INLAND WATERWAYS AUTHORITY OF INDIA

Ministry of Shipping, Government of India

"CAPACITY AUGMENTATION OF NATIONAL WATERWAY.1"

(Jal Marg Vikas Project)

ENVIRONMENTAL IMPACT ASSESSMENT REPORTS

VOLUME - 5:
Environmental Management Plan (EMP)
for
Sahibganj Terminal

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Table of Contents

1.1. Introduction 3
1.2. Brief On Sahibganj Terminal 3
1.3. Description of Environment 4
1.4. Environmental Management and Monitoring Plan 8
1.5. Environment Health and Safety Cell 9
1.6. Reporting Requirements: 9

List of Tables

Table 1.1 : Salient Environmental Features of Sahibganj Terminal Site 5
Table 1.2 : Environment Management Plan Sahibganj Terminal During Construction Phase 10
Table 1.3 : Environment Management Plan Sahibganj Terminal During Operation Phase- Phase I42
Table 1.4 : Environment Monitoring Plan of Sahibganj Terminal for Construction and Operation Phase 61

List of Figures

Figure 1.1 : Location Map 3

List of Annexure

Annexure 1.1: Green Belt Development Plan 65
Annexure 1.2: Occupational Health & Safety Management Plan 69
Annexure 1.3: Construction Debris Management Plan 72
Annexure 1.4: Construction and Labour Camp Management Plan 75
Annexure 1.5: Borrow Area Management Plans 80

Chapter 1. EMP FOR SAHIBGANJ TERMINAL

1.1. Introduction

Inland waterways Authority of India (IWAI) has proposed to augment the navigation capacity of waterway NW-1 (Haldia to Allahabad) and continue to maintain the entire stretch. Under this project, IWAI has proposed to develop the infrastructure facility like Multimodal terminals, Navigation aids for day & night navigation, River information system with all hardware and software, Ro-Ro jetties, Bank & slope protection, River training works, Equipment like tow barges, inland vessels, survey vessels including rescue boats & survey equipment and Dredging of the navigation channel, to augment the navigation capacity of the waterway.

A Multimodal inland water terminal at Sahibganj is proposed under this project to enhance the navigation facility of the NW-1. Proposed terminal site lies within the village Samdha Nala & Rampura, Tehsil & District Sahibganj, Jharkhand. Location map of the project is given in **Figure 1.1** below.

