ENVIRONMENT MANAGEMENT PLAN GUIDELINES

1.1. Scope

1. This Generic Environmental Management Plan provides the mitigation measures to be implemented as different infrastructure facilities of Solar Park's will be constructed. Rajasthan Renewable Energy Corporation (RREC) is developing its first Solar Park in the village of Bhadla, tehsil Phalodi, district Jodhpur, where about 10,000 hectares of government land have been identified. A SPV company "Rajasthan Solarpark Development Company Ltd." (RSDCL) in form of a subsidiary company of RRECL has been formed for the development of infrastructure and management of Solar Parks. The total land is planned to be developed in phases. Phase I is already being implemented with 75 MW of IPP projects. For Phase II 680 MW of power is being planned while Phase III will develop further 1000 MW. It occupies around 1490 hectares of land with a usable area for solar plots of around 1365 hectares (91%) with the remaining being for roads and transmission corridors as well as pooling stations. Two pooling stations of 220 kV are planned to evacuate power from the solar plots at 132 kV. Two new 7 m wide roads of around 5,2 and 3,5 km each will be built to provide access to all planned solar plots in addition to the 4,8 km of upgrade of the existing PWD road to 10 m wide. All roads will have street lighting. A water pipeline from the IGNP canal of 22 km long is also planned to provide water to the solar plots as well as local population, as part of the CSR policy of the solar park company. A fence will demarcate the whole land to be developed including some of the land for Phase III on a total of around 27 km.

1.2. Context of the EMP

2. The management measures have been identified for the specific environmental issues identified in the EIA. This EMP document is structured to be standalone document, and included as part of the bid documents for implementation by the contractor. In addition, this EMP provides guidance to SPV in effective supervision and monitoring of the implementation of the environmental measures proposed.

1.3. Clearance Requirement

3. The proposed infrastructure facilities for Solar Park at Bhadla do not attract any environmental clearance as per EIA notification 2006 stipulated by Ministry of Environment and Forest (MoEF). However, the project shall require obtaining consent from competent authorities such as the RSPCB, for '*Consent to Establish'* by submitting a Common Application (as per Schedule-I), under Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981) and authorization under Hazardous Wastes (Management and Handling) Rules, 1989, as amended. Other clearances to be obtained by SPV / contractor prior to commencement of civil works are presented in Table-2.

Table 2: Applicable Laws and Regulations

Sl. No	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
PROJECT PREPARATION STAGE							
1	No Objection Certificate (NOC)	Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution)	Rajasthan Pollution Control Board	Applicable	3 months	RREC	RREC, PMC

Sl. No	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
		Act 1981					
2	Permission for removal of tree growth within the terminal/ depot area Felling conversion and removal from stump site	Forest Conservation Act 1980 Rajasthan Tree Preservation Act 1976	Local Divisional Forest Officer	Applicable	1 month	Forest department	RREC
PROJECT IMPLEMENTATION STAGE							
3	Permission for Withdrawal of Ground Water	Environment Protection Act 1986	Central Ground Water Board Water resource department, Rajasthan	Applicable	2 months	Contractor	RREC, PMC
4	Permission for Withdrawal of Surface Water from Reservoirs/ Ponds/ Irrigation canals	Rajasthan State Water Policy,	Irrigation Department, Rajasthan	Applicable (If the contractor is extracting surface water)	3 months	Contractor	RREC, PMC
5	Crushers, Cement Batching Plant, Hot Mix Plant	Air (Prevention and Control of Pollution) Act. 1981	Rajasthan Pollution Control Board	Applicable	3 months	Contractor	RREC, PMC
6	Storage of Hazardous Chemicals	Hazardous Waste (Management and Handling) Rules 1989 and Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Rajasthan Pollution Control Board	Applicable	3 months	Contractor	RREC, PMC
7	Disposal of Hazardous Waste	Hazardous Waste (Management and Handling) Rules 1989	Rajasthan Pollution Control Board	Applicable	2 months	Contractor	RREC, PMC
8	Disposal of Construction Waste and liquid effluent from Labour camps	Water (Prevention and Control of Pollution) Act 1974	Rajasthan Pollution Control Board	Applicable	2 months	Contractor	RREC, PMC
9	Pollution Under Control Certificate	Central Motor Vehicles Act 1988	Department of Transport, Govt. of Rajasthan	Applicable	1 Month	Contractor	RREC, PMC
10	Employing Labour	Executing Agency of Building and other construction act, 1996	District Labour Commissioner	Applicable	1 Week	Contractor	RREC, PMC
11	Registration of Workers	Labour welfare Acts.	District Labour Commissioner	Applicable	1 Month	Contractor	RREC, PMC

Source: MoEF

2.2. Environmental Impacts Identified

4. Based on the baseline environmental features of the project area and the proposed engineering works this section assesses the impacts of the proposed activities on various environmental and social attributes of the project area. Infrastructure projects are generally expected to bring in positive impacts to the project area/town. However, these projects are expected to induce negative impacts especially during construction phase, if due care is not taken.

2.2.1. Prediction of Impacts

5. The environmental impacts caused due to infrastructure projects can be categorised either as primary (direct) or secondary (indirect) impacts. Primary impacts are those which are induced directly by the project whereas the secondary impacts are those which are indirectly induced and typically include the associated investment and changing patterns of social and economic activities due to the proposed action. Typically, the potential direct impacts of such infrastructure projects are mainly during the construction phase and the most of the indirect impacts are during the operational phase.

2.2.2. Activities under Construction and Operation Phase

6. The major activities during the construction of the roads, transmission corridors, pooling stations & water pipeline would include earthwork excavation, material movement, construction of building, provision of infrastructural facilities like construction of storm water drains, sewerage lines, septic tanks, electrical and communication network etc. The support activities would include employment of labour, material transport, use of construction equipment's etc. The activities under operation phase would include increase in the movement of public and private vehicles, public and commercial activities. These activities are expected to cause minor environmental problems during the construction and operation phase of the project, which are discussed in the following sections.

2.2.3. Environmental Impacts

Impact on Land

7. In the proposed project, the major activity that is expected to cause an impact on land is earthwork excavation and filling for the construction. Since the proposed site is desert wasteland it can be inferred that impact on land environment because of excavation etc. during construction activities is marginal. However, these activities will necessitate appropriate plans for safety measures for the workers involved in these works.

Impacts on Climate

8. Due to the proposed activities of the project, no changes in climatic conditions are anticipated.

Impacts on Air Quality

9. **Construction Phase**: Suspended Particulate Matter (SPM) and dust are the major sources of air quality impacts during the construction phase. However, when viewed with respect to the existing ambient air quality or with respect to compliance of ambient air quality standards, the impact on air quality during the construction phase of the project is temporary in nature and adequate dust suppression measures during construction will significantly reduce the impacts.

