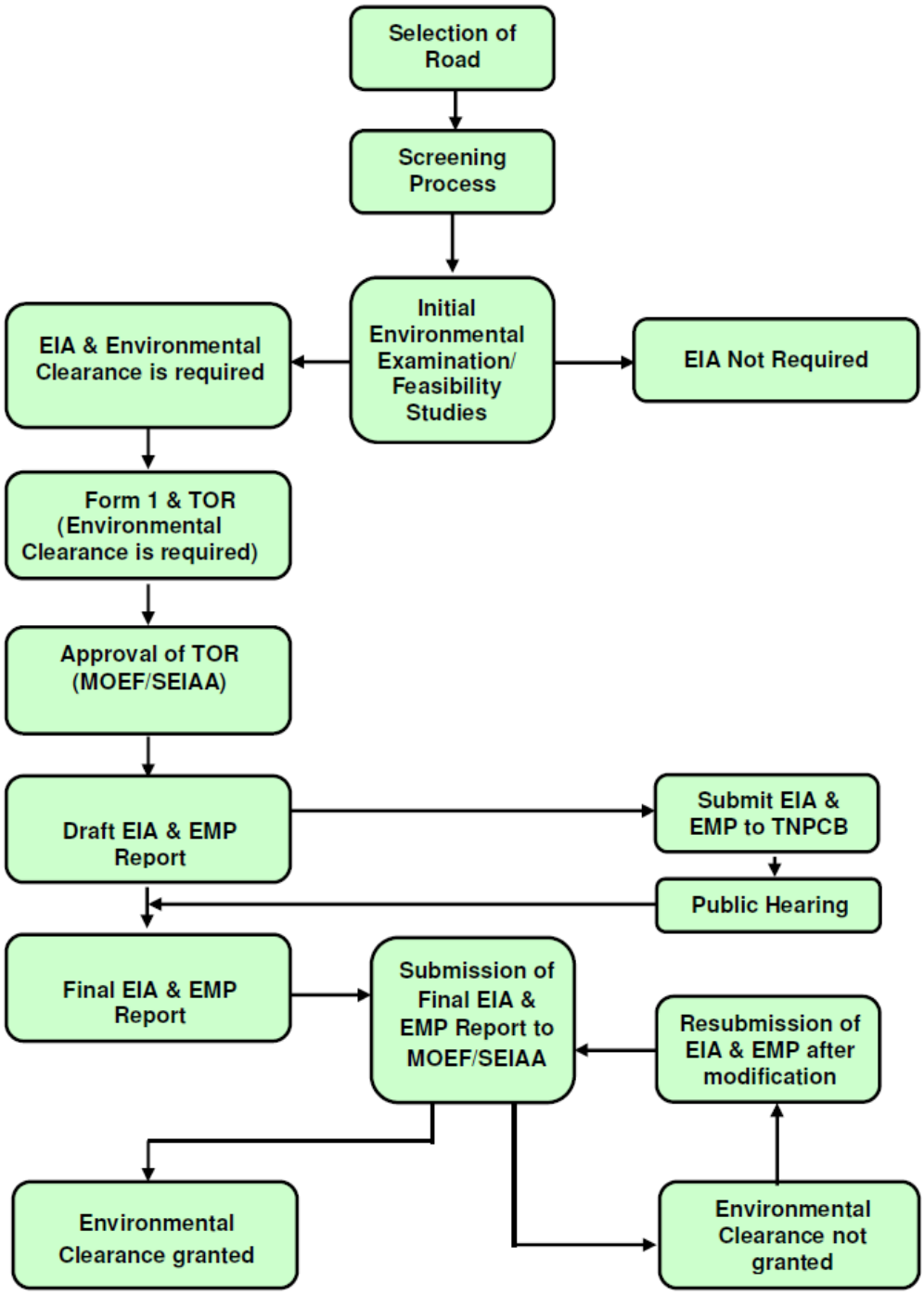


Figure 2-1: Environmental Clearance Procedures

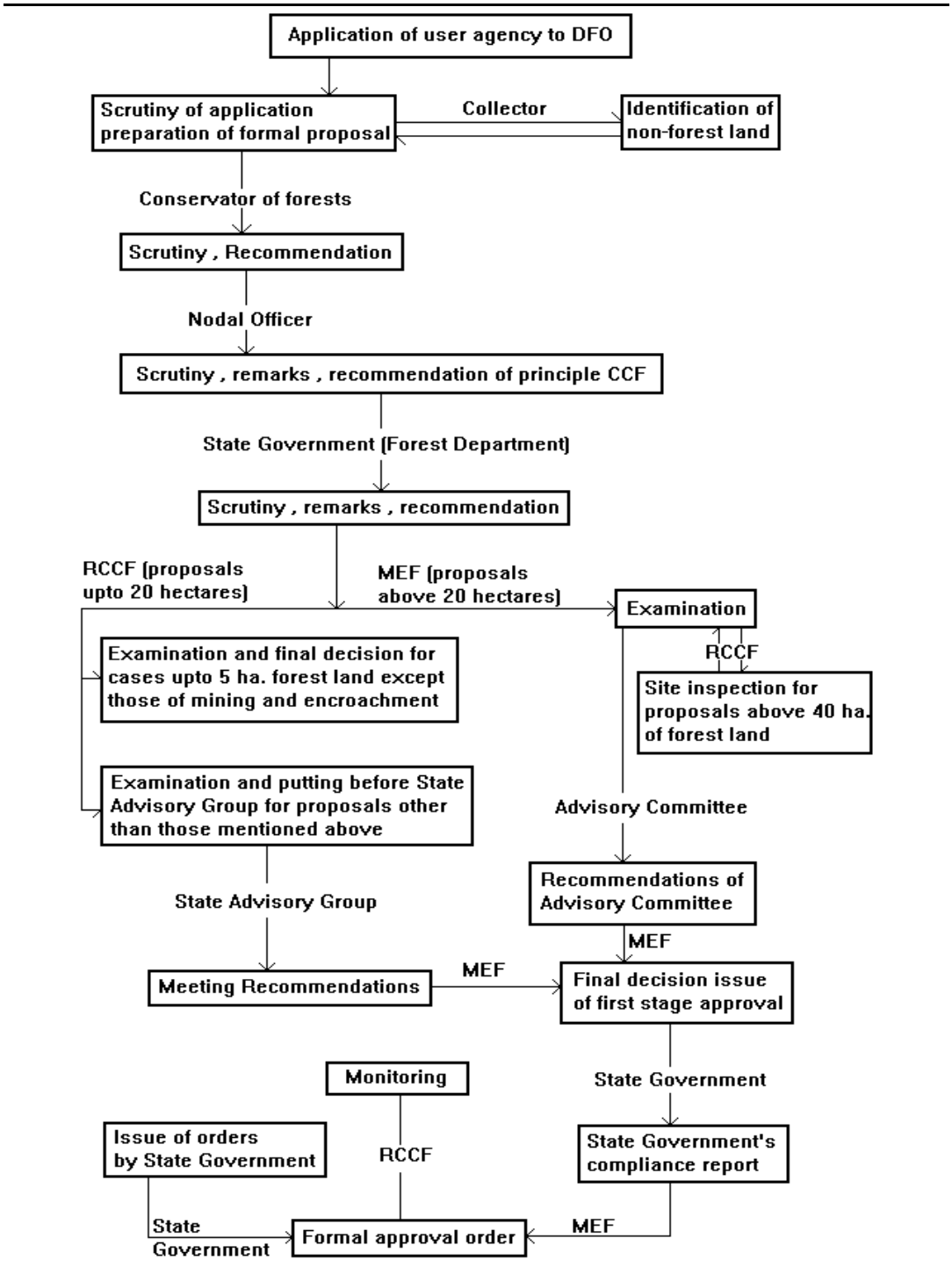


Figure 2-2: Forest Clearance Procedures

2.4.4 Permission of Eco Sensitive Zones

In the Tamil Nadu State, there are 8 wildlife sanctuaries, 12 Bird Sanctuaries, 5 National Parks, 3 Tiger Reserves, 4 Elephant Reserves and 3 Biosphere Reserves for protection and conservation of wild fauna and flora. These are considered ecological protected areas. In case any such protected area is located with the 10 km distance from the project road corridor, prior permission from National

Board for Wildlife (NBWL) will be required under Environmental (Protection) Act, 1986 to start the construction of the project road corridor.

2.4.5 Wildlife Clearance From Supreme Court In Notified Wildlife Areas

If any project corridor under TNRSP –II passes through a protected area, like, a national park, wildlife sanctuary, bird sanctuary, Tiger Reserve or biosphere reserve, prior wildlife clearance will be necessarily obtained from National Board for Wildlife (NBWL) and then from Hon'ble Supreme Court of India. The wildlife clearance is a prerequisite for forest clearance for diversion of forest land located in protected area. It is important to mention that even surveys and geotechnical studies in protected area, require prior clearance from the National Board of Wildlife.

2.4.6 CRZ Clearance for Road Construction in Coastal Regulation Zone (CRZ) Area

If any project corridor under TNRSP –II is passed though Coastal Regulation Zone (CRZ) notification area, prior CRZ clearance will be necessarily obtained as per provisions of Coastal Regulation Zone (CRZ) Notification 2011 and subsequent amendments in 2013.

2.5 Summary of Clearance Requirements

27. Table 2-3 summarizes the clearance requirements for the project, including the agency responsible for obtaining the clearances, the time period required.

Table 2-3: Clearance requirements

Sr. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Estimated Time Frame[5]	Responsibility	
						Execution	Supervision
PROJECT PREPARATION STAGE							
1.	Diversion of forest land for Non-forest use	The Forest Conservation Act (1980)	Regional Office Southern MOEF&CC, Bangalore	Applicable	6-9 months	PIU/DPR Consultants	PIU -
2.	Permission for removal of road side tree within the ROW or in bypass/ realignment	Tamil Nadu Preservation Private Forest Act, 1949 Tamil Nadu Timber Transit Rules, 1968.	District Collector	Applicable	3-6 months for each workout area	PIU/DPR Consultants	PIU -
3.	Environmental Clearance	EIA Notification, 2006 and subsequent amendments under the Environmental (Protection) Act, 1986	SEIAA/MOEF&CC	Applicable (if any State Highway project road under TNRSP – II is passing in hilly terrain (above 1,000 m AMSL) and or ecologically sensitive area)	9 - 12 months	PIU/DPR Consultants	PIU -
4.	Wildlife Clearance	Wildlife Protection Act 1972 and amendments	National Board for Wildlife and then Hon'ble Supreme Court of India	Applicable (Project Road Corridor is passing through National Park, Wildlife Sanctuary, Bird Sanctuary, Tiger Reserve	12 – 18 months	PIU/DPR Consultants	PIU -

[5] The right of permission vests with the Competent Authority

Sr. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Estimated Time Frame[5]	Responsibility	
						Execution	Supervision
				or Biosphere)			
5.	Permission for Eco Sensitive Zone	Environmental (Protection) Act, 1986	National Board for Wildlife	Applicable (If National Park, Wildlife Sanctuary, Bird Sanctuary, Tiger Reserve or Biosphere are situated with 10 km distance from the project road)	6 months	PIU/DPR Consultants	PIU
PROJECT IMPLEMENTATION STAGE							
6.	Consent to Establish for Hot mix plant, Crushers, Batching Plant and Labour Camps	Water (Prevention and Control of Pollution) Act 1974 Air (Prevention and Control of Pollution) Act. 1981	Tamil Nadu Pollution Control Board	Applicable	3 months	Contractor	PIU/ Engineer
7.	Consent to Operate for Operation of Hot mix plant, Crushers, Batching Plant and Labour Camps	Water (Prevention and Control of Pollution) Act 1974 Air (Prevention and Control of Pollution) Act. 1981	Tamil Nadu Pollution Control Board	Applicable	3 months	Contractor	PIU/ Engineer
8.	Authorisation for Disposal of Hazardous Wastes	Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.	Tamil Nadu Pollution Control Board	Applicable	2 months	Contractor	PIU/ Engineer
9.	Permission for Sand Mining from River bed	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, Go TN CTE/CTO from TNPCB	Applicable	2 months	Contractor	PIU/ Engineer
10.	Permission for Opening of New Quarry	Mines and Minerals (Development and Regulation) Act, 1957 Environmental (Protection) Act 1986 Water (P& CP) Act 1974 and Air (P& CP) Act 1981	Commissioner of Geology and Mining, GoTN Environmental Clearance from SEIAA, Go TN CTE/CTO from TNPCB	Applicable	2 – 6 months	Contractor	PIU/ Engineer
11.	Storage of Hazardous Chemicals (Fuel Oils) and Explosives	Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Chief Controller of Explosive, Chennai	Applicable	3 months	Contractor	PIU/ Engineer
12.	Permission for Withdrawal of Ground Water	Environmental (Protection) Act, 1986	Central/State Ground Water Board	Applicable (If the contractor is extracting ground water)	3months	Contractor	PIU/ Engineer

Sr. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Estimated Time Frame[5]	Responsibility	
						Execution	Supervision
13.	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Transport Department (GoTN)	Applicable	1 Month	Contractor	PIU/ Engineer
14.	Employing Labour	The Building And Other Construction Workers. (Regulation of Employment and Conditions of Service) Act, 1996	Labour& Employment Department, GoTN	Applicable	1 Week	Contractor	PIU/ Engineer
15.	Registration of Workers	Labour Welfare Acts.	Labour& Employment Department, GoTN	Applicable	1 Month	Contractor	PIU/ Engineer

Source: Acts, Rules and Regulation from Central and State Government

Chapter 3: Procedure for Conducting Environmental Assessment

3.1 Introduction

28. The Environmental Management Framework (EMF) shall be applied once the need/justification of a project is finalized based on the engineering parameters (like traffic, economic and financial analysis, screening of the project road) to ascertain the category of Environmental Assessment as the first step.

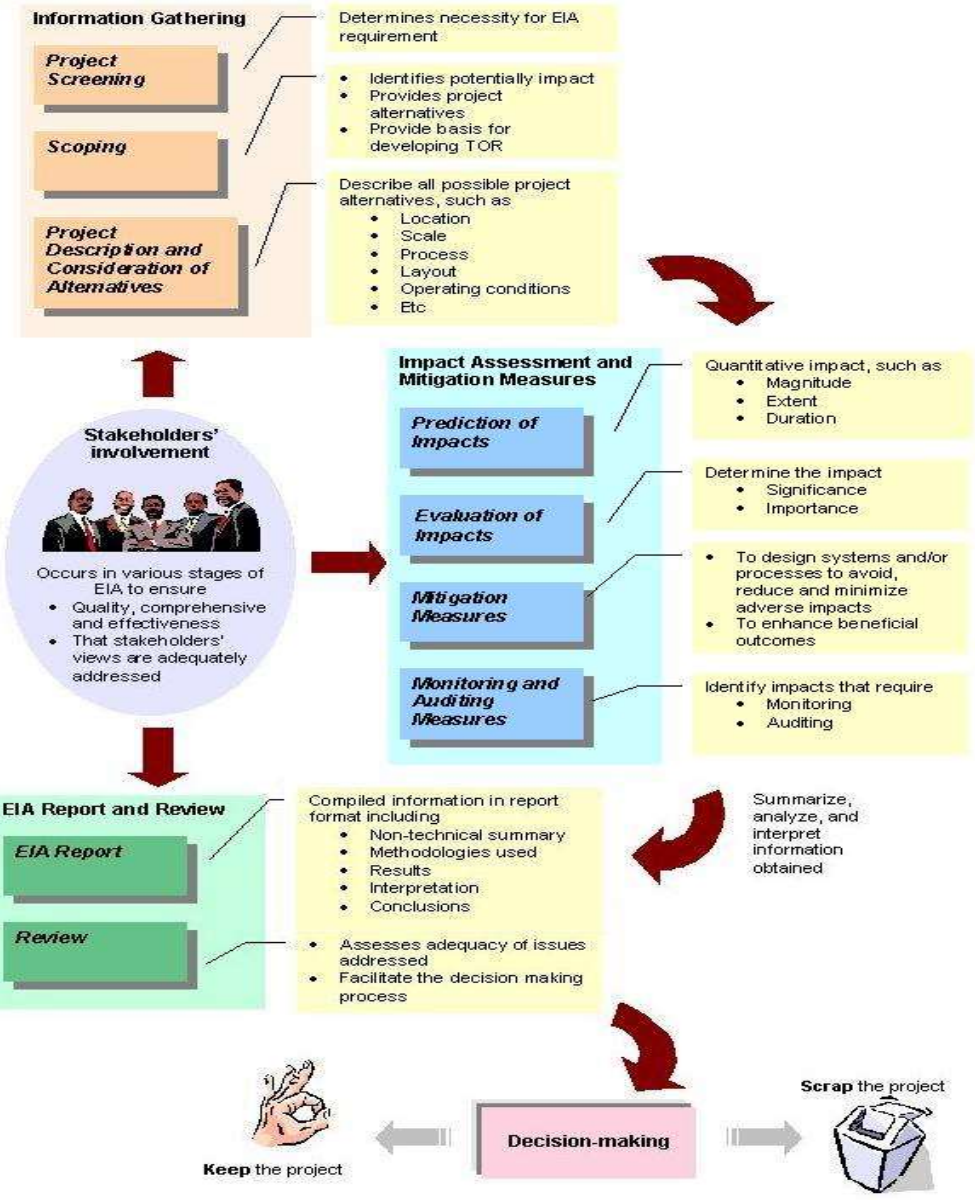


Figure 3-1: The EIA processes in Sequences of Application

Source: The manual in perspective, EIA Training Resource Manual, United Nations Environment Programme, 2002

3.2 Step 1: Screening

29. Screening is the process by which the appropriate level and type of EA is determined for a given project on the basis of its likely environmental impacts. For identification of sensitive sub-projects with respect to the environmental and social issues, a screening and review process shall be worked out. This exercise will be a useful tool to identify the environmental and social issues, and integrate them into the project preparation, and not as an exclusion criterion for avoiding environmental and social impacts. The PIU (TNRSP-II) shall carry out screening exercises for all roads in order to determine the subsequent stages of the project prior to initiation of the DPR activities.

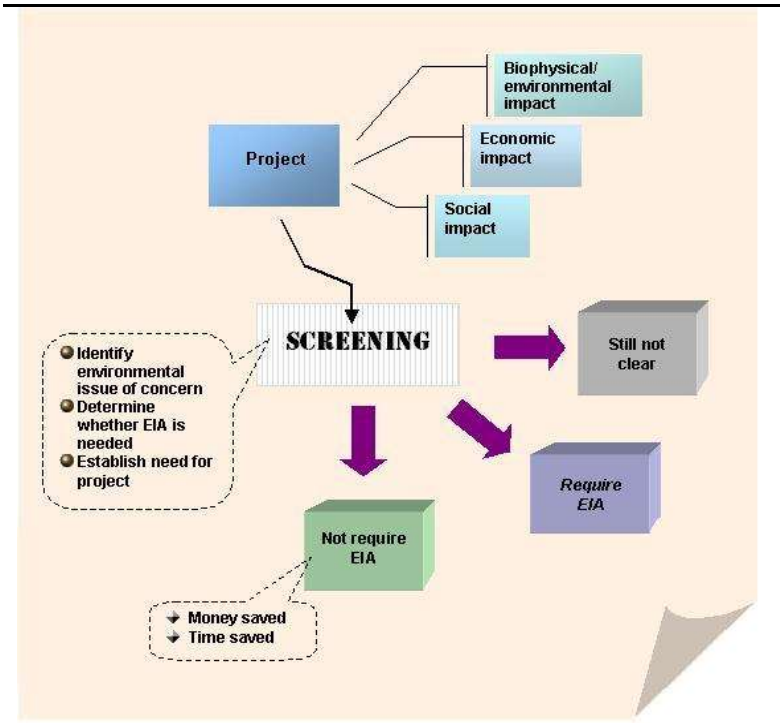


Figure 3-2: The Project Screening Process

30. The screening criteria include:

- Environmental factors, including:
  - Sensitive areas, natural habitats, protected areas
  - Felling of trees outside the protected areas
  - Clearance of vegetative cover
  - Loss of productive agricultural land
  - Cuts across perennial streams or surface water bodies
  - Vulnerability to natural hazards, landslides/slips and
  - Environmental features as marshy areas, sand dunes etc.
- Social factors, including:
  - Land availability
  - Loss of structures
  - Loss of livelihood
  - Impacts on Indigenous population
  - Impacts on common property resources, and
  - Demand from communities for the road

31. The methodology for screening includes Desk study, Reconnaissance survey and review based on available literature.

32. **Desk Study**: Involves collection of secondary information and then chalk out the methodology for carrying out EA study and fix responsibilities of EA team members for preparing a complete Environmental Management Plan, EMP addressing all issues.

- Gathering and reviewing existing environmental data (Secondary Data) relevant to the proposed development, in the form of toposheets, physical maps, thematic maps showing details of soil type, geology, seismic activity, hydrology etc.
- Collecting the various environmental and engineering studies conducted earlier in project influence area.

33. **Reconnaissance Survey**: Involves collection of the first hand information about the project area and develop a perspective of the entire team and revise the methodology and work programme.

- Verifying the data collected during desk study, assessing the likely impacts, identifying the major/main issues and preparing the methodology for detailed investigation.

34. **Screening Statement**: Involves compiling of the collected primary & secondary data, and checking with the legal framework of State and National level thereby suggesting the requirement/category of Environmental Assessment Required. There are usually three possible outcomes (categories) of a screening process:

a. Environmental Category:

- As per Environmental Impact Assessment Notification - 2006, and subsequent amendments; the selected state highways (corridors) which are proposed for expansion, widening or improvement, are not be categorised as Category 'B' as these corridors are not located in hilly terrain (above 1,000 m amsl) and or not passing though ecologically sensitive area, hence Environmental Clearance is not required for the selected corridors. The environmental sensitive locations like major water bodies (rivers, lakes, ponds, swamp area and wetlands); biodiversity hotspots (national parks, sanctuaries and reserved forest) and flora and fauna with respect to Tamil Nadu are enclosed in **Appendix 3-1** in this report for clarification/ guidance.
- For the purpose of this project, a detailed analysis of the locations (as listed in the **Table 3-1**) where sensitive environmental components are found shall be conducted to ensure that these components are not affected due to the project. In the projects where these environmentally sensitive components exist and are likely to be impacted, the Categorisation will be elevated from Category B to Category A to correspond to the Categorisation of projects funded by the World Bank. In such cases, a detailed EA in line with the project ToR for EA shall be initiated. Hence, final categorisation of the projects will correspond to the Categorisation of the Projects as per MoEF & CC and the World Bank.

Table 3-1: List of Sensitive Environmental Components

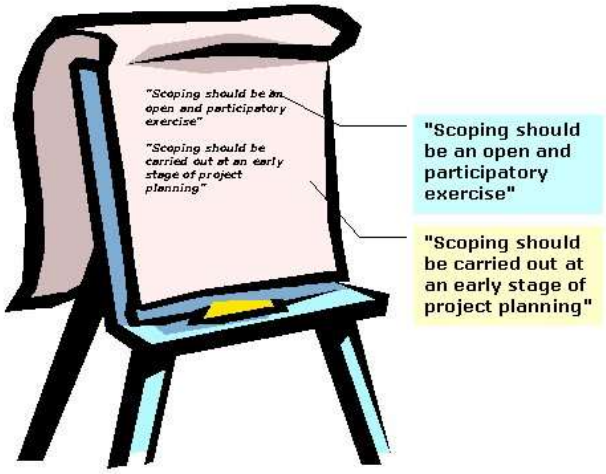
S. No	Sensitive Environmental Component
1	Religious, heritage historic sites and cultural properties
2	Archaeological monuments/sites
3	Scenic areas
4	Hill resorts/Mountains/ Hills
5	Health resorts
6	Biosphere reserves / Wetland / Beel
7	National park and Wildlife sanctuaries and reserves
8	Natural lakes, Swamps Seismic zones tribal Settlements
9	Areas of scientific and geological interests
10	Defense installations, especially those of security importance and sensitive to pollution
11	Border areas (international)
12	Tiger reserves/Elephant reserve/Turtle nestling grounds
13	Habitat for migratory birds
14	Lakes, Reservoirs, Dams
15	Streams/Rivers/Estuary/Seas

3.3 Step 2: Environmental Assessment

35. The assessment process shall constitute a systematic approach to the evaluation of a project in the context of the natural, regulatory and environment of the area in which development is proposed.

