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ABBREVIATIONS

2LGS	2 Lane Gravel shoulders
2LMR	2 Lane Minor Realignment
2LRR	2 Lane Rural Realignment
2LSS	2 Lane Sealed Shoulders
ACF	Assistant Conservator of Forest
ADE	Assistant Divisional Engineer
AE	Assistant Engineer
AIDS	Acquired Immuno Deficiency Syndrome
ASI	Archaeological Survey of India
CO	Carbon monoxide
CoI	Corridor of Impact
CPCB	Central Pollution Control Board
CRZ	Coastal Regulation Zone
DoE	Department of Environment
DoT&CP	Department of Town and Country Planning
EA	Environmental Assessment
ECR	East Coast Road
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPM	Enhanced Periodic Maintenance
ERMP	Environmental & Resettlement Management Plan for Maintenance for Maintenance Roads
GoTN	Government of Tamil Nadu
HC	Hydrocarbons
HD	Highways Department
INR	Indian National Rupees
IPC	Interim Payment Certificate
IRC	Indian Road Congress
IS	Indian Standards
MDR	Major District Roads
MoEF	Ministry of Environment and Forests
NAAQ	National Ambient Air Quality Standards
NH	National Highway
NOC	No-objection Certificates

NOx	Oxides of Nitrogen
ODR	Other District Roads
PAH	Project Affected Household
PAP	Project Affected People
PCC	Project Coordinating Consultants
PD	Project Director
PI	Performance Indicators
PIU	Project Implementation Unit
PUC	Pollution Under Control
PWD	Public Works Department
R&R	Resettlement and Rehabilitation
RAP	Resettlement Action Plan
RF	Reserve Forest
RoW	Right of Way
RPM	Respirable Particulate Matter
SEA	Sectoral Environmental Assessment
SEZ	Special Economic Zone
SH	State Highways
SO ₂	Sulphur dioxide
SOS	Strategic Options Study
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
STD	Sexually Transmitted Diseases
TDS	Total Dissolved Solids
TNPCB	Tamil Nadu Pollution Control Board
TNPWD	Tamil Nadu Public Works Department
WB	World Bank
WPR	Work participation Rate

CHAPTER - 1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Highways Department (HD), Government of Tamil Nadu (GoTN) is undertaking Tamil Nadu Road Sector Project (TNRSP) with World Bank (WB) loan assistance. The project involves upgradation of 743.4 km and maintenance of 2600 km of state roads. The upgradation component has been divided into four contract packages to be implemented in the first phase. These include the Northern corridor (TNRSP 01) 397.1km long¹ and the Eastern Corridor (TNRSP 02, TNRSP 03 and TNRSP 04) along the eastern coast for a length of 334.3 km. The 11.2km long Ramanathapuram bypass (TNRSP05) is likely to be implemented in subsequent phase of the project. A total of 14² bypasses totaling a length of 106.6 km have been planned as part of the upgradation component. The contract packages and proposed lengths along upgradation routes are presented in **Table 1.1**. Implementation of the improvements proposed is to be carried out in a single phase.

Table 1.1: Contract Packages along the Upgradation Routes

Contract Package	Corridors	Description	Length (km)
TNRSP 01	01 - E	Chidambaram bypass	16.9
	01 - E	Sirkazhi bypass	8.8
	01 - N	Arcot - Polur - Elavanasur	152
	01 - N	Polur - Chengam	45.1
	01 - S	Vridhachallam - Jayankondam - Thiruvarur	131.5
	01 - S	Jayankondam - Ariyalur	43.6
TNRSP 02	02	Nagapattinam- Kattumavadi	116.6
TNRSP 03	03	Kattumavadi -Ramanathapuram	99.8
TNRSP 04	04	Ramanathapuram - Tuticorin	117.9
TNRSP 05	05	Ramanathapuram Bypass	11.2
Total			743.4

This Environmental Management Plan (EMP) pertains to Contract Package TNRSP 01. The 397.9 km long contract package TNRSP 01, consists of the following road links and bypasses:

- Arcot – Arani – Polur – Tiruvannamalai – Tirukkivilur – Elavanasur
- Polur – Chengam
- Vridhachallam – Jayankondam – Kumbakonam – Thiruvarur
- Jayankondam – Ariyalur
- Bypasses at ten towns, namely Arani, Polur, Tiruvannamalai, Tirukkivilur, Vridhachallam, Ariyalur, Kumbakonam, Thiruvarur, Chidambaram, and Sirkazhi.

¹ TNRSP 01 is further sub divided into TNRSP 01 (E), TNRSP 01 (N) and TNRSP 01 (S).

² Environmental Assessment for Ramanathapuram Bypass shall be carried out in subsequent phase of the project.

1.2 ENVIRONMENTAL ASSESSMENTS IN THE PROJECT

To assist the GoTN in the project preparation, M/S. Kinhill Pty. Ltd were appointed as the Project Co-ordinating Consultants (PCC). The PCC were entrusted the mandate of prioritization of corridors for improvement and preparation of designs for the same. As part of the project preparation, EA/SA for the project have been prepared. A Sectoral Environmental Assessment (SEA) was conducted to analyze the wider environmental issues in the project. Subsequently Environmental Impact Statements (EIS) and Environmental Management Plans (EMP) were prepared for the individual upgradation corridors. To address the Resettlement and Rehabilitation (R&R) issues, a Resettlement Action Plan (RAP) was prepared by the PCC.

TNRSP has been classified as a Category “A” project due to its cumulative magnitude of environmental and social impacts. In accordance with the requirements of Category A projects of the World Bank, an Independent Review³ of the Environmental and Social assessments in the project has been conducted. This report addresses the gaps and deficiencies identified by the independent review. The EMP prepared is based on the outcome of consolidated EA Report.

1.2.1 TREATMENTS PROPOSED

The treatments proposed along the links and bypasses in TNRSP 01 are listed in **Table 1.2**. The cross-sections and description of each of these five treatment⁴ options are presented in **Appendix 1.1**. The proposed improvements will yield a 7 m wide undivided carriageway and hard / soft shoulders for slow-moving traffic. For each of the treatments three variations of the cross sections as rural, village and urban are considered. Accordingly, alternative cross-sections have been designed to fit the roadside conditions encountered. Treatments proposed for the corridors under different packages of TNRSP are indicated in **Figure 1.1**

Table 1.2: Treatments proposed along road links and bypasses

Sl. No.	Package	Section	Length in km	Treatment option
1	TNRSP 01 - E	Chidambaram Bypass	16.9	2LSS
2		Sirkazhi Bypass	8.8	2LSS
	Sub Total		25.7	
3	TNRSP 01 - N	Arcot - Arani	24.6	2LSS
4		Arani - Polur	20.6	2LRR
5		Polur - Tiruvannamalai	24.7	EPM
6		Chengam - Polur	45.1	2LRR
7		Tiruvannamalai - Tirukkivilur	27.9	2LSS
8		Tirukkivilur - Elavanasur	28.7	2LRR
9		Arani Bypass	5.3	2LSS
10		Polur Bypass	4.9	2LSS
11		Tiruvannamalai Bypass	10.9	2LSS
12		Tirukkivilur Bypass	4.4	2LSS
	Sub Total		197.1	
13	TNRSP 01 - S	Vridhachallam - Jayamkondam	30.4	2LRR
14		Jayamkondam - Ariyalur	43.6	2LMR
15		Jayamkondam - Kumbakonam	39.5	2LRR
16		Kumbakonam - Thiruvavarur	35.5	2LMR

³ M/S. LEA Associates South Asia Private Limited, New Delhi has been entrusted the task of independent review and consolidation of EA/SA.

⁴ Widening of the road to two lane and strengthening of carriageway on the existing alignment is involved in the first four treatments but only maintenance of the road shall be carried out in the EPM.

Sl. No.	Package	Section	Length in km	Treatment option
17		Vridhachallam Bypass	9.2	2LSS
18		Ariyalur Bypass	7.6	2LSS
19		Kumbakonam Bypass	8.8	2LRR
20		Thiruvavur Bypass	0.5	2LSS
	Sub Total		175.1	
	Total		397.9	

2LSS- 2 Lane Sealed Shoulders; 2LGS- 2 Lane Gravel Shoulders; 2LMR - 2 Lane Minor Realignment; 2LRR - 2 Lane Rural Realignment; EPM – Enhanced Periodic Maintenance

1.3 CLEARANCE REQUIREMENTS FOR THE PROJECT

The HD, GoTN has obtained all requisite environmental clearances (detailed in **Table 1.3**) for the project implementation. The HD has complied with the conditions laid down in these clearances and is committed to fulfilling the requirements during project implementation. The conditions of clearance by TNPCB and MoEF are given in **Appendix 1.2**.

Table 1.3 Statutory clearances obtained

S. No.	Statutory Authority	Statute under which Clearance is Required	Current status of Clearance
1	Ministry of Environment and Forests, Government of India	Environmental Impact Assessment Notification, 1994 issued under EP Act, 1986	6 th July 2000 (TNRSPO 02 – 04), 18 th September 2000 (TNRSPO 01)
2	Tamil Nadu Pollution Control Board	Water (P&CP) Act, 1974 & Air (P&CP) Act, 1981	Cleared, 15 th April 1999 for Eastern corridor and 12 th Nov 1999 for Northern corridors
3	Forest Department, Government of Tamil Nadu	Conservation of Forests Act, 1980	NOC obtained for progress of works on 11-08-2000. Permission for transfer of forestland – under process.

Apart from the clearances for overall project works, it is included in the contract documents that the contractors obtain required clearances from various agencies for operating his equipment and carrying out construction. The statutory requirements under which the contractor has to obtain clearances are listed in **Table 1.4**.

Table 1.4: Environmental clearances required during construction

Sl. No.	Construction Activity for which Clearance Required	Statutory Authority	Statute under which Clearance is Required
1	Hot mix plants, Crushers and batching plants	Tamil Nadu State Pollution control board	Air (P&CP) Act, 1981
2	Discharge from construction activities	Tamil Nadu State Pollution Control Board	Water (P&CP) Act, 1974
3	Storage, handling and transport of hazardous materials	Tamil Nadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules, 1989. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989.
4	Sand Mining, quarries and borrow areas	Department of Geology and Mining, Govt. of Tamil Nadu	Tamil Nadu Minor Mineral Concession Rules, 1959 [Corrected upto 31.3.2001]
5	Ground water extraction	Public Works Department (Ground Water)	Tamil Nadu Ground Water Development And Management Act 2000
6	Disposal of bituminous wastes	Tamil Nadu State Pollution Control Board	Hazardous Wastes (Management and Handling) Rules, 1989

Fig 1.1 Corridors for Upgradation in TNRSP

CHAPTER - 2 BASELINE AND IMPACTS SUMMARY

2.1 PHYSICAL RESOURCES

Package TNRSP 01 passes through predominantly plain terrain and no substantial cut-and-fill operations are planned. Hence, the overall impact on the physiography of the area will be limited.

The borrow material will be collected from roadside ponds and tanks apart from designated borrow areas. Borrowing is to be carried out in accordance to the guidelines laid out in IRC-10-1961 and redevelopment of borrow areas will be carried out as a part of project implementation.

Existing quarries, with the requisite environmental clearances and redevelopment plans, will be used for the project and no new quarries have been proposed. The route traverses through Low Damage Risk Zone (seismic zone II) as defined by the vulnerability zoning system.

Soils along the package comprises of four main types: Red Sandy, Reddish Brown Loam, Black Cotton, Recent Sandy and Immature. No leachate or pollutants were identified in the soils along the package.

2.2 WATER RESOURCES

2.2.1 SURFACE WATER RESOURCES

The impacts on ponds and other surface water bodies have been minimized by suitable design modifications. However, a total of 41 ponds (includes ponds along the widening sections and ponds cut across by the bypass alignments) along TNRSP 01 are directly impacted due to the project. At locations where impact has been unavoidable, the loss due to the project has been compensated for. Water bodies, which need to be filled up to accommodate the widened formation, will have a reduced storage capacity. Mitigation measures have been worked out to prevent pollution from the construction activities onto these water bodies. Also, enhancement designs have been contemplated for various pond locations that offer scope for environmental enhancements.

There are 10 major bridges to be constructed along the project corridor, out of which 8 will be along the bypasses. Construction along the watercourses is to be carried out in the lean flow periods. As the rivers are seasonal, the construction activities will not necessitate any major diversion of the waterways.