10. **Operation Phase**: During the operation phase the particulate dust and emission from the vehicular traffic movement will have an impact on the existing ambient air quality of the project area. However, creation of green belt & roadside plantation will bring a positive impact to the air quality.

Impact on Noise Levels

11. **Construction Phase:** During the construction phase of the project, the major sources of noise pollution are movement of vehicles transporting the construction material and the noise generating activities at the construction site itself. Mixing and material movement will be the primary noise generating activities in the project area and will be distributed over the entire construction period. Construction activities are expected to produce noise levels in the range of 80 - 95 dB (A) and can affect the personnel working at the site and the population residing near the project site. Hence the use of proper personal protective equipment (PPE) such as earmuffs is recommended to mitigate any adverse impact of the noise generated by any equipment. Noise generating tools such as pneumatic tools, generators etc, should be avoided during late hours to minimise the impact of noise on the population residing near the project area.

12. **Operation Phase:** During the operation phase the movement of vehicles is expected to contribute some noise pollution. Providing vegetation to act as a sound barrier is recommended as a positive impact to minimise the dispersion of sound to surroundings.

Impact on Water Quality

13. **Impact on Surface Water Quality:** No impact on the surface water quality is anticipated during the construction phase of the project. During the operation phase safe disposal of the sewage generated (howsoever little), during the project design, will mitigate the anticipated impact due to water pollution. Recycling of water is suggested, the recycled water would be utilized for vehicle washing and gardening. This activity is considered as a positive impact.

14. **Impact on Ground Water Quality:** No activities of the project construction are expected to impact the ground water quality of the project area. But during the operation phase the generation of sewage (if any) if not disposed properly is expected to interfere with the ground water characters of the project area. However, proper planning for safe disposal of the sewage generated, during the project design, will mitigate the anticipated impact due to water pollution.

Impact on Ecological Resources

15. The project activities do not involve encroachment of sensitive environmental features or cutting of trees / vegetation and hence no impacts are predicted on the ecological resources of the project area. It is planned to create a green belt in the solar park, this in turn gives positive impact on ecological resources.

Impact on Soils

16. The impact on soil due to the Solar Park project will be in small due to construction activities. Since the proposed project site is an existing Desert wasteland land no impacts on the top soil erosion is anticipated during the construction and the operation phase.

2.2.4. Social impact Assessment

Land Acquisition

17. Since the project is proposed mostly on a designated wasteland, minimum land acquisition is foreseen in the future. Summary of predicted impacts is given in Table 3.

Table3: Summary Matrix of Predicted Impacts

Sl.no	Components	Activities	Predicted impacts	Extent of Impacts
Construction Phase				
1.	Ambient Air Quality	Dust emissions from site preparation, excavation, material handling and other construction activities at Site.	Minor negative impact inside project site premises. No negative impact outside the site.	Impacts are temporary during construction phase. Impacts will be confined to short distances, as coarse particles will settle within the short distance from activities.
2.	Noise	Noise generated from construction activities and operation of construction equipment	Minor negative impact near noise generation sources inside project site premises. No significant impact on ambient noise levels at sensitive receptors.	Temporary impacts during construction phase. No blasting or other high intensity noise activities envisaged. Contribution of noise during operation will be confined in time and space
3.	Water quality	- Surface runoff from project site - Improper debris disposal – Discharge of sewage from labour camp.	Minimal due to effective EMP proposal	Impact will be temporary. Local labour will be employed to reduce size of labour camps. Labour colonies shall be provided potable water for drinking.
4	Landuse and Aesthetics	Land development	**Permanent positive impact**	As open areas and green belt, with sustainable infrastructure plan will enhance the visual appeal of the area.
5	Topography and Geology	The proposed site is an existing Desert Wasteland	No Significant Impacts	no impacts on topography. Structures will be designed as per IS standards for earthquake protection.
6.	Soils	Construction activity leading to erosion.	Minor negative impact	---
7.	Ecology Flora and Fauna	Habitat disturbance during construction activity	Minor negative impact	The site and adjacent areas does not have any significant flora and fauna diversity and density. No endangered species recorded on site.
8.	Socio-economy	Increased job opportunity. Economy related to commercial, material supply etc.	**Overall positive impact**	---
9.	Traffic Pattern	Haul Truck movement and possibility of traffic congestion outside site.	Minor negative Impact	---
Operational Phase				
1.	Ambient Air Quality	Particulate and gaseous emissions from heavy vehicles & DG sets	Minor negative impact inside and downwind direction of project premises.	Soundproof DG sets will be used only as back up. The generators would be provided with scrubbers, which will help reduce the sulphur contents thereby improving the quality of air.
2.	Noise	Noise from vehicle movement.	Minor negative impact inside premises. No significant impact at sensitive receptors.	Provision of trees as landscaping will attenuate the noise pollution and in turn minimise the noise from traversing outside the premises.

Sl.no	Components	Activities	Predicted impacts	Extent of Impacts
3.	Water Quality	Discharge of contaminated storm water	No significant adverse impact	---
4	Soils	Storage and disposal of solid and other wastes during oil change	No negative impact	---
5.	Ecology Flora and Fauna	Landuse change. Discharge of wastewater to surface water bodies	No negative impact	No significant flora and fauna is recorded in impact zone
6.	Socio-economy	Increased job opportunity during construction and operation phase.	**Overall positive impact**	---

2.3. Mitigation Measures for the Identified Environmental Impacts

18. In order to address the impacts predicted in the earlier section mitigative measures are discussed in this section and an Environmental Management Plan (EMP) is recommended. The EMP also identifies the role of various agencies in the implementation of these measures. Since the site is not an ecologically or environmentally sensitive area no major environmental or social issues are anticipated. The critical issue will however be to minimise air and noise impacts during the execution of the project. While the impacts are not very severe and permanent, care has to be taken to ensure that the ambient environmental conditions do not deteriorate.

2.3.1. Impact during Construction Phase

Impact on Air Quality

19. During construction period the impacts on air quality are mainly due to the material movement and actual construction activities. Even though there will be an increase in the dust levels the air quality is not expected to be affected to significant levels and will be temporary.

Mitigation Measures

- Provisions should be made for sprinkling of water at the excavation areas and it has to be ensured that the construction debris is removed daily
- Earthwork should be covered with polythene/ tarpaulin covers during transport.
- Idling of delivery trucks or other equipment should not be permitted during periods of unloading or when they are not in active use
- As soon as construction is completed, the surplus earth should be utilised to fill up low-lying areas if possible or as a filling material for pavement base preparation. In no case, loose earth should be allowed to pile up around the project site.