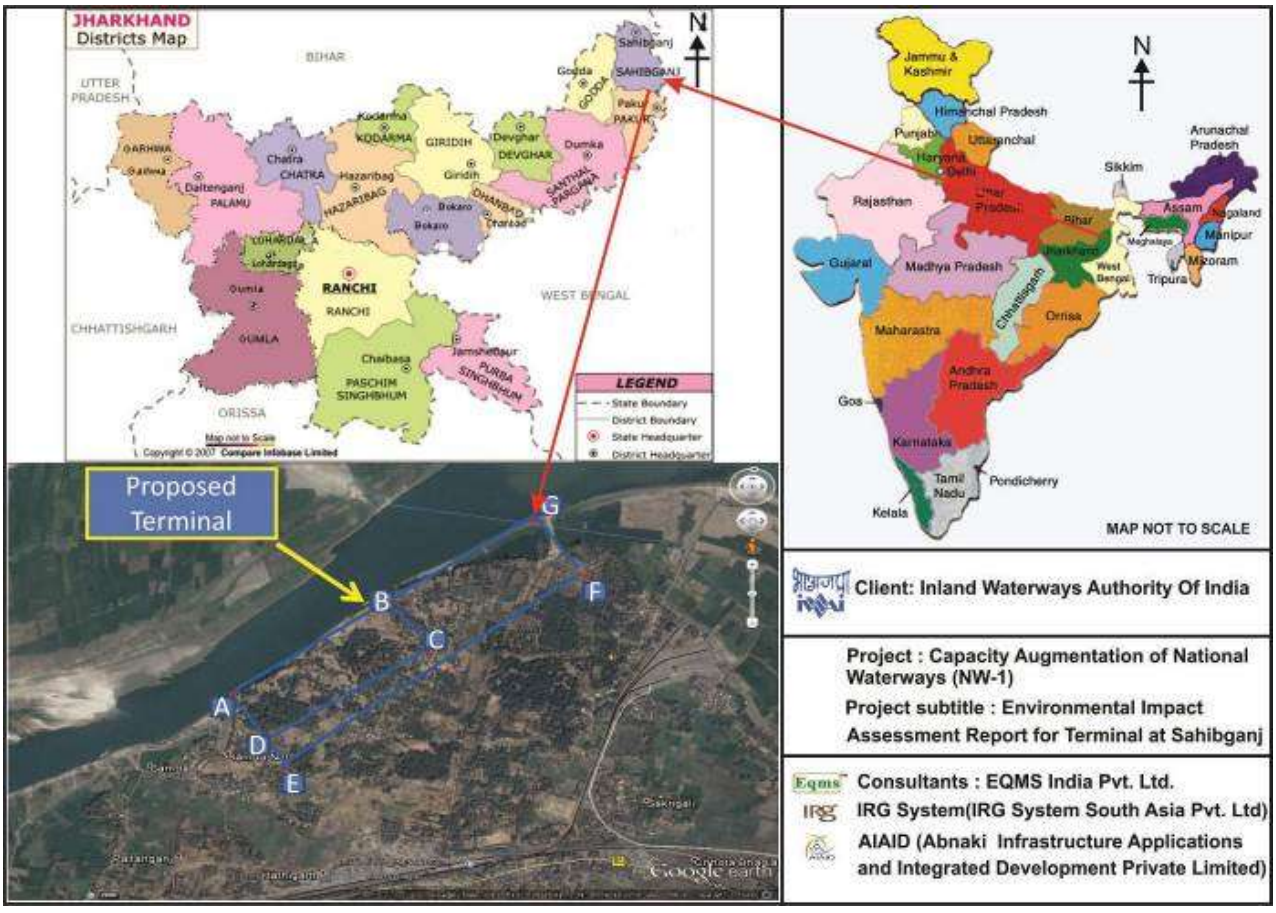

Figure 1.1 : Location Map

1.2. Brief On Sahibganj Terminal

The Sahibganj terminal is proposed to be developed as a multimodal terminal facility. The terminal site is agricultural land at present with land cover comprising of crops, mango orchards and few settlements. Site is highly undulating with ground level difference ranging from 30-56 m. Large quantity of cut & fill is required to achieve flat surface. App. 14.25 lakh

cum of soil will be excavated, out of which 2.1 lakh cum will be re-used for filling. 12.1 lakh cum of remaining earth will be re-used for road and railway construction. Finished level of site achieved after cut & fill will be 37.0 m amsl (above Mean Sea Level) which is more than the highest flood level, i.e. 30.91 m amsl

As per planning this terminal will be connected to rest of the city vide roads and railways both. At present site is not connected to any public road. An access road of 1 km will be developed by PWD to connect the terminal with national highway 80. Railway connectivity will be developed by railways to connect the terminal site to Sakrigali railway station (Eastern railway corridor). Internal road of 12 m width and total length 3.6 km will be developed within the terminal to facilitate smooth movement.

In the phase 1 the terminal shall handle about 2.24 Million Metric Tonnes per annum or 6788 TPD. Material to be handled will be coal, stone chips, food grains, cement, fertilizers and sugar.

Facilities to be developed at terminal site include both onshore and off-shore facilities. Onshore facilities for phase 1 include stockyards for coal (6 stock piles), stone chips (8 stock piles) & 1 covered shed; Unloading & Loading Areas; Internal Roads (12 m wide & 3.6 km length); Administration Building; Workers Amenity Building; Lighting Towers; Other associated facilities like sewerage system(Sewerage Treatment Plant), drainage system, fire-fighting facilities, communication system, water supply & power supply (ESS); Boundary wall of 2.4 m, Green belt- 15-20 m (2.9 ha), Approach Road (1 km connecting to NH-80 crossing LC-54) and Railway Connectivity (through Sagrakali Railway Station) with provision of ROB over LC-54 for approach road to be developed.

Off-shore facilities for phase 1 includes Jetty (1 No.) & Berth (2 Nos.), Water area & approach channel, Turning Circle (2 Nos. at starting & end of channel) and Shore protection (1.5 kms along River Bank).

During phase 1, 2 nos. berths, one for coal and one for stone chips / other cargo, are proposed to be provided in a length of 270 m. Berths are connected to shoreline / bank line by approach trestle (jetty) of 50 m length at its berth ends. Berth extends to another 25 m beyond the jetty into the river. After 50 m, available depth in the river for cargo varies from 7-11 m which is sufficient for cargo movement and will not require dredging. It is estimated app. 0.1Mcum of maintenance dredging will be required annually during operation and maintenance stage of project.

1.3. Description of Environment

The baseline environmental data generation has been done for the period of 15th September to 15th October 2015. The study area within a 10 km radius around the proposed Terminal site has been considered as general impact zone and 2 Km radius as specific impact zone for EIA study. Primary and secondary data has been collected for both the zone however focus of primary data generation has been more for 2 Km radius. Data was generated by following the monitoring plan approved by IWAI and World Bank in line with prescribed TOR by IWAI. The Salient Environmental Features of Sahibganj Terminal site within 500m, 2 Km and 10 Km radius is summarised at Table 1.1.

Table 1.1 : Salient Environmental Features of Sahibganj Terminal Site

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
1	**Ecological Environment**			
A	Presence of Wildlife Sanctuary/ National Park/Biosphere Reserves	None	None	None
B	Reserved /Protected Forests	None	None	Yes, Protected Forest[1] is present in south and south west direction within 10 km study area.
C	Wetland of state and national interest	None	None	None
D	Migratory route for wild animals	None	None	None
E	Migratory routes for birds	None	None	None
F	Presence of Schedule-I Terrestrial Fauna	None	None	None
G	Presence of Schedule-I Aquatic Fauna	Yes, Gangetic Dolphins observed in River Ganga	Yes, Gangetic Dolphins observed in River Ganga	Yes, Gangetic Dolphins observed in River Ganga
H	Tree cover	Yes Mango orchards along with common tree species.	Yes Scattered vegetation is present	Yes Good amount of trees presents in reserve forest area.
2.	**Physical Environment**			
I	Critically Polluted Area	None	None	None
J	Road connectivity	Site is connected with NH-80 through village road	NH-80 (Sahibganj-Rajmahal) is passing at a distance of about 1.0 km south of site	NH-80 (Sahibganj-Rajmahal) .
K	Rail connectivity	None	Sakrigali railway Station about 1.1 km in south direction	Sahibganj railway station is about 6 km away from the site
L	Topography	Mainly flat with elevation ranges between 24-60 m	Undulating. Southern part of the 2 km area	Southern portion (spanning over about 30 percent of

[1]India has two level of classification for forest area. Reserve Forests and Protected Forests.Level of restriction is more in case of reserve forests compared to protected forests.