The design stage has taken care of the drainage across the section as part of good engineering practice. The provision of adequately sized cross drainage structures will improve drainage in the vicinity of the road. The degradation of water quality can occur during construction stage from increased sediment load into watercourses near the construction site. This may be aggravated by removal of trees and consequent increase in soil erosion.

The increase in paved impervious surface is likely to cause increased surface runoff (estimated as 1.4 million cu. m) along the roadsides. However the proposed up-gradation has been designed with table drains to take care of runoff and surface runoff will be drained to the nearest cross drainage structure. The engineering design includes design of cross drainage structures, which shall take care of the extra flow.

2.2.2 GROUND WATER RESOURCES

A number of groundwater sources-wells and hand pumps are located within the CoI of the proposed upgradation. Implementation of TNRSP 01 will affect 153 hand pumps and 10 wells.

The project envisages replacement of each source of water supply prior to relocation, in consultation with the community. Similarly, owners of private wells impacted by the project

will be adequately compensated. Therefore, eventual impact of the proposed widening may only be marginal.

Ground Water Board, PWD, GoTN has categorized blocks based on ground water extraction as over exploited and dark (85-100 %), grey (65-85 %) and white (<65%). Ground water extraction from over exploited, dark and grey blocks for construction activities will be prohibited to ensure that no adverse impacts on the ground water quality occurs due to the project.

2.3 AIR QUALITY

Air quality monitoring along Package TNRSP 01 revealed that all monitored pollutant concentrations were found to be well within the 24-hourly NAAQ Standard for Residential, Rural and other areas.

Impacts on air quality during construction stage are due to operation of construction yards, material transport on trucks and fugitive emissions from the construction sites. Measures required for avoiding the air quality impacts are presented in the Table 3.1, Environmental Management Plan.

2.4 NOISE LEVELS

While comparing with MoEF Ambient Noise Standards for different categories, Leq noise levels at Arani Bypass [60.1 dB(A) during day time & 51.9 dB(A) during night time] and at Jayankondam Intersection [66.8 dB(A) during day time⁵] were found to be exceeding their respective limits. At other monitoring locations, the noise levels were found to be within the permissible limits.

As the construction yards are proposed to be located at least 1000m down wind of habitations, no significant impact due to construction noise is expected. Construction workers will be provided with protection equipment to guard against the noise impacts.

To assess impacts of the increased traffic on the noise levels during the operation stage at various locations along the package, noise levels were predicted using the FHWA Transport Noise Model. Predictions were made at distances of 5m, 9m and 13 m from the centre line of the road at each of the locations for the year 2017. The results show that predicted noise levels (Leq day and night values) exceed the limits stipulated by MoEF for residential and sensitive areas. The day and night time predicted equivalent noise levels were found to vary from 64.03 - 72.79 dB(A) and 62.14 - 70.86 dB(A) respectively along the package. Accordingly the sensitive receptors have been identified (20 Nos.) and double-glazing of their openings have been proposed. The list of such sensitive receptors is presented in **Appendix 3.10**.

2.5 BIOLOGICAL ENVIRONMENT

Natural habitats relevant to TNRSP 01 along with the impact anticipated due to the proposed upgradation and all the mitigation /enhancement measures pertaining to them have been presented in a separate Appendix titled "Natural Habitat Management Plan" (**Appendix 3.5**). Relevant sections of the Appendix are presented in this section.

2.5.1 FLORA

Package TNRSP 01 runs along/ is in close proximity to 8 Reserved Forest areas. They are Kelur RF (Arani Polur Road), Parvathamalai RF and Mundanai RF (Polur Chengam Road), Attipakkam RF and Thippakkadu RF (Tiruvannamalai Tirukkivilur Road), Nattamur RF (Tirukkivilur Elavanasur Road), Siluvaicheri RF (Vridhachallam Jayankondam Road) and

⁵ Night time noise levels at Jayankondam intersection is below standards

Periavalayam RF (Jayamkondam Kumbakonam Road). A very minor portion of forestland is being sought for implementation of the project. It includes 2.9 Ha. in Kelur Forest Range and 0.3 Ha. in Mundanai Forest Range.

The designs have been suitably worked out to minimise impacts on roadside trees. To minimise felling of trees, only trees within 1.5 m from the edge of the proposed shoulder will be cut. The number of roadside trees likely to be felled along TNRSP 01 is estimated to be 4476. Compensatory tree plantation will be carried out in accordance with the landscaping strategy presented in **Appendix 3.12**.

2.5.2 FAUNA

At three locations within the Reserve Forests along TNRSP 01, animals are reported to cross the road mostly in search of water and for forage in some cases. The crossings include Spotted Deer crossings at Mundanai RF (Km 40.0 - 41.0) and Nattamur RF (Km 17.0 -19.0); Monkey and Spotted Deer crossing at Parvathamalai RF (Km 22.0 - 23.0); Monkey crossing is also reported at Peria odai (social forestry area along Vridhachallam Jayamkondam road between Km 4.2 - 5.0). Mitigation measures to prevent vehicle-wildlife collision are presented in **Table 3.1**.

2.6 SOCIO ECONOMIC ENVIRONMENT

2.6.1 RESETTLEMENT AND REHABILITATION

The road design has minimized the number of Project Affected People by reducing the CoI and designing deviations and bypasses around areas of high social impact. The project envisages acquisition/transfer of 358.47 Ha. of land for TNRSP 01 of which 174.46 Ha. is in category of private wet agricultural land. The total number of structures affected is 2529.

2.6.2 CULTURAL PROPERTIES

The corridor passes near many sites of religious, historical, and/or cultural significance. Gangaikondacholapuram is a place of archaeological importance along the Jayamkondam to Kumbakonam stretch. The monument is protected by the Archaeological Survey of India.

The cultural properties relevant to TNRSP 01 along with the impact anticipated due to the proposed upgradation and all the mitigation /enhancement measures pertaining to them have been presented in a separate Appendix titled "Cultural Properties Management Plan" (**Appendix 3.11**).

Some of the corridors are close to few sacred groves. In most cases a temple/shrine is the central feature surrounded by a number of trees. The trees at some places are very old and also considered sacred by the local people. In other cases, ponds/tanks are found in close vicinity of the grove. The Sadakatti sacred grove (Km 11.0-12.0) along Tiruvannamalai Tirukkivilur road will get partially affected due to the proposed road upgrade.

CHAPTER - 3 MITIGATION MEASURES

A description of the various management measures during various stages of the project is provided in the **Table 3.1**. Additional management measures have been suggested through modification of MoRTH Clause 111 and are presented in **Appendix 3.15**.

3.1 PRE-CONSTRUCTION STAGE

3.1.1 PRE-CONSTRUCTION ACTIVITIES BY PIU

Prior to the contractor mobilization, the PIU will ensure that an encumbrance free CoI is handed over to enable the start of construction. The RoW clearance involves the following activities:

- Acquisition of land and structures (including 3.2 ha of forest land),
- Clearance of the RoW including removal of trees, and
- Relocation of common property resources impacted, including cultural properties as temples and community assets as hand pumps and other utilities.
- Formal arrangements for maintenance of enhancement sites

3.1.2 PRE-CONSTRUCTION ACTIVITIES BY CONTRACTOR/ENGINEER

The pre-construction stage involves mobilisation of the contractor, the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:

- Joint field verification of EMP by the Engineer and Contractor
- Modification (if any) of the contract documents by the Engineer.
- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.
- Identification and selection of material sources (quarry and borrow material, water, sand etc).
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc
- Planning traffic diversions and detours, including arrangements for temporary land acquisition.

3.2 CONSTRUCTION STAGE

3.2.1 CONSTRUCTION STAGE ACTIVITIES BY CONTRACTOR

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental impacts. Activities that trigger the need for environmental measures to be followed include:

- Imbibing environmental principles at all stages of construction as good engineering practices.
- Implementation of site-specific mitigation/management measures suggested

- Monitoring the quality of environment along the construction sites (as air, noise, water, soil) and
- Enhancement designs at specific locations suggested.

There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which has been accounted for in the Engineering Costs. They include improvement of roadside drainage, provision of additional cross drainage structures or raising of road height in flood prone stretches, provision of cattle crossings and reconstruction and improvement of bunds of the affected water bodies.

3.2.2 CONSTRUCTION STAGE ACTIVITIES BY PIU

The construction stage involves the following activities by PIU:

- Tree plantation along upgradation corridors and bypasses and landscaping along junctions by the Forest Wing of the PIU.
- Monitoring of environmental conditions through approved monitoring agency

3.3 OPERATION STAGE

Operation stage activities are to be carried out by the Environmental Cell. The activities involved are as follows;

- Monitoring of operational performance of the various mitigation/enhancement measures carried out as a part of TNRSP

3.4 OTHER ACTIVITIES

- Orientation of Implementation agency staff towards project specific issues of EMP implementation
- Conducting additional studies for issues identified during any stage of project preparation/implementation

Table 3.1: Environmental Management Measures

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
1.0	PRE-CONSTRUCTION STAGE				
1.1	<i>Pre construction activities by PIU</i>				
1.1.1	Land Acquisition, R&R	The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement Framework for the project. It will be ensured that all R&R activities are to be completed before the construction activity starts, on any sub-section of project roads. It will be ensured by the PIU that the resettlement sites required for the sections to be taken up for construction in the first year are to be completed prior to the contractor mobilization at site. The PIU will identify suitable locations for resettlement sites in consultation with the PAPs to be relocated. Resettlement sites will be in line with the requirements of generic EMP for resettlement sites.	Corridor of Impact.	LA Act 1894, LA (Amendment) Act 1984, LA (Tamil Nadu Amended 1996) Act R&R policy, TNRSP EMP for Resettlement Sites	R & R Budget
1.1.2	Tree Cutting	Trees will be removed from the Corridor of Impact and construction sites before commencement of Construction with prior intimation to the Forest Department. Prior Permission will be obtained from the District Collector. As part of TNRSP 01, 4476 trees will be removed. The trees cut will be disposed off through auction (inclusive of tree stumps). This disposal will be done immediately to ensure that the traffic movement is not disrupted. Progress of Tree cutting shall be reported to the ACF by foresters as per format EM4, Appendix 5.1	Corridor of Impact.	Design MoRTH 201.6 Appendix 5.1	
1.1.3	Diversion of Forest Land	3.2 ha. of forest land will be acquired for TNRSP 01. The PIU will make arrangements for compensatory afforestation as per the provisions of the Forest Conservation Act.	2.9 ha. in Kelur Reserve Forest along Arani Polur and 0.3 ha. in Mudanai RF along Polur Chengam.	Forest Conservation Act. 1980	A 5.0
1.1.4	Utility Relocation	All utilities lost due to the project will be relocated with prior approval of the concerned agencies before construction starts, on any sub-section of the project road.	Corridor of Impact.	Design MoRTH 110.7	C 11.0
1.1.5	Relocation of Cultural Properties	All cultural properties within the CoI, whose structure is getting affected, will be relocated at suitable locations, as desired by the community before construction starts. Local community meetings (facilitated by NGOs entrusted with the responsibility of R&R implementation) will be held to discuss relocation aspects, siting of structures etc.	Corridor of Impact.	RAP and Design	D 1.0
1.1.6	Formal Arrangements for	The modalities for maintenance of enhancement sites during the post construction stage will be worked out by the PIU in consonance with the communities during the detailed	At all locations proposed for enhancement		

⁶ MoRTH Clause 111.1 with modifications mentioned in Appendix 3.15 shall be applicable for all the EMP Clauses

⁷ EMP/RAP budget items are indicated with suffix A, B, C or D indicating section of the budget followed by the item number, as presented in Table 7.1. Items covered under the BoQ are indicated with the relevant item number