3.3.1 Scoping

36. The next step in the EA will be to define the proposed project activities and the natural, regulatory (*i.e*. legal) and environment of the area in which development will occur. This shall be achieved through Scoping. Scoping shall identify the activities that have a potential to interact with the environment. Scoping will be conducted early in the EA process so that a focus on the priority issues (i.e. those that have the greatest potential to affect the natural and/or environment) can be established for the rest of the EA process.



37. Key elements/inputs to the scoping exercise will be as follows:

- Gathering and reviewing existing environmental data like land width, encroachment, congestion area, bye-pass/ realignment requirement, land use pattern along bypass / realignment, drainage pattern, major river and waterways, cultural heritage sites and eco sensitive areas.
- Identifying project stakeholders; including PAP, Government and non-government agencies (utilities) Forest Department, Irrigation Department, Pollution Control Board, etc.
- Assemble and review relevant legislative requirements, environmental standards and guidelines (national and international) associated with the proposed development as well as World Bank's operational policies and standards.
- Gathering existing information sources and local knowledge;
- Informing stakeholders of the project and its objectives and get input on the EA;
- Identifying the key environmental concerns (community and scientific) related to a project and the relative importance of issues;
- Defining/preparing the EA work program, including a plan for public and stakeholder involvement;
- Carrying out monitoring of natural environment including air, water, soil, noise etc.
- Defining the range of project alternatives to be considered.
- Determining/freezing the spatial and temporal boundaries for the EA studies.

38. The main focus of Scoping will be pertaining to the collection and analysis of pertinent data and the assessment of significant environmental attributes. The end result will be a work program which is well focused and cost-effective. The following issues shall be addressed through Scoping, but will not be limited to.

- To improve the quality of EA information by focusing scientific efforts and EA analysis on truly significant issues;
- To ensure environmental concerns identified and incorporated early in the project planning process, at the same time as cost and design factors are considered;
- To ensure research efforts are not wasted on insignificant issues, rather focused on core issues.
- Reducing the likelihood of overlooking important issues;

- Thinning the chance of prolonged delays and conflicts later in the EA process by engaging stakeholders in a constructive participatory process early in the EA process;
- Establish Terms Of Reference (TOR) for EIA study.

3.3.2 Environmental Impact Assessment

39. Following Scoping, legislative requirements, engineering, environmental and socio-economic data shall be assessed in greater detail to ensure that all the proposed activities and their consequences / likely impacts are considered completely.

3.3.3 Existing Environmental Conditions

40. In order to identify any potential impact and potential changes to the natural and socio-economic environments, the existing baseline environmental data are to be collected. Baseline data shall include but not limited to following:

Baseline data are collected for two main purposes:

(i) To provide a description of the status and trends of environmental factors (e.g., air pollutant concentrations) against which predicted changes can be compared and evaluated in terms of importance.

(ii) To provide a means of detecting actual change by monitoring once a project has been initiated.

- Primary data/monitoring shall define characteristics of the existing natural environment including soil, water, air, noise, land use, cultural properties and flora & fauna.
  - Monitoring to be carried at critical locations
  - Identification of residential, commercial, industrial and forest areas for monitoring
  - Air and Noise Monitoring at Junctions, major settlements, school and hospitals etc.
  - Water Monitoring at river/streams/ponds and ground water sources near major settlements.
  - Soil Monitoring at major settlements, near surface water bodies.
  - Tree inventory to be carried out, in consultation with Forest Department.
  - Inventory of Cultural Property Resources shall be done along with measurements, details and photographs; consultation shall be done for gathering public opinion.
- Secondary Data to define meteorology, geology, seismicity, quarries, borrow areas, disposal sites etc.
  - Details of quarry and borrow areas that are likely to be used shall be collected (Photographs, measurements and public opinion) and a comprehensive plan for extracting material shall be prepared.
  - Meteorological data from IMD, Topo-sheets and maps from Survey of India, geological and soil data from GSoI.
  - Social data including ownership pattern, identification of tribal, vulnerable social groups, land estimates etc.

3.3.4 Assessment of Policy and Regulations

41. Regulatory and administrative framework at the national and state level, applicable World Bank requirements are presented in Chapter 2: Legal Framework

3.3.5 Impact Prediction

42. Impact prediction being the most challenging and controversial stage of the EA process it is necessary that it should be dealt with utmost care. Reliable methods available for predicting some environmental parameters, e.g. air quality impacts should be used, whereas other predictions should be based on professional

judgement as these shall be qualitative and there are no reliable models existing for quantification of the predicated impacts e.g. impacts arising due to construction activity on flora/ fauna.

3.3.6 Analysis of Alternatives

43. An analysis of various alternative options for the project are to be assessed for varying level of impacts and their addressal shall be part of the EA/ SA. The best fit alternative with respect to the engineering economic, social and environmental aspects are to be considered for implementation. Various alternatives that could be considered are as below:

- With or without the project.
- Analysis criteria to include environmental, social, technical/design and economic options.
- Alignment options within existing RoW
- Alternatives of Bypass
- Other engineering alternatives.

3.3.7 Stakeholder Consultation at all stages of project

44. Stakeholder consultations are an integral part of the project design process. The stakeholders are to be consulted at two stages of the project, at a minimum, once in the initial stage of the project conceptualisation and an alternative analysis and another one has to be conducted after finalisation of the design. Both stages of consultations are critical for the success of the project with the community. Various stages in the consultation process are outlined as below.

- Identification of stakeholders both primary as well as secondary
    - Primary stakeholders include people having direct impact.
    - Secondary Stakeholders includes village representatives, women's group, Voluntary organizations NGOs, experts, field level officers and staff, other government officials.
- Structured Consultation
    - Consultation at Village Level
    - Consultation at District Level
    - Consultation at State level

- *Consultation at Village Level*
    - Along with preliminary inventory and survey information, dissemination shall be done along the alignment by one by one canvassing about the project. Date and venue for detailed consultation shall be fixed.
    - Pictorial method (Pamphlet) shall be adopted to explain proposed improvements and possible environmental impact in the concerned villages.
    - Public consensus shall be arrived at for the proposed mitigation.
    - Public suggestion and grievances shall be addressed at appropriate level.
- *Consultation at District Level*
    - Consultation with officers of Revenue, Forest and line department
    - Consultation with the elected representatives and other stakeholders

- *Consultation at state level*
    - Consultation with senior department officers, principal secretary and others to formalize the procedure and mechanism of regulatory clearance, utility shifting, land acquisition etc.

3.3.8 Environmental Impacts Identification

45. Based on base line data collected along with engineering and social inputs, a comprehensive study shall be undertaken to identify the possible impact on environmental attributes. The impacts will be defined in terms of their temporal and spatial implications.

46. An EIA document should typically include:

- **Project Description** describing about the existing as well as proposed scenario with a mention on Right of Way (RoW), roadway improvements, cross drainage structures, community facilities, traffic projections etc.
- **Environmental Regulatory Framework** presents the legal and administrative framework of Government of India and Government of Tamil Nadu. This section underlines various clearances applicable for the project corridor at the State / Central level.
- **Baseline Environmental Status**, the existing environmental conditions along the corridor to be ascertained by conducting a reconnaissance survey along with collection of secondary information pertaining to the corridor. Primary data for various environmental parameters has to be generated using suitable monitoring devices. The methodology has to be strictly adhered to the guidelines stipulated by Central Pollution Control Board's.
- **Public Consultation** to be carried out in order to know the reactions of local population and the project affected people (PAP). Meetings to be held with the stake holders to record their views on the impacts caused and the suggested remedies to be adopted for the proposed project corridor.
- **Analysis of Alternatives** to be presented shall be carried out during feasibility stage, covered in Environmental Screening Report, and the approved alternative to be discussed in detail along with environmental attributes under impact.

47. **Environmental Impacts**, addressing all the anticipated impacts on the physical and social environment of the corridors, have been identified during environmental screening exercise and environmental assessment carried out for roads under TNRSP-II. The quanta of all the identified anticipated impacts on natural environment and social/cultural environment are presented in **Table 3-2** and

48.

49.

50. **Table 3-3**, respectively

Table 3-2: Possible Impacts on Physical Environment

Project Activity	Planning and Design Phase	Pre-construction Phase		Construction Phase					Operation	Indirect effects of operation or Induced development
Environmental Component Affected	Land Acquisition	Removal of Structures	Removal of Tress & Vegetation	Earthworks including Quarrying	Laying of Pavement	Vehicle & Machine Operation & Maintenance	Concrete & Crusher Plants	Sanitation & Waste (labour campus)	Project Operation	
Air		Dust generation during dismantle	Reduced buffering of air and noise pollution, hotter, drier microclimate	Dust Generation	Asphalt odour	Noise, dust pollution	Noise, soot, odour, dust pollution	Odour, smoke	Noise, dust pollution	Other pollution
Land	Loss of Productive Land	Generation of debris	Erosion and loss of top soil	Erosion and loss of top soil	Contamination of soil	Contamination by fuel and lubricants compaction	Contamination compaction of soil	Contamination from wastes	Spill from accidents, Deposition of lead	Change in cropping pattern
Water	Loss of water resources	Siltation due to loose of earth	Siltation due to loose of earth	Alteration of drainage, Break in continuity of ditches, Siltation, Stagnant water pools in quarries	Reduction of ground water recharge area	Contamination by fuel and lubricants	Contamination by leakage of fuel	Contamination from wastes overuse	Spill contamination by fuel, lubricants	Increased contamination of ground water
Noise		Noise pollution	Noise pollution	Noise pollution	Noise Pollution	Noise pollution	Noise pollution		Noise pollution	Noise pollution
Flora		Loss of biomass		Lowered productivity, Loss of ground for vegetation		Removal of vegetation	Lower productivity, Use as fuel wood	Felling trees for fuel	Impact of pollution on vegetation, Lowered productivity, Toxicity of vegetation	
Fauna			Disturbance, Habitat loss	Disturbance		Disturbance	Disturbance	Poaching	Collision with traffic	Distorted habitat

Table 3-3: Possible Impact on Social and Cultural Environment

Project Activity	Planning & Design Phase	Pre-construction Phase			Construction Phase					Operation	
										Direct	Indirect Induced development
Environmental Component Affected	Design decisions & Implementation policies	Land Acquisition	Removal of Structures	Removal of Tress & Vegetation	Earthworks including Quarrying	Laying of Pavement	Vehicle & Machine Operation & Maintenance	Asphalt and crusher plants	Labour Camps	Project Operation	-
Agricultural Land		Change in land prices	Loss of land economic value	Loss of standing crops	Loss of productive land	-	-	Dust on agricultural land, reduce productivity	-	-	Conversion of agricultural land
Building & Built Structures	-	-	Loss of structures, debris generation, noise & air pollution	-	Noise, vibration may damage to structures	-	Noise, vibration may damage to structures	Dust accumulation on building & structures	-	Vibration & noise	Change in building use & characteristics
People & Community	Anxiety & fear among community	-	Displacement of people, psychological impact on people, loss of livelihood	Loss of shade & community trees, loss of fuel wood & fodder, loss of income	Noise & air pollution	Odour & dust	Noise & air pollution, collision with pedestrians, livestock & vehicles	Air & noise pollution and discomfort	Community clashes with migrant labours	Noise pollution, risk of accident	Induced pollution
Cultural Assets	-	-	Displacement, loss of structure from RoW	Loss of sacred trees	Noise, vibration may cause damage to structure	-	Damage from vibration & air pollution	Dust accumulation	-	Damage from vibration & air pollution	-
Utilities and Amenities	-	-	Interruption in supply	-	-	-	Damage to utilities & amenities	Dust accumulation on water bodies	Pressure on exiting amenities	-	-
Labour's Health & Safety	-	-	-	-	Increase of stagnant water & disease	Asphalt odour and dust	Collisions with vehicles, pedestrians & livestock	Impact on health due to inhale of dust	Increase in communicable diseases	Collision of pedestrians & livestock	-

3.3.9 Determining Degree of impact

51. After identifying all environmental aspects of the project, the level of impact that may result from each of the activity-receptor interactions shall be assessed. In assessing the level of impact that an activity may cause, two key elements are to be considered namely:

- **Consequence**: the resultant effect (positive or negative) of an activity's interaction with the legal, natural and/or socio-economic environment's; the categorization for consequence are presented in **Table 3-4** below.

Table 3-4: Consequence categories and rankings

Consequence Category	Addressed
Major	Severe, alternative/avoidance will be proposed
Moderate	Less Severe, measures will be proposed to minimize impact
Minor	Lesser Severe, mitigation measures will be proposed
Negligible	Least Severe, mitigation and enhancement measures will be prepared.
None	No impact, enhancement measures will be proposed.
Positive	Positive Impact

- **Likelihood:** the likelihood that an activity will occur. The categorization for likelihood is presented in **Table 3-5** below**.**

Table 3-5: Likelihood categories and rankings

Likelihood Category	Definition
Certain	The activity will occur under normal operating condition
Very Likely	The activity is very likely to occur under normal operating condition
Likely	The activity is likely to occur at some time under normal operating condition
Unlikely	The activity is unlikely to occur but may occur at some time under normal operating conditions
Very unlikely	The activity is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances.

3.3.10 Cumulative Environmental Impact Assessment

52. In the Tamil Nadu state, various roads, highways and other infrastructure development project activities have been completed in the past, under the progress in the present and planned for future. Therefore, it is necessary to carry out Cumulative Environmental Impact Assessment for the subprojects in TNRSP-II.

53. Cumulative impacts are changes to the environment caused by project activities in combination with other past, present, and future human actions. Cumulative Environmental Impact Assessment is an assessment of such impacts. In practice, assessment of cumulative impacts requires consideration of other assessment concepts, which are different from the conventional approaches used in EIA. The concepts of commutative impact assessment are the following:

- Assessment of impacts during a longer period of time into the past and future; Consideration of impacts on valued ecosystem components (VECs) due to both the project of concern and interactions with other past, existing, and reasonably foreseeable future actions;
- Evaluation of significance in the consideration of other than just local and direct impacts (such as indirect impacts, cumulative impacts, and impact interactions); and assessment of impacts over a larger (*i.e.* "regional") area.

54. Cumulative impacts occur as interactions-between actions, between actions and the environment, and between components of the environment. These pathways between a source and an effect are often the focus of an assessment of indirect or cumulative impacts.

55. Cumulative impacts are incremental effects of past, present, or future activities combined with the proposed project (*e.g.* a habitat lost because of quarries used for road construction).

56. During up-gradation of roads under TNRSP - II, anticipated cumulative impacts have been identified based on environmental screening exercise and same are described below:

- Cumulative impacts of vehicular traffic at junctions
- Cumulative impacts on road safety
- Cumulative impacts on Valued Ecosystem Components (VEC) along the roads under TNRSP-II

57. These anticipated cumulative impacts are expected to be addressed in Environmental Assessment reports for the roads under TNRSP –II and necessary environmental safeguards will be incorporated in EMPs for concerned roads for mitigation of anticipated cumulative impacts. To ensure road safety in concerned roads under TNRSP-II, necessary safeguards/measures have been incorporated in design of roads. For the roads under TNRSP-II, iRAP (International Road Assessment Program) is being planned for implementation.

3.3.11 Mitigation and Monitoring Plan

Mitigation Measures

58. Mitigation measures shall be considered starting with Environmental Assessment process. Severe impacts identified in consequence category and or likelihood category shall be further analyzed to identify additional mitigation measures that are potentially available to eliminate or reduce the predicted level of impacts. Potential mitigation measures shall include:

- Habitat compensation program
- Biodiversity and Natural Habitat
- Species specific management program
- Engineering design solutions
- Alternative approaches and methods to achieving an activity's objective
- Stakeholders participation in finalizing mitigation measures
- Construction practice, including labour welfare measures
- Operational control procedures
- Management systems

59. If identified impacts "Physical/Social/Cultural", *i.e.* are significant and/or important, it is necessary to identify and implement mitigation measures. Mitigation measures are selected to reduce or eliminate the severity of any predicted adverse environmental effects and improve the overall environmental performance and acceptability of the project. Where mitigation is deemed appropriate, the impacts would be addressed in the following order of priority, to:

- Eliminate or avoid adverse effects, where reasonably achievable.
- Reduce adverse effects to the lowest reasonably achievable level.
- Regulate adverse effects to an acceptable level, or to an acceptable time period.
- Create other beneficial effects to partially or fully substitute for, or counter-balance, adverse effects.

60. Mitigation is an integral part of impact evaluation. It looks for better ways of doing things so that the negative impacts of the proposal are eliminated or minimized and the benefits are enhanced. As soon as

significant adverse impacts are identified, discussions should be held to see if they can be 'designed out' through changes in project design, location or operation. For measures that are unavoidable, the Environmental Management Plan should address the anticipated impact.

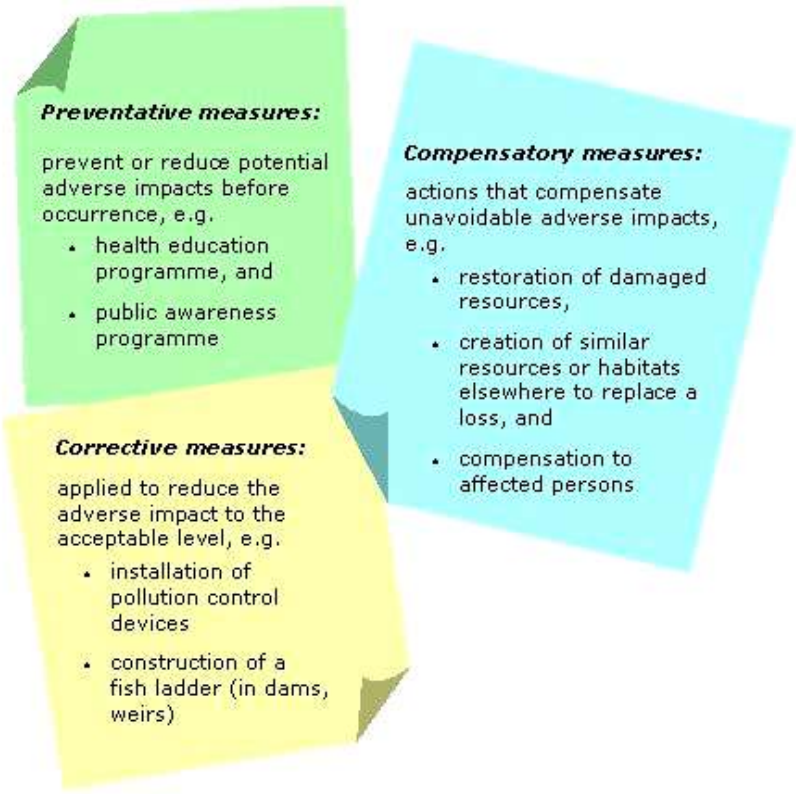


Figure 3-3: Measures Most Relevant To Development Projects

61. EMF is an instrument that examines the issues and impacts associated when a project consists of series of sub-projects, and the impacts cannot be determined until sub-project details have been identified. The EMF contains measures to reduce and mitigate adverse impacts and enhance positive impacts for addressing project impacts. EMF is commitment for incorporation of measures in Contract Bid Document; management, verification & scrutiny of mitigation measures and mid course corrections as needed at implementation stage. EMP for mitigation of identified adverse environmental impacts and to enhance positive impacts is described in **Chapter 4.**

Chapter 4: Environmental Management Plan

62. The EMP should be developed so as to mitigate the impacts assessed during EA process and also the likely impacts during the construction and operational phases. EMP shall be part of contract bid document. Unique environmental issues, specific design measures, site specific mitigation measures with suitable design, generic environmental mitigation measures and environmental enhancement measures should be included in EMP.

63. The protected areas of Tamil Nadu state extend to 3305 km² constituting 2.54% of the geographic area and 15% of the recorded forest area. There are 8 wildlife sanctuaries over 2,82,685.57 ha and 12 Bird Sanctuaries over 17,074.59 ha, 5 National Parks over 30784.23 ha, 3 Tiger Reserves, 4 Elephant Reserves and 3 Biosphere Reserves for *in situ* conservation of wild fauna and flora. In view of that it is imperative that Biodiversity and Natural Habitat studies should be carried out and subsequently Biodiversity and Natural Habitat Protection Plan should be prepared for conservation of biodiversity and natural habitat in the area.

64. A generic EMP has been presented in

65. **Table 4-1** below for reference as sample guidance based on environmental screening exercise of roads under TNRSP-II. This can be used as a reference material for comprehending the scope of EMP.

