1.1 INTRODUCTION

The Government of India has requested World Bank financing for the improvement and rehabilitation of State Highways and Major District Roads in the State of Mizoram that enhance connectivity to Bangladesh and Myanmar. The proposed roads project includes a 336 km north-south alignment starting at the NH44A junction between Aizawl and Tripura State passing through Thenhlum, Phairuangkai,Chawngte, and connecting to the Multi-modal Kaladan Road at the southern end. Other road links in the project include the 112 km east-west Lunglei-Lungsen-Tlabung-Kawrpuichhuah road which links to nearby Chittagong Port (through Rangamati) in Bangladesh and the east-west 28km Champhai-Zowthowkar road and 42 km Chumkhum- chongte road .

The improvement works will consist mainly of widening and some new construction to two-lane Asian Highway standard, pavement construction, strengthening, improving, constructing of bridges, cross drainage structures and longitudinal drainage and provision of adequate slope protection works. Road stretches crossing semi-urban areas and villages may also require provision for covered drains, sidewalks and parking where required. In some cases, new alignments (by-passes) and/or realignments for the existing villages and towns may also be required.

The Project Implementation Unit (PIU) within the Public Works Department (PWD) of the Government of Mizoram will be the implementing agency for the project .The PIU is located in the capital of Mizoram State, Aizwal.

1.2 Project Objective

All the project roads are single lane roads with formation width approximately 5.2 m without conforming any standard / specification. As a result, the heavily loaded trucks and large sized vehicles find it difficult to pass through these stretches safely. Project roads are the main route which provides connectivity between district towns, interstate and international borders (Bangladesh and Myanmar). Development of project roads will connect the neighboring state and country economically and culturally. This will also improve quality of life of the people living along the road in the region.

1.3 Project components

The proposed project will assist the Public Works Department, Govt. of Mizoram to develop roads with a total length of 450 km in a phased manner. These roads traverse across four districts namely, Lunglei, Champhai, Mamit and Lawngtlai in the state.Project road sections are Grouped are as under:

Table 1 – Proposed Project Roads under MSRP II – Regional Transport Connectivity Project			
Group/Project 1		**District(s)**	**Length**
i.	**Lunglei - Tlabung - Kawrpuichhuah**	**Lunglei**	**87.9 km, (E-W road to Bangladesh border)**
ii.	**Champhai – Zokhawthar**	**Champhai**	**27.5 km, (E-W road to Myanmar border)**
iii.	**Chhumkhum-Chawngte**	**Lunglei**	**41.7 km, (part of original N-S road alignment)**
Group/Project 2			
i.	**Junction NH44A (Origination) – Chungtlang – Darlung – Buarpui**	**Mamit & Lunglei**	**83 km**
ii.	**Buarpui – Thenlum – Zawlpui**	**Lunglei**	**95 km**
iii.	**Chawngte including bridge to BungtlangSouth up to Multimodal Road junction**	**Lawngtlai**	**76 km**
iv.	**Zawlpui – Phairuangkai**	**Lunglei**	**30 km**

All roads are expansion of existing road .For group-1 road alignment has been finalised but for group-2 roads alignments are tentative and not finalised . It is proposed to develop these roads to 2-lane National Highways standard (roadway width of 12m – comprising2-

lane carriageway width (7m) and shoulders of 2.5m on either side of the carriageway). Upgrading of project roads will be undertaken mostly on hill side (approximately 15 mtrs. from the centreline on the hill side and 9 m on valley side). Bypasses and realignments has been proposed to avoid adverse impacts in view of linear settlements along the road and also to address safety concerns in group-1 roads. Same approach will be followed for group-2 roads also for which diversions and realignments have not yet finalised.

1.2 PROJECT CORRIDOR – DESCRIPTION

The existing Champhai – Zokhawthar road was originally constructed as other district road (ODR) Standard road during the early part of eighties. It was constructed by the State Public Works Department (PWD). The road was constructed to provide connectivity between district headquarters and International boarder of Indo Myanmar for international trading but also for Eastern part of Mizoram. The total length of the project road is 27.247 km. (including 2.53 km of spur road). The road was upgraded to the status of State highway (SH) and International trading route between India and Myanmar in the year 2005.

Existing road take off from Km 150.0 of Seiling Champhai Road passes through the villages and Terminate at km 26.60 on River Tiau Indo Myanmar Boarder and this road passes through five villages, i.e. Khankawn ,Zotlang, Ruatlang , Mualkawi, Melbuk& Zokhawthar .

Recognizing the current inadequate transportation infrastructure facility of the country and the vital role transportation sector plays in the accelerated economic growth of the country; the Government of India has placed a high priority in this sector's development to meet the current and future highway transportation needs.

Improvements works envisaged for the upgradation corridor are:

- Widening of the road with side drains and shoulders;

- Construction/replacement/reconstruction[1] of bridges and culverts;
- Construction of retaining walls, breast walls and other slope protection works;
- Improvement of the road geometry and junctions wherever necessary; and,
- Provision of road signs and other road furniture required for making travel on these roads safe and comfortable.

The improvements proposed under the project are almost exclusively along the existing alignment, except for some minor realignment to avoid acquisition of properties and for improvement of the road geometry.

1.3 MAJOR FINDINGS OF THE ENVIRONMENTAL ASSESSMENT

The major findings of the EIA are presented in the following sections:

1.3.1 STABILITY OF SLOPES

Widening of upgradation corridor is being carried out by cutting the hillside for a major length of the project route. Stability of the cut slopes is an issue of concern given the immature geology of the project area. 40 vulnerable locations with respect to landslides and potential for severe erosion are identified where adequate protection measures are worked out.

1.3.2 DISPOSAL OF CONSTRUCTION DEBRIS

The cutting activities shall generate an earthwork of 15.3 million cu.m. The disposal of which is an issue of concern. Earth generated from cutting will be utilised as construction fill material and also for building road subgrade . Remaining debris needs to be disposed at dumping locations.

1.3.3 IMPACT ON BIO-DIVERSITY:

The roadside slope all along the upgradation route supports a variety of flora species including ferns, orchids, bryophytes etc. There exist several stretches with a high degree of biodiversity, referred to as Ecological Identity Areas. The proposed widening may affect such Ecological Identity Areas due to construction activities if adequate

precautionary measures are not taken up. Movement of machinery can also destroy the rare and endangered plant species (including the endangered Cyathus species or tree fern) at the very edge of the road on the valley side and medicinal plants within the CoI.