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
	Maintenance of Enhancement Sites during the Post construction Stage	community consultations that are to be carried out for relocating the affected cultural properties.			
1.1.7	Replacement of Common Property Resources	All common property resources such as community sources of water will be replaced. The relocation site identification will be in accordance with the choice of the community. The replacement will be complete before construction starts	Corridor of Impact.	RAP	D 2.0 to D 4.0
1.1.8	Improvement Measures within forests				
1.1.8.1	Provision of Water Source within the Reserve Forest	Deep tube wells will be dug within such forest areas. Water will be pumped from these tube wells with a motor powered by photo voltaic cell. The water will drain into ponds of size 1m x 10m x 0.3m with cement concrete sealing (to prevent percolation losses). Progress of Construction of these structures shall be reported as per format EM5, Appendix 5.1	(i) Inside Parvathamalai RF (Km 22 – 23) along Polur Chengam Road (ii) Inside Mundanai RF (Km 40 – 41) along Polur Chengam Road (iii) Inside Nattamur RF (Km 17 – 19) along Tirukkivilur Elavanasur	Appendix 3.5 Appendix 5.1	B 1.3
1.1.8.2	Plantation of fruit bearing trees and tender shoots	The selection of the species to be planted is to be finalized in consultation with the local forest officials. Progress of Plantation shall be reported as per Format EM5, Appendix 5.1	(i) Inside Parvathamalai RF (Km 22 – 23) along Polur Chengam Road (ii) Inside Peria Odai Social Forestry area (Km 4.2 – 5) along Vridhachallam Jayankondam Road	Appendix 3.5 Appendix 5.1	B 2.3
1.2	<i>Pre construction activities by the Contractor/Engineer of SC</i>				
1.2.1	Field Verification and Modification of the Contract Documents	.			
1.2.1.1	Joint Field Verification	The Engineer and the Contractor will carry out joint field verification of the EMP. The efficacy of the mitigation/enhancement measures suggested in the EMP will be checked. Design changes recommended as part of the independent review shall be included in the designs by the Engineer. The recommended design changes are presented in Appendix 1.3	All locations along the package where mitigation/enhancement/monitoring measures are proposed	EMP	
1.2.1.2	Modification of	If required, the Engineer will modify the EMP and Contract documents (particularly the	All locations along the	EMP	

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
	the Contract Documents	BOQs)	package where changes in mitigation/enhancement/monitoring measures are felt necessary		
1.2.2	Procurement of Machinery				
1.2.2.1	Crushers, Hot-mix Plants & Batching Plants	Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations.		Contract, MoRTH: 111.1, GoI Air & Noise Standards, OSHA Standards	
1.2.2.2	Other Construction Vehicles, Equipment and Machinery	The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. All vehicles, equipment and machinery to be procured for construction will conform to the relevant Bureau of Indian Standard (BIS) norms. Noise limits for construction equipments to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one metre from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.		Contract, Environment Protection Act, 1986 & MoRTH: 111.1	
1.2.3	Identification & Selection of Material Sources				
1.2.3.1	Borrow Areas	Arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. Siting of borrow areas to be as per the Guidelines presented in Appendix 3.1 The contractor will not use any of the locations described here for borrowing (within and upto 1000m either side of Reserve Forest/ Ecologically sensitive areas). Locations identified by the contractor shall be reported to the Engineer and Engineer shall in turn report to the PIU as per the Table 5.1. Format for reporting shall be as per Form EM3, Appendix 5.1	At all borrow area locations suggested for the project. RF/Ecologically Sensitive area (i) Km 17.6-18.0 & Km 148.6-146.4 (Arani Polur) (ii) Km 21-24 & Km 38-40 (Polur Chengam) (iii) Km 85.6-83.8 & Km 102-103 (Tiruvannamalai Tirukkivilur) (iv) Km 17-19 (Tirukkivilur Elavanasur) (v) Km 17-16.4 (Vridhachallam Jayamkondam) (vi) Km 95-96.5 & Km 100-102 (Jayamkondam)	MoRTH: 305.2.2.2 Appendix 3.1 Appendix 5.1 Appendix 3.15, Sub clause 111.2	305.9 (ii) – (iv)

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		<p>Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads should be routed to avoid agricultural areas.</p> <p>In addition to testing for the quality of borrow materials by the SC, the environmental personnel of the SC will be required to inspect every borrow area location prior to approval. The criteria for evaluation of borrow areas is presented in Appendix 3.2</p>	Kumbakonam	Appendix 3.2	
1.2.3.2	Quarries	<p>The Contractor will identify materials from existing licensed quarries with the suitable materials for construction.</p> <p>Apart from approval of the quality of the quarry materials, the Engineer's representative will verify the legal status of the quarry operation, as to whether approval under Tamil Nadu Minor Mineral Concession Rules, 1959 [Corrected upto 31.3.2001] is obtained. Excerpts from the Act has been presented as Appendix 3.3</p> <p>Contractor will not select any quarries within locations specified under Section 1.2.3.1. Some of the locations identified during project preparation is presented in Appendix 3.14</p>	All quarries recommended to be used in the project	MoRTH: 111.3 Appendix 3.3 Section 1.2.3.1 Appendix 3.14	
1.2.3.3	Water	<p>The contractor will source the requirement of water preferentially from surface water bodies, as rivers and tanks in the project area. The contractor will be allowed to pump only from the surface Water bodies. Boring of any tube wells will be prohibited. To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations. The contractor shall consult the local people before finalizing the locations.</p> <p>Only at locations where surface water sources are not available, the contractor can contemplate extraction of ground water. Consent from the Engineer that no surface water resource is available in the immediate area for the project is a pre-requisite prior to extraction of ground water. The contractor will need to comply with the requirements of the state Ground water department and seek their approval for doing so.</p> <p>Ground Water Board, PWD, GoTN has categorized blocks based on ground water extraction as over exploited and dark (85-100 %) and grey (65-85%). The contractor will not be allowed to extract any ground water from such over exploited dark blocks and grey blocks.</p>	<p>All rivers / surface water bodies that can be used in the project</p> <p>OVEREXPLOITED & DARK BLOCKS:</p> <p>(i) Vellore: Vaniyambadi, K.V. Kuppam, Madunur, Tirupattur, Anaicut, Vellore</p> <p>(ii) Tiruvannamalai: Chengam</p> <p>(iii) Villupuram: Kolianur, Tiruvannainallur, Kandanangalam, Vikravandi, Ulunderpettai, Tirunavallur, Gingee, Vallam</p> <p>(iv) Cuddalore: Nellikuppam, Keerapalayam</p> <p>(v) Thanjavur: Papanasam, Kumbakonam, Thiruvidadamaruthur, Thirupanendal, Thiruvaiyar</p> <p>(vi) Thiruvarur: Needamangalam, Nannilam, Koradachery</p> <p>(vii) Perambalur: Nil</p> <p>GREY BLOCKS</p> <p>(i) Vellore: Katpadi, Gudiyattam, Natrampalli, Kandili, Timiri, Kaveripakkam, Jolarpet, Alaryagam, Arcot, Nemili</p> <p>(ii) Tiruvannamalai:</p>	Contract	

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/BoQ Item No. ⁷
			Anakavoor, Cheyyar, Kilpennathur, Tandarampattu, Thuringapuram, Vembakkam, Vandavasi, Arni(E). (iii) Villupuram: Melmalayanoor, Marakanam, Tindivanam, Mailam (iv) Cuddalore: Panruti (v) Thanjavur : Nil (vi) Thiruvapur: Nil (vii) Perambalur: Perambalur, Ariyalur, Vepanthattai		
1.2.3.4	Sand	The contractor will identify sand quarries with requisite approvals for the extraction of sand under Tamil Nadu Minor Mineral Concession Rules, 1959 [Corrected upto 31.3.2001] for use in the project	All riverbeds recommended for sand extraction for the project.		
1.2.4	Labour Requirements	The contractor will use unskilled labour drawn from local communities to avoid any additional stress on the existing facilities (medical services, power, water supply, etc.)	Along project corridor at construction sites	Contract	
1.2.5	Setting up construction sites				
1.2.5.1	Construction Camp Locations – Selection, Design & Layout	Siting of construction camps is to be as per the guidelines presented in Appendix 3.4 of EMP. Locations identified by the contractor shall be reported as per format EM2, Appendix 5.1 Construction camps will not be proposed: (i) Within 1000m of locations as described in Section 1.2.3.1 (Reserve Forest /Ecologically sensitive areas). (ii) Within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. Layout of construction camps will be as per the conceptual design presented in Drawing 3.4.1 of Appendix 3.4 Locations for stockyards for construction materials will be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odour is generated. Unless otherwise arranged by the local sanitary authority, arrangements for disposal of excreta suitably approved by the local medical health or municipal authorities or as directed by Engineer will need to be provided by the contractor.	All Construction Workers Camps including areas in immediate vicinity.	Contract Appendix 3.4 Section 1.2.3.1 Appendix 5.1	
1.2.5.2	Hot Mix Plants & Batching Plant Location	Hot mix plants and batching plants will be sited sufficiently away from habitation, agricultural operations or industrial establishments. Such plants will be located at least 1000m away from the nearest habitation, preferably in the downwind direction.		Contract Appendix 3.15, Sub clause 111.5	
1.2.6	Arrangements for Temporary Land	The contractor as per prevalent rules will carry out negotiations with the land owners for obtaining their consent for temporary use of lands for construction sites/ hot mix	Areas temporarily acquired for construction		

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
	Requirement	plants /traffic detours /borrow areas etc. The Engineer will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.	sites/ hot mix plants / borrow areas / diversions/ detours.		
2.0	CONSTRUCTION STAGE				
2.1	<i>Construction Stage Activities by Contractor</i>				
2.1.1	Site Clearance				
2.1.1.1	Clearing and Grubbing	Vegetation will be removed from the CoI before the commencement of Construction. All works will be carried out 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 will be removed with prior approval from the Engineer. The contractor, under any circumstances will not damage trees (in addition to those already felled with prior permission from the forest department). Vegetation only with girth of over 30 cm will be considered as trees and shall be removed as per Activity 1.1.2.	Corridor of Impact	Design MoRTH 201 Appendix 3.15, Sub clause 111.15.1, Sub clause 111.15.4	201.6. (i)
2.1.1.2	Dismantling of Bridgework / Culverts	The culverts will be dismantled carefully and the resulting materials so removed as not to cause damage to the part of the structure retained and other properties and structures nearby. All necessary measures will be taken especially while working close to cross drainage channels to prevent earthwork, stonework, materials and appendage as well as the method of operation from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems.	At locations where bridge works and culverts are proposed.	MoRTH 202.2	202.6
2.1.1.3	Generation of Debris from dismantling of pavement structures	Debris generated due to the dismantling of the existing pavement structure shall be suitably reused in the proposed construction, subject to the suitability of the material and the approval of the Engineer Unutilized debris material shall be suitably disposed off by the contractor, either through filling up of borrow areas created for the project or at pre-designated dump locations, subject to the approval of the Engineer. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. Dumping sites shall be identified by the contractor as per guidelines provided in Appendix 3.6 . The identified locations will be reported to the Engineer as per format EM1, Appendix 5.1	Throughout Project Corridor	MoRTH 202.5 MoRTH 517 Appendix 3.6 Appendix 5.1	202.7
2.1.1.4	Non-bituminous construction wastes disposal	Location of disposal sites will be finalized prior to completion of the earthworks on any particular section of the road. The Engineer shall approve these disposal sites conforming to the following (a) These are not located within designated forest areas as indicated in Section 1.2.3.1 (b) The dumping does not impact natural drainage courses (c) No endangered/rare flora is impacted by such dumping. (d) Settlements are located at least 1.0km away from the site. Guidelines for siting of disposal sites are presented in Appendix 3.6 .	Dump site locations	Contract MoRTH: 201.4 & 202.5 Section 1.2.3.1	202.7