Table 4-1: Environmental Management Plan

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
1.	**PRE-CONSTRUCTION STAGE**					
	1.1.	**Pre-construction activities by PIU**				
		1.1.1.	Utility Relocation and Common Property Resources (CPRs)	**Clause 110.1.** and **110.7 of MoRTH**	• PIU and concerned line departments shall take necessary precautions, and shall provide barricades/delineation of such sites to prevent accidents including accidental fall into bore holes, pits, drains both during demolition and construction/ relocation of such facilities. Standard safety practices shall be adopted for all such works.	PIU
	1.2.	**Pre-construction activities by the Contractor/Engineer**				
		1.2.1.	Joint Field Verification		• The Engineer and Contractor shall ascertain the feasibility of implementing the Environmental Management Plan (EMP) through Joint field verification. • Any observations / modification required in updating EMP shall be done by the Engineer and a copy of the modified EMP shall be submitted to the PIU for review and approval.	Contractor under the supervision of the Engineer
		1.2.2.	Procurement of Machinery			
		1.2.2.1	Crushers, Hot-mix Plants & Batching Plants	(i) Emission control legislations of **CPCB/ TNPCB** for air, noise etc. (ii) **Clause 111.5 of MoRTH (**Pollution from Hot mix and Batching Plant**)**	• The contractor shall follow all stipulated conditions for pollution control as suggested by the TNPCB in the consent/ NoC for establishing and operating the Hot-mix and Batching Plant. • No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority and the same is submitted to the PIU. • The location of the hot-mix and batching plant shall be at least (i) 1000m away from settlements and shall be placed in the downwind direction and (ii) 10 km aerial distance away from the protected areas (sanctuary, national parks etc.).	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
					• The contractor shall submit the detailed layout plan for approval to the Engineer before getting into formal agreement with landowners for setting up of such site. Actions by Engineer and PIU against any non-compliance shall be borne by the Contractor at his own cost	
		1.2.2.2.	Other Construction Vehicles, Equipment and Machinery	Discharge standards and Noise limits as per **Environment Protection Act, 1986 (EPA)** Emission standards as per **Bureau of Indian Standard (BIS)** preferably **Bharat IV Emission Norms**	• Equipment's conforming to the latest noise and emission control measures shall be used. • Pollution under Control (PUC) certificates for all vehicles and machinery shall be made available to the Engineer and PIU for verification whenever required.	Contractor under the supervision of the Engineer
		1.2.3.	Identification & Selection of Material Sources			
		1.2.3.1.	Borrow Areas	**Clause 305.2.2. of MoRTH Clause 111.2** (borrow pits for embankment construction)	• The Engineer shall inspect every borrow area location prior to issuing approval for use of such sites. • Care shall be taken to avoid agriculture areas for planning haul roads for accessing borrow materials. In case of damage, the contractor shall be solely responsible and shall rehabilitate it, as approved by Engineer. • All borrow areas shall be restored either to the original condition or as per the approved rehabilitation plan by the Engineer, immediately upon completion of the use of such a source.	Contractor under the supervision of the Engineer
		1.2.3.2.	Quarries	**Clause 111.3. of MoRTH (**procuring Quarry materials**)**	• No quarry and/or crusher units shall be established, which is within 500 m from the NH or SH or residential/ settlement locations, forest boundary, wildlife movement path, breeding and nesting habitats and national parks/sanctuaries. • The minimum distance between two stone crusher should be 1 km to avoid dust pollutional influence of one over the other • Contractor shall work out haul road network to be used for transport of quarry materials and report to Engineer who shall inspect and approve the same.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		1.2.3.3.	Arrangement for Construction Water		• The contractor shall source the requirement of water preferably from surface water bodies, rivers, canals and tanks in the project area. • To avoid disruption/disturbance to other water users, the contractor shall extract water from fixed locations. The contractor shall consult the local people before finalizing the locations. • Only at locations where surface water sources are not available, the contractor can contemplate extraction of ground water, after intimation and consent from the Engineer. • The contractor shall comply with the requirements of Tamil Nadu Groundwater Authority and seek their approval for extraction of ground water.	Contractor under the supervision of the Engineer
		1.2.3.4.	Sand (all river and stream beds used directly or indirectly for the project)	**Clause 111.3. of MoRTH**	• In case of selection of new sites for sand quarrying, the Contractor shall obtain prior approval and concurrence from Competent District Authority. • To avoid accidents and caving in of sand banks at quarry sites, sand shall be removed layer by layer. Digging deeper than the permissible limit (0.9 metres) shall not be allowed. Such quarry shall be barricaded 10m away from the periphery on all sides except the entry point, so as to prevent accidental fall of domestic cattle, wildlife and human beings.	Contractor under the supervision of the Engineer
		1.2.4.	Setting up construction sites			
		1.2.4.1	Construction Camp Locations – Selection, Design & Layout		Construction camps shall not be proposed: (i) Within 1000m of ecologically sensitive areas (if any) (ii) Within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community	Contractor under the supervision of the Engineer
		1.2.4.2.	Arrangements for Temporary Land Requirement	**Clause 108.3. of MoRTH**	• The Engineer shall ensure that the temporary site is cleared prior to handing over to the owner (after construction or completion of the activity) and it is included in the contract	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		1.2.4.3.	Stock-yards		• The contractor shall identify the location for stockyards for construction materials at least 1000m from water courses. • Separate enclosures shall be planned for storing construction materials containing fine particles such that sediment-laden water does not drain into nearby storm water drains	Contractor under the supervision of the Engineer
		1.2.4.4.	Fuel storage and refuelling areas	**Clause 2.1.1.7. of EMP (**Stripping of Soil**)** **Clause 2.1.4.1.2 of EMP (**dispose the spent oil and grease**)**	• The contractor shall ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites are located at least 500 m from rivers and irrigation canal/ponds.	Contractor under the supervision of the Engineer
		1.2.5.	Labour Camp Management			
		1.2.5.1	Location of Construction labour camps: Accommodation	**Factories Act, 1948** and **Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 (**construction & maintenance of labor camp**)**	• The contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labourers, to standards approved by the Engineer. • Labour camps shall not be located within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of labour camps shall be submitted to Engineer for approval prior to construction.	Contractor under the supervision of the Engineer
		1.2.5.2	Potable Water	**The Contract Labour (Regulation and Abolition) Act, 1970** and **Factories Act, 1948**	• The contractor shall supply portable water through municipal/ panchayat sources. In case of groundwater it shall be treated prior to supply.	Contractor under the supervision of the Engineer
		1.2.5.3	Sanitation facilities	**Factories Act, 1948** for sanitation	• The sanitation facilities for the camp shall be designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place.	Contractor under the supervision of the Engineer
		1.2.5.4	Waste Disposal	**Municipal Solid Waste (Management and Handling) Rules – 2000** for effective waste disposal	• The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		1.2.5.5	HIV/ AIDS Prevention Measures		• The Contractor shall implement the following measures towards ensuring HIV/AIDS prevention during the entire contract period • (i) conduct awareness campaign including dissemination of IEC materials on HIV/AIDS for all construction personnel (including labourers, supervisors, engineers and consultants) on HIV/AIDS/STDs within 3 months of mobilization and once a year subsequently during the contract period; • (ii) carry out screening of construction personnel for HIV/ AIDS, within the 3 month of mobilisation • (iii) conduct semi-annual health check-up of all construction personnel including testing for STDs; • (iv) erect and maintain hoardings/ information signages on HIV/AIDS prevention at the construction sites, labour camps and truck parking locations; • (v) install condom vending machines at the labour camps, including replenishment of supplies.	Contractor under the supervision of the Engineer
2.	**CONSTRUCTION STAGE**					
	2.1.	**Construction Stage Activities by Contractor**				
		2.1.1.	Site Clearance			
		2.1.1.1.	Clearing and Grubbing	**Clause 201. of MoRTH**	• All works shall be carried out in a manner such that the damage or disruption to flora is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from Engineer.	
		2.1.1.2.	Dismantling of Bridgework/ Culverts	**Clause 202. Of MoRTH**	• The contractor shall follow all necessary measures (including safety) especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.1.3.	Generation & disposal of Debris	**Clause 202.5 of MoRTH**. For Disposal of materials	• Disposal of unutilized non-toxic debris shall be either through filling up of borrow areas or at pre-designated disposal sites, subject to the approval of the Engineer. • At locations identified for disposal of residual bituminous wastes, the disposal shall be carried out over a 60 mm thick layer of rammed clay so as to eliminate the possibility of leaching of wastes into the ground water. • Debris generated from pile driving or other construction activities along the rivers, streams and drainage channels shall be carefully disposed in such a manner that it does not flow into the surface water bodies or form puddles in the area. • The pre-designated disposal locations shall be part of **Comprehensive Solid Waste Management Plan** to be prepared by Contractor in consultation and with approval of Engineer.	Contractor under the supervision of the Engineer
		2.1.1.4.	Non-bituminous construction wastes disposal	**Clause 202. Of MoRTH**	• The contractor shall finalise the location of disposal site based on the following. o not located within designated forest area o does not impact natural drainage courses o No endangered/rare flora is impacted by such dumping. o Settlements are located at least 1000m away from the site. The Engineer shall approve disposal sites after conformation	Contractor under the supervision of the Engineer
		2.1.1.5.	Bituminous wastes disposal	**Clause 202.5. of MoRTH**	• The disposal of residual bituminous wastes shall be done by the contractor at secure land fill sites, with the requisite approvals for the same from the concerned government agencies.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.1.6.	Stripping, stacking and preservation of top soil	**Clause 301.3.2** for stripping and preservation **Clause 305.3.3** for construction and for embankments **Clause 301.7**. for preservation of Top Soil	• Contractor shall strip the topsoil at all locations opened up for construction, including temporarily acquired land for traffic detours, storage, materials handling or any other construction related or incidental activities.	Contractor under the supervision of the Engineer
		2.1.1.7.	Accessibility		• The Contractor shall provide safe and convenient passage for vehicles; pedestrians and livestock to and from roadsides and property accesses by providing temporary connecting road, as necessary. • Construction activities that shall affect the use of side roads and existing accesses to individual properties, whether public or private, shall not be undertaken without providing adequate provisions to ensure uninterrupted access, as approved by the Engineer. • The Contractor shall take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up in a manner that traffic movement in any given area does not get affected.	Contractor under the supervision of the Engineer
		2.1.1.8.	Planning for Traffic Diversions and Detours	**Clause 112. of MoRTH**	• Detailed traffic control plans shall be prepared by the contractor and the same shall be submitted to the Engineer. • The Contractor shall provide specific measures for safety of pedestrians and workers as a part of traffic control plans. The Contractor shall ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. • The Contractor shall inform local community of changes in traffic routes and pedestrian access arrangements with assistance from Engineer and PIU.	Contractor under the supervision of the Engineer
		2.1.2.	Construction Materials			

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.2.1.	Earth from Borrow Areas for Construction	**IRC 010-1961 (**procurement of earth materials**)**		Contractor under the supervision of the Engineer
		2.1.2.2.	Quarries	**Clause 111.3. of MoRTH (**procurement of materials**)**		Contractor under the supervision of the Engineer
		2.1.2.3.	Blasting	**Clause of 302. Of MoRTH**		Contractor under the supervision of the Engineer
		2.1.2.4.	Transporting Construction Materials	**Clause 111.9. of MoRTH**	• All vehicles delivering materials to the site shall be covered to avoid spillage of materials. • The unloading of materials at construction sites close to settlements shall be restricted to daytime only.	Contractor under the supervision of the Engineer
		2.1.3.	Construction work			
		2.1.3.1.	Disruption to other users of Water	**Annexure "A" Protection of the Environment of MoRTH**and**Clause 2 Water Quality of MoRTH**	• In case of diversion of water bodies, the Contractor shall take prior approval of the Irrigation Department and Engineer for any such activity. The PIU shall ensure that Contractor has served the notice to the downstream users of water well in advance where such diversion of the flow is likely to affect the downstream population subject to the condition that under no circumstances the downstream flow shall be stopped.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.3.2.	Drainage and Flood Control	**Clause 202. Of MoRTH**	• Contractor shall ensure that construction materials like earth, stone, ash or appendage disposed off does not block the flow of water of any water course and cross drainage channels. • Where necessary, adequate mechanical devices to bailout accumulated water from construction sites, camp sites, storage yard, excavation areas are to be arranged well in advance before the rainy season besides providing temporary cross drainage systems. • The contractor shall take all adequate precautions to ensure that construction materials and excavated materials are enclosed in such a manner that erosion or run-off of sediments is controlled. Silt fencing shall be installed prior to the onset of the monsoon at all the required locations, as directed by Engineer and PIU. • The contractor shall ensure that no material blocks the natural flow of water in any water course or cross drainage channel. Prior to monsoon, the contractor shall provide either permanent or temporary drains to prevent water	Contractor under the supervision of the Engineer
		2.1.3.3.	Siltation of Water Bodies and Degradation of Water Quality	**Clause 306. of MoRTH** for soil erosion and sedimentation control		Contractor under the supervision of the Engineer
		2.1.3.4.	Slope Protection and Control of Soil Erosion	**Clause 306. of MoRTH** for soil erosion and sedimentation control **Clause 307. of MoRTH** for Turfing works **Clause 308. of MoRTH** for other measures of Slope Protection	• The contractor shall construct slope protection works as per design, or as directed by the Engineer	Contractor under the supervision of the Engineer
		2.1.4.	Pollution Control			
		2.1.4.1.	Water Pollution			

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.4.1.1.	Water Pollution from Construction Wastes	**Schedule VI - General Standards for Discharge of Environmental Pollutants** (Liquid Waste Disposal) - **CPCB** **The Environment (Protection) Rules, 1986** and **Water Act, 1974**	• The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation channels. • Contractor shall avoid construction works close to the streams or water bodies during monsoon.	Contractor under the supervision of the Engineer
		2.1.4.1.2.	Water Pollution from Fuel, Lubricants and Chemicals	**Petroleum Act and Rules** and **Environment (Protection) Rules, 1986** (**Standards for Emission or Discharge of Environmental Pollutants Schedule – I**) for Liquid Waste Disposal **Clause 111.** (Precaution and Safeguarding the Environment) **Annexure 'A'** to **Clause 501** (Protection of Environment) - **Section 2 water quality** **Clause 301.3.2 of MoRTH. (**Stripping and preservation of top soil)	• Oil interceptors shall be provided for vehicle parking, wash down and refuelling areas. • In all, fuel storage and refuelling areas, if located on agricultural land or areas supporting vegetation, the top soil shall be stripped, stockpiled and returned after cessation of such storage.	Contractor under the supervision of the Engineer
		2.1.4.2.	Air Pollution			

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.4.2.1.	Dust Pollution	**Annexure 'A' to Clause 501** (Protection of Environment) - **Section 3 Air Quality** **Clause 111.5. of MoRTH. (**Hot mix plant and batch mix plant**)**	• The conditions for pollution control given in the **NoC (consent for establish and operate)** by the TNPCB shall be strictly followed. • Air pollution monitoring shall be conducted as per the Environmental Monitoring Plan and results shall be used to identify any additional pollution control measures required to be adopted.	Contractor under the supervision of the Engineer
		2.1.4.2.2.	Emission from Construction Vehicles, Equipment and Machineries	**Schedule-I: Standards for Emission** suggested by **CPCB/ TNPCB**	• Certification issued for such contrivances obtained from designated/approved authority shall be submitted along with the specified reporting format to the Engineer. • The contractor shall maintain a separate file and submit PUC certificates for all vehicles/equipment/machinery used for the project. Monitoring results shall be submitted to Engineer and PIU.	Contractor under the supervision of the Engineer
		2.1.4.3.	Noise Pollution			
		2.1.4.3.1.	Noise Pollution: Noise from Vehicles, Plants and Equipments	**Noise Limits for vehicles (Environment (Protection) Amendment Rules, 2000)** and **Part 'E', Schedule – VI of Environment (Protection) Rules, 1986.** **Clause 5A The Noise Pollution (Regulation and Control) Rules, 2000 (**sound emitting construction equipments**)** **Clause 201.2 of MoRTH** for Idling of temporary trucks	• All plants and equipment used in construction shall strictly conform to the MoEF & CC / CPCB noise standards. • Noisy construction activities (such as crushing, concrete mixing, batching etc.) within 150m of the nearest habitation/ educational institutes/health centers (silence zones) shall be stopped during the night time between 9.00 pm to 6.00 am. • Contractor shall provide noise barriers to the suggested locations of select schools/ Temples/health centers prior to commencement of work. • Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to Engineer. Based on the monitoring results, the Engineer, if required, shall recommend any additional noise mitigation measures required to be implemented by the Contractor.	Contractor under the supervision of the Engineer
		2.1.4.4.	Safety			

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.4.4.1	Safety Procedures		The Contractor shall: • Comply with all applicable safety regulations, • Take care for the safety of all persons entitled to be on the Site, • Use reasonable efforts to keep the site and works clear of unnecessary obstruction so as to avoid danger to these persons, • Provide fencing, lighting, guarding and watching of the works until completion and taking over and provide any temporary works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the works, for the use and protection of the public and of owners and occupiers of adjacent land	Contractor under the supervision of the Engineer
		2.1.4.4.2	Care and supply of Documents		• The contractor shall prepare, submit and obtain approval of the Engineer for construction Safety Management Plan 14 days prior to commencement of construction works at site.	Contractor under the supervision of the Engineer
		2.1.4.4.3	Contractors general obligations		• All design calculations and fabrication drawings for temporary works (such as form-work, staging, centring, scaffolding, specialized construction, handling and launching equipment and the like)material lists for structural fabrication as well as detailed drawings for templates, and anchorage and temporary support details for pre stressing cables as well as bar bending and cutting schedules for reinforcement, etc shall be prepared by the contractor at his own cost and forwarded to the Engineer at least six weeks in advance of actual constructional requirements. The Engineer will check the same for the contractor's use with amendments.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.4.4.4	Personal Safety Measures for Labour, Material handling , Painting etc.	**Factory Act, 1948, Factories (Amendment) Act, 1987 (Chapter -5 Safety)** **Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996**	Construction Safety Plan shall be prepared by the Contractor during mobilization and approved by Engineer shall be adhered to by the Contractor throughout the construction period, and shall include provision of. • Protective footwear and protective goggles to all workers employed in mixing asphalt materials, cement, lime mortars, concrete etc. • Welders protective eye-shields to workers engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals • The contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. • The contractor shall ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. • Contractor shall provide facemasks to the workers when paint is applied in the form of spray or a surface having dry lead paint is rubbed and scrapped. • The Contractor shall mark ‘hard hat’ and ‘no smoking’ and other ‘high risk’ areas and enforce non-compliance of use of PPE with zero tolerance.	Contractor under the supervision of the Engineer
		2.1.4.4.5	Health and Safety		• The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the contractor’s personnel. In collaboration with local health authorities, the contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the site.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
					• The contractor shall appoint an accident prevention officer at the site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the works, the contractor shall provide whatever is required by this person to exercise this responsibility and authority. • The contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. • The contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.	
		2.1.4.4.6	Traffic Safety & Pedestrian Safety	**Clause 112. of MoRTH (**Arrangement for traffic during construction**)**	• Pedestrian Safety shall be ensured. Pedestrian circulation shall be demarcated prior to start & unsafe areas shall be cordoned off.	Contractor under the supervision of the Engineer
		2.1.4.4.7	Risk from Electrical Equipment(s)	**Factory Act, 1948 – Chapter -5 (Safety**) and **Factories (Amendment) Act, 1987**	• No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer	Contractor under the supervision of the Engineer
		2.1.4.4.8	Safety during Road Works	**Clause 112.4. of MoRTH (**Traffic safety**)** **Clause 112.5. of MoRTH (**Maintenance and Diversions**)** **IRC:SP:55 (**Road signage and markings **)**	• The contractor shall provide adequate signage and markings as per the instruction of the Engineer in the construction zones.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.1.4.4.9	First Aid	**Section 36 (First Aid) of Building and the other Construction Workers(Regulation of Employment and Conditions of Service) Act, 1996**	• First aid measure shall be provided in the construction zones and labour camps.	Contractor under the supervision of the Engineer
		2.1.4.5.	Cultural Property			
		2.1.4.5.1.	Chance Found Archaeological Property	**Ancient Monuments and Archaeological Sites and Remains Rules 1959** **Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act 2010**	• All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site are the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The contractor shall take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing.	Contractor under the supervision of the Engineer
		2.2.	Environmental enhancement and special issues			
		2.2.1.	Enhancement measures		• Landscaping at junctions to improve aesthetics etc. • Rehabilitation of cultural and community properties	Contractor under the supervision of the Engineer
		2.2.2.	Rehabilitation/ enhancement of Cultural and Religious Properties	**Physical Cultural Resources (WB OP/BP 4.11)**	• The architectural elements of the structure shall be conserved/reflected/translated into the design of new structures/ enhancements in accordance with wishes of the community.	

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.2.3.	Flora and Chance found Fauna		• The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. • If any wild animal is found near the construction site at any point of time, the contractor shall acquaint the Engineer and execute the Engineer's instructions for dealing with the same. • The Engineer shall report to the nearby forest office (range office) and shall take appropriate steps/ measures in consultation with the forest officials.	Contractor under the supervision of the Engineer
		2.2.4.	Sensitive receptors		• Sensitive receptors like schools, hospitals are provided with permanent noise barriers prior to the start of work in order to minimize the dust and noise impacts due to vehicle movement (during / post construction). Their effectiveness to be checked during operation phase. • Construction activities shall be confined within the present available CoI, regularly strict monitoring/supervision shall be done to minimize/control air-noise pollution and abatement of dust particles at minimum level possible using well maintained modern machineries.	Contractor under the supervision of the Engineer
		2.3.	Contractor Demobilization			

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
		2.3.1.	Clearing of Construction of Camps & Restoration		• Contractor to prepare site restoration plans for approval by the Engineer. The plan shall be implemented by the contractor prior to demobilization. • On completion of the works, all temporary structures shall be cleared, 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. • The topsoil removed and conserved earlier shall be spread over the restoration area as per the direction of the Engineer to facilitate the growth of vegetation. • Residual topsoil shall be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75mm – 150mm.	Contractor under the supervision of the Engineer
		2.3.2.	Redevelopment of Borrow Areas		• Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Engineer	Contractor under the supervision of the Engineer
3.	**OPERATION STAGE (Activities to be Carried Out by the Contractor/TNRSP-II/PIU)**					
	3.1.		Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures		• The PIU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project.	Contractor under the supervision of the Engineer
	3.2.		Maintenance of Drainage		• PIU shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the spurs and check dams erected to stabilize the course and flow of all such drainage channels. • PIU shall ensure that all the sediment/oil and grease traps set up at the water bodies are cleared once in every three months.	Contractor under the supervision of the Engineer

ENVIRONMENTAL ISSUES				Ref: CLAUSES	ADDITIONAL MEASURES TO BE ADOPTED BY THE CONTRACTOR	RESPONSIBILITY
	3.3.		Pollution Monitoring		• The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination are to be continued at pre-designated locations and if necessary, at additional locations for comparative study of pre and post operation data in order to ensure further improvement/modification in similar future works.	Contractor under the supervision of the Engineer
	3.4.		Atmospheric Pollution		• Ambient air concentrations of various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre designated locations to compare the levels with the pre-construction data. • Additional data at other location may be collected as per any site specific requirement.	Contractor under the supervision of the Engineer
	3.5.		Noise Pollution		• Noise pollution shall be monitored as per **Environmental Monitoring Plan** at sensitive locations where pre-construction noise data was collected. The functioning of the noise barriers shall be supervised and monitored for further improvement/replication at other affected points if necessary. • Signage near sensitive locations shall be maintained and kept clean. Monitoring the effectiveness of the pollution attenuation measures shall be performed	Contractor under the supervision of the Engineer
	3.6.		Soil Erosion and Monitoring of Borrow Areas		• Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, shall be carried to record and monitor the effectiveness of such structures after the completion of project, so as to evaluate the beneficial effects of each type of activity together with the cost involved.	Contractor under the supervision of the Engineer
	3.7.		Road Safety and Maintenance of Assets		• No advertisement/hoardings shall be allowed within the Right of Way limits of the project road. • Regular maintenance and cleaning of assets such as sign boards, bus stops, drains etc. shall be undertaken.	Contractor under the supervision of the Engineer

4.1 EMP in Bid Documents

- Preparation of EMP cost estimates that needs to be incorporated in Bid Documents.
- Environmental Management Plan, EMP along with the good environmental construction guidelines that has to be incorporated in the Bid document's work requirements.
- Preparation of work requirement (addendum/corrigendum to MoRTH specifications) and Corrigendum / Addendum to FIDIC as Special provisions to be incorporated in Bid Document. Penalty clauses for not complying with EMP requirements to be incorporated. Indicative penalty clauses proposed in the upgradation projects are presented below.

Clause for Nonconformity to EMP - Protection of the Environment

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

1. All lapse in obtaining clearances / permissions under statutory regulations and violations of any regulations with regard to eco-sensitive areas shall be treated as a major lapse.

2. Any complaints of public, within the scope of the Contractor, formally registered with the CSC, Highways Department or with the GoTN and communicated to the Contractor, which is not properly addressed within the time period intimated by the CSC / Highways Department, GoTN shall be treated as a major lapse.

3. Non-conformity to any of the mitigation measures stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.

4. On observing any lapses, CSC shall issue a notice to the Contractor, to rectify the same.

5. Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.

6. If a major lapse is not rectified upon receiving the notice CSC shall invoke reduction, in the subsequent interim payment certificate.

7. For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum of 0.5% of the contract value.

8. If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited.

4.2 Environmental Monitoring Plan

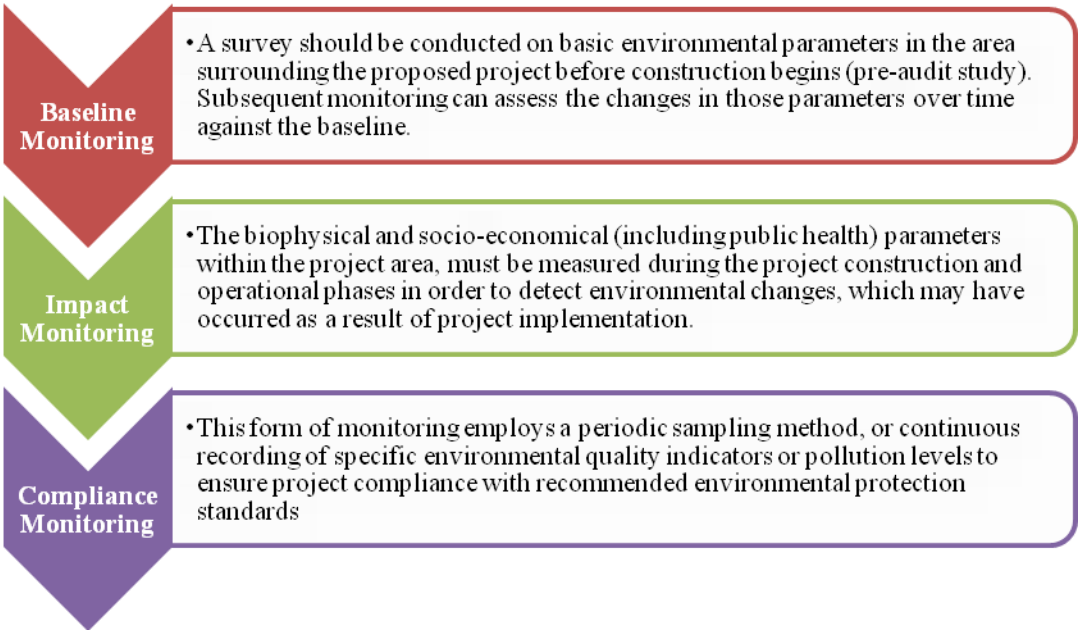
4.2.1 Monitoring Parameters and Standards

66. Environmental monitoring is defined as ***"an activity undertaken to provide specific information on the characteristics and functions of environmental and social variables in space and time"***.