1.3.4 IMPACT ON SENSITIVE SURFACE WATER SOURCES

The corridor passes close to couple of marshy lands that would be impacted due to the proposed widening activities during construction and operation stages. Disposal of debris during construction stage and contamination by road run-off during operation stage onto these sensitive water resources are significant negative impacts that need to be addressed.

In addition, several streams from the hillside, form beautiful waterfalls along the corridor. Cutting of the hill face at these waterfalls will disturb the drainage of these streams and also destroy their visual appeal and deny access to the local people who tap these streams at present.

1.3.5 FAUNA:

During construction, the poaching by labourers can pose a significant threat to the faunal community.

1.3.6 RESETTLEMENT AND LOSS OF LIVELIHOOD

Affected families are being displaced due to the proposed works. Though the magnitude of resettlement is not very high in terms of the families to be displaced, the project needs to address the R&R and loss of livelihood issues, as the entire affected population is tribal.

1.4 ENVIRONMENTAL MANAGEMENT MEASURES PROPOSED

A description of the various management measures during the various stages of the project is provided in the following sections.

1.4.1 PRE-CONSTRUCTION STAGE

During the pre-construction stage, management measures required will be implementation of R&IPDP which includes acquisition and relocation of structures, utility relocation, relocation of cultural properties, removal and replacement of common property resources as washing platforms, relocation of water harvesting structures and pig sty. Identification

of trees likely to be cut with joint verification of MPWD and Forest Department shall be taken up.

1.4.2 CONTRACTOR MOBILISATION AND SITE CLEARANCE

Activities during this stage involves: clearance of vegetation; setting up of construction camps with all environmental safeguards including sanitary provisions; setting up of hotmix plants; identification of dumping sites as per guidelines provided for the same; provision of alternate routes for the villages whose existing access routes will be disturbed in the construction stage. Construction of water harvesting structures as an alternate source of water for construction shall also be completed in this stage.

1.4.3 CONSTRUCTION STAGE

This will be the most crucial and active stage for the Environmental Management Plan. This stage would involve handling huge quantities of earthwork from the proposed cutting on the hillside for the accommodation of the proposed cross-section. Construction activities shall be effectively monitored to ensure that the environment is not impacted beyond permissible limits. Enhancement of waterfall locations, mitigation measures suggested for conservation of critical biodiversity locations and for sensitive water resources will go on simultaneously as the construction progresses.

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1.4.4 OPERATION STAGE

Operation stage will essentially entail monitoring activity along the corridor, for various indicators to evaluate the performance of mitigation measures suggested in the project. Monitoring of the indicators specified in the monitoring plan will serve the two purposes.

- To check the efficacy of the protection/mitigation/enhancement measures implemented, and;
- To help verify or refute the predictions made as a part of the impact assessment[2].
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Measures adopted and/or to be adopted during the different stages of the project have been detailed in Table-2.

Table-2: Environnemental Management Plan

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
PRE- CONSTRUCTION STAGE					
Displacement of people and loss of property and structures	Change the design alignment to save the structures and minimize the land acquisition . If possible LA should be limited with in COI not on ROW.	Select by pass and diversions with suitable analysis of alternative study and select a alignment considering environmental social and technical aspects..	All requirements of the R&IPDP shall be complete before start of construction stage. The activities broadly include acquisition of structures, cultural properties relocation of utilities, common property resources and relocation of domestic water drums and pig sty etc.	NGOs, Collaborating Agencies, SLAO, MPWD, Grievance Redressal Cells (GRC), Village Level Committee (DLC) District Revenue authorities	MPWD
Removal of Vegetation	Change the design alignment to to minimize the tree cutting.	If possible tree cutting should be limited with in COI not on ROW.	Vegetation will be removed from the Corridor of Impact before the commencement of Construction.	Contractor	Engineer, MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
		Only cut those trees which are unavoidable.			
Setting up of construction camps	Local people should be given preference for employment during construction of the roads.	Location of the camp should be selected as per guideline provided .	Construction camps shall be located at least 500m away from the nearest habitation and 200m away from ecological rich area. Camp should be as per standards set by Building and other Construction Workers (regulation of Employment and Conditions of Service) Act, 1996. Camp should be hygienic and should have potable water supply.	Contractor.	Engineer, MPWD.
Setting up of Hot mix plants and batching plants	Plan to set up use minimum number of such plant establishment. Plan to use the plants in phsewise manner.	Location should be in the camp. NOC form MPCB for establishment and operation of the plants.	Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible	Contractor.	Engineer, MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
		Plants should have air pollution control system.	such plants will be located at least 1000m away from the nearest habitation.		
Identification of dumping sites	Change in design to minimize the cutting to minimize the spoil and to minimise the need of dumping site.	Reuse of cut material for road construction , filling, construction of play field and markets	Location of dumping sites shall be finalized based on the guidelines given in Annexure – and the Engineer shall certify that - These are not located within designated forest areas. (b) The dumping does not impact natural drainage courses (c) No endangered/rare flora is impacted by such dumping. (d) Settlements are located atleast 0.8km away from the site.	Contractor	Engineer, MPWD
Identification of landslide locations	Review and modification in design to minimise and avoid such areas.	Geological investigation to identify such locations and avoid to disturb such areas.	The contractor shall identify locations sensitive to landslides in addition to those provided in DPR,	Contractor	Engineer, MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			and shall duly report these to the Supervision Consultant(SC) and to MPWD with suitable protection measures for approval		
CONSTRUCTION STAGE					
Land Slides	Review and modification in design to minimise and avoid such areas.	Geological investigation to identify such locations and avoid disturbing such areas.	Slope of the hill side cut shall not be higher than those suggested in DPR All areas of cutting shall be covered with vegetation. Bioengineering techniques as appropriate shall be undertaken at all vulnerable locations. A combination of bio-engineering techniques and hard engineering solutions shall be as toe walls, breast walls, rock bolting, provision of band drains, gabion at locations	Contractor	Engineer