S. No.	Environmental Features	Within 500 m area around Proposed terminal site	Within 2 km area around Proposed terminal site	Within 10 km area around Proposed terminal site
			shows the higher elevation.	the 10 km zone) consists of hillocks, valley and undulating terrain, rest of the area has almost flat terrain.
M	Seismicity	Falls in Zone-III Moderate damage risk zone as per Seismic Zonal Map of India	Falls in Zone-III Moderate damage risk zone as per Seismic Zonal Map of India	III Moderate damage risk zone as per Seismic Zonal Map of India
N	Surface Water Resources (Rivers)	Ganga River (along northern boundary of site)	Ganga River	Ganga River
O	Groundwater	Falls in Safe Zone as per Central Ground Water Board	Falls in Safe Zone as per Central Ground Water Board	Falls in Safe Zone as per Central Ground Water Board
P	Soil and Land-use	Clay loam Land use in 500m of site is primarily agricultural, vegetation (mango orchards and Settlements	Clay loam Land use in 2 km area of site is primarily agricultural, vegetation (mango orchards and Settlements	Clay loam Land use in 10 km of site: About 41.6% of the land is under cultivation. About 1% of the land is open forest land, about 9.4% land is under dense forest, 15.2% land is under water bodies and rest of the land is under other uses
Q	State Boundary	None	None	Bihar
3.	**Social Environment**			
R	Physical Setting	Rural Settings	Rural Settings	Rural Settings
S	Physical Sensitive Receptors	Yes (Temples, Schools)	Yes (Temples, Schools, Health care)	Yes (Temples, Schools, Hospitals)
T	Archaeological Monuments	None	None	Yes, Jami Masjid (6km), Sahibganj

Meteorology: The predominant wind direction is from southeast and south direction. The average wind speed ranges from 0.5 to 8.8 m/s. Daily mean temperature varied from 22^0C to 39^0C. The relative humidity varied from 30 to 97%. The annual rainfall is 1151 mm.

Air Quality: $PM_{2.5}$, PM_{10}, SO_2, NO_2 and carbon monoxide were monitored at three locations in the study area. Monitoring was done at upwind direction and downwind directions of the project. The baseline air quality levels of all parameters are found to be within the National Ambient Air Quality Standards prescribed for residential and industrial area.

Noise Quality: Noise level monitoring was done in 3 location including connecting village road to the site. The baseline noise levels of all the locations were found to be well within the National Standards for residential area (55 dBA during day time and 45 dBA during night time).

Water Quality: The surface water quality of the study area is found to be satisfactory. No metallic or bacterial contamination was found in the water quality. Groundwater samples were collected from hand pumps and tube wells of villages around the project site. The groundwater quality meets the standards prescribed by Bureau of Indian Standards (BIS 10500).

Soil Quality: The texture of soil is clay loam. The organic matter, nitrogen, potassium and phosphorus content of the soil are moderate. The pH and conductivity of all the soil samples are within the acceptable range.

River Bed Sediments: The results of the analysis of the water and sediment samples from river Ganga at Samda nala did not show the presence of any pesticides. The compounds detected were Lindane, alpha Endosulfan and total DDT as being used for agriculture applications. The concentration of these compounds was very low. The source of DDT might be due to its various uses whereas; the source of Parathion and Endosuphan might be from insecticides and pesticides applications for agriculture purpose.

Though the concentration pesticides and insecticides compounds in the river bed sediments are very low but as these toxic substances do not degrade, and have ability to bio accumulate in the food chain, and may become potential hazards in a long run.

Flora and Fauna: Sal, saja, bija, dhaora, mahua, tendu, seemal, neem, bhelwa, jamun, Asan, khamar, mundi, seesam, bel, keekar, etc are commonly found in the forests of the study area. No rare and endangered species of flora is observed in the study area.

The wild animals commonly found in the study area are fox, hare, squirrel, krait, cobra, mongoose, lizard and avifauna like Brahmini kite (*Haliasur Indus*), Hawk Eagle (*Nasiaetus fasciatus*) and Vultures (*Gyps bengalensis*). The nocturnal birds found in the area are Bat (*Pteropus giganteus*) Owl (*Bobo bobo*), Bee-Eaters, Swallows (*Hirundo rustica*), Shrikes, Fairy Birds and Wegtails etc.

This terminal is proposed at Samdaghat, Sahibganj. There is about 3500-meter width of Ganga River and riparian zone observed by mango gardens of villagers, agricultural fields. Ganga Water Transparency was 30 cm, and velocity was 0.50 m/s. Aquatic ecology of Ganga river at Samda Ghat includes variety of plankton, fishes, benthos. Environmental condition determines the aquatic life in concern zone. Inthe 2 km stretch in upper side and

lower strech of Sahibganj terminal at Samda Ghat, there are several aquatic flora in the riparan zone and in aquatic habitat.

The fish population of Ganga is largely dependent on phytoplankton, zooplankton, periphyton and zoobenthos which establish itself in the form of food chain. The fish production in the stretch of Sahibganj is about 15 kg/day.

Dolphin is found in this region which is listed as endangered Schedule-I species in IUCN category. Dolphin commonly known as Susu in the Jharkhand and Bihar area, scientifically named as Platanista gangetica gangetica is one of the endangered species found in lower stretch of Ganga River. Very few dolphins are found in the area of Sahibganj Terminal at 500-meter radius. During our observation no individual was seen in the stretch of Sahibganj terminal.