Impact on Noise Levels

20. The prime sources of noise levels during the construction phase are the construction machinery and the vehicular noise due to material movement at the site. Though the effect of noise would be insignificant during daytime, the residential areas located in the near vicinity of the construction site may experience increase in the night time ambient noise levels.

Mitigation Measures

- Construction contract should clearly specify the use of equipment emitting noise of not greater than 90 dB(A) for the eight hour operation shift
- Noise measurements should be conducted during the construction to assess the prevailing noise levels.
- Noise generating construction activities should be preferably planned during the day time.
- For protection of construction workers, earplugs should be provided to those working very close to the noise generating machinery.

Impact on Water Quality

21. The construction phase of the roads, pooling station etc. is not expected to alter the existing water quality in the project area. However if proper bypass and temporary drainage arrangement(as required) are to be provided during construction.

Mitigation Measures

22. Adequate bypass and temporary drainage arrangements should be provided during construction to avoid disruption to the existing drainage facilities in the project site.

2.3.2. Impact during Operation Phase

Impact on Air and Noise Quality

23. During the operation phase the particulate dust particles and emission due to traffic movement will have an impact on the existing ambient air and noise quality of the project area.

Mitigation Measures

24. Provision of a vegetative cover around the functional area will act as a barrier to minimise the impact on the existing ambient air and noise levels.

Impact on Water Quality

25. During the operation phase there is a likely impact on the surface and ground water quality if proper sanitation and waste water disposal facilities are not provided.

Mitigation Measures

26. Adequate sewerage and disposal arrangements such as septic tanks, soak pits etc, should be provided for the sewerage generated from proposed toilets etc. in order to avoid the pollution of ground and surface water resources.

Other Impacts

27. Solid waste generated from the pooling stations and office areas if not managed will affect the aesthetics of the stations and office and create unhygienic conditions.

Mitigation Measures

28. Adequate number of garbage collection bins should be placed at prominent locations within the proposed pooling station & office. A plan for the timely clearing of the garbage bins and disposal of the waste should be worked out. Display boards to create awareness among the public on solid waste management, should be placed at strategic locations within the proposed pooling station and the office area.

2.4. Environment Management Plan

29. A description of the various management measures during various stages of the project is provided in Table 4.

2.4.1. Pre Construction Stage

Pre-Construction Activities by Contractor/Engineer

30. 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(PMC) 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, mixing plant for concrete 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 plants,batching plants, labour camps etc.
- Planning traffic diversions and detours, including arrangements for temporary land acquisition

2.4.2. Construction Stage

Construction stage activities by the contractor

31. Construction stage activities require careful management to avoid environmental impacts. Activities that trigger the need for following environmental measures 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 and soil)
32. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs.

Construction Stage Activities by the SPV (RREC)

33. The construction stage involves the following activities by SPV:
    - Tree plantation/ landscaping in the Solar Park.
    - Monitoring of environmental conditions through appointed monitoring agency

2.4.3. Operation Stage

34. Operation stage actives are to be carried out by the Environmental Cell includes mostly environmental monitoring (Ambient air quality, Noise levels, Water quality and Soil quality) of operational performance of the various mitigation/enhancement measures carried out as a part of establishing Solar Park.

2.4.4. Other Activities

35. Other activities are as follows:

- 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

2.4.5. Implementation of Environmental Management Plan

36. Table 4 presents a summary of the EMP, with an objective to minimize negative environmental impacts of the proposed works. The table includes the environmental issues and necessary mitigative measures for the same. It is envisaged that mitigatory measures for the construction phase impacts will form part of tender documents inviting proposals for construction. The responsibility for their compliance thus would be binding for the prospective contractor as part of the contract condition. The overall responsibility for implementation of mitigative measures will, however, remain with the project implementing agency, which will supervise the construction of improvements.

Table 4: Environment management Plan

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
1.0	**PRE-CONSTRUCTION STAGE**					
1.1	**Pre-construction activities by SPV**					
1.1.1	Tree Cutting:	Existing trees (if any) within the Solar Park shall be attempted to retain and shall be maintained as a part of landscaping. Any trees to be cut due to design/ under unavoidable circumstances, it shall be informed to the forest department and permission shall be obtained to fell the trees. SPV will ensure that all necessary permissions are taken from the Forest Dept before felling any trees. The trees cut shall be disposed off through auction (inclusive of tree stumps). Progress of tree cutting shall be reported to the SPV.	Project site/ area (Bhadla Solar Park Phase II)	Design MoRTH 201.6	Rajasthan Forest Department, Tree Felling Contractor, SPV	SPV, Site Engineer/ Project Management Consultant
1.1.2	Utility Relocation	All community utilities and common property resources such as stand posts, supply lines, toilets, sewage lines, drainage systems, optical fiber cables, electric power supply lines, telephone and television cables shall be relocated and restored before the	Project site/ area	Design MoRTH 110.7	SPV; Concerned Agencies/ Departments; Contractor	SPV, Site Engineer/ Supervision Consultant

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

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		commencement of the project activity. While relocating these utilities and facilities, all concerned agencies including SPV shall take necessary pre-cautions and shall provide barricades/ delineation of such sites to prevent accidents including accidental fall into bore holes, pits, drains both during demolition and construction/ relocation of such facilities. Standard safety practices shall be adopted for all such works.				
1.1.3	Orientation of Implementing Agencies	The SPV shall organize orientation sessions during all stages of the project. This shall include on-site training (general as well as specific to the context of this subproject) as well. These sessions shall involve concerned division-level staff of the SPV involved in the sub-project, Staff of the Site Engineer/ Project Management Consultant and the implementing agencies.			SPV, Site Engineer/ Project Management Consultant	SPV
1.2	**Pre-construction activities by the Contractor/Engineer of PMC**					
1.2.1	Joint Field Verification	The Engineer - Incharge of Project Management Consultants and the Contractor shall carry out joint field verification to ascertain the necessity of saving trees, environmental resources (if any) wherever such representations or suggestions in writing have	Project area/ site	EMP	Contractor; Environmental Officer of Project Management Consultant	SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		been received and forwarded by the project authority or by the site engineer in accordance with the local situations. The complaints/suggestions together with the observations and expert opinion of the joint verification team containing the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP shall be summarized in a written document containing all the details with date, time, place and signature of the individuals involved and this shall be sent to SPV for approval. The SPV shall maintain proper documentation and justifications/ reasons in all such cases where deviation from the original EMP is proposed.				
1.2.2	Assessment of Impacts due to Changes/ Revisions in the Project Work	The Engineer - Incharge of PMC shall assess the impacts and revise/ modify the EMP in consultation with the SPV in accordance to the recommendation made by the field survey party in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Project area/ site (terminal, depot, stations and workshop areas)	EMP	Contractor; Environmental Officer of Project Management Consultant	SPV
1.2.3	Procurement of Machinery					
1.2.3.1	Crushers, Hotmix plants & Batching	Specifications of crushers and batching plants shall comply with	Project area/ site	Contract, MoRTH: 111.1,	Contractor	Environmental Officer of PMC ; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
	Plants	the requirements of the relevant current emission control legislations. (Preferably Bharat stage – III for Diesel Construction Machinery) and Consent / NOC for all such plants shall be submitted to the PMC and SPV. Crusher and Batching plants shall be located 1000m away from settlements and commercial establishments, preferably in the downwind direction. No plants can be set-up within 1000m from the residential/ settlement locations. The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - Incharge of PMC before entering into formal agreement with a land owner for setting-up such sites. Actions by PMC and SPV against any non-compliance shall be borne by the Contractor at his own cost. Arrangements to minimize dust pollution through provision of windscreens, mist spray units, and dust encapsulation shall have to be provided at all such sites. No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority and the same is	All construction machineries (Crushers, Hotmix plants & Batching Plants) should be keep/station 1000 m away from the settlements.	GoI Air & Noise Standards, OSHA Standards		