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			vulnerable to landslides shall be provided, based on the suitability at site, as decided by the geotechnical expert of the engineer.		
Generation of Debris	Change in design to minimize the cutting to minimize the spoil and to minimise the need of dumping site.	Reuse of cut material for road construction, As fill materials, for embankments,the sub grade of the existing pavement shall be used as embankment fill material. , filling, construction of play field and markets	Debris generated due to the dismantling of the existing pavement structure and the cutting of the hillside for the widening shall be suitably reused in the proposed construction, as follows: As fill materials, for embankments The sub grade of the existing pavement shall be used as embankment fill material.	Contractor	Engineer, MPWD.
Disposal of Debris and management of disposal	Change in design to minimize the cutting to minimize the spoil and to minimise the need of dumping site.	Reuse of cut material for road construction, As fill materials, for embankments, the sub grade of the existing	The disposal of debris shall be carried out only at sites identified for the purpose. Slope of the disposal side shall not	Contractor, Engineer	Engineer, MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
sites.		pavement shall be used as embankment fill material. , filling, construction of play field and village markets	be higher than those suggested in DPR All slopes of the site shall be covered with vegetation. Bioengineering techniques as appropriate shall be undertaken at all vulnerable locations. A combination of bio-engineering techniques and hard engineering solutions shall be as toe walls, shall be provided, based on the suitability at site, as decided by the environmentalist in consultation with Geo tech engineer.		
Road side Soil Erosion		Erosion protection measures On road embankment slopes, slopes of all cut, fill etc should be completed as early	On road embankment slopes, slopes of all cut, fill etc., shrubs and grass will be planted. On sections with high filling and deep cutting the		

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
		as possible.	side slopes will be graded and covered with bushes and grass, etc., adopting suitable bioengineering techniques. The suitability to be decided by the Engineer at site.		
Soil Erosion at culvert outlets	Design culvert considering catchment area and proper outlet location.	Try to provide culvert outlet in to a water body – drainage channel, stream etc. Avoid agriculture land as culvert outlet	Along sections abutting water bodies' stone pitching needs to be carried out for slopes between 1 vertical: 4 horizontal to 1 vertical to 2 horizontal. At the outfall of each culvert, erosion prevention measure, such as the following, will be undertaken, as provided in the design: 1. Grass scales 2. Rock riprap 3. Rock mattresses	Contractor.	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			4. Cut off wall 5. Downstream silt screens/walls		
Contamination of Soil and water bodies by Fuel and Lubricants	Fuel storage and refilling areas shall be located at least 300m from all cross drainage structures and important water bodies or as directed by the Engineer.	Fuel storage shall be in proper bunded areas. All spills and collected petroleum products shall be disposed off in accordance with MoEF and MPCB guidelines at designated locations	Vehicle/machinery and equipment operation, maintenance and refueling shall be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. An "oil interceptor" will be provided for wash down and refueling areas. Fuel storage shall be in proper bunded areas. All spills and collected petroleum products shall be disposed off in accordance with MoEF and MPCB guidelines at designated locations.	Contractor.	Engineer, MPWD.
Quarry	Material should be taken only	Use existing quarries and	The Contractor shall obtain	Contractor	Engineer,

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Operations	from quarries licensed by the SPCB Wherever hill are used and operated for the purpose of quarrying in the beds or banks of rivers/rivulets will not be used for quarrying.	minimise opening of new quarries. Existing quarries should have a environmental duedeligence report before using for the project .	materials from quarries only after consent of the Department of mining or other concerned authorities and only after development of a comprehensive quarry' redevelopment plan. Alternatively the Contractor shall acquire the required material from quarries licensed by the SPCB. The quarry operations shall be undertaken within the rules and regulations in force.		MPWD.
Loss of Water Sources	Change the design to save such structures considering importance of the structure in consultation with community	Identify such structure before the construction starts and take appropriate measures to save the structure from dmange.	Any source of water (potable or otherwise) for the community such as water tanks along the water streams for community uses etc., incidentally lost shall be replaced immediately. The location and	Contractor	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			siting of the replaced source of water shall be in consultation with the local user population. Generally, the source of water supply will be moved away from the road and within the settlement area. The replacement shall be ready prior to demolition/ dismantling of the existing source.		
Siltation into Water Bodies	Siltation of soil into the water bodies will be prevented as far as possible.	Construction materials containing fine particles shall be stored in an enclosure such that sediment-laden water does not drain into nearby watercourses. All discharge standards promulgated under Environmental Protection	Silt fencing will be provided at the base of the embankment for the perimeter of water bodies abutting the road. Silt fencing shall be as per the technical specifications .	Contractor.	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
		Act, 1986, shall be adhered to. All waste generated from the site shall be disposed off as acceptable to the Engineer			
Use of Water by contractor	Plan the water demand during construction. Identify the source of water which will not create any conflict with local people.	The contractor will minimise wastage of water in the construction process/.	The Contractor shall arrange for supply and storage of water and no such supply and storage will be provided by the MPWD. The Contractor shall not open a new bore well or extract groundwater without permission from the Ground Water Board. The contractor will minimise wastage of water in the construction process/operations.	Contractor.	Engineer, MPWD.
Disruption to other Users of	Plan the water demand during construction. Identify the source	The Contractor may use the natural sources of water	While working across or close to the Rivers, the Contractor shall not	Contractor	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Water	of water which will not create any conflict with local people.	subject to the provision that any claim arising out of conflicts with other users of the said natural source shall be dealt with entirely by the contractor.	prevent the flow of water. If for any bridgework, etc., closure of flow is required, the Contractor shall 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. Construction over and close to the non-perennial streams shall 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.		
Generation of	Dust control during construction	Plants, machinery and	All vehicles delivering materials to	Contractor	Engineer,

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Dust	should be part of contract document and the Contractor shall take every precaution to reduce the level of dust emission from the hot mix plants and the batching plants	equipment shall be so handled (including dismantling) as to minimise generation of dust.	the site shall be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or suppliers of materials or plant and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles or their tyres. Hot mix plants and the batching plants should have air pollution control system.		MPWD.
Pollution from Crusher	Dust control during construction should be part of contract document and the Contractor shall take every precaution to	Crusher should have dust suppression system Living places in camps should not be in down wind	All crushers used in construction shall conform to relevant dust emission control legislations. Clearance for siting shall be	Contractor.	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
	reduce the level of dust emission from the crusher	direction of the crusher .	obtained from the MPCB. Alternatively, only crushers already licensed by the MPCB shall be used. Water will be sprayed during the non-monsoon months, regularly to minimise dust, in the whole crusher plant area. The suspended particulate matter contribution value at a distance of 40m from a controlled isolated as well as from a unit located in a cluster should be less than 500µg/m^3. The monitoring is to be conducted as envisaged in the monitoring plan.		
Noise from Vehicles, Plants and	Noise control during construction should be part of contract document and the	The plants and equipment used in construction (including the aggregate	All vehicles and equipment used in construction shall be fitted with exhaust silencers. During routine	Contractor.	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Equipment.	Contractor shall take every precaution to reduce the level of Noise from the Plants and Equipment.	crushing plant) shall strictly conform to the GoI noise standards.	servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant shall be removed from site. Noise limits for construction equipment used in this project (measured at one metre from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws		