Landuse: The land use of the core terminal site is agricultural with spars mango plantation. As per the land use analysis about 41.6% of the land is under cultivation, about 19.81% of the land is open forest land, about 9.4% land is under dense forest, 15.2% land is under water bodies and rest of the land is under other uses

Sensitive Ecosystem: Within 10 km distance of the project site, no plant species were found to be on the endangered list except Dolphin. Biosphere reserve, tiger reserve, elephant reserve, migratory corridors of wild elephant, wetland, national park, wildlife sanctuary are not present within 10 km distance of the project site. Sloth bear and peacock are the schedule-1 fauna present in the study area.

Socioeconomic Data: There is 1 Municipality/town and 50 villages falls within 10 km Area of the terminal site. According to 2011 census the total population of the 10 km study area including Sahibganj town is 166969 comprising 87645 males and 79324 females. The total population of Sahibganj town is 88214 comprising 46449 males and 41765 females. Male female ratio of the study area is 905 female / 1000 male. Total no. of households is 32267. Total SC population in 10 km area is 14885 comprising of 7828 males and 7057 females. Total ST Population in the study area is 14400 comprising of 7215 males and 7185 females. Out of the total population the SC and ST population of the study area is 8.9% and 8.6% respectively.

1.4. Environmental Management and Monitoring Plan

Effective measures are required to be proposed and implemented during design, preconstruction, construction and operation stage to eliminate or minimize the impact of the project development. **Table 1.2 & 1.3** provides details of mitigation measures with implementation and supervision responsibility.

Since project is likely to have impact on various components of environment, the monitoring requirement covering soil erosion, tree plantation, air quality, water quality noise, river sedimentation has been defined and included under respective head at **Table 1.4.**

It will be essential for contractor to comply with applicable regulations and World Bank safeguard requirements. Contractor will also have to comply with applicable standards with respect to Water, air, Noise, Dredge Material, soil and biodiversity as applicable to this project.

1.5. Environment Health and Safety Cell

It is essential to establish environment health and safety cell for the project by contractor to ensure the health & safety of workers and environmental management of study area through effective implementation of EMP. Highly qualified and experienced persons in the field of Environmental Management of Similar projects shall be considered to man the cell who shall ensure the effective implementation of the environment management plan.

1.6. Reporting Requirements:

It is required that contractor will submit quarterly compliance report to Project Management Consultants (PMC) as well as to PMU (Project Management Unit) of IWAI. PMC will analyze the report and notify the corrective action if any required to contractor under intimation to IWAI.

Table 1.2 : Environment Management Plan Sahibganj Terminal During Construction Phase

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
DESIGN AND CONSTRUCTION PHASE							
1. Climate							
❖ Project is unlikely to cause negative effect on climate. However, project can contribute positively for climate	• Project should be designed in a way to minimize the tree cutting • Compensatory plantation should be carried out in ratio of 1:2 (1000 nos to be planted in place of 500 trees to be cut) as per state policy. Additional compensatory plantation should be carried out in ratio of 1:5 (2500 nos more) so as total compensatory plantations is in the ratio of 1:7(3500 in place of 500 trees) • Compensatory plantation should be carried out in the areas near to the site to the extent possible • Tree species high in organic content like Neem, Mango etc should be preferably planted to compensate for loss of carbon sequestration source • Tree cutting to be carried out only after obtaining NOC from forest department • Shifting to alternative energy options like solar energy • Adoption of best practices to cut down resources and energy requirement • All terminal buildings should have energy efficient design. It should follow GRIHA guidelines and aim for highest ratings under GRIHA.	Kyoto Protocol, National Water Policy, 2012, Forest Conservation Rules & National Forest Policy	Construction site	During Design, and construction stage.	Compensatory /Additional Plantation For 1000 trees	Contractor,	IWAI/PMU/PMC[2]
2. Natural & Man-made Hazard							

[2] It is proposed to set up Project Unit (PMU) in IWAI to manager social and environmental aspect of NW1 augmentation. PMC (Project Management Consultants) anticipated to be appointed for project management and quality check.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
❖ Earthquake-Seismic Zone – III damage risk zone[3] ❖ Risk of flood	• Adoption of Relevant IS codes while designing the civil onshore & off-shore structures to sustain the earthquake of moderate to high magnitude (Seismic Zone III). • Designing of structures above the HFL (30.91 m amsl). • Preparation of emergency preparedness and response plan for natural and man-made hazards like earthquake, floods, fires, shocks, explosion of hazardous materials etc.	NBC, 2005, local building bye laws, state factory rules, Petroleum Rules and MSIHC Rules, 1989	Construction site& Navigation Channel	During Design and construction stage.	Part of Project Costs	Contractor	IWAI/PMU/PMC
3. Site Preparation: Levelling Terminal Site, Construction Camp, Construction Works							
❖ Levelling of terminal site & Removal of vegetation	• Tree cutting should be carried out only after obtaining NOC from forest department and conditions given in NOC should be complied with • Excavation and filling operations should be carried out in parallel so as to minimize the soil erosion • Compaction of soil shall be undertaken by sprinkling the water to minimize the erosion	Municipal Solid Wastes (Management and Handling) Rules, 2015 Hazardous Waste (Management, Handling & Transboundary)	Construction site	During design and Construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

[3] *IS:1893 (Part 1): 2002 Indian Standard Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings Fifth Revision divides the Indian subcontinent into five seismic zones (II to V) depending on the magnitude and damage intensity of seismic activity*