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

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

68. Types of Environmental Monitoring:



- The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections.

4.2.2 Monitoring Plans for Environment Condition

69. The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

- **Ambient Air Quality Monitoring (AAQM)**

70. The air quality parameters viz: Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X), Carbon Monoxide (CO), Fine Particulate Matter ($PM_{2.5}$), Respirable Particulate Matter (PM_{10}) , Ammonia (NH_3), Ozone (O_3), Lead (Pb), Benzo (a) pyrene (BaP), Arsenic (As) and Nickel (Ni) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in

71.

72.

73. Table 4-2.

Table 4-2: Ambient Air Quality Standards (National)

S. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO_2), µg/m^3	Annual* 24 hours**	50 80	20 10	• Improved West and Gaeke • Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual* 24 hours**	40 80	30 80	• Modified Jacob & Hochhieser (Na-Arsenite) • Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m^3	Annual* 24 hours**	60 100	60 100	• Gravimetric • TOEM • Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM_{25}µg/m^3	Annual* 24 hours**	40 60	40 60	• Gravimetric • TOEM • Beta attenuation
5	Ozone (o_2) µg/m^3	8 hours* 1 hours**	100 180	100 180	• UV photometric • Chemiluminescence • Chemical Method
6	Lead (Pb) µg/m^3	Annual* 24 hours**	0.50 1.0	0.50 1.0	• AAS/ICP method after sampling on EMP 2000 or equivalent filter paper • ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m^3	8 hours* 1 hours**	02 04	02 04	• Non Dispersive Infra-Red (NDIR)spectroscopy
8	Ammonia (NH_3) µg/m^3	Annual* 24 hours**	100 400	100 400	• Chemiluminescence • Indophenol blue method
9	Benzene (C_6H_6) µg/m^3	Annual*	05	05	• Gas chromatography based continuous analyser • Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, ng/m^3	Annual*	01	01	• Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) ng/m^3	Annual*	06	06	• AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) ng/m^3	Annual*	20	20	• AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

**Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals*

***24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

- **Noise Quality Monitoring**

74. The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in **Table 4-3.**

Table 4-3: Ambient Noise Quality Standards (National)

Area Code	Category of Zones	Limits of Leq in dB(A) Day*	Night*

A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence Zone **	50	40

** Daytime shall mean from 6.00am to 10.00 pm and Night shall mean from 10.00 pm to 6.00 am*

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

- **Water Quality Monitoring**

75. Water quality parameters such as pH, BOD, COD, DO, Coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500, 2012, presented in **Table 4-4.**

Table 4-4: National Standard of Water

Sr. No	Parameters	IS:2296 (Class C)	Method to be Adopted
1	pH	6.5-8.5	pH meter
2	BOD (3 days 27^0C)	3.0	DO-Azide modification of Wrinkler's method
3	Temperature (^{0}C)	NS	Thermometer
4	Dissolved oxygen	4	Azide Modification of Wrinkler's method
5	Color (Hazen)	300	Visual Comparison method
6	Fluorides (F)	1.5	SPANDS method
7	Chlorides (Cl)	600	Argentometric Titration
8	Total Dissolved Solids	1500	Gravimetric Analysis
9	Sulphates (SO4)	400	Barium Chloride method
10	Iron (Fe)	50	Phenanthrolin method
11	Oil and Grease	0.1	Partition – Gravimetric method
12	Nitrates	50	Chromotropic acid
13	Chromium (Cr6+)	0.05	Atomic Absorption Spectrophotometry
14	Cadmium (Cd)	0.01	Atomic Absorption Spectrophotometry
15	Lead (Pb)	0.1	Atomic Absorption Spectrophotometry
16	Copper (Cu)	1.5	Atomic Absorption Spectrophotometry
17	Cyanide (CN)	0.05	Chloramine-T-method
18	Selenium (Se)	0.05	Atomic Absorption Spectrophotometry
19	Arsenic (As)	0.2	Atomic Absorption Spectrophotometry
20	Phenols	0.005	Spectrophotometer
21	Detergents	1.0	Spectrophotometer
22	DDT	Absent	Spectrophotometer
23	Total Coliform (MPN/100 ml)	5000	Multiple Tube Fermentation Technique

NS: Not specified; Brackets ([ ]) indicates extended limits. All the values in mg/l if otherwise mentioned

Table 4-5: Water Quality Criteria

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand 5 days 20oC 2mg/l or less
Outdoor bathing (Organised)	B	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more • Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand 5 days 20oC 3mg/l or less
Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25oC micro mhos/cm Max.2250 • Sodium absorption Ratio Max. 26 • Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

4.2.3 Environmental Monitoring Locations

76. In addition of the critical locations selected during design stage, the environmental monitoring will also be done at the construction camp site and any other plant site during construction stage. List of critical locations for caring out monitoring should be presented in EIA report.

4.3 Monitoring and Post Auditing

77. Construction monitoring, including field inspections and surveys, should be carried out by an Environmental Specialist to ensure that environmental protection requirements are being met. The monitoring and reporting is to be in line with the reporting system developed for the project and is presented as **Appendix 4-1**. It is important to plan and budget for environmental construction monitoring as part of the project. If construction is to be contracted out, PIU (TNRSP-II) to reconfirm that specific environmental requirements during construction (as already specified) are built into construction bidding documents and contracts to ensure, they are met (*e.g.* requirements for local hiring, penalty for not adhering to EMP clause requirements etc.).

78. Post construction monitoring is used to identify environmental changes resulting from the implementation of the project. In the context of EIA, post construction monitoring programs are carried out to achieve the following results:

- To ensure that the facility is meeting all environmental regulatory requirements, and that commitments made in the EIA document and/or the conditions of approval are being met;
- To test impact hypotheses, and to verify the predictions and assessment of environmental effects, thus contributing to better assessments in the future;
- To evaluate the performance effectiveness of mitigation;

- To compare actual and predicted changes to the environment, so that immediate actions can be taken to mitigate unanticipated impacts;
- To strengthen confidence by both government and the public in the EIA process, the decisions made the road design etc.

79. The monitoring programs to be carried out during the construction and operation of the undertaking are normally described in the EIA document.

4.4 Implementation of EMP

80. The Environmental Management Plan, EMP process does not stop once a project (planning and design) got approval for implementation. During implementation of project PIU (TNRSP-II), Construction Supervision Consultant, CSC (if any) and Contractor will be responsible for ensuring that the environmental commitments made to regulatory agencies, lending agencies and other stakeholders during the EIA process are met. To execute EMP is a cumulative responsibility of all three parties involved, indicative responsibility mechanism has been presented in **Table 4-6**, as developed for upgradation of selected corridors.

Table 4-6: Institutional Responsibilities

System	Designation	Responsibilities
Coordinating/Facilitating Agency	Project Director, PIU TNRSP-II	• Overview of the project implementation • Ensure timely budget for the EMP • Coordination with different state level committee, to obtain Regulatory Clearances • Participate in state level meetings • Monthly review of the progress.
	Superintending Engineer PIU	• Overall responsible for EMP implementation • Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Coordination with PIU Staff (Environmental Specialist). • Responsible for obtaining Regulatory Clearances • Review of the progress made by contractors • Ensure that environmental safeguards in EMP are executed as per specification and schedules.
	Environment and R&R Specialist (PIU)	• Assisting SE in overall implementation of EMP • Review of periodic reports on EMP implementation and advising PIU in taking corrective measure. • Conducting periodic field inspection of EMP implementation • Assisting SE to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Preparing environmental training program and conducting the same for field officers and engineers of contractor
Implementing/ Monitoring Agency	Engineer (Supervision consultant SC)	• Responsible for supervision of effective implementation of EMP measures by the contractor • Review progress reports and periodic reporting to PIU about the status of EMP implementation

System	Designation	Responsibilities
		• Work in close coordination with ERRS (PIU) and contractor
	RAP implementation NGO	• Conducting awareness campaign for all construction personnel (including labourers, supervisors, engineers and consultants) about HIV/AIDS/STDs in the construction and labour camps. • Facilitating the medical testing/ routine check-up for labours as suggested in the HPP
Contractor	Environmental Manager of Contractor	• Responsible for ensuring the implementation of EMP as per provision in the document. • Directly reporting to the Project Manager of the Contractor • Discuss the various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly • Assist the project manager to ensure social and environmentally sound and safe construction practices are adopted • Conduct periodic environmental and safety training for contractor's engineers, supervisors and workers along with sensitization on social issues that may be arise during the construction stage of the project • Assist the PIU on various environmental monitoring and control activities including pollution monitoring; and • Prepare and submit monthly reports to PIU on the status of implementation safeguard measures

Chapter 5: Good Environmental Construction Guidelines

81. Comprehensive environmental construction guidelines have been prepared to guide the planning and implementing agency in preparing the project specific environmental code of conduct for contractor. The list of good environmental practices is as follows. All guidelines listed are presented as **Appendix 5-1** for reference and implementation into the Environmental Management Plans for the specific projects.

Table 5-1: Guideline for Good Environmental Practices

Guidelines	Activities
Guideline-1	Site Preparation
Guideline-2	Construction and Labour Camps
Guideline-3	Borrow Areas
Guideline-4	Topsoil Salvage, Storage and Replacement
Guideline-5	Quarry Management
Guideline-6	Water for Construction
Guideline-7	Slope Stability and Erosion Control
Guideline-8	Waste Management and Debris Disposal
Guideline-9	Water Bodies
Guideline-10	Drainage
Guideline-11	Construction Plants & Equipment Management
Guideline-12	Labour and Worker's Health and Safety
Guideline-13	Cultural Properties
Guideline-14	Tree Cutting and Afforestation
Guideline-15	Forests and Other Natural Habitats
Guideline-16	Air and Noise Pollution

Appendix 2.1

FORM – 'A'

Form for seeking prior approval under section 2 of the proposals by the State Governments and other authorities

PART-I
(to be filled up by user agency)

1. Project details:
   - (i) Short narrative of the proposal and project/scheme for which the forest land is required.
   - (ii) Map showing the required forest land, boundary of adjoining forest on a 1:50,000 scale map.
   - (iii) Cost of the project:
   - (iv) Justification for locating the project in forest area.
   - (v) Cost-benefit analysis (to be enclosed).
   - (vi) Employment likely to be generated.
2. Purpose-wise break-up of the total land required:
3. Details of displacement of people due to the project, if any:
   - (i) Number of families.
   - (ii) Number of Scheduled Castes/Scheduled Tribe families
   - (iii) Rehabilitation plan. (to be enclosed)
4. Whether clearance under Environment (Protection) Act, 1986 required? (Yes/No).
5. Undertaking to bear the cost of raising and maintenance of compensatory afforestation and/or penal compensatory afforestation as well as cost for protection and regeneration of Safety Zone, etc. as per the scheme prepared by the State Government (undertaking to be enclosed).
6. Details of Certificates/documents enclosed as required under the instructions.

Signature
(Name in Block letters)
Designation
Address (of User Agency)

Date:-_____
Place:-_____

State serial No. of proposal_____
(To be filled up by the Nodal Officer with date of receipt)

PART-II
(To be filled by the concerned Deputy Conservator of Forests)

State serial No. of proposal_____

7. Location of the project/Scheme:
   - (i) State/Union Territory
   - (ii) District.
   - (iii) Forest Division
   - (iv) Area of forest land proposed for diversion (in ha.)
   - (v) Legal status of forest
   - (vi) Density of vegetation.
   - (vii) Species-wise (scientific names) and diameter class-wise enumeration of trees (to be enclosed. In case of irrigation / hydel projects enumeration at FRL, FRL-2 meter & FRL-4 meter also to be enclosed.)
   - (viii) Brief note on vulnerability of the forest area to erosion.
   - (ix) Approximate distance of proposed site for diversion from boundary of forest.
   - (x) Whether forms part of National Park, wildlife sanctuary, biosphere reserve, tiger reserve, elephant corridor, etc. (If so, the details of the area and comments of the Chief Wildlife Warden to be annexed).
   - (xi) Whether any rare/endangered/unique species of flora and fauna found in the area- if so details thereof.
   - (xii) Whether any protected archaeological/heritage site/defence establishment or any other important monument is located in the area. If so, the details thereof with NOC from competent authority, if required.
8. Whether the requirement of forest land as proposed by the user agency in col. 2 of Part-I is unavoidable and barest minimum for the project. If no, recommended area item-wise with details of alternatives examined.
9. Whether any work in violation of the Act has been carried out (Yes/No). If yes, details of the same including period of work done, action taken on erring officials. Whether work in violation is still in progress.
10. Details of compensatory afforestation scheme:
    - (i) Details of non forest area/degraded forest area identified for compensatory afforestation, its distance from adjoining forest, number of patches, size of each patch.
    - (ii) Map showing non-forest/degraded forest area identified for compensatory afforestation and adjoining forest boundaries.
    - (iii) Detailed compensatory afforestation scheme including species to be planted, implementing agency, time schedule, cost structure, etc.
    - (iv) Total financial outlay for compensatory afforestation scheme.
    - (v) Certificates from competent authority regarding suitability of area identified for compensatory afforestation and from management point of view. (To be signed by the concerned Deputy Conservator of Forests).
11. Site inspection report of the DCF (to be enclosed) especially highlighting facts asked in col. 7 (xi, xii), 8 and 9 above.
12. Division/District profile:
    - (i) Geographical area of the district.
    - (ii) Forest area of the district.
    - (iii) Total forest area diverted since 1980 with number of cases.
    - (iv) Total compensatory afforestation stipulated in the district/division since 1980 on (a) forest land including penal compensatory afforestation,
      (b) non-forest land.

(v) Progress of compensatory afforestation as on (date) _____ on
(a) forest land
(b) non-forest land.

13. Specific recommendations of the DCF for acceptance or otherwise of the proposal with reasons.

Signature
Name
Official Seal

Date:-_____
Place:-_____

PART-III
(To be filled by the concerned Conservator of Forests)

14. Whether site, where the forest land involved is located has been inspected by concerned Conservator of Forests (Yes/No). If yes, the date of inspection & observations made in form of inspection note to be enclosed.
15. Whether the concerned Conservator of Forests agree with the information given in Part-B and the recommendations of Deputy Conservator of Forests.
16. Specific recommendation of concerned Conservator of Forests for acceptance or otherwise of the proposal with detailed reasons.

Signature
Name

Official Seal
Date:-_____
Place:-_____

PART-IV
(To be filled in by the Nodal Officer or Principal Chief Conservator of Forests or Head of Forest department)

17. Detailed opinion and specific recommendation of the State Forest Department for acceptance of otherwise of the proposal with remarks.

(While giving opinion, the adverse comments made by concerned Conservator of Forests or Deputy Conservator of Forests should be categorically reviewed and critically commented upon).

Signature
Name & Designation
(Official Seal)

Date:-_____
Place:-_____

PART- V

(To be filled in by the Secretary in charge of Forest Department or by any other authorised officer of the State Government not below the rank of an Under Secretary)

18. Recommendation of the State Government:
(Adverse comments made by any officer or authority in Part-B or Part-C or Part-D above should be specifically commented upon)

Signature
Name & Designation
(Official Seal)

Date:-_____
Place:-_____

INSTRUCTIONS (for Part-I):-

1. The project authorities may annex a copy of the approved project/plan in addition to filling Col. 1 (i) e.g. IBM approved mining plan for major minerals/CMPDI plan with subsidence analysis reports, etc.
2. Map has to be in original duly authenticated jointly by project authorities and concerned DCF – Col. 1 (ii).
3. Complete details of alternative alignments examined especially in case of project like roads, transmission lines, railway lines, canals, etc. to be shown on map with details of area of forest land involved in each alternative to be given - Col. 1 (iii).
4. For proposals relating to mining, certificate from competent authority like District Mining Officer about non-availability of the same mineral in surrounding/nearby non-forest areas.
5. In case the same company/individual has taken forest land for similar project in the State, a brief detail of all such approvals/leases be given as an enclosure along with current status of the projects.
6. The latest clarifications issued by the Ministry under Forest (Conservation) Act, 1980 may be kept in mind. In case such information do not fit in the given columns, the same shall be annexed separately.

GENERAL INSTRUCTIONS:-

1. On receipt of proposal, Nodal Officer shall issue a receipt to the user agency indicating therein the name of the proposal, user agency, area in hectare, serial number and date of receipt.
2. If the space provided above is not sufficient to specify any information, please attach separate details/documents.
3. While forwarding the proposal to the Central Government, complete details on all aspects of the case as per Form prescribed above read with the clarifications issued by the Ministry of Environment and Forests, Government of India, New Delhi should be given. Incomplete or deficient proposals shall not be considered and shall be returned to the State Government in original.
4. The State Government shall submit the proposal to the Central Government within stipulated time limits. In case of delay while forwarding, the reasons for the same to be given in the forwarding/covering letter.

Appendix 3-1

Environmental and Social Baseline

As the project corridors are spread all across the state of Tamil Nadu, the environmental and social baseline has been assessed for the entire state. Information collected from secondary and primary sources has been utilized for evaluating the existing environmental and social condition.

1.1 Physical and Biological Baseline Profile

1.1.1 Climate

The climate of Tamil Nadu is essentially tropical. In May and June, the hottest months, maximum daily temperatures in Chennai average about 38 °C, while minimum temperatures average in the low 20^{o} C. In December and January, the coolest months, temperatures usually rise from about 21°C into the mid-about 30 °C daily. The average annual precipitation, falling mainly between October and December, depends on the southwest and northeast monsoons and ranges between 630 mm and 1900 mm a year. The mountainous and hilly areas, especially in the extreme western part of the state, receive the most precipitation, while the lower-lying southern and southeastern regions receive the least rainfall.

1.1.2 Physiography

Tamil Nadu can be divided into three physiographic regions namely, the eastern coastal region, the western hilly region and the plains. The northern and western parts of the state are mainly hilly areas of the Western Ghats with an average elevation of 1220 m, and going up to 2440 m, which is the highest point.

1.1.3 Soil

The predominant soil types in Tamil Nadu are red soils, black soils, coastal soil and laterite. The types of soils in Tamil Nadu are as given below:

- Alluvial soil
- Black soil
- Red soil
- Laterite soil
- Arid desert soil
- Forest and mountain soil
- Saline or alkaline soil

Alluvial Soil - Sediments deposited by the flowing river is alluvial soil. It occurs in the deltas of Cauvery. These soils are deficient in nitrogen & humus. Such soils are suitable for growing all types of cereals, pulses, sugarcane, vegetables oils seeds. In Tamilnadu, Ramanthapuram, Thanjavur, Kanniyakumarioil are rich in this type of soils.

Black Soil - Black soils are formed from the lavas of mountain suitable for cotton cultivation. Black colour is due to the presence of iron. Soil is deficient in nitrogen, phosphates and organic matter, but rich in potash, lime, aluminium, calcium & magnesium. Lemon and sun flower grows well in the soil. In Tamil Nadu, Coimbatore, Madurai, Chengalpattu, Tirunelveli, Salem, Dharmapuri, Nilgirs, Virudhunagar, Sivagangai & Dindigul are rich in this soil.

Red Soil- It consists red-oxide. Red colour soils are formed from the crystalline & metamorphic rocks, rich in iron but deficient in nitrogen, phosphorus. It has a light texture. Crops like rice, ragi, tobacco and vegetables are grown, found in all districts, Salem, Dharmapuri, Coimbatore, Trichy, Thanjavur, Ramanathapuram, Madurai, Tirunelveli, Dindigul, Nilgiris.

Latrite Soil – This soil found in the areas of high rainfall (Parts of the Nilgirs District) & temperature regions. These soils contains high content of iron oxide. These are deficient in nitrogen, phosphorus & potash. These soils are suitable for rice, ragi sugarcane, rubber and cashew cultivation.

Arid Deserts Soil - In Tirunelveli district, this type of soils are found. These soil are infertile.

Forest and Mountain Soil – This type of soil found in Mountain regions, of Yelagiri, Shervorys, Kalvarayen, Agathiyer, & Anamalai regions. These are suitable for coffee, tea, rubber cardamom & cloves.

Saline or Alkaline Soil – This type of infertile soil found in some areas of Vellore, Thirvannamali, Kadalur & Villupuram districts.

1.1.4 Drainage

The major rivers flowing through the State are the Palar, Cheyyar, Ponnaiyar, Cauvery, Moyar, Bhavani, Amaravati, Vaigai, Chittar, and Tamaraparni. The Cauvery is the eighth largest river of the Indian subcontinent and is 760 km long. There are about 37 small rivers and rivulets in the State. Drainage map of Tamil Nadu is shown in **Figure 1.**

Figure 1: Drainage Map of Tamil Nadu

1.1.5 Floral

The principal forest types in Tamil Nadu are the Tropical Rain Forests, Dry Deciduous Forests, Dry Thorn Forests, Montane Shola, Grassland and Mangroves. Tamil Nadu has an area of 22877 sqkm under forests which constitute 17.59% of the geographical area of the State. The forest map of the state is shown in **Figure 1.** Geographic area recorded as "forests" in Government records as given below:

Reserved Forest	19388 km^2
Protected Forest	2183 km^2
Unclassified Forest	1306 km^2
Total	22877 km^2

Of State's Geographic Area	17.59 %
Of Country's Forest Area	2.95 %

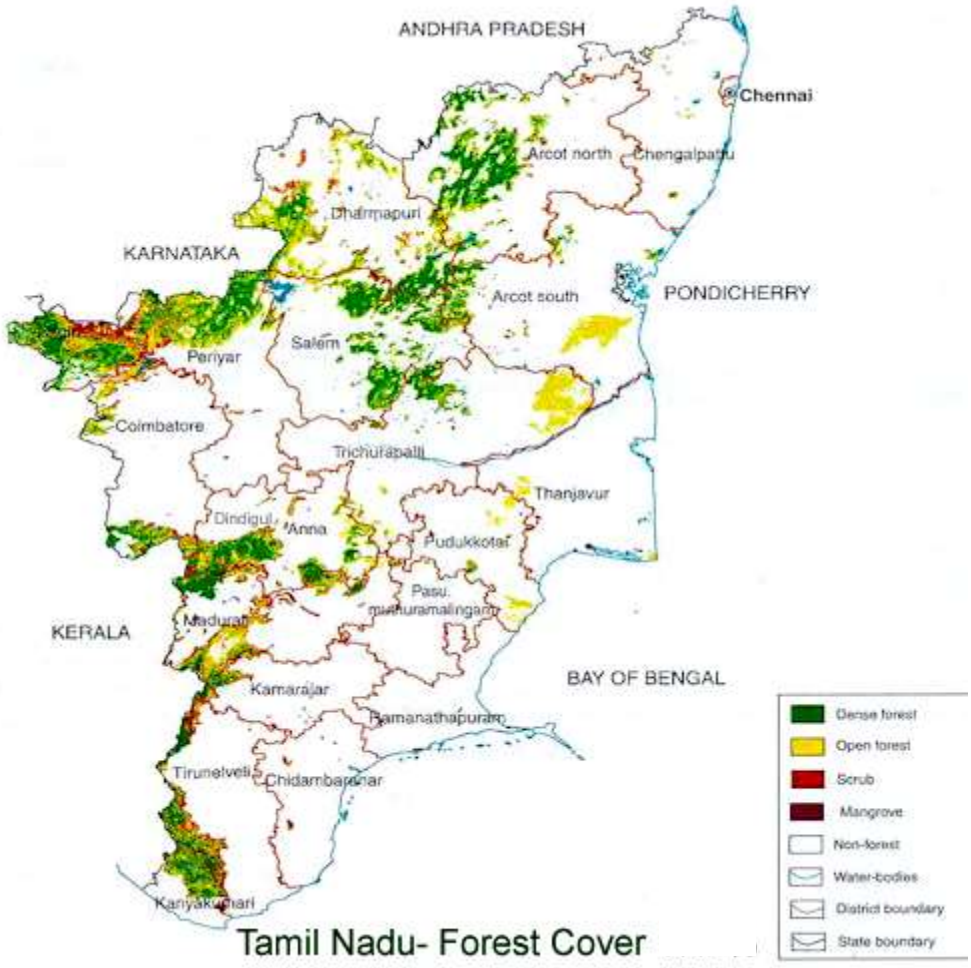


Figure 2: Forest Map of Tamil Nadu

1.1.6 Flora & Fauna /Wildlife

Wild Biodiversity Of Tamilnadu

One sixth of landmass of Tamil Nadu is covered with forests. The total forest cover of the State is 22643 KM² constituting 17.41% of geographic area. This includes 2440 km² of very dense forest, 9567 km² of moderately dense forest and 10636 km² of open forest. Tamil Nadu ranks 11th among the Indian States and Union Territories with reference to total forest cover. The recorded forest area of the state is 22,877 km² constituting 17.59% of the geographic area. Tamil Nadu ranks 13th among the Indian States and Union Territories with reference to total recorded forest area.