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			shall not exceed 75 dB(A), as specified in the Environment (Protection) Rules, 1986. Maintenance of vehicles, equipment and machinery shall be regular and to the satisfaction of the Engineer, to keep noise from these at a minimum. Workers in vicinity of loud noise, and workers working with or in crushing, compaction, concrete mixing operations shall wear earplugs.		
Blasting or Pre-splitting Operations	Control blasting should be part of contract document.	All the statutory laws, regulations, rules etc., pertaining to acquisition, transport, storage, handling and use of explosives shall be	Blasting shall be carried out only with permission of the Engineer. Blasting shall be carried out during fixed hours (preferably during mid-day), as permitted by the Engineer.	Contractor.	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
		strictly followed.	The timing should be made known to all people within 500m (200m for pre-splitting) from the blasting site in all directions. People, except those who actually light the fuse shall be excluded from the area of 200m (50m for pre-splitting) from the blasting site in all directions at least 10 minutes before the blasting.		
Conservation of Biodiversity at specific locations	Change the design or modify the design to save biodiversity rich area.	Avoid the biodiversity rich area and try to minimise the COI in such area.	Bamboo fencing shall be erected to delineate the area rich in biodiversity as identified from field visits. Drains will be provided in the area to prevent exposure to contaminated run-off during the construction phase. Introduction of exotic species will be prevented in the roadside plantation for such	Contractor	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			stretches. Instead of blasting, pre-splitting will be used for stretches extending 200m on either side of the locations identified in Annexure - III.		
			Access to the road shall be restricted using barbed wire fencing along the entire realignment section. Blasting will be prohibited in the stretch extending 200m on either side of the designated Ecological Identity Areas (E.Id.A'). Introduction of exotic species will be prohibited in the E.Id.A'S. Water spraying shall be carried out every day during the duration of earthwork within the E.Id.A's.	Contractor	Engineer, MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Damage or Loss of Chance-found Important Flora	Provision of training and awareness in the contract.	Awareness training of workers and engineers by training for such instances.	During construction, at any point of time, if a rare/ threatened/endangered flora species is found, it shall be conserved in a suitable manner. The Engineer, on specific advice from the MPWD shall approve detailed conservation processes, plans and designs as well as associated modification in the project design..	Contractor, Engineer.	MPWD.
Damage or Loss of Chance-found Important Fauna.	Provision of training and awareness in the contract.	Awareness training of workers and engineers by training for such instances.	During construction, at any point of time, if a rare/ endangered / threatened fauna species is spotted, the contractor shall make all arrangements to intimate the Forests (wildlife) authorities and measures will be taken for its conservation during the operation	Contractor, Engineer	MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			period also.		
Protection/Mitigation of Religious Structures and Shrines	Change in alignment to save the structures without compromising the safety , technical and financial aspect of the project	All necessary and adequate care shall be taken to minimize impact on cultural properties. All conservation and protection measures will be taken up as per design.	Religious Structures and Shrines if impacted are to be shifted in suitable location consultation with local people.	Contractor	Engineer, MPWD.
Chance found Archaeological property	Provision of training and awareness in the contract.	Awareness training of workers and engineers by training for such instances.	All fossils, coins, articles of value of antiquity and 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	Contractor	Engineer, MPWD.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and 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 100m all directions from the site of discovery. The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.		
OPERATION STAGE					

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Contamination of Soil and Water Resources from Spills Accidents			Contingency plans to be in place for cleaning up of spills of oil, fuel and toxic chemicals. Spill of oil, fuel and automobile servicing units without adequate disposal systems in place to be discouraged.	Flying Squad of the Motor Vehicles Department.	Motor Vehicles Inspector.
Accidents involving Hazardous Materials			Compliance with the Hazardous Wastes (Management and Handling) Rules, 1989 including: For delivery of hazardous substances, permit license, driving license and guidance license will be required. Public security, transportation and fire fighting departments will designate a special route for	MPWD, Motor Vehicles Department.	MPWD, Motor Vehicles Department.

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
			vehicles delivering hazardous material. These vehicles will only be harboured at designated parking lots. In case of spill of hazardous materials, the relevant departments will be intimated at once to deal with it with the spill contingency plan.		
Biodiversity			Conservation measures in the biodiversity rich areas include the contributed restriction of access to these. No development shall be allowed along the short realignment on the valley side in a stretch extending 500m on both sides of the short realignment	Institution/NGO selected by MPWD Village Councils	MPWD MPWD

Environmental Impact/Issue	Prevention	Minimisation	Mitigation Measures	Responsibility	
				Implementation	Supervision
Landslides on cut faces of the hills.			Monitoring of land slide locations ,MPWD to determine locations and extent of occurrence of landslides	MPWD	MPWD

1.5 REPORTING SYSTEM

Reporting system provides the necessary feedback for project management to ensure quality of the works and that the program is on schedule. The rationale for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Management Plan get implemented in the project.