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Water sprinkling to be carried out for dust suppression • Top soil (15 cm) should be stripped and preserved under covered conditions for landscaping purpose in later stage. This should be stored in the form of the heap with the slide slopes covered with grass. Excavated soil should be used within the site for filling purpose (2.1 lakh cum to be used for filling & leveling) and remaining (11.0 lakh cum) should be used for construction of the approach road, railway track and rehabilitation of the mines located about 4-5 km from the terminal site • The soil storage location shall be identified in advance in consultation with PWD which is likely to construct the approach road. • Dredge soil shall also be either utilised for construction activity or disposed off along with excavated soil to the identified debris disposal site • Compensatory plantation should be carried out as per the details given under climate section above • Green belt (area of 2.9 ha) should be developed at the site and as per the Green Belt Management Plan (**Annexure 1.1**) • Survival rate of tree should be regularly monitored. It is should be minimum 70%. • Work timings should be restricted from 6:00 AM to 10:00 PM. Adequate illumination should be provided at site during evening hours • Rest area should be provided for workers at site and sleeping/lying down at site should be strictly prohibited to prevent accidents • Develop and obtain approval from IWAI for occupational health & safety management.	Rules, 2008 Forest (Conservation) Act Social Impact Assessment requirements					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	The plan should follow safety guidelines as given at **Annexure 1.2** and other tools such as OSHAS 18001 • Movement of construction vehicles shall be restricted to the designated haulage roads only to prevent compaction of soil in other areas • The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Sedimentation tanks shall be provided with storm water drain to arrest the sediments and these sediments shall be removed and stored with remaining excavated soil • Shore protection works like stone pitching along the bank and construction of stone apron in the river to prevent the scouring of banks shall be undertaken • Bio-turfing of embankments shall be made enhance the slop stabilization • Wash-off from concrete mixing tanks and wash from washing area shall not be allowed to enter the soil. This wash shall be collected through drains into tanks and concrete shall be settled, collected, dried and re-used in the site again **Solid Waste Management:** • Arrangement should be made for segregation of waste into recyclable and non-recyclable waste • Non-recyclable waste generated should be disposed regularly through authorized agency. Recyclable waste should be sold to authorized vendors. • Construction waste generated should be segregated at site into recyclable, reusable & rejected fraction. Recyclable should be sold to authorized vendor, reusable waste should be stored at site for usage and						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	rejected fraction should be disposed at designated sites by the municipal authority • If no debris or waste disposal site exists in the area then a site should be identified for debris disposal, should be approved by IWAI and should be used & manage for the same as per the Debris Management Plan **(Annexure 1.3)** • Any waste oil generated from construction machinery, that should be stored on concrete platform and disposed off to authorized recyclers.						
❖ Setting of Labour Camps: Loss of agriculture land, contamination of land and water resources from municipal waste from Camps, worker's health, Pressure on natural resources due to establishment of labour camps	**Location of Camp:** • Construction camp siting, establishment, location and management should be as per proposed Construction & Labour Camp Management Plan **(Annexure 1.4)** • Labour camps should be located close to the construction sites to the extent possible **Sanitation and Worker's Health& Safety:** • Hygiene in the camps should be maintained by providing good sanitation and cleaning facilities. Soak Pits can be provided only if labour camp is located away from river. • Camp should be well ventilated. It should have adequate provision for illumination, kitchen and safe drinking water facility. Proper drainage to be maintained around the sites to avoid water logging leading to disease • Proper sanitation facility like toilet and bathing facility should be provided at site and labour camps. Wastewater generated from these facilities should be disposed off through septic tanks and soak pit • Preventive medical care to be provided to workers • Segregated, collection and disposal of solid	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 and The Water (Prevention & Control of Pollution) Act, 1974 and amendments thereof. Municipal Solid Wastes (Management and Handling) Rules, 2000	Labour Camp Locations	During design and Construction Stage	For sanitation and health facilities in labour camps and construction site	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	waste on regular basis at identified municipal solid waste disposal location. If municipal solid waste site not available than waste should be land fill following the regulations. • Provision should be made essential material supply like cooking fuel (gas) • Provision should be made for day crèche for children • First aid facilities, first aid room, first aid trained personnel and ambulance should be provided at the site 24 X 7. Also tie-ups with local hospital should be done to handle emergency case, if any • Rest area should be provided at the site where labour can rest after lunch and should not lie on site anywhere • Working hours of labour should not exceed than standard norms as per state factory law • Wastewater from construction site should not be allowed to accumulate at site as standing water may lead to breeding of mosquitoes. Septic tanks/soak pits should be provided for its disposal • Temporary storm water drainage system should also be provided at camp site and construction site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies						
❖ Setting up Concert Mix Plant, Hot Mix Plant, Mechanical Workshop, Fuel storages,	• All these facilities shall be installed at proposed terminal site itself. In case these are to be set up away from site than these shall be located at minimum distance of 500 m from habitation, water bodies and 1000 m from forest areas. • All maintenance facilities, hot mix plant and concrete mixing plant shall be established	Air (Prevention and Control of Water Pollution) Act, 1981 and Water (Prevention and Control of Water Pollution) Act, 1974	Site construction Camp	During design and construction Stage	For waste management facilities in construction site and labour camps	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
Lubricant storages	with prior consent to establish to be obtained from SPCB. • All such equipment/plant shall be fitted with air pollution control system and shall comply with condition of consent to establish. • Periodic monitoring shall be carried as per consent conditions.						
4. Site Preparation: Power supply, Water Supply, and Drainage, disposal of piling muck and debris							