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
				Appendix 3.6	
2.1.1.5	Bituminous wastes disposal	The disposal of residual bituminous wastes will be done by the contractor at secure land fill sites, with the requisite approvals for the same from the concerned government agencies.	Throughout Project Corridor	Contract & Appendix 3.6 MoRTH: 201.4	
2.1.2	Planning Traffic Diversions & Detours	<p>Temporary diversions will be constructed with the approval of the Engineer.</p> <p>Detailed Traffic Control Plans will be prepared and submitted to the Engineer for approval, 5 days prior to commencement of works on any section of road. The traffic control plans shall contain details of temporary diversions, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, safety measures for transport of hazardous material and arrangement of flagmen.</p> <p>Environmental personnel of the Engineer will assess the environmental impacts associated as the loss of vegetation, productive lands and the arrangement for temporary diversion of the land prior to the finalisation of diversions and detours.</p> <p>Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night.</p> <p>The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He shall inform local community of changes to traffic routes, conditions and pedestrian access arrangements.</p> <p>The temporary traffic detours will be kept free of dust by frequent application of water.</p>	All along the Project Corridor.	MoRTH: 112.1 MoRTH: 112.4 MoRTH:112.2 MoRTH: 112.5	112.6
2.1.3	Procurement of Construction Materials				
2.1.3.1	Borrow Areas	<p>No borrow area will be opened without permission of the Engineer</p> <p>Borrow pits will not be dug continuously in a stretch. The location, shape and size of the designated borrow areas will be as approved by the Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961)</p> <p>The borrowing operations will be carried out as specified in the guidelines for siting and operation of borrow areas (Appendix 3.1)</p> <p>The unpaved surfaces used for the haulage of borrow materials will be maintained dust free by the contractor. Since dust raising is the only impact along the haul roads sprinkling of water will be carried out twice a day along such roads during their period of use.</p>	All along the project corridor, all access roads, sites temporarily acquired & all borrow areas	MoRTH: 305.2.2.2 IRC 10 1961 Appendix 3.1 Appendix 3.15, Sub Clause 111.2, Sub clause 111.15.2	305.9 (ii) – (iv)
2.1.3.2	Stripping, stocking and preservation of top soil	The topsoil from borrow areas, areas of cutting and areas to be permanently covered will be stripped to a specified depth of 150mm and stored in stockpiles. At least 10% of the temporarily acquired area will be earmarked for storing topsoil.	Throughout Project Corridor, where productive land is	MoRTH: 301.3.2 & MoRTH: 305.3.3 MoRTH: 301.7 &	305.3 (i)

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		<p>The stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is to be restricted to 2m. Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles will be covered with gunny bags or tarpaulin. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.</p> <p>Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes. The management of topsoil shall be reported regularly to the Engineer as per format EM8, Appendix 5.1</p>	acquired.	MoRTH: 305.3.9 Appendix 5.1	
2.1.3.3	Quarries	The quarry operations will be undertaken within the rules and regulations in force.	All along the project corridor and all haul roads	Tamil Nadu Minor Mineral Concession Rules, 1959 [Corrected upto 31.3.2001]. Appendix 3.15, Sub Clause 111.3	
2.1.3.4	Blasting	<p>Except as may be provided in the contract or ordered or authorized by the Engineer, the Contractor will not use explosives.</p> <p>Where the use of explosives is so provided or ordered or authorized, the Contractor will comply with the requirements of the following Sub-Clauses of MoRTH 302 besides the law of the land as applicable.</p> <p>The Contractor will at all times take every possible precaution and will comply with appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives. The contractor will at all times when engaged in blasting operations, post sufficient warning flagmen, to the full satisfaction of the Engineer.</p> <p>The Contractor will at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government Authorities, public bodies and private parties whomsoever concerned or affected or likely to be concerned or affected by blasting operations.</p> <p>Blasting will be carried out only with permission of the Engineer. All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives will be strictly followed.</p> <p>Blasting will be carried out during fixed hours (preferably during mid-day) or as permitted by the Engineer. The timing should be made known to all the people within 1000m (200m for pre-splitting) from the blasting site in all directions.</p>	All blasting and Pre-splitting Sites.	MoRTH: 302.4	301.9 (i) 304.5
2.1.3.5	Transporting Construction Materials	<p>All vehicles delivering materials to the site will be covered to avoid spillage of materials.</p> <p>All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or suppliers of materials and similarly roads which are part of the works will be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles</p>	All along the Project corridor and all haul roads	MoRTH: 111.9	

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		The unloading of materials at construction sites close to settlements will be restricted to daytime only.			
2.1.3.6	Water Extraction	Procurement of water is to be carried out as per Section 1.2.3.3 The contractor will minimize wastage of water during construction.	All water bodies recommended to be used in the project	Section 1.2.3.3	
2.1.4	Infrastructure provisions at construction camps	<p>The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the resident Engineer.</p> <p>There shall be provided within the precincts of every workplace, latrines and urinals in an accessible place, and the accommodation, separately for each for these, as per standards set by the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Except in workplaces provided with water-flushed latrines connected with a water borne sewage system, all latrines shall be provided with dry-earth system (receptacles) which shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year. If women are employed, separate latrines and urinals, screened from those for men (and marked in the vernacular) shall provided. There shall be adequate supply of water, close to latrines and urinals.</p> <p>All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. The sewage system for the camp must be designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp, shall be regularly emptied and the garbage disposed off in a hygienic manner. Construction camps are to be sited at least 1000m away from the nearest habitation and adequate health care is to be provided for the work force.</p> <p>Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta by putting a layer of night soils at the bottom of a permanent tank prepared for the purpose shall be taken up by the contractor. It should be covered with 15 cm layer of waste or refuse and then with a layer of earth for a fortnight (by then it will turn into manure).</p>	Construction camps	Contract	
2.1.5	Operation of construction equipments and vehicles	<p>All vehicles and equipment used for construction will be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers will be checked and if found to be defective will be replaced. Noise limits for construction equipment used in this project (measured at one metre from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986</p> <p>Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of noise emission.</p>	All construction equipments and vehicles	Environment (Protection) Rules, 1986 Monitoring Plan Table 5.1 & Table 5.2	

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		<p>The contractor will ensure that the AAQ concentrations at these construction sites are within the acceptable limits of industrial uses in case of hot mix plants and crushers and residential uses around construction camps.</p> <p>Dust screening vegetation will be planted on the edge of the RoW for screening dust crusher.</p> <p>Monitoring of the exhaust gases and noise levels will be carried out by the agency identified for Environmental Monitoring for the project.</p>			
2.1.6	Material Handling at Site	<p>All workers employed on mixing asphaltic material, cement, lime mortars, concrete etc., will be provided with protective footwear and protective goggles.</p> <p>Workers, who are engaged in welding works, would be provided with welder's protective eye-shields.</p> <p>Workers, engaged in stone breaking activities will be provided with protective goggles and clothing and will be seated at sufficiently safe intervals.</p> <p>The specifications for the safety appliances to be used is presented in Appendix 3.7</p> <p>The use of any herbicide or other toxic chemical will be strictly in accordance with the manufacturer's instructions. The Engineer will be given at least 6 working days notice of the proposed use of any herbicide or toxic chemical. A register of all herbicides and other toxic chemicals delivered to the site will be kept and maintained up to date by the Contractor. The register will include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product.</p> <p>No man below the age of 14 years and no woman will be employed on the work of painting with products containing lead in any form. No paint containing lead or lead products will be used except in the form of paste or readymade paint. Face masks will be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.</p>	All construction sites	<p>MoRTH: 111.6 MoRTH: 105</p> <p>Appendix 3.15, Sub clause 111.4, Sub clause 111.15.3</p> <p>Appendix 3.7</p>	
2.1.7	Precautionary/Safety Measures During Construction	<p>All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996 will be adhered to.</p> <p>Adequate safety measures for workers during handling of materials at site (Section 2.1.6) will be taken up.</p> <p>The contractor has to comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress.</p>	All construction sites	<p>Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996</p> <p>Section 2.1.6 MoRTH 105 Appendix 3.15, Sub clause 111.11</p>	C 16.0
2.1.8	Protection of Religious Structures and	<p>All necessary and adequate care shall be taken to minimize impact on cultural properties (which includes cultural sites and remains, places of worship including temples, mosques, churches and shrines, etc., graveyards, monuments and any other important</p>	All construction sites	Appendix 3.15, Sub clause 111.15.9	

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
	Shrines	structures as identified during design and all properties/sites/remains notified under the Ancient Sites and Remains Act). No work shall spillover to these properties, premises and precincts. Access to such properties from the road shall be maintained clear and clean.			
2.1.9	Chance found Archaeological property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing. He shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped. The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.	All construction sites		
2.1.10	Earthworks				
2.1.10.1	Excavations	All excavations will be done in such a manner that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand. The excavations shall conform to the lines, grades, side slopes and levels shown in the drawings or as directed by the engineer. While planning or executing excavation the contractor shall take all adequate precautions against soil erosion, water pollution etc (clause 306) and take appropriate drainage measures to keep the site free of water (clause 311), through use of mulches, grasses, slope drains and other devices. The contractor shall take adequate protective measures to see that excavation operations do not affect or damage adjoining structures and water bodies. For safety precautions guidance may be taken from IS:3764	All along the project corridor	MoRTH 301.3.3 MoRTH 304.3.6 IS:3764	301.9 (i)
	Earth fill	Embankment and other fill areas, unless other wise permitted by the Engineer, be constructed evenly over their full width and the contractor will control and direct movement of construction vehicles and machinery over them	Along earthfill areas	MoRTH 305.3.5.3	
2.1.10.2	Stripping, stocking and preservation of top soil	Stock piling of top soil as per Section 2.1.3.2 The stockpiles will be located at least 100m from watercourses.	All along the project corridor	Section 2.1.3.2	305.3 (i)
2.1.10.3	Slope protection and control of erosion	Embankments and other areas of unsupported fill will not be constructed with steeper side slopes, or to greater widths than those shown in design drawings. While planning or executing excavations the Contractor will take all adequate precautions against soil erosion as per MoRTH 306. Turving on critical road embankment slopes with grass sods, in accordance with the recommended practice for treatment of embankment slopes for erosion control. The work will be taken up as soon as possible provided the season is favorable for the establishment of sods. Other measures of slope stabilization will include mulching,		MoRTH 306 MoRTH 307 & MoRTH 308	307.01 308.7

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		netting and seeding of batters and drains immediately on completion of earthworks. Dry stone pitching for apron and revetment will be provided for bridges and cross drainage structures.			
2.1.10.4	Drainage requirements at construction sites	In addition to the design requirements, the contractor will take all desired measures as directed by the Engineer such measures to prevent temporary or permanent flooding of the site or any adjacent area.	All along the project corridor		
2.1.10.5	Dust	All earthwork will be protected in a manner acceptable to the Engineer to minimise generation of dust. The contractor will take every precaution to reduce the level of dust along construction sites involving earthworks, by frequent application of water.	All along the project corridor	MoRTH 111.8	
2.1.10.6	Contamination of soil	Vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptor* (6 Nos.) will be provided for vehicle parking, wash down and refueling areas within the construction camps as per the Dwg. No 2002/73121/Env/01/56 given in Appendix 4.1 . Fuel storage will be in proper bunded areas. All spills and collected petroleum products will be disposed off in accordance with MoEF and SPCB guidelines. Fuel storage and refilling areas will be located at least 1000m from rivers and irrigation ponds or as directed by the Engineer. In all fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the topsoil will be stripped, stockpiled and returned after cessation of such storage and refueling activities as per Section 2.1.3.2	All along the project corridor	MoRTH 306 & MoRTH 311 Appendix 4.1, Dwg. No. 2002/73121/Env/01/56 Section 2.1.3.2	
2.1.10.7	Compaction of soil	To minimize soil compaction construction vehicle, machinery and equipment will move or be stationed in designated area (RoW or CoI, haul roads as applicable) only. The haul roads for construction materials should be routed to avoid agricultural areas	All along the project corridor	Annexure 'A' to MoRTH 501	
2.1.10.8	Silting, Contamination of Water bodies	Silt fencing will be provided around stockpiles at the construction sites close to water bodies. The fencing needs to be provided prior to commencement of earthworks and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. A list of the roadside water bodies (ponds and tanks) is presented in Appendix 3.8 . Construction materials containing fine particles will be stored in an enclosure such that sediment-laden water does not drain into nearby watercourses. All discharge standards promulgated under Environmental Protection Act, 1986, will be adhered to. All liquid wastes generated from the site will be disposed off as acceptable to the Engineer.	Water bodies close to the project corridor	Environmental Protection Act, 1986 Appendix 3.8	C 2.0
2.1.10.9	Cutting/Filling of Surface water bodies	Earth works shall be undertaken such that the existing embankments of water bodies are not disturbed. In case of cutting of embankments, the same shall be reconstructed with appropriate slope protection measures and adequate erosion control measures. Filling of surface water bodies will be compensated by digging an equal volume of soil	Surface Water bodies whose water storage capacity is affected by the project and whose embankments are being	Contract	B 6.0 C 2.0