The reporting system will operate linearly with the contractor reporting to the Supervision Consultant, who in turn shall report to the MPWD. All reporting by the contractor and Supervision Consultant shall be on a quarterly basis. The MPWD shall be responsible for preparing targets for each of the identified EMP activities. All subsequent reporting by the contractor shall be monitored as per these targets set by the MPWD before the contractors move on to the site. The reporting by the Contractor will be a monthly report like report of progress on construction and will form the basis for monitoring by the MPWD, either by its own Environmental Engineer/s or the Environmental Specialist hired by the Supervision Consultant. The monitoring and the subsequent reporting would include:

- Monitoring of facilities at construction camps
- Monitoring of air, noise, soil and water parameters including silt load
- Monitoring of survival rate of trees planted on valley slopes
- Monitoring of cleaning of drains and water bodies
- Monitoring for biodiversity – protection measures during construction phase
- Monitoring of bio-engineering measures suggested

Table 3: Desired Monitoring and Reporting Process and Responsibilities

Format No.	Item	Timing	Supervision Consultant (SC)	MPWD	World Bank (WB)

			Supervision	Reporting to MPWD	Oversee/ Field Compliance Monitoring	Report to WB	Desired Supervision
CONTRACTOR MOBILISATION AND SITE CLEARANCE							
M1	Reporting by contractor to SC for dumping locations	Before start of construction	As required	As required		Quarterly	Half yearly
CONSTRUCTION PHASE							
C1	Monitoring of construction site and construction camp	Before start of work		Quarterly		Quarterly	Half yearly
C2	Target sheet for Pollution Monitoring		As required	After Monitoring		After Monitoring	Half yearly
C3	Target sheet for Tree cutting		Monthly	Quarterly	Quarterly	Half yearly	Yearly
C4	Target sheet for monitoring of cleaning Culverts		Monthly	Monthly	Quarterly	Half yearly	Yearly

Format No.	Item	Timing	Supervision Consultant (SC)		MPWD		World Bank (WB)
			Supervision	Reporting to MPWD	Oversee/ Field Compliance Monitoring	Report to WB	Desired Supervision
C5	Target sheet for protection measures at specific locations where endangered flora is found	Before start of work at the location	Quarterly	Quarterly	As required	Half yearly	Yearly
C6	Monitoring sheet for specific endangered flora locations to be protected	Before start of work	Quarterly	Quarterly	As required	Half yearly	Yearly
OPERATION PHASE							
O1	Target sheet for Pollution Monitoring		As per Monitoring Plan	After Monitoring		After Monitoring	Half yearly
O2	Target sheet for roadside plantation				Quarterly	After monitoring	Once after completing plantation

Format No.	Item	Timing	Supervision Consultant (SC)		MPWD		World Bank (WB)
			Supervision	Reporting to MPWD	Oversee/ Field Compliance Monitoring	Report to WB	Desired Supervision
O3	Target sheet for monitoring of cleaning culverts				Quarterly	After monitoring	Twice during operation phase
O4	Monitoring of Landslide clearance	As required			As required	After Monitoring	Twice during operation phase

1.6 INSTITUTIONAL ARRANGEMENTS

The MSRP 2 has been initiated and is being carried out by the Public Works Department. The MPWD through the Engineer – in – Chief, is responsible for the effective implementation of the project activities. To carry out the project prioritisation, and to design for the various improvements that are proposed, the MPWD has appointed international consultants as the Project Co-ordinating Consultants (PCC) for the project. A Project Director from the MPWD and a team of 3 Executive Engineers have been entrusted to oversee effective preparation and timely implementation of the project. They will also look into the Procurement, Environment and Social Aspects. Each of these executive engineers are assisted by an Assistant engineer for carrying out their responsibilities..

During the implementation of MSRP, the MPWD will be assisted by a Supervision Consultant (here after referred as SC), procured through International Competitive Bidding. The SC will assume the role of an Engineer and ensure construction in an environmentally sound manner through their Environmental Specialist. The monitoring of construction activities by the

MPWD will be carried out in conjunction with the Mizoram Pollution Control Board Officials for the pollution component (Air, Water, Noise). For the implementation of R&IPDP activities and tree plantation, local NGO will be procured.

The roles and responsibilities of the various individuals/agencies responsible for the implementation of the Environmental Provisions have been worked out and detailed terms of reference worked out for:

- Environmental Engineer of the MPWD
- Assistant Environmental Engineer of the MPWD
- Environmental Specialist – Supervision Consultant
- Non-Governmental Organisations – responsible for tree plantation and maintenance of the plantation on the valley side
- Environmental specialist of the Quality Assurance Consultant
- Environmental Engineer of the Contractor.

1.7 TRAINING

1.7.1 NEED FOR TRAINING

Staff of MPWD entrusted for MSRP is already in place and are overseeing the project preparation activities. However, the lack of environmental and social expertise and sensitivity of the MPWD, though has been mitigated to a certain extent due to the exposure to the preparation of the Environmental Assessments for the MSRP 2 , is a matter of concern. This deficiency should be mitigated as soon as possible to enable the MPWD in integrating the social and environmental issues in its day-to-day operation and in internalising the environmental and social issues in the future road development projects. To achieve this goal, staff of MPWD, need to be trained on road development and environment management and the effective implementation of the environmental issues.

1.7.2 TARGETS OF PROPOSED TRAINING

The training programme should equip the members of the Environmental cell to implement and supervise the EMP and expose senior members of the MPWD to environmental and social issues associated with the highway projects. Such a group of senior staff can then be given the

responsibility of active dissemination of the culture of environmental/social consciousness and ethics within the rest of the organisation.

Once the staff of the MPWD have received training and have gained experience through the implementation of the EMP, they should be ready to resume leadership role within the MPWD in providing training and in implementing future projects. In order to disseminate environmental experience gained by the MPWD, each staff would be required to maintain good records and prepare dissemination notes on specific issues and problems encountered and resolved, and how the experience gained could be integrated in future road projects. Competent members of the MPWD should be offered additional environmental training and should be encouraged to train other staff.

1.7.3 TRAINING COMPONENTS

The environmental training(both natural & social environment) aspects of the Environmental staff of the MPWD should encompass the following:

- Understanding of the relevant environmental regulations and their application to the project.
- Environmental management practices in hill roads upgradation and maintenance
- Main impacts of the project on the environment.
- Mitigation measures as given in the EMP and their implementation through incorporation in the design, construction supervision and monitoring.
- Duties and responsibilities of the Contractors, Supervisor Engineers, Supervision Consultants and the MPWD.
- Public/community consultation and its role during the implementation of the project.
- Liaison with other departments and relevant agencies (such as Forestry).
- Supervision of the implementation of the EMP and social issues during construction and operation. Resolution of environmental and social issues and their reporting.
- Monitoring during construction and operation.
- Weekly, monthly and quarterly report preparations and submission.
- Preparation of dissemination notes, holding of workshops, and training of other staff in MPWD.

The training modules to be worked out for the project need to be of relevance to the specific context of the roads in Mizoram, focussing on the following issues:

- Conservation of biodiversity
- Slope stability and vulnerability to landslides
- Siting criteria for identification of dumping sites
- Harnessing water resources, including rain water harvesting
- Concepts of bio-engineering.