❖ Power supply and Energy Conservation: Air Pollution, energy loss	• Power (588 KW for phase-1) shall be sourced from Jharkhand Urja Vikas Nigam Limited during construction stage as well • DG sets shall be used only in case of power failure. DG sets shall be enclosed in acoustic enclosures and shall be provided with stacks as per CPCB norms to discharge exhaust gases • Back-up power shall be set up with all provisions of containment for fuel leakages, air pollution control (stack height as per regulation) and with acoustic enclosure. • Solar energy shall be used in common lighting area on 1:2 basis. • Energy Conservation Building Code shall be used as applicable to various office and other structures.	Air (Prevention and Control of Water Pollution) Act, 1981 & ECBC Norms, 2007	Construction Sites and Labour Camp Locations	During design and construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
❖ Water Supply, Drainage and effluent discharge	• The Area is under safe category as per Central Ground Water Board. However, necessary permission shall be taken from district authorities as applicable before digging the bore well. • Caution signage shall be placed at site for optimal use of water • Garland storm water temporary drains shall be provided around the excavated or activity area so as to divert rainfall run-off away from these locations. These pits shall be covered during rainy season to the extent	Central Ground Water Board, Water (Prevention and Control of Water Pollution) Act, 1974	Construction Sites and Labour Camp Locations	During design and construction stage	For construction of grease traps and de-siltation chambers	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	possible. Excavation shall be avoided during monsoon season. • Storm water drains shall be connected to sedimentation tank for arresting the sediments before discharging into the river • All washing and maintenance effluent from the workshop area of vehicle maintenance area should Darin to separate collection areas fitted with oil and grease trap and de-siltation chamber. The treated water shall be used for dust separation and green belt development. This water shall not be discharged to river at all. • Vehicle washing and maintenance workshops shall be located away from river • Rain water should be collected into temporary ponds which should be used for various construction activities and dust suppression.						
❖ Disposal of piling earth, muck and debris: uncontrolled disposal may lead to increased sedimentation of the river.	• Excavated soil (14.25 lakh cum) shall be stored in covered conditions only. It should be used to the extent possible for filling &levelling purpose (2.15 lakh cum) and remaining (12.1 lakh cum) shall be used for road, railway construction and mine rehabilitation at distance of 4-5 km from the site • Provision shall be made for collection and draining of water for the piling earth. It shall be used for embankment protection or road construction depending on its suitability. • Piling earth or dredged soil (1.5 lakh cum) shall not be disposed off on the River bank as they are critical habitats especially during the breeding and spawning season. • Provision shall be made for geo Synthetic Screen for arresting silt flowing down stream.	Solid Waste (Management & Handling) Rules, 2015	River Bank along the terminal site	Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
5. Embankment Design and Construction, Drainage Pattern							
❖ River Bank Erosion Protection: Construction of Embankment and construction of jetty may lead to accumulation of sediments on the up drift side and erosion of the down drift side.	• Embankment protection measures (stone pitching & apron) shall be made all along the length of bank. In addition, apron of 40 m length shall be provided along the River bank to prevent erosion and bank scouring • During stone pitching, the stone shall be dropped from suitable distance and shall not by drop from height to prevent injury or killing of aquatic species. Stones shall be placed by making grid in pitching area. • Erosion monitoring shall be carried out periodically downstream as well. • River Bed material/dredged soil (1.5 lakh cum) shall be tested for toxicity before its use or disposal for land fill site. If any level of heavy metal contamination or toxicity is found than it shall be disposed off in a secure manner to TSDF.	Water (Prevention and Control of Water Pollution) Act, 1974	1600-meter stone pitching (800m in phase I & 700 m in phase II) River Bank along the terminal site & 40 m apron inside the river	During design, Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
❖ Dredging activities: Impacts on dolphins, fishes, and benthic organisms	As part of the detailed engineering design and when dredging is required, the Contractor shall prepare a Dredging plan that will ensure no adverse impacts shall occur on the local biodiversity. The Dredging Plan shall comply with the following: • **Roles and Responsibilities**. Define roles and responsibilities for implementing and adhering to the commitments made within this Dredge Management Plan. • **Legislative Requirements and Guidelines**. All dredging and disposal of dredge material will be undertaken in compliance with relevant national and state legislation. In case no standards exist, best international practice will apply. • **Studies on the existing Environment**:	Part of EMP/Wild Life Protection Act, 1972	stone pitching along the river bank and 40 m stone apron	During design and construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	Contractor shall carry out supplementary EIA study including Key Environmental Sensitivities, Physical Freshwater Environment: Riverbed morphology and geology, Bathymetry, Hydrodynamics, Sediment quality. Fresh Water Quality: Physiochemical, Chemical, Sediment plume modelling. Biological freshwater Environment: Benthic Primary Producer Habitat, Freshwater Fauna. • **Dredging Environmental Impact Assessment and Management**: The Contractor shall prepare a supplementary EIA to establish potential impacts and its effective management in terms key performance indicators, mitigation and monitoring measures on the: freshwater quality, benthic primary producer habitat (BPPH), tidal, riverbank including bank, freshwater fauna, dredge materials disposal and spoil ground management **The Dredging Plan shall highlight the following:** • Location of dredging sites must avoid key habitat areas such as breeding and feeding grounds etc. of key biodiversity species found in the project area such as dolphins etc. • The schedule or time of dredging must avoid breeding season of dolphins, fishes etc. • Decisions on method of dredging and type of technology and equipment to be used must consider the noise and vibration levels and extent of siltation being generated. Noise and vibration levels must be far below levels that can cause injury to dolphins and other wildlife. The dredging						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	space must include measures to contain silt or suspended solids to a minimum area within the river as excess siltation can hamper wildlife activities. • Appropriate protocols and procedures must be prepared for sighting of dolphins and other endangered wildlife species (migratory birds, reptiles etc.) within the vicinity of the dredging site. The objective of the protocols and procedures must be aimed at having no or minimal impacts on the respective wildlife species. • Dredged soil (1.5 lakh cum) shall be tested for contamination and toxicity and accordingly shall be disposed • Dredged soil shall not be pilled on the River banks						