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		submitted to the SPV and the PMC. The contractor shall procure metals and other construction materials from the RSPCB licensed quarry/ borrow areas (where the environmental monitoring/ management plan are in place) and submit a copy of their license to SPV and PMC for verification				
1.2.3.2	Other Construction Vehicles, Equipment and Machinery	The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A),when measured at one metre distance from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. Efficient and environment friendly equipment confirming to the latest noise and effluent emission control measures available in the market shall be used in the project.		Contract, Environment Protection Act, 1986 & MoRTH: 111.1	Contractor	Environmental Officer of PMC ; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced to the Project Management Consultant for verification whenever required.				
1.2.4	Identification & Selection of Material Sources					
1.2.4.1	Borrow Areas	Arrangement for locating the source of supply of material as well as compliance to environmental requirements, as applicable, shall be the sole responsibility of the contractor. The environmental personnel shall be required to inspect every borrow area location prior to approval. The Engineer - Incharge of the PMC shall be required to inspect every borrow area location and evaluate such proposals in accordance to environmental requirements prior to issuing approval for use of such sites. No borrow areas shall be opened within 500m of wildlife movement zones and forest areas. The borrow areas shall be at least 300m from schools and village access roads. The Contractor shall not borrow earth from the selected borrow area until a formal agreement is signed between land owner and Contractor and a copy of this	Ecologically sensitive area (If any)	MoRTH: 305.2.2.2	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		agreement is submitted to the Engineer – In-charge of the PMC. The Project Management Consultant shall report these facts to the SPV along with the remarks in the prescribed format with documentary proofs. Planning of haul roads for accessing borrow materials shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas. In case agricultural land is disturbed, the Contractor shall rehabilitate it as per Borrow Area guideline given or as approved by the Engineer – In-charge of PMC. Haul roads shall be maintained throughout the operation period of the borrow areas by undertaking the required maintenance and repair works, which may include strengthening, pot hole repairing and diversions. Improvements shall be done to reduce inconvenience to users of these roads, residents living along the haul roads and minimize air and water pollution. Such measures shall include, but not limited to, frequent sprinkling of water, repairing of the road, road safety provisions (warning and informatory signage, flagmen etc.), and ensuring covering of loaded vehicles by waterproof tarpaulin; consultation				