The training modules suggested are given in the Table-4. The training will be conducted in broadly two sessions. The first session will focus on the implementation aspects of the EMP involving Staff of MPWD, NGOs and District officials. This session will be concluded before construction stage of the project. The second session will be for capacity building of the MPWD for conducting EIA inhouse.

Table 4: Training Modules for Environmental & Social Management

S. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered training module	Training Conducting Agency
SESSION – I				
Module – I	Environmental staff of "Environmental and Social Management Cell". Associated NGOs in implementation and MPWD staff associated with construction supervision	Lecture System Workshops & Presentation	Environmental overview: • Key issues • Methodology • Public Consultation • Value Addition	Environmental Specialist, Supervision consultant
Module - II	Members of MPWD staff involved in	Lectures; Group discussions	Mizoram State Road Project: • Environmental	Environmental Specialist, Supervision

S. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered training module	Training Conducting Agency
	supervising upgradation corridor, Major Maintenance; NGO representatives; District Officials & Members of special committees – MVAC and GRC		Impact Assessment • Social Impact Assessment • Environmental Management Plan & Environment & Social Management Plan • Resettlement & Indegenous People Development Plan	consultant
Module - III	Contractors' representatives; NGO representatives; Supervision Consultants' representatives; Members of MPWD staff involved in supervising upgradation corridor, Major Maintenance; District Officials & Members of special committees –	Lectures and Presentations	Institutional Framework for Implementation of MSRP: • The role of the MPWD • The responsibilities of the Supervision Consultant and the NGO • Reporting requirements • Contractual Obligations and Environmental Protection	Environmental Specialist, Supervision consultant, MPWD

S. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered training module	Training Conducting Agency
	MVAC and GRC			
Module - IV	Members of MPWD staff involved in supervising Major Maintenance, Upgradation; NGO staff implementing the R&IPDP; District Officials & Members of special committees – MVAC and GRC	Presentations; Site Visits; Demonstration Sessions	Special Issues in MSRP: • Bio-Diversity Assessment and Conservation • Geomorphological Assessment and Slope Protection • Consultation and Counselling • Income generation and Economic Rehabilitation • Preparation of Micro-plans	MPWD and PCC Consultant
SESSION - II				
Module - V	Members of the MPWD; Selected Officers of the line Departments such as Forests, Officials of the Pollution Control Board, Mining and Geology department	Lectures; Group Discussions	Improved Co-ordination with other departments: • Overview of the MSRP • Environmental & Social Impacts of the proposed improvements • Statutory	External agency.

S. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered training module	Training Conducting Agency
			permissions – procedural requirements • Co-operation with the Forests Department • Co-operation with the Village Councils and Revenue Department .	
Module - VI	Members of MPWD involved in MSRP	Lectures; Demonstration sessions; Group Discussions	Long-term issues in Planning Roads development in Mizoram • Environmental & Social Assessment Methodology • Preparation of EMP & RAP • Stability of Hill Roads and mitigation measures • Conserving bio-diversity along roadside • Highway related diseases and AIDS	

S. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered training module	Training Conducting Agency
			• Consultation tools and techniques	

1.8 LOGISTICAL SUPPORT REQUIRED

The various items that need to be procured for the Environmental Cell are listed below:

- Own equipments for monitoring noise levels viz. portable sound level meter, water sampling kit etc.
- Equipments as a Digital Camera and adequate computing facilities to allow the documentation unit to be self-sufficient. They should have access to one licensed copy of the latest version of the software useful for environmental wing. These could include CALINE-4 (for air pollution modeling from traffic emissions), SOUND 32 (for traffic noise) and a fugacity-based model (for predicting the behaviour of volatile/hazardous material that might spill on the road).
- A well-stocked library with books and manuals related to environmental impacts of infrastructure in general and roads in particular, would be an advantage.

1.9 ENVIRONMENTAL MONITORING PLAN

The monitoring programme is devised to ensure that the envisaged purposes of the project are achieved and result in desired benefits to the target population. To ensure effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. The environmental monitoring programme provides such information on which management decision may be taken during construction and operational phases. It provides basis for evaluating the efficiency of mitigation and enhancement measures and suggest further actions that need to be taken to achieve the desired effect.

The monitoring includes:

- Visual observations;
- Selection of environmental parameters at specific locations;

- Sampling and regular testing of these parameters.

1.9.1 OBJECTIVES

The objectives of environmental monitoring programme are:

- Evaluation of the efficiency of mitigation and enhancement measures;
- Updating of the actions and impacts of baseline data;
- Adoption of additional mitigation measures if the present measures are insufficient;
- Generating the data, which may be incorporated in environmental management plan in future projects.

1.9.2 METHODOLOGY

Monitoring methodology covers the following key aspects:

- Components to be monitored;
- Parameters for monitoring of the above components;
- Monitoring frequency;
- Monitoring standards;
- Responsibilities for monitoring;
- Direct responsibility,
- Overall responsibility;
- Monitoring costs.

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

1.9.3 AMBIENT AIR QUALITY (AAQ) MONITORING

Ambient air quality parameters recommended for monitoring road transportation developments are PM10 ,PM 2.5, Carbon Monoxide (CO), Oxides of Nitrogen (NO_X), Sulphur Dioxide (SO_2) and Lead (Pb).

These will be monitored at designated locations starting from the commencement of construction activity. Data should be generated at all identified locations in accordance to the National Ambient Air Quality Standards ,2009 (Table 5) .The location, duration and the pollution parameters will be monitored and the responsible institutional arrangements are detailed out in the Monitoring Plan (Table 8)

Table 5 : National Ambient Air Quality Standards (2009)

NATIONAL AMBIENT AIR QUALITY STANDARDS
CENTRAL POLLUTION CONTROL BOARD
NOTIFICATION

New Delhi, the 18th November, 2009

No. B-29016/20/90/PCI-L—In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in supersession of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual*	50	20	- Improved West and Gaeke
		24 hours**	80	80	-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours**	80	80	- Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} $\mu g/m^3$	Annual*	60	60	- Gravimetric - TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ $\mu g/m^3$	Annual*	40	40	- Gravimetric - TOEM
		24 hours**	60	60	- Beta attenuation
5	Ozone (O_3) $\mu g/m^3$	8 hours**	100	100	- UV photometric - Chemiluminescence
		1 hour**	180	180	- Chemical Method
6	Lead (Pb) $\mu g/m^3$	Annual*	0.50	0.50	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
		24 hours**	1.0	1.0	- ED-XRF using Teflon filter
7	Carbon Monoxide (CO) mg/m^3	8 hours**	02	02	- Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour**	04	04	
8	Ammonia (NH_3) $\mu g/m^3$	Annual*	100	100	-Chemiluminescence
		24 hours**	400	400	-Indophenol blue method

(1)	(2)	(3)	(4)	(5)	(6)
9	Benzene (C_6H_6) $\mu g/m^3$	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo[a] Pyrene (BaP) - particulate phase only, ng/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m^3	Annual*	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m^3	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

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

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note. — Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman
[ADVT-III/4/184/09/Extr.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

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and Published by the Controller of Publications, Delhi-110054.