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
		<p>for water storage. Such dug-up soil will be used for spreading as topsoil.</p> <p>Wherever digging is undertaken, the banks will be protected as designed or as approved by the Engineer. The excavation will be carried out in a manner so that the side slopes are no steeper than 1 vertical to 4 horizontal, otherwise slope protection work, as approved by the Engineer will be provided.</p> <p>As far as practicable, and as approved by the Engineer, excavation for replacement of water bodies will be at the closest possible place/location, with respect to the original water body or part thereof consumed by filling.</p>	cut		
2.1.11	Sub-Base & Base	<p>The contractor will take all necessary measures/ precautions to ensure that the execution of works and all associated operations are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in Annexure A to MoRTH 501.</p> <p>The contractor will plan and provide for remedial measures to be implemented in event of occurrence of emergencies such as spillage of oil or bitumen or chemicals. The contractor will provide the Engineer with a statement of measures that he intends to implement in event of such an emergency, which will include a statement of how he intends to adequately train personnel to implement such measures.</p> <p>Adequate safety measures for workers during handling of materials at site (Section 2.16) will be taken up.</p> <p>The contractor will take every precaution to reduce the level of dust along construction sites by frequent application of water as per Section 2.1.10.5</p> <p>Noise levels from all vehicles and equipment used for construction will conform to standards as specified in Section 2.15.</p> <p>Construction activities involving equipments with high noise levels will be restricted to the daytime.</p> <p>Transport of materials for construction will be as per Section 2.1.35</p> <p>The contractor will provide for all safety measures during construction as per Section 2.17</p>	All along the project corridor	<p>Annexure A to MoRTH 501</p> <p>Section 2.16</p> <p>Section 2.1.10.5</p> <p>Section 2.15.</p> <p>Section 2.1.35</p> <p>Section 2.17</p>	
2.1.12	Surfacing	<p>The contractor will take all necessary means to ensure that works and all associated operations are carried out in conformity with Annexure A to MoRTH 501.</p> <p>All workers employed on mixing asphaltic material etc. will be provided with protective footwear as specified in Section 2.16</p> <p>Noise levels from all vehicles and equipment used for surfacing will conform to standards as specified in Section 2.15.</p> <p>Construction activities involving equipments with high noise levels will be restricted to the daytime.</p> <p>Transport of materials for construction will be as per Section 2.1.35</p> <p>The contractor will provide for all safety measures during construction as per Section 2.17</p>	All along the project corridor	<p>Annexure A to MoRTH 501</p> <p>Section 2.16</p> <p>Section 2.15</p> <p>Section 2.1.35</p> <p>Section 2.17</p>	C 16.0

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No. ⁷
2.1.13	Bridge Works & Culverts	While working across or close to the rivers, the Contractor will not disrupt the flow of water. If for any bridgework, etc., closure of flow is required, the Contractor apart from obtaining the requisite clearances from the PWD (irrigation department), will seek approval of the Engineer. The Engineer will have the right to ask the Contractor to serve notice on the downstream users of water sufficiently in advance. The list of major and minor bridges along TNRSP 01 is presented in Appendix 3.9 . Construction over and close to the non-perennial streams will be undertaken in the dry session. Construction work expected to disrupt users and impacting community water bodies will be taken up after serving notice on the local community. Dry stone pitching for apron and revetment will be provided for bridges and cross drainage structures.	At locations where bridge works and culverts are proposed.	MoRTH 2500 Appendix 3.9	2510
2.1.14	Mitigation Measures for Noise Sensitive Receptors	Double glazing of windows of the sensitive receptors will be carried out during construction stage only in case of excessive noise causing disturbance to the sensitive receptors wherever feasible. Provision is made for double-glazing at locations exceeding operation stage noise levels. Other noise mitigation options shall be explored based on site conditions. A brief description of available options is presented in the Appendix 3.10 . The details of the 20 sensitive receptors identified for TNRSP 01 has been presented in Appendix 3.10 . The measures shall be taken during construction stage only in case of excessive noise causing disturbance to the sensitive receptors otherwise the measures shall be implemented in operation stage.	Appendix 3.10	Appendix 3.10	
2.1.15	Road Furniture	Road furniture including footpaths, railings, storm water drains, crash barrier, traffic signs, speed zone signs, pavement markers and any other such items will be provided as per design. The contractor shall provide Recharge pits for Urban drains as per Dwg. No. 2002/73121/Env/01/58 given in Appendix 4.1 . The drains will be provided for each kilometre of the road through urban settlements and near the outfall to a natural drain if the road crosses one inside a settlement. As part of TNRSP 01 40 Nos. of recharge pits has been proposed.	All along the project corridor	MoRTH 801 Appendix 4.1, Dwg. No 2002/73121/Env/01/58	801.6 803.8 804.5 805.4 806.3
2.1.16	<i>Enhancements</i>	Enhancement of all cultural properties, water bodies, incidental spaces will be carried out as per the enhancement designs prior to completion of construction in road sub sections. Adequate signages along these enhancement locations will be erected. Specific and generic enhancement measures proposed for the various cultural properties and the specifications are provided in Appendix 4.1& 4.2 Generic measures have been suggested for various enhancements required. The Contractor will finalise the designs for enhancements after approval from the Engineer. Progress of construction of enhancements shall be reported as per format EM6, Appendix 5.1	At the locations mentioned in Table 4.1	Design Table 4.1 Appendix 3.11 Appendix 4.1& 4.2 Appendix 5.1	B 6.0
2.1.17	Monitoring Environmental Conditions	The contractor will undertake seasonal monitoring of air, water, noise and soil quality through an approved monitoring agency. The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 5.2).	Monitoring Locations as specified in Table 5.3	Table 5.2 Table 5.3	B 4.0

Sl. No	Activities	Management Measure	Location	Reference ⁶	EMP/RAP/ BoQ Item No.7
2.1.18	<i>Contractor Demobilization</i>				
2.1.18.1	Clearing of Construction Camps & Restoration	Contractor to prepare site restoration plans for approval by the Engineer. The plan is to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures will be cleared away, all rubbish burnt, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the Engineer. Residual topsoil will be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75mm - 150mm.	All Construction Workers' Camps		
2.1.18.2	Redevelopment of Borrow Areas	Redevelopment of borrow areas will be taken up in accordance with the plans approved by the Engineer. Guidelines for redevelopment of borrow areas are presented in Appendix 3.13	At all borrow area locations suggested for the project.	Appendix 3.13 Appendix 3.15, Sub clause 111.2	
2.2	CONSTRUCTION ACTIVITIES BY PIU-ENVIRONMENTAL CELL				
2.2.1	Tree Plantation and Landscaping	Tree plantation and landscaping shall be implemented through the forestry unit of the PIU. Trees felled will be replaced in accordance with the Forest (Conservation) Act, 1980. Four trees will be planted for every tree lost. 17904 trees will be planted along the upgradation corridors. Additional tree planting (22108 Nos.) is also proposed along the ten bypasses. Road landscape plantation, re-vegetation of road embankments and other slopes, edge treatment of water bodies will be taken up as per landscape designs for the project (Appendix 3.12 details the landscape plan). Stockpiled topsoil will be utilized for landscaping, incidental spaces etc. Progress of tree plantation shall be reported by foresters to the ACF as per Format EM7, Appendix 5.1.	Entire Project Corridor, as per the tree plantation strategy Entire Project Corridor, as per the landscape plan prepared.	Forest (Conservation) Act, 1980 Appendix 3.12 Appendix 5.1	314.9 B 2.0 B 3.0
3.0	OPERATION STAGE ACTIVITIES BY PIU-ENVIRONMENTAL CELL				
3.1	Monitoring Operational Performance	The PIU will monitor the operational performance of the various mitigation/enhancement measures carried out as a part of TNRSP. The indicators selected for monitoring include the survival rate of trees, utility of enhancement provisions for cultural properties, water bodies, incidental spaces and within forest areas, status of rehabilitation of borrow areas and utility of double glazing for noise sensitive receptors.	Refer Table 5.1	Table 5.1 Table 5.4	E 1.0 E 2.0
4.0	OTHER ACTIVITIES				
4.1	<i>Orientation of implementing agency and contractors</i>	The PIU shall organize orientation sessions during all stages of the project. The orientation session shall involve all staff of Environmental Cell, field level implementation staff of PIU, Engineer and Contractor.			

CHAPTER - 4 ENHANCEMENT MEASURES

Environmental Enhancements specifically refers to the **positive actions** to be taken up during the implementation of the project for the benefit of the road users and the communities living along the TNRSR Corridors. These positive actions are in addition to several other enhancements that occur inherently because of the very nature of the project such as improved drainage, pedestrian facilities, prevention of existing erosion, overtopping and flooding etc. as these improvements are in-built in the design, as part of good engineering practices. The enhancements have been carried out with the following objectives:

- To enhance the appeal and environmental quality of the project corridor to its users,
- To enhance visual quality along the highway, and
- To generate goodwill amongst the local community towards the project, by the enhancement of common property resources.

The enhancement measures have been suggested for the following environmental components:

- Enhancement of surface water bodies
- Enhancement of Cultural properties
- Enhancements at community spaces and incidental spaces.

Selection criteria and design concepts have been provided for each type of the enhancements proposed. The need for enhancements and the spirit in which these have to be carried out is obtained through the descriptions. The description is expected to guide the contractor in identifying locations for the generic enhancements proposed.

4.1 SURFACE WATER BODIES

4.1.1 CRITERIA FOR SELECTION

The criteria for selection of a surface water body (pond/tank) as an enhancement candidate is:

- The sites directly impacted by the project and are in active use of the community. These should essentially be a community property, and not under private ownership.
- The sites not directly impacted (upto 100m and directly opens onto the highway), being a part of a religious structure or any other property, but still can be of visual as well as social importance

4.1.2 DESIGN CONCEPTS- OVERVIEW

Enhancements for the surface water bodies have been conceived with an aim of improving the present status of water body, which can be more useful to the local community. The enhancement includes general landscaping, access to the water edge and other measures as per the site requirements. Edge protections, walkways, plantation of shade and ornamental trees are integral part of the enhancement.

The concept for enhancements is based on information collected from the local people through community consultation. The information collected included name, distance of nearest Settlement, local importance, religious or historical significance, type and frequency of use e.g. drinking/washing/etc. The site observation provided vital inputs in concept formulation.

Water body lying just at the edge of the carriageway will have an impact on the water quality as well as quantity. For such community ponds proper edge protection should be given in the form of Gabion, brick pitching or stone pitching. The design concept includes provision of physical access only to the existing steps but maintaining visual accessibility throughout the length as well as the surrounding area.

Other parameters taken into consideration for concept formulation are whether water pollution is being caused by activities of the settlement, existing erosion/slope condition, catchment area details by visual inspection, presence of aquatic life, details of seasonal fair/festival/congregation held, if any. Washing platforms are provided at the edge of the pond on the side where the community uses the water body for washing or bathing purposes. Canopy is provided wherever need is felt for a covered or a shaded sitting area due to the lack of existing trees.

4.2 CULTURAL PROPERTIES

Sites of cultural importance identified as suitable for enhancements along the TNRSP01 can be classified into three broad categories on the basis of values attached with them. These include:

- cultural sites having only religious value,
- cultural sites having both the religious as well as historical value and
- cultural sites having only historical values.

Of these categories, the second one has been given importance in the enhancement proposals.

4.2.1 CRITERIA FOR SELECTION

The criterion for the selection of sites suitable for enhancement was based on four factors.

- the importance for the local people
- the religious significance,
- the historical importance and
- the scope for enhancements.

The importance of the site for the local people as well as the historical significance was identified through extensive discussions with the local community and general observations of the sites and structures.

The scope for enhancement included the possibility of any further improvement, availability of space for enhancements and the likely benefits for the local community as well as the road users. Poor condition of some historical structures was a constraint in selecting sites for enhancement. Such sites though having high historical values exist in a very bad physical condition. At such places, enhancement measures will not be effective unless main structure is restored, which is beyond the scope of the project.

4.2.2 DESIGN CONCEPTS - OVERVIEW

The concept for enhancements is based on the suggestions given by the people. Extensive community consultations were carried out on each of the enhancement sites. The information gathered included

- Age of the structure,
- Importance for the local people,
- Religious significance, historical importance,
- Extent of use,
- Suggestions for enhancements,
- Willingness of people to participate.

The site observation also provided vital inputs in concept formulation. It provided the general information about the condition of the main structure and the surrounding, visibility of the enhancement site from the project road, the scenic beauty of the site as well as the surrounding area.