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		with public and special precautions are required when measures are implemented near schools, health centers and settlement areas. All borrow areas whether in private, community or govt. land shall be restored either to the original condition or as per the approved rehabilitation plan immediately upon completion of the use of such a source.				
1.2.4.2	Quarries	The Contractor shall identify materials from existing licensed quarries with the suitable materials for construction. Apart from approval of the quality of the quarry materials, the Engineer's representative shall verify the legal status of the quarry operation, as to whether approval from Rajasthan State Government is obtained. No quarry and/or crusher units shall be selected or used, which is within 1000m from the forest boundary, wildlife movement path, breeding and nesting habitats and national parks/sanctuaries. No plants can be set-up within 1000m from the residential/ settlement locations Contractor shall also work out haul road network used for quarry transport and report to Engineer - Incharge of Project	Quarry area should be located 1000m away from the settlements.	MoRTH: 111.3	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		Management Consultant who shall inspect and in turn report to SPV on the suitability of such haul roads from safety of residents, biodiversity and other environment point of views.				
1.2.4.3	Arrangement for Construction Water	The contractor shall source the requirement of water preferentially from surface water bodies, like lakes and tanks in the project area. The contractor shall be allowed to pump only from the surface Water bodies. Boring of any tube wells shall be prohibited. To avoid disruption/disturbance to other water users, the contractor shall extract water from fixed locations. The contractor shall consult the local people before finalizing the locations. Only at locations where surface water sources are not available, the contractor can contemplate extraction of ground water. 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 shall need to comply with the requirements of Irrigation Department, Rajasthan and seek their approval for doing so.	All surface water bodies that can be used in the project	Contract	Contractor	Environmental Officer of PMC ; SPV
1.2.4.4	Sand (all river and stream beds	The contractor shall identify sand quarries with requisite approvals	All riverbeds recommended for		Contractor	Environmental Officer of PMC ; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
	used directly or indirectly for the project)	for the extraction of sand. In case of selection of new sites for sand quarrying, the Contractor shall obtain prior approval and concurrence from Competent District Authority and the Engineer – Incharge of the PMC keeping in view the objections and convenience of the local population, who may restrain such activities for their own security and safety. Where the supplier of sand is another party, the authentic copy of lease agreement that has been executed between the local Tahasildar and the supplier has to be submitted to PMC and SPV of the project, before any procurement is made from such a site. To avoid accidents and caving in of sand banks at quarry sites, sand shall be removed layer by layer. Digging deeper than the permissible limit has to be completely avoided by the Contractor. Such quarry shall be barricaded 10m away from the periphery on all sides except the entry point, so as to prevent accidental fall of domestic cattle, wildlife and human beings.	sand extraction for the project.			
1.2.5	Labour Requirements	The contractor shall use unskilled labour drawn from local communities to avoid any additional stress on the existing facilities (medical services,	Project area at construction sites	Contract	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		power, water supply, etc.)				
1.2.6	Setting up construction sites					
1.2.6.1	Construction Camp Locations – Selection, Design & Layout	Construction camps shall not be proposed: (i) Within 1000m of 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 shall be as per the conceptual design presented in by the contractor & approved by the Engineer of PMC**.** Location's for stockyards for construction materials shall be identified at least 1000 m away from watercourses. The waste disposal and sewage system for the camp shall 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 shall be provided by the contractor.	All Construction Workers Camps including areas in immediate vicinity.	Contract	Contractor	Project Management Consultant; SPV
1.2.6.2	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules shall carry out negotiations with the land owners for obtaining their consent for temporary use of lands for construction sites/ hot mix plants	Areas temporarily acquired for construction sites / batching plant/ borrow areas / diversions / detours	Contract Document	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		/traffic detours /borrow areas etc. The Engineer shall ensure that the site is cleared prior to handing over to the owner (after construction or completion of the activity) and it is included in the contract.				
2.0	**CONSTRUCTION STAGE**					
2.1	**Construction Stage Activities by Contractor**					
2.1.1	**Site Clearance**					
2.1.1.1	Clearing and Grubbing	Site clearance including clearance of marked trees for felling (if any) and removal has to be carried out much before the actual construction takes place. Structures and utilities (power transmission lines, cable connections, telephone lines, stand posts, etc.) shall be relocated; clearing or grubbing activities are to be undertaken as these activities may damage structures (private and govt.) and essential facilities/utilities of public use. All works shall be carried out in a manner such that the damage or disruption to flora is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works shall be removed with prior approval from Engineer - Incharge of PMC.	Project area/ site	Design MoRTH 201	Contractor	Project Management Consultant; SPV
2.1.1.2	Generation & disposal of Debris	Debris generated due to the dismantling of the structures shall be suitably reused in the	Project area/ site	MoRTH 202.5 MoRTH 517	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		proposed construction The Contractor shall suitably dispose off unutilized non-toxic debris either through filling up of borrows areas located in wasteland or at pre-designated disposal sites, subject to the approval of the Engineer In-charge of PMC. The pre-designated disposal locations shall be part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Engineer In-charge of PMC and approval local competent authority.				
2.1.1.3	Construction of wastes disposal sites	Location of disposal sites shall be finalized prior to completion of the earthworks. The Engineer shall approve these disposal sites conforming to the following (a) These are not located within designated forest area (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.	Disposal site locations	Contract MoRTH: 201.4 & 202.5 Section 2.1.1.3	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.1.4	Planning for Traffic Diversions and Detours	Detailed traffic control plans shall be prepared by the contractor and the same shall be submitted to the Engineer - Incharge of PMC for approval.	Traffic diversion and detour at work front	MoRTH: 112; IRC SP:55	Contractor	Project Management Consultant; SPV
2.1.2	**Construction Materials**					
2.1.2.1	Earth from Borrow Areas for Construction	No borrow area shall be opened without permission of the Engineer – Incharge of PMC. Borrow pits shall not be dug continuously in a stretch. The location, shape and size of the designated borrow areas shall be as approved by the Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations shall be carried out as specified in the guidelines for siting and operation of borrow areas The unpaved surfaces used for the haulage of borrow materials shall be maintained dust free by the contractor. Since dust rising is the most significant impact along the hauled roads, sprinkling of water shall be carried out twice a day along such roads during their period of use.	All access roads, sites temporarily acquired & all borrow areas	MoRTH: IRC 10 1961	Contractor	Project Management Consultant; SPV
2.1.2.2	Quarries	The Contractor shall obtain materials for quarries only after the approval of Department of Mines and Geology, Rajasthan	All along the haul roads	Department of Mines and Geology, Rajasthan	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		and the District Administration. A copy of this consent must be submitted to SPV through Engineer –Incharge of PMC. The Contractor shall develop a Comprehensive Quarry Redevelopment Plan, as per the Mining Rules of the State and submit a copy to SPV and PMC prior to opening of the quarry site. The quarry operations shall be undertaken within the rules and regulations in vogue.				
2.1.2.3	Blasting	Blasting shall 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 shall be strictly followed.	All blasting and Pre-splitting Sites.	MoRTH: 302.4	Contractor	Project Management Consultant; SPV
2.1.2.4	Water Extraction	Procurement of water is to be carried out as per Section 1.2.4.3. The contractor shall minimize wastage of water during construction.	All water bodies recommended to be used in the project	Section 1.2.4.3	Contractor	Project Management Consultant; SPV
2.1.2.5	Transporting Construction Materials	All vehicles delivering materials to 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 and similarly roads which are part of the works shall be kept clean and clear of all	All along the haul roads	MoRTH: 111.9	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		dust/mud or other extraneous materials dropped by such vehicles The unloading of materials at construction sites close to settlements shall be restricted to daytime only.				
2.1.3	**Construction work**					
2.1.3.1	Drainage and Flood Control	Contractor shall ensure that no construction materials like earth, stone, ash or appendage disposed off so as not to block the flow of water of any water course and cross drainage channels. Where necessary adequate mechanical devices to bailout accumulated water from construction sites, camp sites, storage yard, excavation areas are to be pre-settled and arranged well in advance of the rainy season besides providing temporary cross drainage systems.	Surface water sources/ drains/ irrigation canal etc.	MoRTH:305.3.7; MoRTH:306	Contractor	Project Management Consultant; SPV
2.1.3.2	Slope Protection and Control of Soil Erosion	The contractor shall construct slope protection works as per design, or as directed by the Engineer - Incharge of PMC to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fiber mats, mulches, grasses, slope drains and other devices as required under specific local conditions.	High raised embankment	MoRTH: 305.2.2.2; MoRTH: 306.2; Guideline for Slope Stability and Erosion Control	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.4	**Pollution Control**					
2.1.4.1	**Water Pollution**					
2.1.4.1.1	Water Pollution from Construction Wastes	The Contractor shall take all precautionary measures to prevent the wastewater generated during construction from entering into water bodies or the irrigation system. All waste arising from the project are to be disposed off in the manner that is acceptable to the Rajasthan State Pollution Control Board or as directed by Engineer – Incharge of PMC. The Engineer – Incharge shall certify that all liquid wastes disposed off from the sites meet the discharge standards.	Surface water sources/ drains/ irrigation canal etc.	MoRTH: 111.4; MoRTH: 111.1; Water Act, 1974	Contractor	Project Management Consultant; SPV, RSPCB
2.1.4.1.2	Water Pollution from Fuel, Lubricants and Chemicals	Contractor shall ensure that all 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 water. Oil interceptors shall be provided for vehicle parking, wash down and refueling areas as per the design provided. Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites approved by the Engineer – Incharge. All spills and collected petroleum products	Surface water sources/ drains/ irrigation canal etc.	MoRTH: 111.4; MoRTH: 111.1; Petroleum Act and Rules; MoEF/CPCB Notifications; Guideline -2 for Construction Camps	contractor	Project Management Consultant; SPV, RSPCB