Source : Central Pollution Control Board, Delhi.

*Average Arithmetic mean of minimum 104 measurements in a year taken for a week 24 hourly at uniform interval.

**24 hourly/8 hourly values should meet 98 percent of the time in a year

1.9.4 WATER QUALITY MONITORING

The physical and chemical parameters recommended for analysis of water quality relevant to road development projects are pH, total solids, total dissolved solids, total suspended solids, oil and grease, COD, chloride, lead, zinc and cadmium. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan. The monitoring of the water quality is to be carried out at all identified locations in accordance to the Indian Standard Drinking Water Specification – IS 10500: 1991 (stated in Table-6)

Table-6: Indian Standard Drinking Water Specification-IS 10500:1991

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
Essential Characteristics						
1	Colour, Hazen units, Max.	5	Above 5, consumer acceptance decreases	25	3025 (Part 4) 1983	Extended to 25 only if toxic substances are not suspected, in absence of alternate sources
2	Odour	Unobjectionable	-	-	3025 (Parts 5):1984	a) Test cold and when heated b) Test at several dilutions
3	Taste	Agreeable	-	-	3025 (Part 7 and 8) 1984	Test to be conducted only after safety has

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
						been established
4	Turbidity NTU, Max.	5	Above 5, consumer acceptance decreases	10	3025 (Part 10) 1984	-
5	Ph Value	6.5 to 8.5	Beyond this range, the water will affect the mucous membrane and/or water supply system	No relaxation	3025 (Part 11) 1984	-
6	Total hardness (as $CaCO_3$) MG/1, *Max*	300	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21) 1983	-
7	Iron (as Fe) mg/1, *Max*	0.3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	1	32 of 3025 : 1964	-
8	Chlorides (as CI) mg/1, *Max*	250	Beyond this limit, taste, corrosion and palatability are	1000	3025 (Part 32) 1988	-

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
			affected			
9	Residual, free chlorine, mg/1, *Min*	0.2	-	-	3025 (Part 26) 1986	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be *Min* 0.5 mg/1
Desirable Characteristics						
1	Dissolved solids mg/1, *Max*	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2000	3025 (Part 16) 1984	-
2	Calcium (as Ca) mg/1, *Max*	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40) 1991	-
3	Magnesium (as Mg), mg/1, *Max*	30	Encrustation to water supply structure and adverse effects on	100	16, 33, 34 of IS 3025: 1964	-

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
			domestic use			
4	Copper (as Cu) mg/1, *Max*	0.05	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this	1.5	36 of 3025: 1964	-
5	Manganese (as Mn) mg/1, *Max*	0.1	Beyond this limit taste/appearance are affected, has adverse effects on domestic uses and water supply structures	0.3	35 of 3025: 1964	-
6	Sulphate (as 200 SO_4) mg/1, *Max*	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	3025 (Part 24) 1986	May be extended up to 400 provided (as Mg) does not exceed 30
7	Nitrate (as NO_2) mg/1, *Max*	45	Beyond this, may cause methaemoglobinemia	100	3025 (Part 34) 1988	-
8	Fluoride (as F) mg/1, *Max*	1	Fluoride may be kept as low as possible. High fluoride may cause	1.5	23 of 3025: 1964	-

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
			fluorosis			
9	Phenolic compounds (As C_6H_5OH) mg/1, *Max*	0.001	Beyond this, it may cause objectionable taste and odour	0.002	54 of 3025: 1964	-
10	Mercury (as Hg) mg/1, *Max*	0.001	Beyond this, the water becomes toxic	No relaxation	(see Note) Mercury ion analyser	To be tested when pollution is suspected
11	Cadmium (as Cd), mg/1, *Max*	0.01	Beyond this, the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
12	Selenium (as Se), mg/1, *Max*	0.01	Beyond this, the water becomes toxic	No relaxation	28 of 3025: 1964	To be tested when pollution is suspected
13	Arsenic (As As) mg/1, *max*	0.05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37) 1988	To be tested when pollution is suspected
14	Cyanide (As CN), mg/1, *Max*	0.05	Beyond this limit, the water becomes toxic	No relaxation	3025 (Part 27) 1986	To be tested when pollution is suspected
15	Lead (as Pb), mg/1, *Max*	0.05	Beyond this limit, the water becomes toxic	No relaxation	(see note)	To be tested when pollution is suspected
16	Zinc (As Zn). Mg/1, *Max*	5	Beyond this limit it can cause astringent taste and an opalescence in	15	39 of 3025: 1964)	To be tested when pollution is suspected

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
			water			
17	Anionic detergents (As MBAS) mg/1, *Max*	0.2	Beyond this limit it can cause a light froth in water	1	Methylene-blue extraction method	To be tested when pollution is suspected
18	Chromium (As Cr^{6}+) mg/1, *Max*	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025: 1964	To be tested when pollution is suspected
19	Poly nuclear aromatic hydrocarbons (as PAH) g/1, *Max*	-	May be carcinogenic above this limit	-	-	-
20	Mineral oil mg/1, *Max*	0.01	Beyond this limit undesirable taste and odour after chlorination take place	0.03	Gas Chromatographic method	-
21	Pesticides mg/1, *Max*	Absent	Toxic	0.001	-	-
22	Radioactive materials:				58 of 3025:01964	-
23	a) Alpha emitters Bq/1, *Max*	-	-	0.1	-	-
24	Beta emiters pci/1, *Max*	-	-	1	-	-

Sl. No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect Outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref. To IS)	Remarks
25	Aluminium (as Al), mg/1, *Max*	200	Beyond this limit taste becomes unpleasant	600	13 of 3025:1964	-
26	Aluminium (as A1), mg/1, *Max*	0.03	Cumulative effect is reported to cause dementia	0.2	31 of 3025: 1964	-
27	Boron, mg/1, *Max*	1	-	5	29 of 3025: 1964	-

Source: Indian Standard Drinking Water Specification-IS10500:1991

1.9.5 NOISE LEVELS MONITORING

The measurements for monitoring noise levels would be carried out at all designated locations in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989 (refer Table 7) Sound pressure levels would be monitored on twenty-four hour basis. Noise should be recorded at an "A" weighted frequency using a " slow time response mode" of the measuring instrument. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan (Table-8).