Floral Diversity

The Angiosperm diversity of India includes 17,672 species. With 5640 species, Tamil Nadu ranks 1st among all the States in the Country. This includes 533 endemic species, 230 red-listed species, 1559 species of medicinal plants and 260 species of wild relatives of cultivated plant. The Gymnosperm

diversity of the country is 64 species of which Tamil Nadu has 4 species of indigenous Gymnosperms and about 60 introduced species. The Pteridophytes diversity of India includes 1022 species of which Tamil Nadu has about 184 species. Tamil Nadu wild plant diversity also includes vast number of Bryophytes, Likens, Fungi, Algae and Bacteria.

Protected Areas

The protected area of the country is 156006 km² constituting 4.75% of the geographic area and 20.03% of the recorded forest area. The protected areas of Tamil Nadu extend to 3305 km² constituting 2.54% of the geographic area and 15% of the recorded forest area. Tamil Nadu ranks 14th among all the States and Union Territories of India in terms of protected area. There are 8 wildlife sanctuaries over 2, 82,685.57 ha and 12 bird sanctuaries over 17,074.59 ha, 5 National Parks over 30784.23 ha, 3 Tiger Reserves, 4 Elephant Reserves and 3 Biosphere Reserves for in situ conservation of wild fauna and flora. There is one Conservation Reserve in Tamil Nadu. The list of protected area is given in the **Table** .

Table 1: List of Protected Areas in Tamil Nadu

Sl. No.	Name of the Protected Areas	Year of Estbl.	Area (sq km)	District (s)
	National Park			
1	Guindy NP	1976	2.82	Chennai
2	Gulf of Mannar Marine NP	1980	6.23	Ramanathpuram, Tuticorin
3	Indira Gandhi (Annamalai) NP	1989	117.10	Coimbatore
4	Mudumalai NP	1990	103.23	Nilgiris
5	Mukurthi NP	1990	78.46	Nilgiris
	Wildlife Sanctuary			
1	Chitrangudi Bird WLS	1989	0.48	Ramanathpuram
2	Indira Gandhi (Annamalai) WLS	1976	841.49	Coimbatore
3	Kalakad WLS	1976	223.58	Tirunelveli
4	Kanjirankulam Bird WLS	1989	1.04	Ramanathpuram
5	Kanyakumari WLS	2002	457.78	Kanyakumari
6	Karaivetti WLS	1999	4.54	Perambalur
7	Karikili WLS	1989	0.61	Kanchipuram
8	Kilaselvanur-Melaselvanur WLS	1998	5.93	Ramanathpuram
9	Kuthankulam-Kadankulam WLS	1994	1.29	Tirunelveli
10	Mudumalai WLS	1942	217.76	Nilgiris
11	Mundanthurai WLS	1977	567.38	Tirunelveli
12	Point Calimere WLS	1967	17.26	Nagapattinam
13	Pulicat Lake WLS	1980	153.67	Tiruvellore
14	Satyamangalam WS	2008	524.35	Erode
15	Srivilliputhur Grizzled Squirrel WLS	1988	485.20	Virudhunagar
16	Udayamarthandapuram Lake WLS	1991	0.45	Thiruvarur
17	Vaduvoor WLS	1991	1.28	Thiruvarur
18	Vedanthangal WLS	1936	0.30	Chengalpet

Sl. No.	Name of the Protected Areas	Year of Estbl.	Area (sq km)	District (s)
19	Vellanadu (Blackbuck) WLS	1987	16.41	Tuticorin
20	Vellode WLS	1997	0.77	Erode
21	Vettangudi WLS	1977	0.38	Siva-gangai
	Conservation Reserves			
1	Tiruppadaimarathur Con. Res.	2005	0.03	Tirunelveli
	Tiger Reserves			
1	Kalakad Mundanthurai Tiger Reserve	1988	895	Tirunelveli
	Biosphere Reserve			
1	Nilgiris Biosphere Reserve	1986	5520 Sq. K.m, 2537.6 Sq. Kms. In Tamil Nadu	Nilgiris North (448.3 sqkm), Nilgiris South(198.8 sqkm), Erode (Sathyamangalam 745.9 sqkm), Erode(49.3 sqkm)) and Coimbatore (696.2 sqkm)
2	Agasthiyarmalai Biosphere Reserve	2001	3500.36 Sq. K.m out of which 1672.36 Sq. Kms. is in Tamil Nadu	Tirunelveli and Kanyakumari Districts

Source: Forest Department, GoTN

Faunal Diversity

The faunal diversity of Tamil Nadu includes 165 species of fresh water Pisces, 76 species of Amphibians, 177 species of reptiles, 454 species of birds and 187 species of mammals. According to the CAMP reports the red-listed species include 126 species of Pisces, 56 species of Amphibians, 77 species of reptiles, 32 species of birds and 40 species of mammals. The endemic fauna includes 36 species of Amphibians, 63 species of reptiles, 17 species of birds and 24 species of mammals. Schedule I animals include 22 species of mammals, 42 species of birds and 9 species of reptiles. Schedule II animals include 13 species of mammals. Schedule III animals include 5 species of mammals. Schedule IV animals include 5 species of mammals, 367 species of birds, 109 species of reptiles and 23 species of Amphibians. Schedule V animals include 13 species of mammals and 1 species of birds.

1.2 SOCIO-ECONOMIC BASELINE PROFILE

1.2.1 Area and Population

Tamil Nadu has an area of about 130,058 km^2. The state is divided into 32 districts. Total population of Tamil Nadu as per 2011 census is 72,147,030 of which male and female are 36,137,975 and 36,009,055 respectively. In 2001, total population was 62,405,679 in which males were 31,400,909 while females were 31,004,770. The total population growth in this decade was 15.61 percent while in previous decade it was 11.19 percent. The population of Tamil Nadu forms 5.96 percent of India in 2011. In 2001, the figure was 6.07 percent.

1.2.2 Population Density

Total area of Tamil Nadu is 130,058 sq. km. Density of Tamil Nadu is 555 per sq km which is higher than national average 382 per sq km. In 2001, density of Tamil Nadu was 480 per sq km, while nation average in 2001 was 324 per sq km.

1.2.3 Sex ratio

Sex Ratio in Tamil Nadu is 996 *i.e.* for each 1000 male, which is below national average of 940 as per census 2011. In 2001, the sex ratio of female was 986 per 1000 males in Tamil Nadu state.

1.2.4 Literacy

Literacy rate in Tamil Nadu has seen upward trend and is 80.09 percent as per 2011 population census. Of that, male literacy stands at 86.77 percent while female literacy is at 73.14 percent. In 2001, literacy rate in Tamil Nadu stood at 73.45 percent of which male and female were 83.28 percent and 64.91 percent literate respectively.

In actual numbers, total literates in Tamil Nadu stands at 51,837,507 of which males were 28,040,491 and females were 23,797,016.

1.2.5 Urbanisation

As per Census Record 2013, Out of total population of Tamil Nadu, 48.40% people live in urban regions. The total figure of population living in urban areas is 34,917,440 of which 17,458,910 are males and while remaining 17,458,530 are females. The urban population in the last 10 years has increased by 48.40 percent.

Sex Ratio in urban regions of Tamil Nadu was 1000 females per 1000 males. For child (0-6) sex ratio the figure for urban region stood at 952 girls per 1000 boys. Total children (0-6 age) living in urban areas of Tamil Nadu were 3,512,530. Of total population in urban region, 10.06 % were children (0-6).

Average Literacy rate in Tamil Nadu for Urban regions was 87.04 percent in which males were 91.80% literate while female literacy stood at 82.31%. Total literates in urban region of Tamil Nadu were 27,335,312.

1.2.6 Scheduled Caste and Scheduled Tribes

The Scheduled Castes (SCs) and Scheduled Tribes (STs) comprise about 7.2 percent and 1.1 percent, respectively, of Tamil Nadu's population (according to the 2011 census).

The total population of Tamil Nadu, as per the 2011 Census is 72,147,030. Of this, 5194586 (7.2 per cent) are Scheduled Castes (SCs) and 793617 are Scheduled Tribes (STs). The SC population constitutes 7.2 per cent of the country's SC population. Seventy-six (76) SCs have been notified in Tamil Nadu by the Scheduled Castes and Scheduled Tribes Order (Amendment) Act, 1976. Of these, fifteen SCs namely, Ayyanavar, Bharatar, Kakkalan, Kavara, Kootan, Mannan, Padannan, Panan, Paravan, Pathiyan, Thandan, Vannan, Vetan and Vettuvan have been notified with area restriction in Kanniyakumari district and Shencottah taluk of Tirunelveli district. Kanakkan have been notified in Nilgiri district only.

Appendix 4-1
Environmental Monitoring Formats

Format EM1: Selection of Disposal Site Locations

From _____ To _____

(Give chainage and nearest settlements from both ends)

Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
Area covered (m^2)				
Total Material that can be dumped within the site (m^3)				
Depth to which disposal is feasible (m)				
Distance of nearest watercourse (m)				
Nearest Settlement (m)				
Date/s of Community Consultation/s				
Whether the community is agreeable to siting of dumping site (Y/N)				
Date of Permission from Village Council President (VCP)				
Proposed future use of the Site				

Selected Site (tick any one column only)
Certified that the above information is correct to the best of my knowledge and belief.

Contractor

Signed: Date:
Name & Designation:

Recommendation on the suitability of the site

Decision Taken (tick one): Approved/Not Approved

Engineer – In-Charge

Signed: Date:
Name and Designation of Deciding Authority

Enclosures
(Tick as appropriate)
1 Maps of each location
2 Photographs
a Each disposal location
b Each community consultation
3 Photocopies of permissions from VCPs

Format EM2: Construction Camp and Storage Area

Construction Stage: Report - Date____ Month_____ Year_____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)
Format to be submitted before target date (decided by PIU) of establishing camps

Location of Camp (km_____)

Sl. No	Item	Unit	Details	Remarks
1	**Detail of item camp**			
a	Size of Camp	m x m		
b	Area of Camp	sq.m		
c	Distance from Nearest Settlement			
d	Distance from Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
e	Date of camp being operational dd/mm/yy			
f	Present land use			
g	No other trees with girth > 0.3m.			
h	Details of Storage area(Availability of impervious surface)	m x m		
i	Availability of separate waste disposal from storage area	Cum		
2	**Details of top soil stacking**			
a	Quantity of top soil removed	Cum		
b	Detail of storage of topsoil	Describe stacking arrangement		
3	**Details of Workforce**			
a	Total No of Labourers	nos		
b	Total no of Male Workers	nos		
c	No of Male Workers below 18 years of age	nos		
d	Total No of Female Workers	nos		
e	No of Female workers below 18 years of age	nos		
f	No of children	nos		
4	**Details of Dwelling Units**			
a	No of dwellings/huts	nos		
b	Minimum Size of Dwelling	m x m		
c	No of openings per dwelling	nos		
d	Minimum size of opening	m x m		
e	Walls	specifications		
f	Roofing	specifications		
g	Flooring	specifications		
h	Drinking Water Tank	specifications		
i	Capacity of Drinking water Tank	cum		
j	Size of Drinking Water Tank	m x m x m		
k	Total no of WC	Nos		
l	No of Wcs for female workers	Nos		
m	Minimum Size of WC	m x m x m		
n	Total No of Bathrooms for female workers	Nos		
o	Size of septic tank for WC/Baths	m x m x m		
p	Capacity of Water Tank for WCs/ Bathrooms and general purpose			
q	Fencing around camp	Y/N		
5	**Details of Facilities**			
a	Availability of security guard 24 hrs a day	Yes/No		
b	Details of First Aid Facility	Yes/No		
c	Availability of Day Care Centre	Yes/No		
d	Availability of dust bins (capacity 60 ltr)	nos		

Certified that the furnished information is correct the quality of work is as per god practice and all relevant information as required is attached

Contractor

Engineer – In -Charge

Format EM3: Reporting for Borrow Areas

Construction Stage Report: Date ____ Month_____ Year_____ Site Layout of Borrow Area and Proposed Borrow Area Redevelopment Plan to be attached with Format to be submitted before target date as (decided by PIU) for establishing Borrow Areas Borrow Area No. BA_____
Location of Borrow Area (Km_____)

Sl. No	Item	Unit	Details	Remarks by CSC, if any
1	**Details of Borrow Area**			
a	Date of Borrow Area becoming operational dd/mm/yy			
b	Current Landuse			
c	Distance from Nearest Settlement	Km		
d	No of settlements within 200m of Haul Road	No.		
e	No of settlements within 500m of Borrow Area	No.		
f	Total Capacity	cum		
g	No of Trees with girth more than 0.3 m	No.		
h	Length of Haul Road	km		
i	Width of Haul road	m		
j	Type of Haul Road	metal/dirt		
k	Size of Borrow Area	sqkm		
l	Area of Borrow Area	km x km		
m	Quantity Available	cum		
n	Distance of Nearest Water Source	Type/Size/Capacity/Present Use/Ownership		
o	Quantity of top soil removed	cum		
p	Detail of storage of topsoil			
q	Daily/occasional use of the Borrow Area by the community, if any	-		
r	Probable reuse of Borrow pit-ask community	-		
s	Drainage channels/slope/characteristics of the area	-		
2	**Enhancement Elements**			
a	Quantity of top soil removed	sq.m		
b	Detail of storage of topsoil	sq.m		
c	Adjoining land use/Natural elements			
d	Near by catchment for storing water			
e	Erosion Control Programme			
f	Preventive measures for			
i	Leaching			
ii	Mosquito Breeding			
iii	Water run-off/contamination			
iv	Any other environmental degradation			
3	**Details of workforce**			
a	Total No of Labourers	No.		
b	Total no of Male Workers	No.		
c	No of Male Workers below 18 years of age	No.		
d	Total No of Female Workers	No.		
e	No of Female workers below 18 years of age	No.		
4	**Details of redevelopment, Plan to be enclosed**			

Certified that the furnished information is correct the quality of work is as per good practice and all relevant information as required is attached

Contractor

Engineer – In -Charge

Format EM4: Tree Felling

S.No	Links	Physical Target				Completion Target		
		Total	Target	Target Achieved	% of task completed	Target Date	Date of Completion if task completed	Reason for Delay if any
		Unit						
1		nos						
2		nos						
3		nos						
4		nos						

Contractor

Engineer – In -Charge

EM 5 Topsoil Conservation Monitoring

Contract _____

Report No. _____ Date_____

Location (Chainage)	Original Use of Topsoil removed	Measures for preventing spillage of topsoil on Haul Roads(Earthen/ Metalled)	Present Method of Storage	Anticipated period of Storage (Months)	Distance of nearest Water course (m)	Present Slope of Pile (V: H)	Whether silt fencing provided?	Is any other covering / measure provided? If yes, what is it?	Improvements required	Extent of Compliance as on date of report

Certified that the above is true.

Signed_____

Contractor

Verified

Signed_____

Engineer – In-charge

EM 6 Redevelopment of Borrow Areas

Operation Stage: Report: Date ____ Month_____ Year_____

To be monitored by PIU during operation period

Details of remarks to be appended wherever necessary.

Sl. No	Activity	Particulars	Drawbacks Identified			Improvements Required		
			Construction	Financial	Others (Ask Community)	Technical	Financial	Remarks/ Suggestions
1	Details of Borrow area and Surrounding Landuse							
2	End use of the borrow area							
3	Whether rehabilitation has been carried out in line with owners request							
4	Erosion Control Measures							
5	Number of trees planted							
6	Reuse of topsoil							
7	Preventive measures taken for -Mosquito Breeding -Water runoff/ contamination -Other Environmental Degradation							
8	Any problems faced by owner							
9	Any problems faced by the local community							
10	If it has been developed as a fish pond,							
a	Details of available catchment for storing water							
b	Economic Benefits/Utility							
11	If it has been developed as an orchard							
a	Details of suitability of soil and water.							
B	Type of Plantation							
c	Economic Benefits/Utility							
12	Any Other End use							
a	Particulars							
b	Economic Benefits/Utility							

Contractor

Engineer – In -Charge

EM 7 Checklist for Construction Safety

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
Safety during Construction Stage							
1	Appointment of qualified Construction safety officers						
2	Approval for Construction Safety Management Plan by the Engineer.						
3	Approval for Traffic Management/Control Plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the Contractor.						
5	Provision of Temporary Traffic Barriers/ Barricades/caution tapes in construction zones						
6	Provision of traffic sign boards						
7	Provision for flags and warning lights						
8	Provision of metal drum/empty bitumen drum delineator, painted in circumferential strips of alternate black and white 100mm wide 2 coats fitted with reflectors 3 Nos of 7.5cm diameter						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work and access (ladders with handrail) for works at a height of more than 3.0 m						
11	Provision of adequate shoring / bracing / barricading / lighting for all deep excavations of more than 3.0 m depth.						
12	Demarcations (fencing, guarding and watching) at construction sites						
13	Provision for sufficient lighting especially for night time work						
14	Arrangements for controlled access and entry to Construction zones						
15	Safety arrangements for Road users / Pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular Inspection of Work Zone Traffic Control Devices by authorized contractor personnel						
18	Construction Workers safety - Provision of personnel protective equipments						
19	A. Helmets						
	B. Safety Shoe						
	C. Dust masks						
	D. Hand Gloves						
	E. Safety Belts						
	F. Reflective Jackets						
	G. Earplugs for labour						
20	Workers employed on bituminous works, stone crushers, concrete batching plants etc. provided with protective goggles, gloves, gumboots etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						

Sl. No.	Safety Issues	Yes	No	Non compliance	Corrective Action	Penalty	Remarks
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders and other safety devices shall be maintained in as safe and sound condition						
24	Regular health check-up for labour/ Contractor's personnel						
25	Ensuring the sanitary conditions and all waste disposal procedures & methods in the camps.						
26	The Contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers and flag persons for traffic control						
27	Provision for insurance coverage to the contractor's personnel						

Contractor

Engineer – In -Charge

Format EC1: Target Sheet for Pollution Monitoring

Construction Stage: Report - Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted as per EMP)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Contractor

Engineer – In -Charge

Format EC 2: Target Sheet for Pollution Monitoring

Operation Stage: Report - Date_____ Month_____ Year_____

(Locations at which monitoring to be conducted)

Sl. No	Chainage	Details of Location	Duration of Monitoring	Instruments Used	Completion Target		Reason for Delay if any
					Target Date	Date of Completion if task completed	
Air Monitoring							
1							
2							
3							
4							
5							
Water Monitoring							
1							
2							
3							
4							
5							
Noise Monitoring							
1							
2							
3							
4							
5							

Certified that the Pollution Monitoring has been conducted at all the locations specified in the EMP

Contractor

Engineer – In -Charge

Appendix 5-1

Guidelines for Environmental Management

GUIDELINE-1: SITE PREPARATION

1. GENERAL

The preparation of site for construction involves: (i) clearing of land required for construction; and (ii) management of traffic during construction. These activities have been detailed out for road construction activities separately.

2. ROAD CONSTRUCTION

2.2 Site Preparation Activities

After obtaining the consent of the community on the alignment, the Project Implementation Unit (PIU) of the Divisional Office shall be responsible to stake out the alignment by establishing working bench marks on ground. It shall be the responsibility of the PIU to take over the possession of the proposed RoW and hand over the land width required to clear of all encumbrances to the Contractor. Activities pertaining to the clearance of land and relocation of utilities need to be initiated by the PIU well in advance to avoid any delays in handing over the site to the Contractor. Assistance of the Revenue Department shall be sought in accomplishing the task. To summarize, the PIU's responsibilities before handing over the site to the contractor include:

- Clearance of encroachments within proposed RoW;
- Initiation of process for legal transfer of land title;
- Alignment modification or Relocation of common property resources in consultation with the local community;
- Alignment modification or Relocation of utilities in consultation with the various government departments; and
- Obtain clearances required from government agencies for
  - Cutting of trees; and
  - Diversion of forestlands if any, etc.

2.2 Site Preparation Activities by the Contractor

Site preparation shall involve formation of the road base where in it is ready for construction of protective/drainage works, carriageway, shoulders, parapets and other road furniture. The PIU shall transfer the land for civil works to the Contractor after peg marking of the alignment.

The Contractor shall verify the bench marks soon after taking possession of the site. The Contractor, prior to initiation of site preparation activities, shall highlight any deviations/discrepancies in these benchmarks to the Engineer – In-charge in writing. The contractor shall submit the schedules and methods of operations for various items during the construction operations to the Engineer – In-charge for approval. The Contractor shall commence operations at site only after the approval of the schedules by the Engineer In-charge.

The activities to be undertaken by the contractor during the clearing and grubbing of the site are as follows:

The clearance of site shall involve the removal of all materials such as trees, bushes, shrubs, stumps, roots, grass, weeds, part of topsoil and rubbish. Towards this end, the Contractor shall adopt the following measures: (i) Limiting the surface area of erodible earth material exposed by clearing and grubbing; (ii) Conservation of top soil and stock piling as per the measures suggested as part of **Guideline 4**, "Top Soil Salvage Storage and Replacement"; and (iii) Carry out necessary backfilling of pits resulting from

uprooting of trees and stumps with excavated or approved materials to the required compaction conforming to the surrounding area.

To minimize the adverse impact on vegetation, only ground cover/shrubs that impinge directly on the permanent works shall be removed. Cutting of trees and vegetation outside the working area shall be avoided under all circumstances. In case the alignment passes through forest areas, The Forest Ranger shall be consulted for identification of presence of any rare/endangered species within the proposed road way. Protection of such species if found shall be as per the directions of the Forest Department.

The locations for disposal of grubbing waste shall be finalized prior to the start of the works on any particular section of the road. The selection of the site shall be approved by the Engineer – in - charge. The criteria for disposal of wastes shall be in accordance with the measures given in Guideline on, "Waste Management and Debris Disposal" (**Guideline 8**).

In locations where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion and sedimentation control features can follow immediately, if the project conditions permit.

Dismantling of CD structures and culverts shall be carried out in a manner as not to damage the remaining required portion of structures and other surrounding properties. The disposal of wastes shall be in accordance with the provisions given in **Guideline 8**, "Waste Management and Debris Disposal". The following precautions shall be adopted: (i) The waste generated shall not be disposed off in watercourses, to avoid hindrance to the flow, and (ii) All necessary measures shall be taken while working close to cross drainage channels to prevent earthwork, stonework as well as the method of operation from impeding cross drainage at rivers, streams, water canals and existing irrigation and drainage systems.

The designated sites duly approved by Implementing Agency shall be cleared of its existing cover for setting up of the construction sites, camps and related infrastructure facilities, borrow areas and other locations identified for temporary use during construction. The contractor shall comply with all safety requirements in consideration as specified in the **Guideline 12** on, "Labour & Worker's Health and Safety". Before initiation of site preparation activities along these lands to be used temporarily during construction, it shall be the responsibility of the Contractor to submit and obtain approval of the site redevelopment plan from the implementing agency. The letter/contract agreement between the owner(s) of the land parcel for temporary usage shall include site redevelopment to its original status. The guidelines for the same are furnished in the Guideline on, "Construction Plants & Equipment Management"; guideline, "Construction and Labour Camps"; and "Borrow areas".