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		shall be disposed off in accordance with MoEF and RSPCB guidelines. Engineer – Incharge shall certify that all arrangements comply with the guidelines of RSPCB/ MoEF or any other relevant laws.				
2.1.4.2	**Air Pollution**					
2.1.4.2.1	Dust Pollution	The contractor shall take every precaution to reduce the level of dust (SPM and RSPM) from crushers, material storage yards, haul roads and construction sites (including earthwork, dismantling, scarification and material mixing sites) by sprinkling of water, mist spray, encapsulation of dust source and erection of screen / barriers. Batch mix plant shall be fitted with dust extraction units and mist spray to keep down the dust emission levels. The suspended particulate matter value at a distance of 40m from a unit located in such a cluster should be less than 500 µg/m^3. The contractor shall provide necessary certificates to confirm that all crushers used in the project conform to relevant dust emission control legislation. Air pollution monitoring shall be conducted as per the Pollution Monitoring Plan and results shall be used to strengthen/rectify problematic areas. If other	Construction area/ site, Construction camps, Materials Loading / unloading facilities	MoRTH:111.1; MoRTH:111.5; MoRTH:111.9; MoRTH:111.10; Air Act; SPCB Rules and Guidelines	Contractor	Project Management Consultant; SPV, RSPCB

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		existing crushers are used, such units need to have valid license from the RSPCB.				
2.1.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm to the emission standards specified by the CPCB. Certification issued for such contrivances obtained from designated/approved authority shall be submitted along with the specified reporting format. The contractor shall maintain a separate file and submit PUC certificates for all vehicles/equipment/ machinery used for the project. Monitoring results shall also be submitted to PMC and SPV as per the Pollution Monitoring Plan in the specified format.	Construction camps, Materials Loading / unloading facilities	Motor Vehicles Act Pollution Monitoring Format	Contractor	Project Management Consultant; SPV, RSPCB
2.1.4.3	**Noise Pollution**					
2.1.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipment's	The Contractor shall confirm the following: • All plants and equipment used in construction (including the NHAI aggregate crushing plant) shall strictly conform to the MoEF/ CPCB noise standards. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery shall	At Sensitive locations (Religious places, schools and Hospitals)	Noise rules, 2002` MoRTH - Section: 201.2 MoRTH - Section 111.3	Contractor	Project Management Consultant; SPV; RSPCB, Affected Communities; NGOs; Staff at Schools and Health Centres

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		be done regularly and during routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found defective shall be replaced. • Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter distance from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. • Idling of temporary trucks or other equipment shall not be permitted during periods of unloading or when they are not in active use. (MoRTH - Section: 201.2) At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching shall `be stopped during the night time between 9.00 pm to 6.00 am. No noisy construction activities shall be permitted up to a distance of 100 m around sensitive receptors (educational institutes/health centers) (silent zones) between 9.00 am to 6.00 pm.				

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		Monitoring shall be carried out at the construction sites as per the monitoring schedule and results shall be submitted to Engineer-Incharge of PMC. Engineer shall be required to inspect regularly to ensure the compliance of EMP. (Refer MoRTH - Section 111.3)				
2.1.4.4	**Safety**					
2.1.4.4.1	Personal Safety Measures for Labour, Material handling , Painting etc.	Contractor shall provide all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staff. • Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. • Welder's protective eye-shields to workers engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers shall be seated at sufficiently safe intervals • Earplugs to workers exposed to loud noise (above 75dB (A)), and workers working in crushing, compaction, or concrete mixing operation. • Adequate safety measures for workers during handling of materials at site are taken up.	All construction sites	Factories Act, 1948; Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		• The contractor shall comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. The contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed for the work of painting with products containing lead in any form. The contractor shall also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. Contractor shall provide facemasks to the workers when paint is applied in the form of spray or a surface having dry lead paint is rubbed and scrapped. The Contractor shall mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These shall be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and shall be approved by Engineer.				
2.1.4.4.2	Risk from Electrical Equipment(s)	The Contractor shall take all required precautions to prevent danger from electrical equipment	All construction equipment		Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		and ensure that - • No material shall be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights shall be provided to protect the public in construction zones. All machines to be used in the construction shall conform to the relevant Indian Standards (IS) codes, shall be free from patent defect, shall be kept in good working order, shall be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer - Incharge.				
2.1.4.4.3	First Aid	The contractor shall arrange for - A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital Equipment and trained nursing staff at construction camp.	All construction sites	Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Contractor	Project Management Consultant; SPV
2.1.4.5	**Labour Camp Management**					
2.1.4.5.1	Location of Construction labour camps: Accommodation	• The contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and	At the location of construction labor camps	Building and the other Construction Workers	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		ancillary facilities during the progress of work for labour to standards and scales approved by the Engineer-Incharge. • Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labor camp. • Construction camps shall not be proposed within 1000m from the nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of each labour camp shall be submitted to Engineer prior to their construction. The construction shall commence only upon the written approval of the Engineer - Incharge.		(Regulation of Employment and Conditions of Service) Act, 1996		
2.1.4.5.2	Potable Water	The Contractor shall construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. within the precincts of every workplace in an accessible place, as per standards set by the Building and	Construction labor camps	Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act,	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996). The contractor shall also guarantee the following: • Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. • If any water storage tank is provided that shall be kept such that the bottom of the tank is at least 1mt. from the surrounding ground level. • If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well shall be disinfected before water is used for drinking. • All such wells shall be entirely covered and provided with a trap door, which will be dust proof and waterproof. • A reliable pump shall be fitted to each covered well. The trap door shall be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. • Testing of water shall be done every month as per parameters prescribed in IS 10500:1991. Compliance to EMP shall be		1996		

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		reported to Engineer - Incharge every week. Engineer - Incharge shall inspect the labour camp periodically, to ensure compliance of the EMP.				
2.1.4.5.3	Sanitation and Sewage System	The contractor shall ensure that - • The sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place • Separate toilets/ bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women • Adequate water supply is to be provided in all toilets and urinals • All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition • Night soil is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight. Adequate health care is to be provided for the work force during the entire phase.	Construction labor camps	Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	Contractor	Project Management Consultant; SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.1.4.5.4	Waste Disposal	The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer - Incharge. Unless otherwise arranged by local sanitary authority. The contractor has to make arrangements for disposal of night soils (human excreta) either by suitably approved by the local medical health or municipal authorities or as directed by Engineer - Incharge as provided by the contractor.	Construction labor camps	Environment Protection Act, 1986 and Rules	Contractor	Project Management Consultant; SPV, RSPCB, Local Authorities
2.1.4.5.5	Stock-yards	Location for stockyards for construction materials shall be identified at least 1000 m from water course and separated and sufficiently away from the labour camps. Separate enclosures shall be planned for storing construction materials containing fine particles such that sediment-laden water does not drain into nearby storm water drain & underground sewerage pipes.	Construction labor camps	MoRTH - Section 306	Contractor	Project Management Consultant; SPV, RSPCB, Local Authorities
2.1.4.5.6	Fuel storage and refueling areas	The contractor shall ensure that all construction vehicle parking location, fuel/ lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites are located at least 500 m from surface water bodies.	Construction labor camps		Contractor	Project Management Consultant; SPV, RSPCB, Local Authorities