Table 7: Noise Level Standards (CPCB)

Km.	Noise level for	Noise level
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence zone	50	40

Day time - 6.00 am - 9.00 pm (15 hours)

Night time - 9.00 pm - 6.00 am (9 hours)

The monitoring plan along with the environmental parameters and the time frame is presented, environmental monitoring plan.

1.10 MONITORING PLAN

The monitoring plan for the various performance indicators of the project in the construction and operation stages is summarised in the Table 8.

Table 8 : Environmental Monitoring Plan

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Air	Construction stage	SPM, RSPM, SO_2, NO_X, CO, HC	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	Hot mix plant/Batching plant	Quarterly for three years	Continuous 24 hours/ or for 1 full working day	Contractor through approved monitoring agency	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	**Special Guidance**	**Standards**	**Location**	**Frequency**	**Duration**	**Implementation**	**S**
	Construction stage	SPM, RSPM	High Volume Sampler to be located 40 m from the earthworks site downwind direction. Use method specified by CPCB for analysis	Air (Prevention and Control of Pollution) Rules, CPCB, 1994	Stretch of the road where construction is in progress site	Quarterly for three years	Continuous 24 hours/ or for 1 full working day	Contractor through approved monitoring agency	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Water Quality	Construction stage	pH, BOD, COD, TDS, TSS, DO, Oil & Grease and Pb	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	As directed by the Engineer (At maximum 5 locations)	End of summer before the onset of monsoon every year for 3 years	-	Contractor through approved monitoring agency	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	**Special Guidance**	**Standards**	**Location**	**Frequency**	**Duration**	**Implementation**	**S**
	Operation stage	pH, BOD,COD,TDS,TSS, DO, Pb, Oil and Grease.	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Water quality standards by CPCB	As directed by the Engineer (At maximum 5 locations)	End of summer before the onset of monsoon in 2004, 2006 and 2010	-	MPWD	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	**Special Guidance**	**Standards**	**Location**	**Frequency**	**Duration**	**Implementation**	**S**
		Flooding and Cleaning of drains/water bodies	Flooding locations to be identified and choked drains, water bodies under going siltation and subject to debris disposal should monitored under cleaning operations	Water quality standards of CPCB and cleaning shall be to the satisfaction of the engineer (MPWD)	All along the corridor + land slide location	Thrice in monsoon and post-monsoon seasons of 2004, 2006 and 2010.	-	MPWD	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Noise levels	Construction stage	Noise levels on dB (A) scale	Free field at 1 m from the equipment whose noise levels are being determined.	Noise standards by CPCB	At equipment yards	Once every month (max) for three years, as required by the engineer	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	Contractor through approved monitoring agency	
		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	Noise standards by CPCB	As directed by the Engineer (At maximum 5 locations)	Thrice a year for three years during the construction period.	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	Contractor through approved monitoring agency	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Soil Erosion	Construction stage	Turbidity in Storm water Silt load in ponds, water courses	-	As specified by the engineer MPWD / Water quality standards	As directed by the Engineer (At maximum 5 locations)	Pre-monsoon and post-monsoon seasons for three years		Supervision Consultant	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Construction Sites and Construction Camps	Construction Stage	Monitoring of: 1. Storage Area 2. Drainage Arrangements 3. Sanitation in Construction Camps	The parameters mentioned are further elaborated in the reporting format C1. These are to be checked for adequacy.	To the satisfaction of the MPWD and the standards given in the reporting form.	At Storage area and construction camps	Quarterly in the construction stage.		Engineer	
Bio-diversity	Construction stage	Species diversity	Quadrate method	Comparison with pre-project situation	At locations selected by engineer	Quarterly	1 time evaluation at each site	Engineer	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
Bioengineering measures	Operation Stage	Vegetation cover (sq.m)			Selection of locations as advised by Geotechnical personnel of Engineer	Quarterly	1 time evaluation at each site	Engineer	
Landslides	Construction	Monitoring of soil movement using pegs/bolts on cut slopes	The study location to be identified in consultation with Geotechnical Expert of Engineer		At vulnerable land slide location	Fortnight	1 time measurement	GSI	

Env. component	Project Stage	MONITORING						Institutional respo	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	S
	Operation	Monitoring of soil movement using pegs/bolts on cut slopes	The study location to be identified in consultation with Geotechnical Expert of Engineer		At vulnerable land slide location	Fortnight	1 time measurement	GSI	

1.11 ENVIRONMENTAL MANAGEMENT – BUDGET

The Environmental Assessment and its incorporation into the designs and the contract documents will be taken up at all stages of the preparation and will continue during the implementation of the project. As part of good engineering practices in the project, there have been several measures as slope protection , erosion prevention, rehabilitation of borrow areas, safety, signage, provision of temporary drains, etc the costs for which will be included in the engineering costs. Therefore, these items of costs will not be included in the EMP budget. Only those items not covered under budgets for construction and RAP are coasted in the EMP budget. The EMP costs will include:

- Mitigation / Enhancement Costs (including purpose-designed protection for flora, designs of waterfalls as picnic spots, provision of barbed wire-fencing of important areas, etc.)
- Monitoring Costs
- Training cost
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The summary of approximate budget for the Environmental management costs for the MSRP-2 is 45,500,000 (INR) which are presented in the Table 9.

Table 9: Environmental Budget – MSRP-2 (in INR)

Budget Head	**Upgradation / Improvement**
Mitigation/Enhancement	40,000,000
Monitoring	3,500,000
Training of MPWD	2,000,000
Total	**45,500,000**