❖ Drainage Pattern	• Natural Drainage pattern of area around shall be maintained. • Storm water management drains shall be provided at site for management of storm water management		Construction Sites, Access road, and Labour Camp Locations	During construction stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
6. Construction Material Sourcing							
❖ Borrow areas for sourcing earth for filling as required (erosion, loss of productive land, land degradation, air pollution)	Material shall be sourced from nearby area like nearby quarries, Bhagalpur (80 kms) and local markets of Sahibganj to the extent possible. As surplus soil is available from excavation of the site, no borrow area may be required. However, if borrow area is required then it should be as per following: • Non-productive lands, barren lands, raised lands; wastelands shall be used for borrowing earth with the necessary permissions/consents. • Agricultural areas not to be used as borrow areas unless requested by the landowner	IRC Guidelines on borrow areas and for quarries. EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)	All Identified Borrow sites	During design and construction stage	Part of Project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	for lowering the land for making it cultivable. • Excavation depth should not exceed 1.5 m bgl • Environmental Clearance from State Environmental Impact Assessment Authority under EIA Notification, 2006 and required permission from District Magistrate shall be obtained prior to excavation. Copy of this permission shall be submitted to IWAI before start of excavation. • Record of location, area, accessibility to the location and photograph of borrow area should be maintained prior to excavation • Site selected for borrow area should be approved by PMC/PMU & IWAI expert prior to excavation • Ridges of not less than 8m width will be left at intervals not exceeding 300m. Small drains will be cut through the ridges, if necessary, to facilitate drainage. • The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal). • Topsoil to be stockpiled and protected for use at the rehabilitation stage. • Rehabilitation shall be satisfactorily undertaken immediately after the use has ceased and at least three weeks prior to monsoon. • Unpaved surfaces used for the haulage of borrow materials to be maintained. • Transportation of earth materials shall be through covered vehicles.						
❖ Quarries for sourcing stone and aggregates	• Aggregates required for embankment stone pitching and roads shall be procured from licensed quarries. Some of the	EIA Notification 2006(under Environmental Protection Act and	Quarry Site	During design and construction stage	Part of Project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
(loss of productive land, land degradation, air pollution. Any illegal quarrying may lead to land use change, unstable rock formation)	quarries are located in Rajmahal hills and by the side of the eastern railway located about 4-5 km from the terminal site. • It shall be ensures that selected quarries are having requisite environment clearance, and comply with Air Pollution Control and Noise level requirements as per the law. • Copy of Environmental Clearance letter and Consent to operate and shall be obtained from the quarry owner and submitted to IWAI. • Material shall be transported in covered vehicles only. • No new quarry shall be opened without due permissions. If new quarry is opened, then it is require to obtain environment clearance from MoEF&CC/SEIAA • Each Quarry shall be visited prior to its selection to ensure its compliance with lease conditions, EC and consent conditions. • Stone crushers, if required, shall be set up only after consent from SPCB and taking adequate measures for air pollution control	Rules, 1986;)					
7. Protection of Flora and Fauna							
❖ Protection of terrestrial flora & fauna	• Project layout design shall be in a way to minimize tree cutting • Permission shall be obtained from forest department prior tree cutting and only the identified and permitted tree shall be cut and remaining shall be maintained properly • Thick green belt shall be developed at the periphery and along the roads on the project site which will prevent spread of dust and reduce noise propagation. • Areas reserved for future development at						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	site shall also be made green by growing grass and shrubs and herbs • Caution sign shall be placed to prevent hunting of animals • Provision shall be made for strict penalty for hunting/harming any animal • Construction activities shall be restricted to 6:00 Am-10:00 Pm especially noise generating activities. • Compensatory plantation should be carried out in ratio of minimum 1:7 (2 mandatory +5 voluntary) and in nearby areas to the extent possible • Green belt to be developed should be mainly naturally growing native species of the area. Green belt should be developed as per the CPCB guidelines proposed above climate section. • Survival rate for compensatory plantation and green belt to be developed at the site shall be monitored regularly and measures shall be taken so as to achieve minimum rate of 70% • All efforts shall be made to minimise the cutting of tree through design changes. Layout should be designed in a way so as to minimize the tree cutting. Only trees identified for cutting should be cut and • Workers should not use any timber or firewood as fuel for any purpose. LPG should be made available to workers in construction camp. • Tree cutting should be carried out only after obtaining due tree cutting permission from forest department. • No hazardous material or waste shall be disposed off in the other land or nearby area as it may harm the animals, if						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	consumed accidently • Speed limit will be regulated to prevent any accidents of animals. Regular maintenance of the dumper shall be done to prevent leakage of oil so as to prevent pollution of the soil and impact on fauna and flora dependant on soil. • Regular Water Sprinkling shall be carried out to minimize dust generation and settling the dust on surface of flora. • Trees retained at the site (after site clearance) should not be disturbed, cut or harmed in anyway. These trees should be maintained. • Adequate parking space should be provided within the site for construction vehicle and equipment so as they are not parked in other areas like road side, others agricultural field, open areas etc to avoid any harm to flora of that area due to movement of heavy vehicles. • Construction camps should not be established inside or near the forest area • Construction activities and vehicle washing should not be undertaken at the river or any other water body or close to the water body • Site should be barricaded to prevent entry of the animal in the site • Hunting, poaching and harming any animal (wild or domestic) by any worker or project related person should be strictly prohibited and monitored • Illumination at the night time should be reduced during the night time (if no activity is going on) as it may disturb the nocturnal animals • Noise generating activity should not be						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	undertaken during night time to minimize disturbance to animals. Noise levels should be maintained within the prescribed CPCBs limits to the extent possible during the day time. • Workers should not use any timber or firewood as fuel for any purpose						