In case of religious places enhancements are suggested on the basis of usage. For example paving is suggested around the temple in most of the cases as people move around the temple. This ritual known as *prabkshira* is a common practice in most of the temples in Tamil Nadu. Similarly in mosques paving is proposed in front side where people perform 'Namaaz' on Fridays.

Type of paving proposed varies at different places within a site according to the use of spaces and their relative importance. For example, paving proposed in front of temple is different than that for approach pavement, which is again different from the paving for *prabkshira*. Such variation in the paving pattern is maintained in all the enhancement proposals.

In the religious places like temples mosque, dargah and church where large number of people gathers weekly or annually, measures are taken for the safety of the people, as they tend to spill over on road. Compound wall and fencing is suggested as safety measures at such places.

In many cases the local people were concerned about the safety of the property. Compound wall with gate and fencing are proposed for such sites.

There are many important religious and historical centers that are accessible from the project road. Approach enhancement is proposed at the place where the approach meets the project road. Enhancement measures are suggested to emphasize the presence of important such religious or historical place. Measures include provision of decorative arch columns and informative signage. These measures are conceived in such a way so as to reflect the architectural characteristics and the religious or historic significance of the place.

There are sites along the project corridor, which have high historical significance, but are neglected. The lack of awareness among the people and negligence on the part of authorities is evident from the very state of these structures. Enhancement measures for these sites are proposed in such a way as to increase public awareness, which may in turn lead to conservation of these structures.

4.3 COMMUNITY AND INCIDENTAL SPACES

Any other type of space identified along the project corridor rendered important for the local communities are enhanced on similar guidelines. Such spaces include:

- cultural properties or common property resources along the corridor with space in its front,
- incidental space along the road due to realignment (between the proposed and existing roads), providing an opportunity for enhancement.

4.3.1 CRITERIA FOR SELECTION

The aim of enhancement on the incidental space would be to create a spot of usual relaxation for onlookers in the locality and the traveling motorists. Consultation with public at some of the locations revealed that they are willing to participate in the enhancement programme though they may not be able to contribute monetarily. The example of this type of space includes the space in front of a temple or any realignment section of road that creates open space in between.

4.3.2 DESIGN CONCEPTS OVERVIEW

The open space has the potential to be a very interesting stop over. Also some of the site has a historic, sacred & emotional value. In case of religious places attached to this enhancements are suggested on the basis of the usage that would be harmonically integrate the two sites. For example paving is suggested around the shrine and sitting arrangements are made with shade giving trees. The enhancement especially at these places includes planting flowering shrubs. It improves the quality of space before the temple and also forms a relief along the roadside. Green fencing is done to define the boundary. Garden spaces are provided for giving fresh views and to bring in an air of freshness. Area for parking is demarcated.

The sites having good scenic beauty and ample space for parking and sitting are conceived as potential stopovers. Shading and pleasant views are considered important in such places. The presence of pond near stopover is considered preferable as it not only gives a pleasant view but also provides refreshing cool breeze. The incidental spaces resulting by the realignment of the road is proposed to be developed as landscaped green areas to improve the visual quality

of the road. Tree plantations are suggested only at those places where the local people are willing to take care of the trees, as maintenance of trees is a major issue.

4.4 ENHANCEMENTS CONSIDERED UNDER TNRSP 01

The list of enhancement sites selected under TNRSP01 is presented in **Table 4.1**. A total of 23 sites were selected for which specific enhancements designs have been prepared. Apart from these 9 generic designs were also prepared. The Table also shows importance of each site which is either social (including religious importance) or historic or both. Willingness and contribution from the local community as expressed by them during the consultations carried out at each enhancement location is also presented. At some locations as indicated in the Table the local community has expressed their willingness by agreeing to provide labour or financial contribution or both. Formal arrangements for maintenance during the post construction stage will be finalised in consultation with the communities. The modalities will be subsequently worked out by the PIU in consonance with the communities during the detailed community consultations that are to be carried out for relocating the affected cultural properties.

The detailed designs and Bill of Quantities for each enhancement design has been worked out. The cost worked out on the basis of BOQs for each individual enhancement is presented in the Table. Drawings and BoQ are presented in **Appendix 4.1** and **Appendix 4.2** respectively.

Table 4.1: List of Enhancements under TNRSP 01

Sl. No.	Drawing Number	Property Type	Road Stretch	Location	Distance from Road	Direction	Ownership	Willingness/ Participation	Effect on Property	Importance	Size of Complex	Proposed Enhancement
1	2002/73121/Env/01/01	Temple & TV room	Arcot to Arani	2/0	9.6	Right	Community	1	TV. Room & Hundi	Social	205	Specific
2	2002/73121/Env/01/02	Temple & Pond	Arcot to Arani	3/4	9.5	Right	Community	2	Shrine	Social	2564	Specific
3	2002/73121/Env/01/03	Temple										9 (Generic)
4	2002/73121/Env/01/04	Temple & Shrine	Arcot to Arani	13/1	9	Right	Community	1	Small Shrines	Social	3494	Specific
5	2002/73121/Env/01/05	Pond	Arani to Polur	3/1	11.2	Right	Community	2	-	Social	3228	Specific
6	2002/73121/Env/01/06	Temple	Polur to Chengam	5/10	8.4	Right	Community	2	-	Social + Historic	1844	Specific
7	2002/73121/Env/01/07	Temple	Polur to Chengam	10/4	9.5	Right	Community	2	-	Social	137	Specific
8	2002/73121/Env/01/08	Temple	Polur to Chengam	47/8	11.4	Right	Community	2	-	Social + Historic	3650	Specific
9	2002/73121/Env/01/09	Temple	Polur to Tiruvannamalai	134/6	8.3	Left	Community	2	Houses	Social	2195	Specific
10	2002/73121/Env/01/010	Shrine + Pond										3 (Generic)
11	2002/73121/Env/01/11	Temple on rocks & Pond	Tiruvannamalai to Tirukkivilur	93/4	13	Right	Community	1	-		1077	Specific
12	2002/73121/Env/01/12	Approach to Church	Tirukkivilur to Elavanasur	22/6	9-11.5	Left	Community	1	Affected	Social	-	Specific
13	2002/73121/Env/01/13	Temple	Tirukkivilur to Elavanasur	30/0	2.35	Right	Community	3	-	Social + Historic	272	Specific
14	2002/73121/Env/01/14	Temple Complex	Vridhachallam to Jayankondam	3/4	-		Temple-HRCE/ Pond Comm.	3	-	Social + Historic	7914	Specific
15	2002/73121/Env/01/15	Ancient Temple Complex + Tank										2 (Generic)
16	2002/73121/Env/01/16	Temple	Vridhachallam to Jayankondam	0/5	8	Left	HRCE	3	-	Social + Historic	2708	Specific
17	2002/73121/Env/01/17	Tank + Park + Temple Complex	Jayankondam to Ariyalur	1/8	5	Left	Temple-HRCE/ Pond-Community	2	-	Social	4731	Specific
18	2002/73121/Env/01/18	Temple Complex	Jayankondam to Ariyalur	10/8	5	Left	Community	2	-	Social + Historic	5461	Specific
19	2002/73121/Env/01/19	Ancient Temple Complex	Jayankondam to Kumbakonam	92/5	5.2	Left	HRCE	2	-	Historic	-	Specific
20	2002/73121/Env/01/20	Mandapams	Jayankondam to Kumbakonam	106/7	5	Right	Private Trust	1	-	2002/73121/Env/01/01	940	Specific
21	2002/73121/Env/01/21	Temple Complex	Jayankondam to Kumbakonam	107/0	6.1	Right	Private Trust	1	-	Historic + Architectural	934	Specific
22	2002/73121/Env/01/22	Ancient Temple Complex	Jayankondam to Kumbakonam	111/6	6	Left	HRCE	2	-	Social + Historic	1374	Specific
23	2002/73121/Env/01/23	Buddha Statue	Jayankondam to Kumbakonam	112/0	6	Right	Community	2	-	Historic	3548	Specific
24	2002/73121/Env/01/24	Ayyanar Temple	Kumbakonam to Thiruvavur	24/2	6	Right	Community	2	-	Social + Historic	122	Specific

Sl. No.	Drawing Number	Property Type	Road Stretch	Location	Distance from Road	Direction	Ownership	Willingness/ Participation	Effect on Property	Importance	Size of Complex	Proposed Enhancement
25	2002/73121/Env/01/25	Church	Kumbakonam to Thiruvavur	20/050	6	Right	Private Trust	1	-	Social	3967	Specific
26	2002/73121/Env/01/26	Temple Complex	Kumbakonam to Thiruvavur	17/2	5	Right	HRCE	1	-	Historic	8903	Specific
27	2002/73121/Env/01/27	Pipal Tree & Shrine										4 (Generic)
28	2002/73121/Env/01/28	Incidental Space in front of Temple										7 (Generic)
29	2002/73121/Env/02/33	Mosque & Pond										5 (Generic)
30	2002/73121/Env/04/38	Temple										1 (Generic)
31	2002/73121/Env/04/46	Temple										8 (Generic)
32	2002/73121/Env/04/47	Space created due to Realignment										6 (Generic)

LEGEND**Willingness/ participation**

- 1- Willingness only
- 2- Willingness+ Labour Contribution
- 3- Willingness+ Labour + Financial contribution

Categories for Generic Enhancement

- | | |
|-----------------|---|
| 1- Temple | 6- Incidental Space created due to Road Realignment |
| 2- Temple+ Pond | 7- Incidental space in front of temple |
| 3- Shrine+ Pond | 8- Temple+ Stop over |
| 4- Sacred Grove | 9- Temple Relocation |
| 5- Mosque+ Pond | |

CHAPTER - 5 MONITORING MEASURES

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

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations
- To provide feedback on adequacy of Environmental Impact Assessment

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. Budgetary provisions for the envisaged programme is presented in Chapter – 7: Budgetary and cost estimates.

5.1 PERFORMANCE INDICATORS

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

- (a) Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- (b) Environmental management indicators to determine compliance with the suggested environmental management measures
- (c) Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed.

The Performance Indicators and monitoring plans prepared for TNRSP 01 are presented in **Table 5.1**

Table 5.1: Performance Indicators for TN RSP 01

Sl. No	Indicator	Details	Stage	Responsibility
A	Environmental Condition Indicators and Monitoring Plan			
1	Air Quality	The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per the Monitoring Plan prepared (Refer Table 5.2)	Construction	Contractor through approved monitoring agency
2	Noise Levels		Construction	Contractor through approved monitoring agency
3	Water Quality		Operation	HD through approved monitoring agency
4	Soil Quality		Construction	Contractor through approved monitoring agency
B	Environmental Management Indicators and Monitoring Plan			
1	Dumping Locations	Locations for dumping have to be identified and parameters indicative of environment in the area has to be reported	Pre-Construction Stage	Contractor
2	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	Contractor

Sl. No	Indicator	Details	Stage	Responsibility
3	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	Contractor
4	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Foresters
5	Protection Measures at RF locations	Progress of measures suggested as construction of water sources is to be reported	Pre-construction /construction	Contractor
6	Enhancements	Progress of enhancement measures suggested for cultural properties, water bodies and incidental spaces is to be reported	Construction	Contractor
7	Tree Plantation and Landscaping	Progress of measures suggested as part of the Landscaping Strategy is to be reported	Construction	Foresters
8	Top Soil	Implementation of the measures suggested for top soil preservation shall be reported by Contractor to Engineer	Construction	Contractor
C	Management & Operational Performance Indicators			
1	Survival Rate of Trees	The number of trees surviving during each visit will be compared with the number of saplings planted	Operation	The Engineer will be responsible for monitoring upto the Defect Liability Period in any particular stretch. After this period the Forest wing of the PIU will be responsible for monitoring over a period of 5 years.
2	Utility of Enhancement Provisions	The PIU will visit each of the enhancement locations (for cultural properties, water bodies and incidental spaces) to determine the efficacy of the enhancements carried out and the community utilisation of such areas.	Operation	The Engineer will be responsible for monitoring upto the Defect Liability Period in any particular stretch. After this period the Environmental Cell of the PIU will be responsible for monitoring over a period of 5 years (Provisions have been included in the budget for five such visits by a two member team of the PIU for inspecting the enhancements carried out along all packages)
3	Status Regarding Rehabilitation of Borrow Areas	The PIU will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowners request and to their full satisfaction.	Operation	The Engineer will be responsible for monitoring upto the Defect Liability Period in any particular stretch. After this period the Environmental Cell of the PIU will be responsible for monitoring over a period of 5 years (Provisions have been included in the budget for five such visits by a two member team of the PIU for inspecting the borrow areas utilized by the project along all packages)
4	Utility of enhancement measures within Forest Areas	The PIU will visit the locations where plantations have been carried out and water sources have been provided within forest areas. They will check for the availability of water and fodder especially during peak summer months to determine the fruitfulness of such measures.	Operation	The Engineer will be responsible for monitoring upto the Defect Liability Period in any particular stretch. After this period the Environmental Cell of the PIU will be responsible for monitoring over a period of 5 years (Provisions have been included in the budget for five such visits by a two member team of the PIU for inspecting the enhancements carried out within the forest areas along TNRSP 01)
5	Utility of Double Glazing of Sensitive Receptors	The PIU will visit such sensitive locations along with the environmental monitoring agency (responsible for monitoring of noise levels during operation stage) to check for the efficacy of the double-glazing carried out.	Operation	The Engineer will be responsible for monitoring upto the Defect Liability Period in any particular stretch. After this period the Environmental Cell of the PIU will be responsible for monitoring over a period of 5 years (Provisions have been included in the budget for five such visits by a two member team of the PIU for inspecting the noise sensitive receptors along all packages)

5.2 MONITORING PLAN FOR ENVIRONMENTAL CONDITIONS

For each of the environmental condition indicator, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for environmental condition indicators of

the project in construction and operation stages is presented in **Table 5.2**. Details of monitoring locations are presented in **Table 5.3**.