2.2 Traffic Management During Construction

Traffic management during construction is an activity specific to the contractors. Contractors must ensure a reasonably smooth flow of traffic during construction. The following are the general principles to be followed for traffic management during construction:

- Partial pavement construction **over long lengths will not be permitted.** The contractor should concentrate his activities over sections such that he can complete continuous fronts of up to a maximum of 1 km before starting the adjacent front. The contractor may open more than one continuous 1 km front provided that he has the separate resources to do so. The resources working on a 1 km front may not be shifted to another front until no longer required on that front.
- The construction activities should be staggered over sub-sections to the extent that the use of plant and equipment is optimized to maximum efficiency and to avoid idling. For road widening operations, excavation **adjacent to the existing road shall not be permitted on both titles simultaneously.** Earthworks must be completed to the level of the existing road before excavation work on the opposite side will be permitted.
- The construction operations taking place on a particular front must be managed efficiently such that delays between successive pavement layers are minimized.
- Before the start of the monsoon season (June) the contractor shall ensure that the pavement over any front is complete, full width, at least upto Dense Bituminous Macadam, DBM level, but preferably with Asphaltic Concrete, AC wearing course. The contractor **should not start any sections of**

pavement that he cannot complete by the start of the monsoon season.

- In the absence of permanent facilities, temporary drainage and erosion control measures, as required by the Specifications, are to be implemented prior to the onset of the monsoon.

In cases where separate traffic diversions are not essential or cost effective the construction methodology should be in accordance with the guidelines following:

On a 1km section, the pavement construction (except new alignments) should be limited to 500m sub-sections with a minimum of 1 to 1.5 km between successive sub-sections to ease traffic management and safety issues. The earthworks in the widening portions are not limited in, this respect. Excavation on both sides of the existing, road over the same sub-section simultaneously shall not be permitted for reasons of safety to the traffic, particularly at night.

Sub-sections longer than 500 m may be authorized by the Engineer if two-way traffic flow can be comfortably managed and the Contractor **can demonstrate his ability to maintain dust control, proper road edge delineation, proper signage and traffic control.** Where single file traffic is permitted ('only applicable to final wearing course operations), the sub-sections shall be reduced to a maximum length whereby safe traffic regulation can be physically managed. Single file traffic may not be permitted at certain locations or times of the day when traffic volumes are such that excessive congestion shall occur.

GUIDELINE-2: CONSTRUCTION AND LABOUR CAMPS

1. INTRODUCTION

The scope of this guideline pertains to the siting, development, management and restoration of construction and labour camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of labourers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labour camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

2. PRE-CONSTRUCTION STAGE

Identification of site for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the Engineerin charge. **Table 1** gives the lands that could be avoided for construction camps and conversely those that could be preferred.

Table 2-1: Selection Criterion for Construction Camps.

Avoid the following …	Prefer the following …
• Lands close to habitations. • Irrigated agricultural lands. • Lands belonging to small farmers. • Lands under village forests. Lands with in 100m of community water bodies and water sources as rivers. • Lands within 100m of watercourses. • Low lying lands. • Lands supporting dense vegetation. • Grazing lands and lands with tenure rights. • Lands where there is no willingness of the landowner to permit its use.	• Waste lands. • Waste Lands belonging to owners who look upon the temporary use as a source of income. • Community lands or government land not used for beneficial purposes. • Private non-irrigated lands where the owner is willing. • Lands with an existing access road.

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

a) photograph of the proposed camp site in original condition;

b) activities to be carried out in the site;

c) environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;

d) detailed layout plan for development of the construction and labour camp that shall indicate the various structures to be constructed in the camp including temporary, drainage and other facilities (**Figure 1** gives a layout plan for a construction camp); and

e) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the Engineer -incharge to enable redressal of grievances at a later stage of the project.

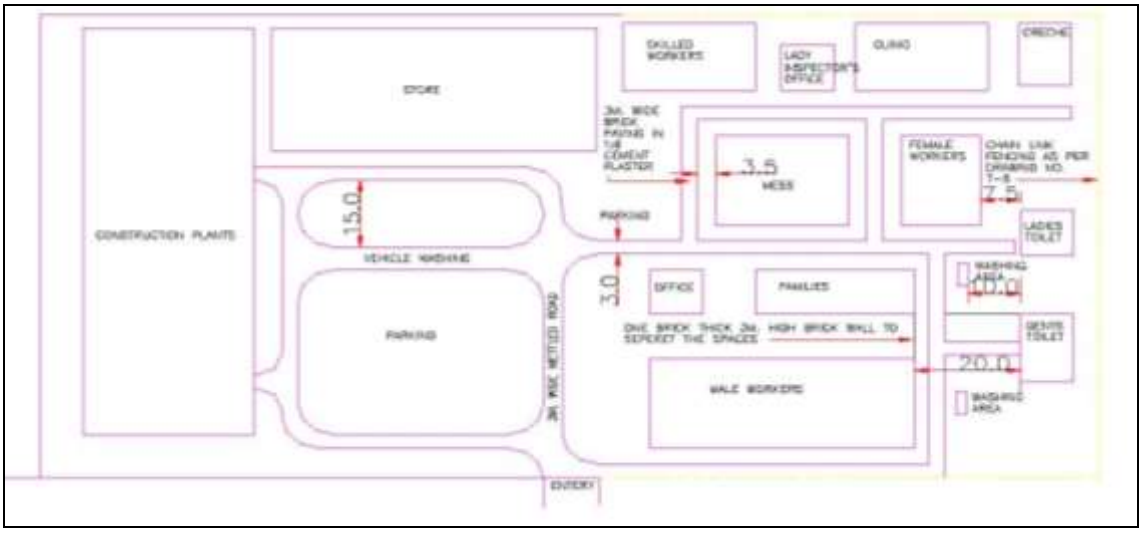


Figure 2-1: Layout Plan for Construction Camp

2.2 Setting up of labour camp

The contractor shall provide, free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him for complete construction/maintenance work is in progress. A minimum area of 6 sq.mts per person shall be provided. The rooms of labour shall be well lighted and ventilated. The facilities to be provided for the labour are discussed below:

a) Drinking Water

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.
- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to be covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.

b) Washing and Bathing Facilities

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

c) Toilets Facilities

Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:

- A latrine for every 15 females or part there of (where female workers are employed).
- A latrine for every 10 males.
- Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.

- Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers "For Men Only" or "For Women Only" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system;
- Water shall be provided in or near the latrines and urinals by storage in suitable containers.

d) Waste Disposal

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.

e) Medical and First Aid Facilities

Medical facilities shall be provided to the labour at the construction camp. Visits of doctor shall be arranged twice a month where in routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following.
- 6 small sterilized dressings
- 3 medium size sterilized dressings
- 3 large size sterilized dressings
- 3 large sterilized burns dressings
- 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
- 1 (30 ml) bottle containing salvolatile
- 1 snakebite lancet
- 1 (30 gms) bottle of potassium permanganate crystals
- 1 pair scissors
- Ointment for burns
- A bottle of suitable surgical antiseptic solution

In case, the number of labour exceeds 50, the items in the first aid box shall be doubled.

f) Provision of Shelter during Rest

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

g) Crèches

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realisation. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

2.2 Storage of Construction Material in Construction Camps

For storage of Petrol/Oil/Lubricants, brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. These should be kept

away from labour residential areas. The storage of cement shall be at Damp-proof flooring, as per IS codes. All materials shall be stored in a barricaded area. In case of electrical equipments, danger signs shall be posted. The batch mix plant is to be located away from the residential area and not in the wind direction. Separate parking areas for vehicles and also workshop areas need to be provided.

2.2 Fire Fighting Arrangement

- The following precautions need to be taken:
- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of fire;
- Contractor shall educate the workers on usage of these equipments.

2.2 Interactions with host communities

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to labourers and residents of construction camps.

3. CONSTRUCTION STAGE

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Waste water should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed off safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction should be kept in a designated and barricaded area.

The Engineer in charge will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the period of the contract.

4. POST CONSTRUCTION STAGE

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed off suitably (Refer **Guideline - 10** on "Waste Management and Debris Disposal").
- Ramps created should be leveled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.
- Proper documentation of rehabilitation site is necessary. This shall include the following: −Photograph of rehabilitated site;
- Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
- Undertaking from contractor; and
- Certification from Engineer in-charge.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

GUIDELINE-3: BORROW AREAS

1. INTRODUCTION

Embankment fill material is to be procured from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, pre-construction, construction stage and post construction stage. Borrow areas are related only to road construction activities.

2. PROJECT PLANNING AND DESIGN STAGE

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Borrow area siting should be in compliance with IRC: 10-1961. The DPR shall contain (i) Guidelines for locating site of borrow areas and borrow material specifications.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the Engineer in charge. Borrowing to be avoided on the following areas:

- Lands close to toe line.
- Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. The subsequent Guidelines discuss in detail the conservation of topsoil.
- Grazing land.
- Lands within 0.8km of settlements.
- Environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands. Also, a distance of 1000 m should be maintained from such areas.
- Designated protected areas / forests.
- Unstable side-hills.
- Water-bodies.
- Streams and seepage areas.
- Areas supporting rare plant/ animal species;
- Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

3.1 Arrangements for Borrow Area

The Contractor will work out arrangements for borrowing with the land owner/concerned department. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the Engineer In charge to enable redressal of grievances at a later stage of the project. The Engineer In charge shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and land owner. The contractor shall commence borrowing soil only after the approval by the Engineer In charge. The contractor shall submit to the Engineer-In charge the following before beginning work on the borrow areas.

- Written No-objection certificate of the owner/cultivator;
- Estimate extent of earth requires;
- Extent of land required and duration of the agreement;
- Photograph of the site in original condition; and
- Site redevelopment plan after completion.

The depth of excavation should be decided based on natural ground level of the land and the surroundings, and rehabilitation plan. In case higher depth of excavation is agreed with backfilling by unsuitable

excavated soil (from roadway), then filling should be adequately compacted except topsoil, which is to be spread on the top most layer (for at least 20m thick). The guidelines for location, depth, size and shape of the borrow areas are available in the following:

- Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;
- Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989: (IRC: 104-1988);
- IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;
- IRC SP: 58-2001 guideline for use of fly ash in road construction;
- EIA manual of MOEF&CC, 2001;
- MoEF notification on utilisation of fly ash dated 27 August, 2005.

3.2 Documentation of Borrow Pit

The contractor must ensure that following data base must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

- Chainage along with offset distance;
- Area (Sq.m);
- Photograph of the pit from all sides;
- Type of access/width/kutcha/pucca etc from the carriageway;
- Soil type;
- Slope/drainage characteristics;
- Water table of the area or identify from the nearest well, etc;
- Existing land use, for example barren/agricultural/grazing land;
- Location/name/population of the nearest settlement from borrow area;
- Present usage of borrow area; and
- Community facility in the vicinity of borrow pit.

3.3 Redevelopment Plans for Borrow Pits

The following checklist provides guidelines in order to ensure that redevelopment of borrow areas must comply with MoRTH, clause 305.2.2.2 and EMP requirement. Borrow areas can be developed as:

- Ponds (various types) (*eg:* Drinking Water only; Washing and for other Domestic Chores; Only for Cattle; Mixed Uses etc.) (a large pond can be divided into two parts - each having a defined use)
- Farmland submission
- Water Recharging Zones
- Pastureland
- Fish Ponds (Pissiculture)
- Waste disposal Sites (depending upon the location, distance from settlements, pollution risks, safety, associated environmental risks and hazards, regulations/ permissions of appropriate authority and other such factors)
- Plantation Zones
- Recreational Zones (depending upon location, size, potential of the site, willingness of the local bodies to develop it)
- Wildlife Refuge and Drinking Area (applicable only in case of sensitive environs with appropriate planning and understanding including regulation of depth for safety of animals etc.)

The rehabilitation measures for the borrow areas shall be dependent on the following factors:

- Land use objectives and agreed post-borrowing activities;
- Physical aspects (landform stability, erosion, re-establishment of drainage);
- Biological aspects (species richness, plant density,) for areas of native re vegetation;

- Water quality and soil standards; and
- Public safety issues.

Rehabilitation should be simple and maintenance free. Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be: (i) Restoring the productive use of the land (ii) Development of detention ponds in barren areas.

Option I: Suitable in locations with high rainfall and productive areas

Topsoil must be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs.

Plants must be planted during the first growing season following the reclamation phase.

Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 75% survival rate.

Option II: In barren land, the borrow areas can be redeveloped into detention ponds.

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Following parameters are to be observed while setting up a detention pond:

- Pond should be located at the lowest point in the catchment area. Care should be taken that the horizontal velocity should be less then settling velocity to prevent suspension or erosion of deposited materials.
- Minimum Effective Flow Path: 5 times the effective width
- Minimum Free Board: 0.15 m
- Minimum Free Settling Depth: 0.5 m
- Minimum Sediments Storage Depth: 0.5 m
- Maximum interior slope: 2H : 1V
- Maximum exterior slope: 3H : 1V
- The inlet structure should be such that incoming flow should distribute across the width of the pond. A pre-treatment sump with a screen should provide to remove coarse sediments. Settled sediment should be removed after each storm event or when the sediment capacity has exceeded 33% of design sediment storage volume. Accumulated sediment must be disposed of in a manner, which will prevent its re-entry into the site drainage system, or into any watercourse.

4. CONSTRUCTION STAGE

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in IRC: 10-1961. In addition, the contractor should adopt precautionary measures to minimize any adverse impacts on the environment. Checklists for monitoring borrow areas operation and management has been prepared (**Table 3-1**).

Table 3-1: Checklist for Monitoring Borrow Area Operation and Management

Attributes	Requirements
Access Road	Access road shall be used for hauling only after approved
Top soil preservation	To soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line

Attributes	Requirements
	of the proposed embankment.
Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the Engineer-Incharge.
Dust Suppression	Water should be sprayed on kutcha haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

5. POST CONSTRUCTION STAGE

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the Engineer-In-charge after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The final payment shall be made after the verification by Engineer-In-charge.

6. CHECKLIST FOR INSPECTION OF REHABILITATION AREA

Inspection needs to be carried out by the Engineer – In-charge for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the Engineer – In-charge is given below.

- Compliance of post-borrowing activities and land use with the restoration plan;
- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
- Levelling of the bottom of the borrow areas;
- In case the borrow area is on private property,the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement "no responsibility of R&BD on contractor in the event of accident.
- Condition of the reclaimed area in comparison with the pre-borrowing conditions.

GUIDELINE-4: TOPSOIL SALVAGE, STORAGE AND REPLACEMENT

1. INTRODUCTION

Loss of topsoil is a long term impact along roads due to (i) site clearance and widening for road formation (ii) development of borrow areas (iii) temporary construction activities such as construction camps, material storage locations, diversion routes etc. The environmental measures for both these activities during all stages of construction activity are discussed in the subsequent sections.

2. PROJECT PLANNING & DESIGN STAGE

At the project preparation stage, the following shall be estimated: (i) Extent of loss of top soil due to widening and siting of construction activities (ii) Estimates of borrow area requirements and (iii) Area requirement for topsoil conservation. The bid document shall include provisions that necessitate the removal and conservation of topsoil at all locations opened up for construction by the Contractor.

3. PRE-CONSTRUCTION STAGE

The arrangements for temporary usage of land, borrowing of earth and materials by the Contractor with the land owner/concerned department shall include the conservation / preservation of topsoil.

4. CONSTRUCTION STAGE

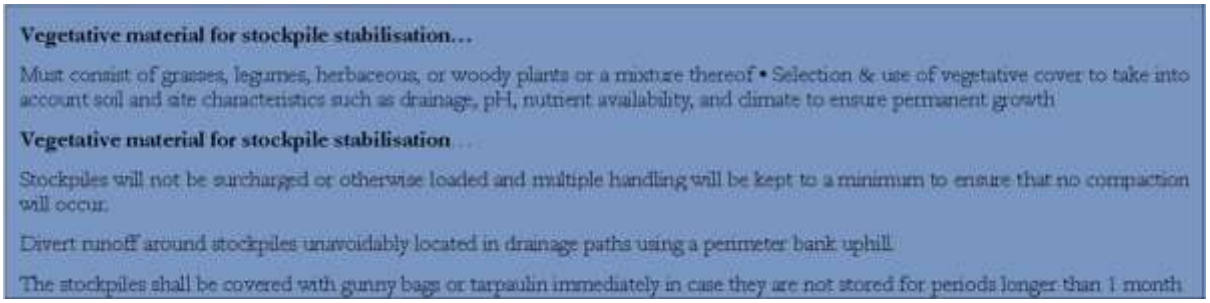
It shall be the responsibility of the Contractor to strip the topsoil at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the Engineer In charge. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. In case of hilly and desert areas, topsoil with humus wherever encountered while opening up the site for construction shall be stripped and stockpiled. The stockpiles shall be located at:

- Areas away from Grade, Subsoil & Overburden materials;
- Areas away from pit activities and day-to-day operations;
- Areas that do not interfere with future pit expansion; and
- Areas away from drainage paths and uphill of sediment barriers.

The stockpiles for storing the topsoil shall be designed such that the slope should not be less than 1:2 (Vertical to horizontal), and the height of the pile is restricted to 2m. A minimum distance of 1m is required between stockpiles of different materials.

In cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilised within 7 days of forming. The stabilisation shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control.

After spreading the topsoil on disturbed areas, it must be ensured that topsoil is seeded, and mulched within 30 days of final grading. During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses. The Contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the Engineer.



5. POST CONSTRUCTION STAGE

The topsoil shall be re-laid on the area after taking the borrow earth to maintain fertility of the agricultural field, finishing it to the required levels and satisfaction of the farmer. The area to be covered with vegetation shall be prepared to the required levels and slope as detailed in the DPR. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material. The top soil can also be used for the following purposes:

a. Covering the borrow areas;

b. Embankment and turfing;

c. Median; and

d. Rehabilitation of construction and labour camp.

GUIDELINE-5: QUARRY MANAGEMENT

1. INTRODUCTION

This guideline pertains to the measures to be taken to address environmental concerns in quarry areas. The general practice adopted is to procure materials from existing quarries operating with the requisite permits. The measures to be taken for operation and management for quarries during all stages of construction have been discussed in this Guideline.

2. PROJECT PLANNING AND DESIGN STAGE

The PIU shall provide in the DPR / bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, the DPR shall contain the following: (i) Quantity of materials available in quarries (ii) Lead from the various existing quarries and (iii) Adequacy of materials for the project in these quarries. **Table 5-1** and **5-2** give the format for preparing a list of quarries.

Table 5-1 Details of Sand Quarry

Sample No.	Source of Sand	Name of quarry area	Site Identification/ Location			Approximate Quantity (cum)	Approximate basic cost of the material (Rs.)	Remarks
			Nearest Chainage (Km.)	Left/Right	Offset from nearest chainage (km)			

Table 5-2 Details of Quarry Area for Aggregates

Sample No.	Chainages (Km.)	Left/ Right	Name of Quarry Area	Name of Crusher	Lead from nearest chainage (Km.)	Basic Cost of the Material (Rs.)	Available land/terrain	Surrounding land Terrain	Remarks

Only in the event of non-availability of existing quarries, the Contractor shall open a new quarry in accordance with Mines and Minerals (Development & Regulation) Act, 1957. The bid document shall include the exhaust quarry reclaim plan per needs of the landowner / community.

3. PRE-CONSTRUCTION STAGE

The Contractor shall select an existing licensed quarry identified in DPR for procuring materials. The Contractor shall establish a new quarry with the prior consent of the Engineer – In charge only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the Engineer – In charge.

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

4. CONSTRUCTION STAGE

4.1 Development of Quarry Area

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

- Adequate drainage system shall be provided to prevent the flooding of the excavated area
- At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
- Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the

plant to minimize the adverse impact due to dust and noise.

- The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
- In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules,1983.

4.2 Setting up of Crushers and other equipments

The following measures shall be undertaken for setting up of crushers are other equipments.

- No new / proposed stone crushers should be located within 500 metres from any National highways or State highways or 'inhabited site[6]' or places of public and religious importance.
- The minimum distance between new / proposed stone crushers should be 1 km to avoid dust pollutional influence of one over the other
- The stone - crushing unit shall provide adequate green belt cover around the periphery as suggested by the Board depending on site and meteorological conditions.
- The existing and new / proposed stone crushing units should provide dust containment and dust suppression systems
- The contractor shall obtain prior "Consent to Establish" and "Consent to Operate" for crusher from the Tamil Nadu State Pollution Control Board.
- All vehicles must possess Pollution Under Control (PUC) Certificate and shall be renewed accordingly
- All machinery, equipments, and vehicles shall comply with existing CPCB noise and emission norms.
- The Engineer – In charge must ensure that contractor shall submit the copy of CTE, CTO and PUC Certificate before the start of work.

4.3 Quarry operations

The followings precautions shall be undertaken during quarry operations. vii) Overburden shall be removed and disposed as per **Guideline 8** "Waste Management and Debris Disposal".

- During excavation slopes shall be flatter than 20 degrees Guideline 8 on to prevent their sliding
- In case of blasting, the procedure and safety measures shall be taken as per The Explosive Rules, 1983
- The Contractor shall ensure that all workers related safety measures shall be done as per measures for, "Labour & Workers Health & Safety" (**Guideline 12**).
- The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.
- Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in **Guideline 4**, "Topsoil Salvage, Storage & Replacement."
- During transportation of the material, measures shall be taken as per **Guideline 11** "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents

[6] 'Inhabited site' shall mean a village site or town site or a house site as referred to in the revenue records or a house site or layout approved by a Local Body or Town or Country or Metropolitan Planning Authority, where
the said Body or Authority is created under a statue and empowered to approve such an area as a house site or layout area (as desired in Rule 35 of Tamil Nadu Minor Minerals Concession Rules, 1959)

- The Engineer-In charge and the concerned authority shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

5. POST CONSTRUCTION STAGE

A quarry redevelopment plan shall be prepared by the Contractor. All haul roads constructed for transporting the material from the quarries to construction site shall be restored to their original state.

The Engineer – In charge and the concerned authority shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.

The plan shall include:

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site
- Safety measures during quarry operation
- Design for redevelopment of exhaust site.

Two options for redevelopment of quarry areas are given below:

Option A: Vegetating the quarry to merge with surrounding landscape. This is done by conserving and reapplying the topsoil for the vegetative growth.

Option B: Developing exhausted quarries as water bodies. The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/ natural drainage slopes towards it.

GUIDELINE-6: WATER FOR CONSTRUCTION

1. INTRODUCTION

The scope of this guideline includes the procurement of water required for construction of roads. Except bituminous works, water is required during all stages of road construction such as Embankment Sub-Grade; Granular sub-base (GSB) and Water Bound Macadam (WBM). Management of water in various stages of construction is given in the following sections.

2. PROJECT PLANNING & DESIGN STAGE

- The Detailed Project Report for both road constructions shall contain the following information:
- Estimate of water requirement during different seasons based on construction schedule of various stages of construction.
- Identification of potential sources of water for construction,
- Arrangements to be worked out by the contractor with individual owners, when water is obtained from private sources, and
- Whether scarcity of water would have any impact on schedule of construction.

In water-scarce regions, provide the following additional information in Project Reports…

- Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users.
- Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works.
- Identification of alternate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.

In water scarce regions, if water-harvesting structures are to be constructed, suitable locations and mechanism for siting these structures will be identified. These are envisaged to be permanent water tanks for collection of stream water. Detailed drawings of water harvesting structures based on site conditions will need to be worked out and presented in the DPR. No extra payment shall be generally made for these works and the Contractor has to include the cost of these items in his offer while quoting his tendered rate.

Scheduling Construction in Water Scarce Areas: As part of the project preparation, the Engineer – In charge shall conduct an assessment of water requirement and availability in water scarce regions. As far as possible, schedule for construction in these water scarce areas shall be prepared such that earthwork for embankment is carried out just before monsoon, so that water requirement for subsequent construction works such as granular sub-base and water bound macadam are met in monsoon and post monsoon season. Carrying out these activities even during the monsoon is possible as the rainfall may not be high enough to disrupt construction.

3. PRE-CONSTRUCTION STAGE

Prior to commencement of extraction of water for construction, the contractor shall work out arrangements as specified in the DPR.