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
		All location and lay-out plans of such sites shall be submitted by the Contractor prior to their establishment and shall be approved by the Engineer. The plan for the construction camp site shall also include the process of collection and disposal of spent oil and grease. The collection and disposal methods for the spent oil and grease submitted as part of the construction camp plan should be duly approved by the Engineer - Incharge.				
2.2	**Contractor Demobilization**					
2.2.1	Clearing of Construction of Camps & Restoration	Contractor to prepare site restoration plans for approval by the Engineer. The plan has to be implemented by the contractor prior to demobilization. On completion of the works, all temporary structures shall 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 shall 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		Contractor; Resident Engineer of SC; Environment Officer of SC	SPV

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
2.2.2	Redevelopment of Borrow Areas	Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Engineer.	At all borrow area locations suggested for the project.		Contractor; Resident Engineer of SC; Environment Officer of SC	SPV
3.0	**Environmental enhancement and special issues**					
3.1	Enhancement measures	Enhancement of all incidental spaces shall be planned and carried out prior to completion of construction. Some of the enhancement measures to be considered in the Solar Park include tree plantation at the available space, Planting of shrubs, rain water harvesting measures, adequate storm water drainage, Landscaping to improve aesthetics etc.	At suitable locations in the project site		SPV; DPR consultants; Forest Department; Project Management Consultant	SPV
4.0	**OPERATION STAGE (Activities to be Carried Out by the SPV/ Forest Department, GoR)**					
4.1	Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures provided in the Project	The SPV shall monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. Monitoring and performance indicators have been indicated in **Chapter 5** (**section 5.1 Environmental Monitoring Plan**).	Project site/ area	**-**	SPV	SPV
4.2	Maintenance of Drainage	SPV shall ensure that all drains (within the terminals, depot and workshop) are periodically cleared (once in every three months) especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding.	Project site/ area	MoRTH specifications; IRC guidelines	SPV	SPV
4.3	Atmospheric	Ambient air concentrations of	Project site/ area	Environmental	SPV, RSPCB	SPV, RSPCB

Sl. No	Activities	Management Measure	Location	Reference[1]	Responsibility	
					Planning and Execution	Supervision and Monitoring
	Pollution	various pollutants shall be monitored as envisaged in the Environmental Monitoring Plan at pre designated locations to compare the levels with the pre-construction data. Additional data at other location may be collected as per any site specific requirement.		Monitoring Plan (section 5.1)		
4.4	Noise Pollution	Noise pollution shall be monitored as per environmental monitoring plan at sensitive locations where pre-construction noise data was collected. Signage indicating 'no horn zones' near sensitive locations shall be maintained and kept clean.	All along the project corridor	Environmental Monitoring Plan (section 5.1)	SPV, RSPCB	SPV, RSPCB
4.5	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankments and other places expected to be affected, shall be carried out before monsoon, during monsoon and after winter rains to record and monitor the effectiveness of such structures after the completion of project, so as to evaluate the beneficial effects of each type of activity together with the cost involved.	Borrow areas		SPV	SPV

2.5. Implementation Arrangements

37. Effective implementation of the environmental measures suggested based on the baseline environmental conditions and environmental impact assessment requires robust procedures. Implementation could be ensured only when a pragmatic approach for environmental management is adopted. This chapter provides the necessary tools and approaches for ensuring effective implementation.

2.5.1. Environmental Monitoring Plan

38. 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 the 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

2.5.2. Monitoring Indicators

39. The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. 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:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures.

40. Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed and described in Table 5..

Table 5: Environmental Monitoring Indicators

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 under the monitoring of SPV
			Operation	SPV through approved monitoring agency
			Pre-Construction	SPV through approved monitoring agency
2	Noise Levels		Construction	Contractor under the monitoring of SPV
			Operation	SPV through approved monitoring agency
			Pre-Construction	SPV through approved monitoring agency

Sl. No.	Indicator	Details	Stage	Responsibility
3	Water Quality		Construction	Contractor under the monitoring of SPV
			Operation	SPV through approved monitoring agency
			Pre-Construction	SPV through approved monitoring agency
4	Soil Quality		Construction	Contractor under the monitoring of SPV
			Operation	SPV through approved monitoring agency
B	**Environmental Management Indicators and Monitoring Plan**			
1	Construction Camps	Location of construction camps have to be identified and parameters indicative of environment in the area has to be reported	Pre-construction	SPV
2	Borrow Areas	Location of borrow areas have to be identified and parameters indicative of environment in the area has to be reported.	Pre-construction	SPV
3	Tree Cutting	Progress of tree removal marked for cutting is to be reported	Pre-construction	Forest Department to SPV
4	Tree Plantation	Progress of measures suggested as part of the Strategy is to be reported	Construction	Forest Department
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	Forest Department/ SPV
2	Status Regarding Rehabilitation of Borrow Areas	The SPV will undertake site visits to determine how many borrow areas have been rehabilitated in line with the landowner's request and to their full satisfaction.	Operation	The SPV will be responsible for a period of three years.
3	Soil Erosion	Visual monitoring and operation inspection of embankments will be carried out once in three months.	Operation	The SPV will be responsible for a period of three years.

41. 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 6.

Table 6: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO_2, NO_x, PM_{10} $\mu g/m^3$ $PM_{2.5}$ $\mu g/m^3$and CO	High volume sampler to be located 50m from the plant in the Downwind direction. Use method specified by CPCB for analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Three seasons per year	24 hours Sampling	Batching /Hotmix plant / surrounding the project area	Contractor / SPV
	Operation[2]				Continuous monitoring (Three seasons in a year)		Surrounding the facilities	Contractor / SPV
Water	Construction	All essential characteristics and some of the desirable characteristics for water recycling/ harvesting etc.as decided by the Environmental Specialist of the PMC and SPV	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	Four seasons per year	Grab Sampling	Surface water sources	Contractor / SPV
	Operation				Continuous monitoring (Four seasons in a years)			Contractor / SPV
Noise	Construction	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 Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Three seasons per year	Leq in dB(A) of day time and night time	Batching plant/ surrounding the project area	Contractor / SPV
	Operation				Continuous monitoring (Three seasons per		Surrounding the facilities	Contractor / SPV

2

Parameters to be monitored for Operation stage is same as Construction stage

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
					year).			
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Four seasons per year	Grab Sampling	Batching /Hotmix plant/ construction camp	Contractor / SPV
	Operation				Continuous monitoring (Four seasons per year)		Within/ Surrounding the facilities	Contractor / SPV
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a month	-	Borrow area location	Contractor
Tree plantation	Operation stage	As per Design			Continuous monitoring (Quarterly)	-	Areas where plantation is being done	Contractor / SPV

2.5.3 Reporting System

42. 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 SPV level

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

44. Contractor will report to the Engineer 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 SPV on a quarterly basis which will be reviewed. Along with these reports, Environmental Cell of the SPV shall report progress of tree cutting, compensatory plantation, landscaping and survival rate as per the monitoring plan. Reporting formats should be prepared, which will form the basis of monitoring, by the Engineer and/or the Environmental Cell. Summary details of reporting are given in Table 7.