Table 5.2 Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Measures	Institutional Responsibility	
									Impl'ion	Super'ion
Air	Construction	SPM, RPM, SO ₂ , NOX, CO & Pb.	High volume sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 1994	Once every season for three seasons (except monsoons) per year for each year of Construction	Continuous 24 hours/ or for 1 full working day	(i) Wherever the contractor decides to locate the Hot mix plant (ii) At critical stretches as indicated in Table 5.3	Wherever air pollution parameters increase above specified standards, additional measures as decided by the Engineer shall be adopted	Contractor through approved monitoring agency	PIU(EC)/ HD, Engineer
Water	Construction	(i) pH, BOD, COD, TDS, Pb, Oil & Grease and Detergents for Surface (ii) Water pH, TDS, Total Hardness, Sulphate, Chloride, Fe, Pb for Ground Water	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982) and for Drinking Water (IS : 10500, 1991)	Twice a year (Pre monsoon and Post monsoon seasons) for each year during the Construction Period	Grab Sampling	At all locations as indicated in Table 5.3	At locations of increase in water pollution, all inflow channels shall be checked for pollution loads and channel delivering higher pollution load shall be terminated from disposal into the water source and other methods of disposal shall be adopted	Contractor through approved monitoring agency	PIU(EC)/ HD, Engineer
Noise	Construction	Noise levels on dB (A) scale Noise levels on dB (A) scale	Free field at 1 m from the equipment whose noise levels are being determined.	MoEF Noise Rules, 2000	Once every season (except monsoons) for each year of Construction	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	Wherever the contractor decides to locate the Equipment yard	Incase of noise levels causing disturbance to the sensitive receptors, double-glazing of openings of the	Contractor through approved monitoring agency	PIU(EC)/ HD, Engineer

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Measures	Institutional Responsibility	
									Impl'ion	Super'ion
		Noise levels on dB (A) scale Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Once every season (except monsoons) for each year of Construction	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	At critical stretches as indicated in Table 5.3	receptor shall be provided.	Contractor through approved monitoring agency	PIU(EC)/ HD, Engineer
	Operation	Noise levels on dB (A) scale Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Once every seasons (except monsoons) for five year after completion of construction activity.	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	At all the critical receptors as mentioned in Table 5.3 (ii) Additional sites will be monitored. The location will be decided by the PIU (EC).	Incase of noise levels causing disturbance to the sensitive receptors, double-glazing of openings of the receptor shall be provided.	HD, through an approved monitoring agency	HD
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption spectrophotometry	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	During the Pre monsoon & Post monsoon season each year for the entire construction period	Grab Sampling	At productive agricultural lands abutting traffic detours and traffic diversions and major intersections, as indicated in Table 5.3	At locations of increase in pollution levels, source shall be identified and shall be diverted from further disposal	Contractor through approved monitoring agency	PIU(EC)/ HD, Engineer
		Monitoring after any major accidents / spillage during bulk transport of hazardous material. Depending on the type of spillage/accident the parameters to be monitored will be decided by the Engineer apart from those mentioned above.								Contractor through approved monitoring agency

Table 5.3: List of Monitoring Stations

Attribute	Stage	TNRSP 01 (N)	TNRSP 01 (S)	TNRSP 01 (E)
AIR	Construction	Wherever the contractor decides to locate the Hot mix plant. (Number of Locations = 5)		
		At Critical Locations Arani Bypass @ Km 2.0 Kamayansur School @ Km 5.0 along Polur Chengam Mundanai Reserve Forest @ Km 38.0 Tiruvannamalai Bypass @ Km 103.0 Attipakkam Reserve Forest @ Km 85.0 Pugaipatti @ Km Km 26.8	At Critical Locations Sulavacheri Reserve Forest @ Km 18.0 Jayankondam @ Km 1.0 Ariyalur Bypass @ Km 23.0 Sendurai @ Km 103.00 Kumbakonam Bypass @ Km 121.0	At Critical Locations Chidambaram Bypass @ Km 44.0
WATER	Construction	Surface Water Monitoring Cheyyar River @ Km 13 along Polur Chengam Kumlapatti Tank @ Km 95.4 at Adapatti along Tiruvannamalai Tirukkivilur Ponnaiyar River @ Km 13.0 along Tirukkivilur Elavanasur Pond @ Km 29.0 at Fatimabadhaka along Tirukkivilur Elavanasur	Surface Water Monitoring Pond @ Km 1.1 at Mirambhatti along Jayankondam Ariyalur Kollidam River @ Km 102.0 along Jayankondam Kumbakonam Vettar River @ Km 7.9 along Kumbakonam Thiruarur	Surface Water Monitoring Vellar River @ Km 43.0 near Chidambaram Bypass Upnar River @ Km 26.0 near Sirkazhi Bypass
		Ground Water Monitoring at Arani @ Km 2.0 Chengam @ Km 48.0	Ground Water Monitoring at Vridhachallam @ Km 2.0 Kumbakonam @ 121.0	Ground Water Monitoring at Chidambaram @ 5.0 Sirkazhi @ 27.0
NOISE	Construction	Wherever the contractor decides to locate the Equipment Yard. (Number of Locations = 5)		
		At Critical Locations Arani Bypass @ Km 2.0 Kamayansur School @ Km 5.0 along Polur Chengam Mundanai Reserve Forest @ Km 38.0 Tiruvannamalai Bypass @ Km 103.0 Attipakkam Reserve Forest @ Km 85.0 Pugaipatti @ Km Km 26.8	At Critical Locations Sulavacheri Reserve Forest @ Km 18.0 Jayankondam @ Km 1.0 Ariyalur Bypass @ Km 23.0 Sendurai @ Km 103.00 Kumbakonam Bypass @ Km 121.0	At Critical Locations Chidambaram Bypass @ Km 44.0
	Operation	At the 6 Critical Locations as listed above	At the 5 Critical Locations as listed above	At 1 Critical Locations as listed above
		Additional sites will be monitored (Number of Locations = 6). The location will be decided by the PIU (EC)		
SOIL	Construction	At productive agricultural lands abutting / close to the intersections and along other sensitive landuses as listed below: Junction at Arani @ Km 24.4 Junction at Polur @ Km 2.4 Junction at Tiruvannamalai @ Km 111.5 Junction with NH at Elavanasur @ Km 30	At productive agricultural lands abutting / close to the intersections and along other sensitive landuses as listed below: Junction at Karuvepillankurichi @ Km 5.8 Junction at Jayankondam @ Km 0.0 Junction at Kumbakonam @ Km 123.6 Junction at Thiruarur @ Km	At productive agricultural lands abutting / close to the intersections and along other sensitive landuses as listed below: Proposed Junction @ Km 5.0 near Chidambaram Bypass Proposed Junction @ Km 54.0 near Sirkazhi Bypass
		At any accident / spill locations involving bulk transport carrying hazardous materials. The budgetary provisions provide for monitoring at 15 such locations for all 4 packages of TNRSPO during the construction stage		

5.3 REPORTING SYSTEM

Reporting system for the suggested monitoring program operates at two levels as:

- Reporting for environmental condition indicators and environmental management indicators (except tree cutting indicator)
- Reporting for operational performance indicators at the PIU level.

Contractor and construction supervision consultants operate the reporting system for environmental condition and environmental management indicators (except tree cutting). The Environmental Cell of PIU will operate the reporting system for environmental management tree cutting indicator and operation performance indicators. The PIU will set the targets for each activity envisaged in the EMP beforehand and all reports will be against these targets.

Contractor will report to the Engineer of construction supervision consultant, on the progress of the implementation of environmental conditions and management measures as per the monitoring plans. The Engineer will in turn report to the PIU on a quarterly basis which will be reviewed and forwarded by the PIU to the World Bank. Along with these reports, forestry wing of the PIU(EC) shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. The quarterly reports of the EMP will form an integral part of the Quarterly Progress Reports that are to be regularly submitted to the Bank. The PIU will also send compliance report to the MoEF every six months as per the conditions of clearance granted for the project after receiving the report from the contractor and duly verified by the Engineer. The reports submitted to the MoEF will also be forwarded to the Bank along with the Quarterly Progress Reports. A detailed reporting system for all the Performance Indicators has been developed and is presented in **Appendix 5.1**. Reporting formats for contractors have been prepared, which will form the basis of monitoring, by the Engineer and/or the Environmental Cell as required. The details of reporting formats prepared for the project is presented in **Table 5.4**.

Table 5.4: Summary Details of Reporting Formats

Format No.	Item	Stage	Contractor	Forest Wing	Supervision Consultant (SC)		Project Implementation Unit (PIU)	
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring	Report to WB
EM1	Identification of Dumping Locations	Pre-Construction	One Time	-	One Time	One Time	One Time	One Time
EM2	Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time	One Time
EM3	Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time	One Time
EM4	Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly	Quarterly
EM5	Enhancement Provisions within Forest Areas	Pre-Construction/ Construction	-	-	Quarterly	Quarterly	Quarterly	Quarterly
EM6	Enhancement Measures for Cultural Properties, Water bodies & Incidental Spaces	Construction	Monthly	-	Monthly	Monthly	Quarterly	Quarterly
EM7	Tree Plantation and Landscaping	Construction		Monthly			Quarterly	Quarterly
EM8	Top Soil Monitoring	Construction	Quarterly		Continuous	Quarterly	Quarterly	Quarterly
EC 1	Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly	Quarterly
EC 2	Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan	Half yearly
OP 1	Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly	Half yearly
OP 2	Utility of Enhancement Measures for Cultural Properties, Water bodies and Incidental Spaces	Operation	-	-	-	-	Half Yearly	Half yearly
OP 3	Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly	Half yearly

Format No.	Item	Stage	Contractor	Forest Wing	Supervision Consultant (SC)		Project Implementation Unit (PIU)	
			Implementation & Reporting to SC	Implementation & Reporting to PIU	Supervision	Reporting to PIU	Oversee / Field Compliance Monitoring	Report to WB
OP 4	Utility of Enhancement Provisions within Forest Areas	Operation	-	-	-	-	Half Yearly	Half yearly
OP 5	Utility of Double Glazing of Sensitive Receptors	Operation	-	-	-	-	Half Yearly	Half yearly

In addition to these formats, to ensure that the environmental provisions are included at every activity of the implementation by the contractor, it is suggested that the approval of the environmental personnel of the engineer is required in the Request for application to proceed or other similar reporting formats used by the contractor. These will not only ensure that the environmental provisions are addressed but also link the satisfactory compliance to environmental procedures prior to approval of the Interim Payment Certificate (IPC) by the Engineer. The activities by the contractor that can impact the environment will be identified based on discussions between the Environmental Specialist of the PIU, team leader of the Engineer and the Environmental personnel of the Engineer. The decisions will be communicated to the contractor prior to the start of the construction activities.