In water-scarce regions, provide the following additional information in Project Reports…

- Exploring possibilities for use of existing perennial sources, through interactions with water user groups as the villagers, relevant Government Departments, keeping in view that the water extraction does not infringe upon the usufruct rights of the existing water users.
- Identification of potable water source for domestic use of workers and for use in cement - based construction such as cement concrete roads, culverts and other cross drainage works.
- Identification of altemate water sources, water-harvesting techniques will be explored to avoid water extraction from the existing community sources.
  from any septic tank/soak pit or other source of pollution.
- **In case of water harvesting structures** (if required), the Contractor shall in consultation with the residents, identify suitable locations for siting the structure and construct the same.
- **In case of perennial sources,** the Contractor shall adhere to all administrative procedures pertaining to procurement of water from such sources.

CONSTRUCTION STAGE

During construction, the Contractor shall be responsible to monitor the following:

- The arrangements worked out with the Panchayat/individual land owners for water extraction is adhered to;
- Extraction of water is restricted to construction requirement and domestic use of construction workers;
- Water requirement for curing of concrete shall be minimized by pooling of water over the concrete or by covering with wet gunny bags; and
- The potable water used for drinking purposes of construction workers shall be as per the Indian Standard for Drinking Water IS: 10500, 1991.

GUIDELINE-7: SLOPE STABILITY AND EROSION CONTROL

1. INTRODUCTION

Stability of slopes is a major concern in locations of high embankment. In cases of high embankment, water retention at the embankment base initially causes toe failure and subsequently failure of the whole embankment. Soil erosion is consequent to high runoff on hill slopes. Embankments made up of silty and sandy soils get eroded, in the absence of vegetative cover, when the slopes are steep say more than 20 Degree.

The scope of this guideline includes measures to minimize the adverse environmental impacts due to slope instability and soil erosion. The adverse environmental impact can be: (i) Damage to adjacent land, (ii) Silting of ponds and lakes disturbing the aquatic habitat (iii) Erosion of rich and top fertile top layer of soil (iv) Contamination of surface water bodies and (v) Reduction in road formation width due to erosion of shoulders/berms.

2. PROJECT PLANNING AND DESIGN STAGE

During the detailed project preparation phase, the following investigations shall be carried out prior to finalisation of alignment.

- Topographical;
- Hydrological;
- Geo-technical; and
- Geological Investigation (in case of roads in hill areas and areas of high seismic activity)

In addition to the slope stability analysis the alignment should be such that (i) steep as well as heavy cuts are avoided, (ii) Flora and fauna of the area are not disturbed and (iii) Natural drainage pattern is not obstructed.

For high embankments, geo-technical investigations (determination of C, φ, density etc.) of the available material need to be done to check its suitability as fill material.

In case of the CD structures, measures for preventing siltation and scouring shall be undertaken as per Guideline on, “Drainage”.

Following guidelines shall be followed in desert areas while using cohesion-less soils for embankment construction.

- The alignment should follow the natural ground level to the extent possible and the embankment shall be restricted to minimum to achieve ruling grades.
- Slope of the embankment should be 3 (H): 1(V) or flatter.
- The corners of the embankment should be rounded for better aerodynamic performance.

3. PRE-CONSTRUCTION STAGE

Interceptor ditches are constructed along hilly slopes or areas with high rainfall to protect the road bench and hillside slope from erosion due to heavy rainfall and runoff. Interceptor ditches are very effective in the areas of high intensity rainfall and where the slopes are exposed. These are the structures designed to intercept and carry surface run-off away from erodible areas and slopes, thus reducing the potential surface erosion. The Engineer - Incharge must ensure that the layout and siting of ditches is as per specifications.

4. CONSTRUCTION STAGE

When alternative material such as fly ash is used for embankment formation, it needs to be ensured that sufficient filter bed is provided along with the top cap. All tests as per IS: 2720 (Parts: 4, 5, 8 & 40) and IRC: SP: 20-2002 are to be conducted on the embankment to keep a check on the compaction achieved. Slope stabilisation techniques and erosion control measures such as stone pitching, use of geotectile and turfing.

Box-1: Detailed specifications for Vegetative cover

Description:

The vegetative cover should be planted in the region where the soil has the capacity to support the plantation and at locations where meteorological conditions favours vegetative growth.

Site Preparation:

- To prevent the seeds from being washed away subsequent to sowing, the area should be protected with surface roughening and diversions.
- Soil samples should be taken from the site and analysed for fertiliser and lime requirements.

Seed Application:

- The seed should be sown uniformly as soon as preparation of the seedbed has been completed.
- No seed should be sown during windy weather. The best time for needing would be during monsoon.

Maintenance:

During first six weeks, the planting should be inspected by the PIC, to check if the growth is uniform and dense. Appropriate moisture levels shall be maintained. There may be requirement of watering the plantings regularly during the dry seasons.

5. POST CONSTRUCTION STAGE

All the exposed slopes shall preferably be covered with vegetation using grasses, brushes etc. Locally available species possessing the properties of (i) good growth (ii) dense ground cover and (iii) deep root shall be used for stabilization.

In case of steep and barren slopes, in order to retain the seedling to the ground asphalt mulch treatment shall be given. Seedling are covered with asphalt emulsion and spread into a thin layer. The asphalt film gradually disintegrates and a carpet of green vegetation and deep-rooted species of grass and clovers, takes its place. Anchoring shall be carried out as per IRC: SP: 48-1998.

Regular inspection of check dams and repositioning/replacement of dislodged or stolen stones need to be carried out.

Repair and maintenance of eroded side drain inverts is to be done in order to arrest retrogation of levels in side drains. Slopes of high embankment can give a fertile base for growth of vegetative cover / sodding.

In arid areas, in order to avoid the deposition of sand over or near the road surface, shrubs are to be planted at an appropriate distance from the formation. The shrubs should not be abutting the road and the distance for carrying out plantation shall be determined based on prevalent wind speeds as well as quantity of sand being carried amongst various other factors. There should be a clear gap between the roadway and shrubs to allow the wind to pick up its velocity and carry along with it any sand that is deposited.

GUIDELINE-8: WASTE MANAGEMENT AND DEBRIS DISPOSAL

1. INTRODUCTION

This guidance describes procedures for handling, reuse and disposal of waste materials during road construction. The Guideline describes waste management measures in all stages of construction. Also, the Guideline discusses the measures to be taken for debris disposal.

2. PROJECT PLANNING AND DESIGN STAGE

As part of DPR preparation, the Engineer - Incharge shall carry out the following measures

- Finalize road design and alignment to minimize waste generation through balancing of cut and fill operations and minimizing excess cuts requiring disposal.
- Identify the type of wastes as well as sources of waste during construction and suggest options for possible reuse
- Provide guidelines to the contractor for locating waste disposal sites for non-toxic wastes
- Identify existing landfill sites if available for disposal of toxic materials.
- Incase no existing landfill sites are available, identification of landfill site as well as identification of the clearance requirements.
- Identify sites of disposal of debris.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the activities during construction, that have the potential to generate waste and work out measures for reducing, reusing and proper disposing of the generated waste in the construction schedule to be submitted to the Engineer – In charge. A sequential listing of the activities during road construction and the nature of wastes together with the possible options for reuse are specified in **Table 8-1**. For the disposal of excess cut and unsuitable (non-toxic) materials, the contractor shall identify the location for disposal in consultation with the community / concerned department. Any toxic materials shall be disposed in existing landfill sites that comply with legislative requirements. Prior to disposal of wastes onto private/community land, it shall be the responsibility of the Contractor to obtain a No-objection Certificate (NOC) from the land owner/community. The NOC shall be submitted to the Engineer – In charge prior to commencement of disposal.

Practices to avoid – waste disposal …
•Tipping of waste into stream channels, water bodies, forests and vegetated slopes
•Non-cleaning of wastes after day's work
•Leaching of wastes
•Littering in construction camps / sites
•Storing wastes on private land

The Contractor shall educate his workforce on issues related to disposal of waste, the location of disposal site as well as the specific requirement for the management of these sites.

4. CONSTRUCTION STAGE

The contractor shall either reuse or dispose the waste generated during construction for roads depending upon the nature of waste, as specified in **Table 1**. The reuse of waste shall be carried out by the contractor only after carrying out the specific tests and ascertaining the quality of the waste materials used, and getting the same approved by the Engineer – In charge. Wastes that were not reused shall be disposed off safely by the contractor. The contractor shall adopt the following precautions while disposing wastes:

- Bituminous wastes shall be disposed off in 60mm thick clay lined pits and covered with 30cm good earth at top, so as to facilitate growth of vegetation in long run.
- In case of filling of low-lying areas with wastes, it needs to be ensured that the level matches with the surrounding areas. In this case care should be taken that these low lying areas are not used for rainwater storage
- In case oil and grease are trapped for reuse in a lined pit, care shall be taken to ensure that the pit should be located at the lowest end of the site and away from the residential areas.

The waste management practices adopted by the Contractor, including the management of wastes at construction camps etc shall be reviewed by the Engineer – In charge and the Pollution Control Board (PCB) during the progress of construction.

5. POST CONSTRUCTION STAGE

On decommissioning of construction sites, the Contractor shall hand over the site free of all debris/wastes to the satisfaction of Engineer – In charge. In case of any temporary disposal of wastes on private land, certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is restored to his satisfaction". The same is to be submitted to the Engineer – In charge before final payment is claimed.

Table 8-1: Type of wastes and scope for reuse- road construction

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
I	**CONSTRUCTION WASTES**			
1.	Site Clearance and grubbing	Vegetative cover and top soil	Vegetating embankment slopes	
		Unsuitable material in embankment foundation	Embankment Fill	Low lying areas Land fill sites
2.	Earthworks			
a)	Overburden of borrow areas	Vegetative cover and soil	Vegetating embankment slopes	
b)	Overburden of quarries	Vegetative cover and soil	Vegetating embankment slopes	
		Granular material	Embankment Fill, Pitching	
c)	Accidental spillages during handling	Dust		
d)	Embankment construction	Soil and Granular Material	Embankment Fill	
e)	Construction of earthen drains	Soil	Embankment Fill	
3.	Concrete structures Dust			
a)	Storage of material	Dust, Cement, Sand	Constructing temporary structure, embankment fill	
		Metal Scrap		Scrap Yard
b)	Handling of materials	Dust		
c)	Residual wastes	Organic matter	Manure, Revegetation	
		Cement, sand	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail	
4	Reconstruction works			
a)	Dismantling of existing pavement	Bitumen Mix, granular material	sub-base	
		Concrete	Road Sub-base, reuse in concrete, fill material and as rip rap on roads	
		Guard rail sign post, guard stone	Reuse for same	
b)	Dismantling of cross drainage structures	Granular material & bricks	Constructing temporary structure, embankment fill	
		Metal scrap	Diversion sign, Guard Rail Culvert	
		Pipes	Culvert	

S. No	Activity	Type of waste	Scope for possible reuse	Disposal of waste
5	Decommissioning of sites			
a)	Dismantling of temporary structures	Granular material and bricks	Constructing temporary structure, embankment fill	
6	Maintenance operation			
a)	Desilting of side drains	Organic matter and soil	Revegetation	
II	**OIL AND FLUIDS**			
1	Construction machinery – maintenance and refueling	Oil and Grease	Incineration, Cooking, Illumination	
2	Bituminous works			
a)	Storage	Bitumen	Low Grade Bitumen Mix	
b)	Mixing and handling	Bitumen	Low Grade Bitumen Mix	
		Bitumen Mix	Sub-base, Paving access & cross roads	
c)	Rejected bituminous mix	Bitumen Mix	Sub-base, Paving access & cross roads	
III	**DOMESTIC WASTES**			
1	Construction camps	Organic waste,	Manure	
		Plastic and metal scrap		Scrap Yard
		Domestic effluent	Irrigation	

6. Disposal of Debris

For the purpose of disposal of debris, dumping sites need to be selected. The criteria for selection of dumping sites include:

- No residential areas are located downwind side of these locations;
- Dumping sites are located at least 1000 m away from sensitive locations;
- Dumping sites do not contaminate any water sources, rivers etc; and
- Dumping sites have adequate capacity equal to the amount of debris generated;
- Public perception about the location of debris disposal site has to be obtained before finalizing the location;
- Permission from the Village Panchayat is to be obtained for the dumping site selected;
- Productive lands are avoided; and
- Available waste lands shall be given preference

GUIDELINE-9: WATER BODIES

1. INTRODUCTION

Water bodies may be impacted when the road construction is adjacent to it or the runoff to the water body is affected by change of drainage pattern due to construction of embankment. The following activities are likely to have an adverse impact on the ecology of the area:

- Earth moving;
- Removal of vegetation;
- Vehicle/Machine operation and maintenance;
- Handling and laying of asphalt; and
- Waste disposal from construction camps.

Impacts on water bodies impairs …

- Change in Catchment area of the water body
- Drainage system
- Flood level and water logging
- Flora and fauna dependant on the water body
- Ground water recharging
- Animal husbandry as water bodies are used by animals
- Water quality &
- Runoff (increase/decrease)

2. PROJECT PLANNING AND DESIGN STAGE

All efforts are to be taken to avoid the alignments passing adjacent or close to water bodies. Where possible, it should be realigned away from the water body without cutting its embankment, decreasing the storage area or impairing the catchment area. Adequate drainage arrangements as per IRC guidelines have to be provided. Stream bank characteristics and hydrology of the area are to be studied before finalizing the alignment, the profile and cross-drainage structures.

Complete filling of water body with soil is not contemplated in the project. The DPR and its cost estimates have to accommodate costs of rehabilitation (to be estimated as lump sum at DPR stage) of water bodies impacted by the project. Water body rehabilitation shall be as per the Rehabilitation Plan prepared by the Contractor which should have approval of the Engineer - Incharge. Details of the tasks to be performed as per the sequence of activities during the project planning and design are as follows:

- Consultations with the people regarding alternate routes that were devised to avoid the pond. If alternate routes are not available, consent of the villagers is to be sought for affecting the pond and also the measures that would be taken to mitigate the impacts.
- Final design is to be prepared indicating the pond location in the alignment drawings.
- If impacting the pond, the extent of impact is to be clearly indicated on a separate drawing showing blown up portion of the pond. The drawing should aid the contractor in setting up exact lines for cutting the pond.
- All necessary measures for mitigation of impacts and precautionary measures while working close to the water body are to be incorporated into the DPR and cost estimates. The measures to be incorporated shall be as per this guideline.

PRE-CONSTRUCTION STAGE

The Contractor after an assessment of the likely impacts on the water body and review of the provisions of this guideline shall prepare a detailed work plan at the pre-construction stage. The Contractor shall prepare a Rehabilitation Plan for rectifying the likely impact to be caused and approval of Engineer - Incharge shall be sought prior to commencement of work. The Rehabilitation Plan should include:

- Locations of erosion protection works and silt fencing to prevent sediment laden runoff entering the water body;
- Location of side drains (temporary or otherwise) to collect runoff from the embankment before entering the water body in accordance with IRC guidelines;
- Work program in relation to the anticipated season of flooding/overflowing of the water body;

- Obstructions likely to cause temporary flooding and information to seek clearance to remove the obstruction; and
- Drawings in Rehabilitation Plan should indicate the landscape details along with species to be planted in the surrounding environs of the water body.

The rehabilitation of water body should be with the objective of restoring it to its original state or to a better state with necessary enhancement of its environs. Rehabilitation Plan shall include:

- Reconstruction and stabilization of embankment in case it is impacted;
- If storage area is lost, then the water body is to be deepened to regain an equivalent volume;
- Further enhancement of the water body as a focal point with place for seating and provision of shade; and
- Costs of rehabilitation

Concurrence of the community has to be sought on the Rehabilitation Plan prepared by the Contractor. Concerns of the community have to be incorporated into the plan before submitting it for approval of the Engineer - Incharge.

The Engineer – In charge shall scrutinize the Rehabilitation Plan, verify the implementation on site and finally approve the plan. The Rehabilitation Plan should be implemented by the Contractor immediately after completion of construction at the stretch near the water body.

Working near Water Bodies – Precautions

- Avoid locating roads on pond embankment
- Collect road runoff before entering the water bodies
- Runoff to be filtered of sediments before letting into water bodies
- Avoid debris disposal into water bodies
- Avoid disposal of oil/grease/other contaminants into water bodies

When there is interruption to regular activities of villagers near water body due to construction or rehabilitation work, following are the Contractor's responsibilities:

- Restriction on use of water, if any, should be intimated to the community in advance;
- Alternate access to the water body is to be provided in case there is interruption to use of exiting access. The access provided should be convenient for use of all the existing users whether community or cattle; and
- If the water body affected is a drinking water source for a habitation, alternate sources of water are to be provided to the users during the period for which its use is affected.

3. CONSTRUCTION STAGE

It should be ensured by the contractor that the runoff entering the water body is free from sediments

Silt fencing and/or brush barrier shall be installed in the drainage channels for collecting the sediments before letting them into the water body silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they have to be revegetated. Cutting of embankment reduces the water retention capacity and also weakens it, hence:

- The contractor should ensure that the decrease in water retention should not lead to flooding of the construction site and surroundings causing submergence and interruption to construction activities.
- Any perceived risks of embankment failure and consequent loss/damage to the property shall be assessed and the contractor should undertake necessary precautions as provision of toe protection, erosion protection, sealing of cracks in embankments. Failure to do so and consequences arising out of embankment failure shall be the responsibility of the contractor. The Engineer - Incharge shall monitor regularly whether safe construction practices near water bodies are being followed.

Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body. Movement of machinery and workforce shall be restricted around the

water body, and no waste from construction camps or sites shall be disposed into it.

4. POST CONSTRUCTION STAGE

With the completion of construction, the Engineer - Incharge has to ensure implementation of rehabilitation/restoration plan for the water body, as indicated by the Contractor in the bid submission. The precincts of the water body have to be left clean and tidy with the completion of construction. Drainage channels of adequate capacity shall be provided for the water body impacted.

GUIDELINE-10: DRAINAGE

1. INTRODUCTION

Inadequate and faulty drainage arrangements during road construction result in obstruction to natural drainage pattern. The problem is further aggravated in the low-lying areas and flood plains receiving high intensity rainfall, which can lead to the instability of embankment, damage to pavement, sinking of foundation, soil erosion, safety hazards and disruption in traffic. Provision of cross-drainage and longitudinal drainage increases the life of the road and consequently reduces water logging and related environmental impacts. The functioning of the drainage system is therefore a vital condition for a satisfactory road.

However, construction or upgradation of Cross Drainage structures and longitudinal drains is likely to increase sediments, scour the banks, change water level and flow, and also affect the ecology of the surrounding area. The guideline shall address the environmental concerns related to drainage aspects during different stages of the project execution.

2. PROJECT PLANNING AND DESIGN

Drainage shall be broadly divided as (i) Cross-Drainage and (ii) Longitudinal Drainage both surface & subsurface drainage. The alignment shall be routed such that minimum drainage crossings are encountered. Also the geometric design criteria as per IRC 73, guidelines for effective surface drainage should be ensured.

All drains crossing the alignment shall be identified on site and marked on map while undertaking transect walk. Basic information on the width of channel, frequency of traffic holdup and flow would provide inputs into screening of alternate alignments as well as fixing the alignment. Consultations with the community shall provide information on the HFL in the area.

In areas of high and medium intensity rainfall (>400 mm/year), flood prone areas and hilly areas, detailed hydrological studies will need to be conducted. The studies shall be conducted as per IRC: SP-13: 1973 “Guidelines for the Design of Small Bridges & Culverts” and IRC: SP-33:1989 “Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures”.

Design of cross-drainage structures shall be based on the inputs from the hydrological studies as per clause 12.2.3 and in other areas, the C-D structure design shall be as per IRC: SP-13. Design of C-D structure shall be such that:

- Normal alignment of the road is followed even if it results in a skew construction of culverts and stream bank protections are incorporated.
- Afflux generated is limited to 30 cm in plains with flat land slopes.
- It is fish friendly – fish passage is not interrupted either in upstream or downstream direction.
- Adequate scour protection measures for stream bank, roadway fill as head walls, wing walls and aprons are included.
- Reinforced road bed (of concrete or rock) for protection against overflow in case of low water crossing (floods/causeways) is included.
- The design of C-D structure (minor and major bridge) should have stairs leading to the bed of the drainage channel, for regular inspection of the sub-structure.
- Schedule of construction of C-D structures should be confined to dry months to avoid contamination of streams.

Longitudinal drains are to be designed to drain runoff from highest anticipated rainfall as per rainfall data for the past 20 years or 50 years as per hydrological analysis in high rainfall areas (annual rainfall > 1000 mm) and hill areas. For design of longitudinal drains in other areas, the design shall be as per IRC: SP-20:2002.

Outfall of the roadside drains shall be into the nearby stream or culvert. The outfall should be at such

a level that there would be no backflow into the roadside drain. Wherein pond/low lying areas exist in the vicinity, the flow may be diverted into them after removal of sediment for possible ground water recharge.

In case of high embankment (>1.0m) or bridge approaches, lined channels shall be provided to drain the surface runoff, prevent erosion from the slopes and avoid damage to shoulders and berms. Detailed specifications shall be as per IRC: SP-20:2002. The type of drains that can be constructed include brick lined, pucca with RCC, covered drain with RCC slabs and piped drain.

3. PRE-CONSTRUCTION STAGE

Following measures are to be undertaken by the contractor prior to the commencement of CD/Bridge construction:

- The downstream as well as upstream user shall be informed one month in advance
- The contractor shall schedule the activities based on the nature of flow in the stream.
- The contractor should inform the concerned departments about the scheduling of work. This shall form part of the overall scheduling of the civil works to be approved by Engineer - Incharge.
- Erosion and sediment control devises are to be installed prior to the start of the civil works.
- Runoff from temporary drains and interceptor drains to be directed into natural drains in hill roads
- In case of up-gradation of the existing CD Structures, temporary route / traffic control shall be made for the safe passage of the traffic, depending upon the nature of the stream
- All the safety/warning signs are to be installed by the contractor before start of construction

In case of utilization of water from the stream, for the construction of the CD structures, the contractor has to take the consent from the concerned department (refer Guideline on “Water for Construction”)

4. CONSTRUCTION PHASE

Drainage structures at construction site shall be provided at the earliest to ensure proper compaction at the bridge approach and at the junction of bridge span and bridge approach. Velocity of runoff to be controlled to avoid formation of rills/gullies as per guideline, “Slope stability & erosion control”

While working on drainage channels, sediment control measures shall be provided. Silt fencing (as per the detailed specifications of guideline, “Slope Stability & Erosion Control”) shall be provided across the stream that carries sediment.

The sediments collected behind the bunds shall be removed and after drying, can either be reused or disposed off as per guideline, “Waste Management and Debris Disposal”. Safety devises and flood warning signs to be erected while working over streams and canals.

5. POST CONSTRUCTION

Inspection and cleaning of drain shall be done regularly to remove any debris or vegetative growth that may interrupt the flow. HFL should be marked as per hydrological data on all drainage structure. Temporary structure constructed during construction shall be removed before handing over to ensure free flow through the channels. The piers and abutments should be examined for excessive scour and make good the same if required. The upstream and downstream areas should be cleared of all CD works.

In case of Causeway following aspect shall be taken into consideration:

- Dislocation of stones in stone set pavements, scouring of filler material due to eddy currents.
- Floating debris block the vents. In case of large amount of floating material, debris arrestor shall be provided in upstream side.
- Damage to guide stones, information board shall be inspected and replaced accordingly.

Schedule of Inspection shall be drawn up for checking cracks, settlements and unusual backpressures. It must be ensured that all the rectification shall be undertaken as and when required. Following are broadly the items to be checked:

- Settlement of piers/abutments & settlement of approach slabs have to be checked;
- Cracks in C-D structures or RCC slabs;
- Drainage from shoulders to be ensured;
- Ditches & drains to be kept clean of debris or vegetation growth; and
- Repairs to parapet of culverts whenever required are to be undertaken.

GUIDELINE-11: CONSTRUCTION PLANTS & EQUIPMENT MANAGEMENT

1. GENERAL

During execution of the project, construction equipments, machinery and plants are likely to cause adverse impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the safety and health of the workers, surrounding settlements and environment as a whole. This guideline describes the activities during the project stages where pollution control measures are required.