Table 7: Summary details of Reporting

Item	Stage	Contractor	Environmental Cell	Project Management Consultant (PMC)		Project Implementation Unit (SPV)
		Implementation & Reporting to PMC	Implementation & Reporting to SPV	Supervision	Reporting to SPV	Oversee / Field Compliance Monitoring
Identification of Disposal Locations	Pre-Construction	One Time	-	One Time	One Time	One Time
Setting up of Construction Camp	Pre-Construction	One Time	-	One Time	One Time	One Time
Borrow Area Identification	Pre-Construction	One Time	-	One Time	One Time	One Time
Tree Cutting	Pre-Construction	-	Monthly	-	-	Quarterly
Tree Plantation	Construction	-	Monthly	-	-	Quarterly
Top Soil	Construction	Quarterly		Continuous	Quarterly	Quarterly

Monitoring						
Pollution Monitoring	Construction	As Per Monitoring Plan	-	Quarterly	Quarterly	Quarterly
Pollution Monitoring	Operation	-	-	-	-	As Per Monitoring Plan
Survival Rate of Trees	Operation	-	Quarterly	-	-	Quarterly
Status Regarding Rehabilitation of Borrow Areas	Operation	-	-	-	-	Half Yearly

45. 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 PMC 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 SPV, team leader of the PMC and the Environmental personnel of the PMC. The decisions will be communicated to the contractor prior to the start of the construction activities.

2.5.4. Institutional Setup

46. The Environmental Management Plan, EMP process does not stop once a project (planning and design) has been approved for implementation. During implementation of project, Project Management Consultant, PMC and Contractor will be responsible for ensuring that the environmental commitments made to regulatory agencies, lending agencies and other stakeholders during the EIA process are met. To execute EMP is a cumulative responsibility of all three parties involved, indicative responsibility mechanism has been presented in Table 8.

Table 8: Institutional Responsibilities

System	Designation	Responsibilities
Coordinating/Facilitating Agency	Managing Director (SPV)	• Overview of the project implementation • Ensure timely budget for the EMP • Coordination with different state level committee, to obtain Regulatory Clearances

	DGM(Infrastructure & Operations) -SPV	• Participate in state level meetings • Monthly review of the progress. • Overall responsible for EMP implementation • Reporting to various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Coordination with SPV Staff (Environmental officer). • Responsible for obtaining Regulatory Clearances • Review of the progress made by contractors • Ensure that BOQ items mentioned in EMP are executed as per Contract provisions.
	Manager (Environment) -SPV	• Assisting DGM (infrastructure & Operation) in overall implementation of EMP • Review of periodic reports on EMP implementation and advising Project Manager in taking corrective measure. • Conducting periodic field inspection of EMP implementation • Assisting DGM to reporting various stakeholders (World Bank, Regulatory bodies) on status of EMP implementation • Preparing environmental training program and conducting the same for field officers and engineers of contractor
Implementing/ Monitoring Agency	Engineer- Incharge (PMC if any)	• Act as an “Engineer” for supervising EMP implementation • Responsible for maintaining quality of EMP envisioned in Detail Project Report • Maintaining progress reports on EMP implementation • Periodic reporting to SPV about the status of EMP implementation • Work in close coordination with Manager (Environment) of SPV and contractor
Executing Agency	Environmental Manager / Engineer of Contractor	• Responsible for ensuring the implementation of EMP as per provision in the document. • Directly reporting to the Project Manager of the Contractor • Discussing various environmental/social issues and environmental/social mitigation, enhancement and monitoring actions with all concerned directly or indirectly • Assisting his project manager to ensure social and environmentally sound and safe construction practices • Conducting periodic environmental and safety training

for contractor's engineers, supervisors and workers along with sensitization on social issues that may be arising during the construction stage of the project

- Assisting the SPV on various environmental monitoring and control activities including pollution monitoring; and
- Preparing and submitting monthly/bio-monthly reports to SPV on status of implementation safeguard measures

2.6. EMP Budget

47. Budgetary estimates for environmental management in the project include all items envisaged as part of the EMP. The environment budget includes provisions for various environmental management measures (other than measures considered under good engineering practices) and the environmental monitoring costs. Indicative Budgetary items for the project are presented in Table 9.

Table 9: Budgetary Provisions for Environmental Management Measures

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)
A	**CONSTRUCTION PHASE**				
1	*Mitigation Measures*				
1.1	Oil Interceptors	Number			
1.2	Recharge pits	Number			
2	*Tree Plantation and Protection*				
2.1	Trees	Number			
2.2	Brick Tree Guards	Number			
2.3	Landscaping	LS			
3	*Monitoring of Environmental Attributes during Construction Activity*				
3.1	Air Quality				
3.1.1	Monitoring of Air Quality near Hot mix plants	No. of Samples			
3.1.2	Monitoring of Air Quality at Critical Locations	No. of Samples			
3.2	Noise Levels				
3.2.1	Monitoring of Noise Level at Equipment Yards	No. of Samples			
3.2.2	Monitoring of Noise Levels at Critical Locations	No. of Samples			
3.3	Water Quality	No. of Samples			
3.4	Soil Quality	No. of Samples			
B					
1	Monitoring of Air Quality during Operation Phase				
1.1	Monitoring of Air Quality at Critical Locations	No. of Samples			
1.2	Monitoring at additional locations	No. of Samples			
2	Monitoring of Noise during Operation Phase				
2.1	Monitoring of Noise Levels at Critical Locations	No. of Samples			

S. No.	Item	Unit	Rate (in INR)	Quantity	Cost (in INR)
2.2	Monitoring at additional locations	No. of Samples			
3	Monitoring Soil Quality	No. of Samples			
4	Monitoring of Management & Operational Performance Indicators				
4.1	Survival Rate of Trees (three year maintenance cost)	Number			
	Environmental Budget During Operation Phase				
	Sub Total (A+B)				
	Grand Total INR. (Environmental Budget Exclusive of Cost of Measures Included Under Good Engineering Practices, A+B+10% contingency)				