CHAPTER - 6 IMPLEMENTATION ARRANGEMENTS

The HD is responsible for the implementation of the provisions made within the EMP through the PIU. To monitor the construction activities to assist the department in implementation, the services of an Engineer are procured for each corridor. In addition to the monitoring of the implementation of the environmental provisions by the Environmental personnel of the engineer, the Environmental Cell (EC) created within the PIU (including officials deputed from the Forests Department officials in addition to engineers from the HD) will oversee the effective implementation of the measures suggested. An externally sourced environmental expert will be procured to provide key inputs to the Environmental Cell, especially during the initial stages of project implementation. The Environmental Cell will also include the Superintending Engineer (SE), Assistant Divisional Engineer (ADE, one for both corridors), eight Assistant Engineers (AE, four for each corridor) and the members of the Forest wing. Three AEs along each corridor will be deputed at the field level. As the implementation of the avenue plantations suggested in the project is to be carried out in-house by the highways department, an elaborate setup of the Forest wing of the EC headed by an Assistant Conservator of Forests and assisted by two rangers and six foresters at the field levels has been suggested. Together, this unit shall be entrusted the responsibility of managing the nurseries for the project, and the planting and maintenance of the same. The EMP implementation arrangements for TNRSF are summarized in **Figure 6.1**

The Environmental Specialist, ACF and SE have been duly appointed/deputed and are already functioning as a part of the Environmental Cell of the PIU. The HD is under the process of appointing /deputing the remaining members of the Environmental Cell, so that the EC is in place before the start of construction activity.

6.1 ORIENTATION OF MEMBERS OF THE ENVIRONMENTAL CELL

Members of the Environmental Cell will be trained in environmental protection both in theoretical and practical aspects. While theoretical aspects will form the bedrock of the orientation programme, it will be the practical site visits and /or hands-on training at project site itself, which will be of direct use to the project.

Basic orientation required for environmental awareness shall be provided initially and then experts in specific aspects of road-related works who will train the officials regarding the detailed procedures will be identified. Specific modules customized for the available skill set shall be devised after assessing the capabilities of the members of the Environmental Cell and the requirements of the project. The entire orientation programme would cover basic principles of environmental assessment and management; mitigation plans and programmes, implementation techniques, monitoring methods and tools. The modules designed will be suitable for both upgradation and maintenance components. Specific issues for upgradation and maintenance shall be taken up in separate sessions. Details of training modules envisaged are presented in **Appendix 6.1**

6.2 INTEGRATION OF EMP WITH PROJECT

Environmental provisions to be implemented in the project are presented in **Table 3.1**. Detailed monitoring plan and reporting formats for ensuring effective implementation of those measures are suggested as part of the EMP. The environmental measures suggested as part of TNRSPO1 broadly fall into the following categories:

- Management measures that are stand-alone items and can be implemented by the contractor (as provision of oil interceptors, monitoring of environmental components etc)
- Management measures that are to be taken up incidental by the contractor as part of Good Engineering practices (dust suppression during earthworks, slope protection measures etc)
- Enhancement measures including measures not directly related to the road construction (enhancement of cultural properties, common property resources as ponds etc).

The environmental management measures will be included as specific items within the Bid document. These are in addition to the provisions of Annexure A to clause 501 of the Specifications for Road and Bridge Works (MoRT&H). Material quantities for implementing these measures have been worked out based on the designs and specifications. These are included in the BoQs for the project as a separate head entitled “Environmental Quantities”. To ensure the availability of sufficient funds for implementation of these provisions, the environmental costs have been integrated into the overall costs for the project.

FIGURE 6.1: ORGAN OGRAM

CHAPTER - 7 BUDGETARY PROVISIONS

Budgetary estimates for environmental management in TNRSP 01 includes all items envisaged as part of the EMP. These have been worked out based on the detailed BoQs and specifications for the enhancement and mitigation measures.

The environment budget includes provisions for various environmental management measures (other than measures considered under good engineering practices), the environmental monitoring and orientation costs. The budgetary provisions for TNRSP 01 are presented in **Table 7.1** The cost estimates for each item along with basis of costing is presented in the volume, Cost Estimates for Environmental Management for perusal of PIU and the World Bank.

Table 7.1: Environmental Budgetary Provisions for TNRSP 01

S. No.	Item	Unit	Quantity	Spec No.	Drg. No. / Appendix No.
			TNRSP01		
A	GENERAL ITEMS				
1.0	Vehicles	Number	2.0		
2.0	Administration (Departmental Staff)	Years/Corridor	5.0		
3.0	Out Sourced Environmental Specialist	Years/Corridor	5.0		
4.0	Firm for implementation of EMP	Included in overall cost for procuring SC			
5.0	Compensatory Afforestation over land transferred to forest dept.	Ha	6.4		
6.0	Training of members of Environmental cell(preconstruction stage)	Amount/Session	0.5		Appendix 6.1
B	CONSTRUCTION PHASE				
1.0	Mitigation Measures other than Good Engineering practices				
1.1	Oil Interceptors	Number	6.0	MoRTH 304, 1700	Dwg.No. 2002/73121/Erw/01/56
1.2	Recharge pits for urban drains	Number	40.0	MoRTH 304, 1700	Dwg.No. 2002/73121/Erw/01/58
1.3	Water Source to prevent animal crossings	Number	3.0	EMP 1.0	Appendix 3.5
1.4	AIDS awareness hoardings	Number	5.0	EMP 2.0	
1.5	Deepening of Ponds	Number	41.0	EMP 8.0	
2.0	Tree Plantation and Protection				
2.1	<i>Along Upgradation Corridors</i>				
2.1.1	Nursery Trees	Number	17904	EMP 3.1	Appendix 3.12
2.1.2	Maintenance for 2 years	Number	17904	EMP 3.1	Appendix 3.12
2.1.3	Tree Guards				
2.1.3.1	Brush wood Fence (Fast Growing Species)	Number	16114		
2.1.3.2	Iron Tree Guards (Slow Growing Species)	Number	1790	EMP 3.2	Fig. In EMP 3.2
2.2	<i>Along Bypasses</i>				
2.2.1	Nursery Trees	Number	22108	EMP 3.1	Appendix 3.12
2.2.2	Maintenance for 2 years	Number	22108	EMP 3.1	Appendix 3.12
2.2.3	Tree Guards				

S. No.	Item	Unit	Quantity	Spec No.	Drg. No. / Appendix No.
			TNRSPO1		
2.2.3.1	Brush wood Fence (Fast Growing Species)	Number	19897		
2.2.3.2	Iron Tree Guards (Slow Growing Species)	Number	2211	EMP 3.2	Fig. In EMP 3.2
2.3	<i>Buffer Plantation along Reserve Forest Stretches</i>				
2.3.1	Reserve Forest on one side of the road	Number	13500	EMP 3.1	Appendix 3.12
2.3.1	Reserve Forest on both sides of the road	Number	26400	EMP 3.1	Appendix 3.12
2.4	<i>Plantation within Forests</i>	Locations	2.0	EMP 3.1	Appendix 3.12
3.0	Landscaping				
3.1	Along T Junctions	No. of Shrubs	184450	EMP 3.1	Appendix 3.12
3.2	Along X Junctions	No. of Shrubs	28560	EMP 3.1	Appendix 3.12
4.0	Monitoring of Environmental Attributes during Construction Activity				
4.1	<i>Air Quality</i>				
4.1.1	Monitoring of Air Quality near Hot mix plants	No. of Samples	52.5	EMP 4.0	EMP Table 5.2
4.1.2	Monitoring of Air Quality at Critical Locations	No. of Samples	126.0	EMP 4.0	EMP Table 5.2
4.2	<i>Noise Levels</i>				
4.2.1	Monitoring of Noise Level at Equipment Yards	No. of Samples	53.0	EMP 4.0	EMP Table 5.2
4.2.2	Monitoring of Noise Levels at Critical Locations	No. of Samples	126.0	EMP 4.0	EMP Table 5.2
4.3	<i>Water Quality</i>				
4.3.1	Monitoring of Water Quality	No. of Samples	105.0	EMP 4.0	EMP Table 5.2
4.4	<i>Soil Quality</i>				
4.4.1	Monitoring of Soil Quality	No. of Samples	70.0	EMP 4.0	EMP Table 5.2
4.4.2	Additional Soil Monitoring during Spills	No. of Samples	36.0	EMP 4.0	EMP Table 5.2
5.0	Orientation of Implementing agency staff	Cost /Session	7.0		
6.0	Enhancement Measures	Number			
6.1.1	Specific Enhancements	Number	28.0	EMP 5.0	Drawing Nos. in EMP Table 4.1
6.1.2	Generic Enhancements	Number			
6.1.2.1	For Cultural Properties	Number	100.0	EMP 5.0	Drawing Nos. in EMP Table 4.1
6.1.2.2	For Incidental spaces	Number	60.0	EMP 5.0	Drawing Nos. in EMP Table 4.1
C	GOOD ENGINEERING PRACTICES				
1.0	Dust Suppression		Covered under Engineering Costs	TS 111.15.4	
2.0	Erosion Control Measures (Turving / Pitching / Seeding & Mulching)			TS 306, 307.01, 308.7	
3.0	Provision of Cross drainage & side drainage structures			-	
4.0	General Borrow area management and maintenance of haul roads related to borrow areas			TS 111.2	
5.0	Air/noise pollution control measures in construction equipments			TS 111.5	
6.0	Management and disposal of scarified waste bituminous material			TS 305.9.6	
7.0	Provision of Informatory Signs			TS 111.15.6, 112.4	

S. No.	Item	Unit	Quantity	Spec No.	Drg. No. / Appendix No.
			TNRSP01		
8.0	Busbays			TS 815.2	
9.0	Construction of Speed Humps			TS 812.4	
10.0	Cattle Crossings			TS 816.2	
11.0	Relocation of Public Utilities and services			-	
12.0	Management of quarries		Will form a part of the Contractor's cost only if the entire quarry is taken up for the project	TS 111.3	
13.0	Redevelopment of Borrow Areas		Will form a part of the Contractor's Cost. 10,98,078 sq m along TN RSP 01	TS 111.2	Appendix 3.13
14.0	Construction Camp Management Costs		Will form a part of the Contractor's cost		
15.0	Silt Fencing	Number	Covered under Engineering Costs	TS 111.15.2	
16.0	Safety measures for workers	Persons/ Annum		EMP 6.0, TS 111.15.6	
D	ITEMS COVERED UNDER THE RAP BUDGET				
1.0	Relocation of Cultural Properties		Covered under RAP Budget	R&R Budget	
2.0	Relocation of Water points (wells,tanks,water taps and hand pumps)			R&R Budget	
3.0	Relocation of graveyards, statues, motor sheds			R&R Budget	
4.0	Relocation of Other Community Assets			R&R Budget	
E	OPERATION PHASE				
1.0	Monitoring of Noise during Operation Phase				
1.1	Monitoring of Noise Levels at Critical Locations	No. of Samples	180	EMP 4.0	EMP Table 5.2
1.2	Monitoring at additional locations	No. of Samples	90	EMP 4.0	EMP Table 5.2
1.3	Noise mitigation measures in form of double glazing of sensitive receptors*	Sq. m	420.0	MoRTH 501, Annex 'A', Section 4, EMP 7.0	
2.0	Monitoring of Management & Operational Performance Indicators				
2.1	Utility of enhancement provisions				
2.1.1	For Northern Corridor	No. of trips	5	EMP 4.0	EMP Table 5.2
2.2	Status of Redevelopment of Borrow Areas				
2.2.1	For Northern Corridor	No. of trips	5	EMP 4.0	EMP Table 5.2
2.3	Utility of noise mitigation measures of Sensitive Receptors				
2.3.1	For Northern Corridor	No. of trips	5	EMP 4.0	EMP Table 5.2
2.4	Utility of Plantations & Water sources within RF				
2.4.1	For Northern Corridor	No. of trips	5	EMP 4.0	EMP Table 5.2
3.0	Information Dissemination				
		Sessions/ Location	13		
4.0	Co-ordination with other departments and administrative costs during operation stage				
		Years/Corridor	3		

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Last Saved By: p4
Total Editing Time: 1 Minute
Last Printed On: 06-May-03 4:19 PM
As of Last Complete Printing
Number of Pages: 55
Number of Words: 18,162 (approx.)
Number of Characters: 103,530 (approx.)