2. PROJECT PLANNING AND DESIGN STAGE

Selection criteria for setting up a plant area and parking lot for equipments and vehicles shall be done as per siting criteria for construction camp specified in Guideline on "Construction and Labour Camps".

3. PRE-CONSTRUCTION STAGE

The Contractor must educate the workers to undertake safety precaution while working at the plant / site as well as around heavy equipments. Before setting up the crusher, Batching plant, hot-mix plant Camp site and generator, the Contractor shall acquire prior "Consent to Establish (CTE)" and "Consent to Operate (CTO)" from the Tamil Nadu State Pollution Control Board for the same. The Contractor shall ensure all vehicles must possess Pollution under Control (PUC) Certificate, which and shall be renewed regularly. The Contractor must ensure that all machinery, equipments, and vehicles shall comply with the existing Central Pollution Control Board (CPCB) noise and emission norms. The Engineer - Incharge must ensure that the Contractor shall submit a copy of the CTE, CTO and PUC Certificates before the start of work. The Contractor shall design the service road with protection measures as black topping at vulnerable points as in low lying areas.

4. CONSTRUCTION STAGE

The Contractor shall undertake measures as per **Table 11-1** to minimize -the dust generation, emissions, noise, oil spills, residual waste and accidents at the plant site as well as during transportation of material to construction site.

Table 11-1: Measures at Plant Site

Concern	Causes	Measures
Dust Generation	Vehicle Movement	•Water sprinkling •Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation •Tail board shall be properly closed and sealed to be spill proof
	Crushers	• Regular Water Sprinkling to keep the dust below visibility level
	Concrete-Mix Plant	• Educate the workers to follow/adopt good engineering practices while material handling
Emissions	Hot-Mix Plant	•Site Selection as per Clause 6.5.2, Section 6.5, IRC's Manual for Construction & Supervision of Bitumen Work •Regular maintenance of Dust Collector as per manufacture's recommendations
	Vehicles	• Regular maintenance as per manufacture's recommendation
	Generators	• Exhaust vent of adequate height conforming the TNPCB's requirement and emission to confirm to PCB norms.
	Heavy Load Vehicles	• Exhaust silencer, Regular maintenance as per manufacture schedule
Noise	Crushers	• Siting as per guideline, "Construction and Labour Camps"
	Generators	• All generators should have mandatorily acoustic enclosures and confirms to PCB norms.
Oil Spills	Storage and Handling	• Good practice, guideline, "Waste Management and Debris Disposal"
Residual waste	Dust Collector and Pits	• Guideline , "Waste Management and Debris Disposal"
Concrete waste	Concrete-Mix plant	• Guideline, "Waste Management and Debris Disposal"
Bitumen and bitumen mix	Hot-mix Plant	• Guideline, "Waste Management and Debris Disposal"

Concern	Causes	Measures
Stone chips	Crushers	• Guideline, "Waste Management and Debris Disposal"
Safety	Trajectory of Equipments	• No worker shall be present in the vicinity of the equipments
	Movable Parts of Equipments	• Caution Sign, awareness among workers
	Plant Area / Site	• Caution Sign, Safety Equipments
	Accidents / Health	•First Aid Box, Periodic Medical Checkup Break down of
	Break down of vehicles	• Arrangement for towing and bringing it to the workshop

During site clearance, all cut and grubbed materials shall be kept at a secured location so that it does not raise any safety concerns. During excavation, water sprinkling shall be done to minimize dust generation. Frequent water sprinkling shall be done on the haul roads to minimize dust generation. In case of loose soils, compaction shall be done prior to water sprinkling. Cautionary and informatory sign shall be provided at all locations specifying the type of operation in progress. The contractor must ensure that there is minimum generation of dust and waste while unloading the materials from trucks. The construction waste generated shall be disposed as per Guideline on, "Waste Management and Debris Disposal". The equipments, which are required to move forward and backward, shall be equipped with alarm for backward movement. It shall be ensure that the workers shall remain away from the working areas at such times. Also, equipments at construction camp should be barricaded and kept away from residential quarters of workers.

The Engineer - Incharge shall carry out periodic inspections to ensure that all the pollution control systems are appropriately installed and comply with existing emission and noise norms.

Safety Measures During Bitumen Construction Work…

- The Contractor shall ensure that bitumen storing, handling as well as mixing shall be done at hot-mix plant or designated areas[1] to prevent contamination of soil and ground water.
- Skilled labour shall be used while hand placing the pre-mixed bitumen material. The hand placing of pre-mixed bituminous material shall be done only in following circumstances:
  - For laying profile corrective courses of irregular shape and varying thickness
  - In confined spaces where it is impracticable for a paver to operate and
  - For filling potholes
- The Contractor shall provide safety equipments i.e. gumboots and gloves to the workers while handling bitumen.
- While applying Tack Coat, spraying of bitumen shall be done in the wind direction. The labour shall wear jacket while spraying the bitumen.
- All the bituminous work shall be done as per IRC's Manual for Construction and Supervision of Bituminous Works.

5. POST-CONSTRUCTION STAGE

The Engineer - Incharge shall ensure that all the haul roads are restored to their original state. Incase any inner village road is damaged while transporting the procured material; the contractor shall restore the road to its original condition. The Engineer - Incharge must ensure that the decommissioning of plant shall be done in environmentally sound fashion and the area to bring its original state.

Designated area refers to paved surfaces and barren parcels of land, with adequate drainage and disposal system. It must be ensure that these are away from agriculture land, water body and other sensitive areas.

GUIDELINE-12: LABOUR AND WORKER'S HEALTH AND SAFETY

1. INTRODUCTION

The safety and health concerns of the workers and the community are impacted due to the hazards created during the construction of road. **Box: 1** gives the safety concerns during construction. This Guideline describes the hazards and measures that need to be taken to mitigate the impacts.

2. PROJECT PLANNING AND DESIGN STAGE

To address health and safety concerns, the DPR shall contain selection criteria for setting up:

- Construction Camps (as per guideline);
- Borrow Areas (as per guideline); and
- In case of opening new quarry areas (as per guideline).

To address the safety concerns to road user during operational phase, the DPR shall contain the following:

- Selection and location of regulatory as well as informatory signs as per IRC: 67-2001, depending upon the geometry of the road.

Box 1: Safety Concerns during Construction

Community due to:

- Improper scheduling of construction activities especially near the settlements and sensitive areas;
- Parking of equipments and vehicles at the end of the day likely to cause accidents to the general public especially during night hours;
- Transportation of uncovered loose material or spillage of material increases the chances of accidents to road users and surrounding settlements.

Workers due to:

- Improper handling of materials like bitumen, oil and other flammable material at construction sites, likely to cause safety concerns to the workers;
- Lack of safety measures such as alarm, awareness and safety equipment result in accidents, especially working with or around heavy machinery / equipments.

PRE-CONSTRUCTION STAGE

In order to incorporate public health and safety concerns, the Engineer - Incharge and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas;
- Extent of work;
- Time of construction;
- Diversions, if any;
- Precaution measures in sensitive areas;
- Involvement of local labours in the road construction;
- Health issues - water stagnation, exposure to dust, communicable disease; and
- Mechanism for grievances.

Health Concerns are adversely impacted.....

Public due to:

- Unhygienic conditions due to water logging (improper drainage of waste water), either by improper decommissioning of Construction Camps and parking lots, or improper disposal of construction wastes, leading to the breeding of vectors that are likely to impact the health of the general public
- Interaction between workers and host community is likely to increase the risk of spread of communicable diseases.

Workers due to:

- Low quality drinking water as well as inappropriate storage of drinking water likely to cause water borne diseases among workers.
- Absence of proper sanitary facility likely to act as a breeding ground for vectors raising health concerns among workers.

The information dissemination could be through the local newspaper, billboards, panchayats meetings, etc. The Contractor must educate the workers to

undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Awareness on HIV/AIDS awareness and usage of safety measures such as condoms;
- Awareness on hygienic sanitary practices;
- Personal safety measures and location of safety devices;
- Interaction with the host community;
- Protection of environment with respect to:
  - Trampling of vegetation and cutting of trees for cooking;
  - Restriction of activities in forest areas and also on hunting;
  - Water bodies protection;
  - Storage and handling of materials;
  - Disposal of construction waste.

3. CONSTRUCTION STAGE

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal Protective Equipments (PPE) for the workers. **Table 12-1** gives the safety gear to be used by the workers during each of the construction activities.
- All measures as per bidding document shall be strictly followed.
- Additional provisions need to be undertaken for safety at site:
  - Adequate lighting arrangement;
  - Adequate drainage system to avoid any stagnation of water;
  - Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, as well as at the location of generator (grease trap); and
  - Facilities for administering first aid.

FIRST AID FACILITIES

- First Aid Kit, distinctly marked with Red Cross on white back ground and shall contain minimum of following:
  - 6 small-sterilized dressings
  - 3 medium and large sterilized dressings
  - 1 (30 ml.) bottles containing 2 % alcoholic solution of iodine
  - 1(30 ml) bottle containing salvolatile
  - 1 snakebite lancet
  - 1 pair sterilized scissors
  - 1 copy of first-aid leaflet issued by the Director General, Factory Service & Labour Institute, Government of India
  - 100 tablets of aspirin
  - Ointment for burns
  - A suitable surgical antiseptic solution
- Adequate arrangement shall be made for immediate recoupment of the equipments, whenever necessary.
- A trained personnel incharge of first aid treatment to be readily available during working hours at construction site
- Suitable transport to the nearest approachable hospital should be made available.
- Tetanus injection must be made compulsory for all workers every 6 months.

Table 12-1: Worker Safety Measures

Sl. no.	Activity	Safety Requirement
1.	Setting out and levelling	• Luminous jackets; • Helmets; • Boots for protection against insect bite; and Dust Mask
2.	Tree cutting	• Helmet Boots • Luminous safety jackets
3	Reinforced yard/ carpentry/ reinforcement cutting/ bending work.	• Hand gloves
4.	Shuttering work	• Goggles Hand gloves
5.	Plant and Machinery	• Hand gloves • Boots • Helmets • Dust Mask
6.	Material handling	• Hand gloves • Dust mask
7.	Batching plant	• Goggles • Hand gloves • Dust mask
8.	Weeding	• Goggles

Sl. no.	Activity	Safety Requirement
9.	Binding reinforcement	• Safety belt • Boots
10.	Manual concrete laying	• Gum boots • Hand gloves • Helmet
11.	Piling	• Helmet • Hand gloves, gumboots.

The following measures need to be adopted by the contractor to address public safety concerns:

- The Contractor shall schedule the construction activities taking into consideration factors such as:
  - Sowing of crops;
  - Harvesting;
  - Local hindrances such as festivals etc.; and
  - Availability of labour during particular periods.
- All the cautionary signs as per IRC: 67-2001 and traffic control devices (such as barricades, etc) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed.
- Following case specific measures need to be followed during the progress of the activity:
  - Incase of blasting, the Contractor must follow The Explosives Rules, 1983.
  - Incase of construction activity adjoining the water bodies, measures shall be taken as per measures suggested in Guideline on "Water Body".
  - If construction of road is within the settlement, the contractor must ensure that there shall not be any unauthorized parking as well as storage of material, adjacent to road.
  - Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all the water logging areas

The Engineer - Incharge shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per the guideline.

4. POST-CONSTRUCTION STAGE

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the Engineer -Incharge to ensure safer roads:

- Inspection and maintenance of installed regulatory and informatory signs.
- Ensure that the location of signage does not obstruct the visibility
- Incase of hill roads, maintenance of parapet wall as well as of overtaking zones.

The Engineer - Incharge must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per the measures given in Guideline on "Construction and labour Camp" and "Waste Management and Debris Disposal."

GUIDELINE-13: CULTURAL PROPERTIES

1. INTRODUCTION

The cultural properties located close to the road are likely to be impacted by the road construction. Most of the properties are avoided in general during finalization of alignment. This Guideline discusses the mitigation measures for cultural properties.

2. PROJECT PLANNING AND DESIGN STAGE

Measures for mitigation of impacts on cultural properties during project preparation shall be as per the following steps:

- Identification of locally significant cultural properties should be done;
- Assessment of likely impacts on each cultural property due to project implementation;
- The extent of impact on the identified culture property should be assessed and possible measures for avoidance should be devised based on the site investigation. Incase impact is not avoidable, identification of alternative routes or possibility of relocation of the culture property shall be assessed in consultation with the local public, based on the economic feasibility.

Incase of relocation, relocated site should be suggested by the local people and the size of relocated structure should at least be equal to the original structure. A written consent letter is to be obtained from the community regarding the relocation site of the cultural property in the form of resolution on the letter pad of the sarpanch/gram panchayat or with the signatures of community members.

A detailed design of the relocated structure and its site plan along with the necessary BoQ are to be presented DPR. The relocation and other avoidance measures should be carried out before the start of the road work

It must be ensured by the Engineer – In-charge that the BoQ and rates are incorporated into the contract document.

Information to be collected…

- Location
- Direction (North/ South/East/West) With Respect to Road
- Distance of the structure from existing centerline of the road
- Type of Property eg: temple/mosque/shrine/dargah etc
- Plan of the structure
- Importance of the structure – historical/social/archeological
- Ownership of the property
- Probable loss to the property
- Specific periods/durations in which large congregations as festivals/mela take place causing hindrance to vehicular movement
- Choice of community, issue of relocation

3. CONSTRUCTION STAGE

Major impacts on the properties during this stage are mainly due to movement of construction machinery as well as due to construction activity in the vicinity of the cultural property. Following are precautionary measures that need to be undertaken by the contractor while working near these structures:

- Restrict movement of heavy machinery near the structure
- Avoid disposal or tipping of earth near the structure
- Access to these properties shall be kept clear from dirt and grit

During earth excavation, if any property is unearthed and seems to be culturally significant or likely to have archeological significance, the same shall be intimated to the Engineer. Work shall be suspended until further orders from Engineer - Incharge. The State Archeological Department shall be intimated of the chance find and the Engineer shall carry out a joint inspection with the department. Actions as appropriate shall be intimated to the Contractor along with the probable date for resuming the work.

The Engineer - In charge must ensure that the contractor implements the precautionary measures as suggested. Also, the Engineer - Incharge must conduct monitoring for the cultural property.

GUIDELINE-14: TREE CUTTING AND AFFORESTATION

This Guideline discusses the issue of tree cutting and afforestation. Loss of trees creates adverse environmental impacts. In order to mitigate there impacts, suitable measures have been suggested as part of this Guideline. These measures have been given for each of the stages of the road construction activities.

1. PROJECT PLANNING AND DESIGN STAGE

During alignment finalisation, due consideration shall be given to minimise the loss of existing tree cover, encroachment of forest areas / protected areas etc as specified in guideline on**,** "Site preparation". Tree felling, if unavoidable, shall be done only after compensatory plantation of at least three saplings for every tree cut is done.

The plantation/afforestation would be carried out by the forest department. It should be ensured that plantation is carried out only in areas where water can be made available during dry seasons and the plant can be protected during the initial stages of their growth. The species shall be identified giving due importance to local flora (suggested in **Table 14-1**). It is recommended to plant mixed species in case of both avenue or cluster plantation.

The plantation strategy shall suggest the planting of fruit bearing trees and other suitable trees. Development of cluster plantations will be encouraged in the community lands, at locations desired by the community. The choice of species will be based on the preferences of the community. The Engineer - Incharge shall oversee the plantation to check the following:

- Whether trees are obstructing live of right at junctions;
- Whether trees are at the inside of the junctions;
- Whether trees are within 5 mts of the proposed centerline.

2. POST-CONSTRUCTION STAGE

The maintenance of the saplings (including activities much as weeding, watering, planting of replacement saplings, etc application of manure etc) shall be the responsibility of the forest department. The Engineer – In-charge shall ensure the following:

- Shoulder of roads to be kept clear of weeds/undesirable undergrowth; and
- Branches of trees do not obstruct clear view of the informatory and cautions signs.

Table 14-1: Endemic Species of Tamil Nadu

Sl.no	Tree Species with Tamil Name	Sl.no	Tree Species with Tamil Name
1	Vembu *(Azadirachta Indica)*	9	Asvattam *(Ficus religiosa)*
2	Vagai (*Albizia lebbeck)*	10	Tirunamappalai *(Alstonia scholaris)*
3	Kovarakki *(Albizia procera)*	11	*Naru (Ailanthus excelsa)*
4	Konrai *(Cassia fistula)*	12	*Kaya (Kaya senegalensis)*
5	Nellikkai *(Emblica officinalis)*	13	*Vellai Kadambu (Anthocephalus cadamba)*
6	Puliyamaram *(Tamarindus indica)*	14	*Thothakathi (Dalbergia latifolia)*
7	Naval *(Syzygium cumini)*	15	*Kurangadi (Acrocarpus fraxinifolius)*
8	Veppamaram *(Melia Azadirachta)*	16	*Savukku maram (Casuarina Junghuhniana)*

GUIDELINE-15: FORESTS AND OTHER NATURAL HABITATS

1. INTRODUCTION

This guideline envisages measures to be undertaken during blacktopping / widening of road sections passing through natural habitats. These measures shall be undertaken in addition to the measures laid down in the other Guidelines.

Conservation of natural habitats is essential for long-term sustainable development. A precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development has been adopted for the project.

Natural Habitats means…
• National Park
• Reserve Forest
• Sanctuaries
• Notified Wetlands
• Fisheries and Aquatic Habitats

2. PROJECT PLANNING AND DESIGN

To minimize the adverse impact on the ecology of the natural habitats, selection of alignment should be as per guideline. An officer of at least the rank of a forest ranger shall be deputed for detailed inventory of ecological features along the road. The nature and type of impact on natural habitats due to road construction shall be identified. Magnitude of the impact to the extent feasible on the ecological features shall also be assessed.

Ecological Features…	Adverse Impacts…
• Area of natural habitat; • Type and number of endangered species of flora and fauna; • Stream and water bodies; • Breeding ground and seasons; • Migration season of bird species; and • Animal crossing.	• Diversion of forest land; • Cutting of trees; • Trampling of vegetation; • Contamination of water due to the usage of water from the source within the natural habitat; • Loss of breeding grounds; and • Interruption to animal crossings during the construction.

Impacts identified on the natural habitats shall be minimized to the extent required. Minimization shall be through precautionary measures or through appropriate mitigation measures. Following are the measures should be undertaken along the road passing through natural habitats:

- Constricting the road width to 6.0 m and embankment height to 0.5 m to minimize the extent of diversion of forest land and cutting of trees
- Drainage Structures shall be designed strictly in accordance with guideline on “Drainage”.
- Rumble strips shall be provided at every kilometer along the length of the natural habitat and invariably at the start and end of the natural habitat
- Signage (viz. speed limit, animal crossing, switch of headlight etc) shall be provided as per IRC: 67-2001 Code of Practice for road sign (first revision)

In addition to the above measures, specific impacts identified on site shall be mitigated as per the recommendation of the forest department / officer in charge of the identified natural habitat.

In case proposed alignment falls within the catchments of a water body or a stream, a flush causeway shall be constructed without impacting the drainage system. The length of the causeway shall be as per the existing water spread. The causeway shall be strictly in compliance with IRC:SP-20:2002. In no circumstances a water body within the natural habitat shall be cut across or filled for the purpose of laying the road.

3. PRE-CONSTRUCTION STAGE

No Construction Camps, Stockyards, Concrete Batching or Hot Mix Plants shall be located within the natural habitat or within 500m from its boundary.

Contractor in consultation with forest ranger or any other concerned authority shall prepare a schedule of construction within the natural habitat. Due consideration shall be given to the time of migration, time of crossing, breeding habits and any other special phenomena taking place in the area for the concerned flora or fauna.

4. CONSTRUCTION STAGE

Procurement of any kind of construction material (as quarry or borrow material) from within the natural habitat shall be strictly prohibited. No water resources within the natural habitat shall be tapped for road construction. Use of mechanized equipment shall be kept minimum within the natural habitat. Contractor must ensure that there will be no parking of vehicles machine and equipment within the natural habitat. Disposal of construction waste within the natural habitat shall be strictly prohibited and as far as possible reuse shall be undertaken as per **Table -1** type of waste of guideline, "Waste Management and Debris Disposal".

5. POST CONSTRUCTION STAGE

The road passing through the natural habitat shall be declared as a silence zone. Compensatory tree plantation within the available Right of Way shall be done in accordance with guideline, on "Tree Cutting and Afforestation". The Engineer - Incharge must ensure maintenance of drainage structure shall be undertaken as per guideline, "Drainage"

GUIDELINE-16: AIR AND NOISE POLLUTION

1. INTRODUCTION

This guideline deals with the mitigation of adverse impacts due to air and noise pollution. Both of these have been discussed in the subsequent sections respectively.

2. AIR POLLUTION

The types of air pollution due to construction activities might include generation of dust, emission from hot mix plants and batching plants, odour from construction labour camps, emission from construction machinery/vehicles etc. The measures for mitigation of impacts from each of these are given below.

Generation of Dust

- All vehicles delivering materials to the site shall be covered to avoid spillage of materials.
- The Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants up to the satisfaction of the Engineer in accordance with the relevant emission norms.
- All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles or their tyres.
- Spillage shall be cleared immediately by manual sweeping and removal of debris or if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed completely. Additionally, if so directed by the Engineer, the road surfaces shall be hosed or watered using necessary equipments.
- Plants, machinery and equipment shall be so handled (including dismantling) so as to minimize generation dust.
- All earthwork shall be protected in a manner acceptable to the Engineer to minimise generation of dust.
- The hot mix plant is sited at least 1000m from the nearest habitation. The hot mix plants shall be fitted with dust extraction units in order that the exhausts comply with the requirements of the relevant current emission control legislation.
- Generation of dust should be suppressed during unloading of construction material and also during storage of the construction material.

Emission from Hot-Mix Plants and Batching Plants

- Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible such plants will be located at least 1000m away from the nearest habitation.
- The exhaust gases shall comply with the requirements of the relevant current emission control legislation. All operations at plants shall be undertaken in accordance with all current rules and regulations protecting the environment.

Odour from Construction Labour Camps

- Construction labourers camp shall be located at least 500 m away from the nearest habitation.
- The waste disposal and sewerage system for the camp shall be properly designed, built and operated so that no odour is generated. Compliance with the Factory Act, the construction workers (regulation of employment and conditions of service) Act, 1996 and all other relevant legislation shall be strictly adhered to.

Emission from Construction Vehicles, Equipment and Machinery

- The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment and machinery used for construction shall conform to the relevant Indian Standard (IS) norms.
- All vehicles, equipment and machinery used for construction shall be regularly maintained to ensure that pollution emission levels\comply with the relevant requirements of SPCB & the

Engineer.

Pollution from Crusher

- All crushers used in construction shall confirm to relevant dust emissions control as legislated. Clearance for siting shall beobtained from the TNPCB. Alternatively, only crushers already licensed by the TNPCB shall be used.
- Dust screening vegetation will be planted on the edge of RoW for all existing roadside crushers.
- If crusher owned by contractor, the suspended particulate matter will be controlled by adopting dust suppression measures like water spraying. The monitoring is to be conducted at least twice a month for all the 12 months in a year during the crushing operation for the project.

3. NOISE POLLUTION

Noise from Vehicles, Plants and Equipment

- The plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the Gol noise standards.
- All vehicles and equipment used in construction shall be fitted with exhaust silences. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site.
- Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986.
- Maintenance of vehicles, equipment and machinery shall be regular and proper, to the satisfaction of the Engineer, to keep noise from these at a minimum.
- In construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, etc., will be stopped between 2200 hours to 0600 hours. In silence zone (areas up to 100 m around such premises as hospitals, educational institutional and courts) no hot-mix, batching or aggregate crushing plant will be allowed. No construction shall take place within 100m around hospitals between 21.00 hours to 06.00 hours.
- Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall wear earplugs.

Noise from Blasting (or) Pre splitting Operations.

- Blasting shall be carried out only with permission of the Engineer. All the statutory laws, regulators, rules, etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be strictly followed.
- Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer. The timing should be made known to all the people within 500m (200m for pre-splitting) from the blasting site in all directions. People, except those who actually light the fuse shall be excluded from the area of 200m (50m for pre-splitting) from the blasting site in all directions at least 10m minutes before the blasting.