❖ Protection of Aquatic Fauna including Dolphins from high sound generation during piling	• The area in which the construction of the Berth (jetty) is planned, advisable to carefully determine drop sites before anchor placement to ensure that Dolphin and fish communities that could locally still be present in the area are not unnecessarily damaged. • Before starting piling allow some time to aquatic fauna to displace from the piling area. Bubble curtains can be provided at the time of pilling so as to displace the aquatic fauna prior start of construction activities • The piling activities must be carried out in shortest possible timeframe as possible • All the debris shall have disposed away from river course as per debris management plan of the project. • Decisions on method of construction and type of technology and equipment to be used must consider the noise and vibration levels and extent of siltation being generated. Noise and vibration levels must be far below levels that can cause injury to dolphins and other aquatic life. • Noise reducing devices like mufflers, enclosures shall be fitted with the equipments as much as feasible. Erecting barreries shall also be installed • Fish exclusion devises shall be installed in water column around the pile driving area	Wild Life (Protection) Act, 1972	Around Pilling Area	During design and construction stage	Part of project costs	PMU through DFO	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	to prevent fish access • Geo Textile synthetic sheet curtain &turbidity traps shall be placed around pilling and construction area to prevent movement of sediments and construction waste						
❖ Protection of Aquatic Fauna including Dolphins from increased sedimentation in water body during piling & dredging and other construction activities	• To avoid the construction debris wash or blown into the water the area shall be surrounded bysilt screens, which must be placed in the water before the work starts. Geo-Textile synthetic sheet curtain can act silt screen which should be placed around pilling and construction area to prevent movement of sediments and construction waste The screens should also be placed around storage areas, to prevent waste from blowing away and to prevent sediment run-off into the river. The storm water drain shall be connected to temporary sedimentation pit and collected water shall be used for dust suppression. Run-off from site should also pass through oil/grease traps and flow down to the same sedimentation tank before its reuse • In addition to silt screens, building guidelines of the Bonaire National Marine Park require that storage areas for sand and soil, and all work areas, must be at least 20 meters away from the high water mark and construction equipment must not be cleaned or washed within 50 meters of the high water mark. • Piling and dredging activities should be carried out rapidly. Piling should not be carried out during breeding and spawning season means during rainy season. It should be carried out in low water season, i.e. pre-monsoon	Wild Life (Protection) Act, 1972	Around Pilling Area	During design and construction stage	Part of project costs	PMU through DFO	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Piling/Dredging should be stopped for some time, if any dolphin is sighted in activity area • Equipments shall be maintained in good condition to prevent leaks or spills of potentially hazardous materials like hydraulic fluid, diesel, gasoline and other petroleum products • Excavation activities onshore should not be undertaken during monsoon season so as to minimize sediment load of run-off • Workers should be trained to handle the equipment and material at site so as to minimize the spillage of materials and contamination of water • All workers should be made aware of not throwing any waste in the river or any drain • No construction debris/ already accumulated solid waste at site or waste generated from labour camp should be thrown in river or any drain • Sewage generated from labour camp should not be directed into river but should be disposed off through septic tank/soak pit • Aquatic ecology monitoring should be carried out prior start of construction and after completion of construction so as to assess the impact of construction activities on aquatic life. • Run-off from site should pass through oil/grease traps and sedimentation tank prior discharging into the river • All construction and operation equipment shall be maintained in good condition shall be checked for oil & grease leakage • Dredged soil (1.5 lakh cum) shall not be disposed off in river or its banks especially						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	during breeding spawning seasons of aquatic organisms •						
❖ Conservation of Dolphins	• Appropriate protocols and procedures must be prepared for sighting of dolphins in the construction zone. The objective of the protocols and procedures must be aimed at having no or minimal impacts on the dolphins.	Wild Life (Protection) Act, 1972	Around Pilling Area	During design and construction stage	Part of project Costs	Contractor	IWAI/PMU/PMC
8. Air Quality							
❖ Fugitive Dust Generation due to construction activities	• Barricading the site to prevent dust dispersion to nearby areas • Excavation and filling shall be carried out in parallel. Excavation and filling shall be carried out in phases • Excavated soil shall be stored under covered conditions • Transport of loose and fine materials through covered vehicles. • Loading and unloading of construction materials in covered area. • Approach roads shall be paved and widened. • Water spraying on earthworks, unpaved haulage roads, other dust prone areas and construction yard. Flow of water sprinklers shall be maintained to avoid water ponding • Make Provision of PPEs like face masks to workers. • Raw materials like cement, sand and construction debris should be stored under covered conditions • Wheel wash facility shall be provided at exit points of the site • Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	Construction sites, Loading areas, storage areas,	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	EMP • Development of green belt (area of 2.9 ha) at the site efficient for arresting the particulate matter • LPG should be used as fuel source in construction camps instead of wood. Tree cutting shall not be allowed for fuel wood. • Mixing Plant, crushers and batching plant shall be located on downwind direction of the site fitted with adequate stack height to ensure enough dispersion of exit gases. with appropriate pollution control measures • Loading and unloading of construction materials shall be made at designated locations in project area with provisions of water fogging around these locations • Low sulphur diesel should be used for operating DG sets and construction equipment.						
❖ Exhaust gas emissions from machinery and vehicular traffic.	• Regular maintenance shall be carried out of machinery and equipment. • Periodic Ambient air quality monitoring shall be carried out. • DG sets to be fitted with stacks of adequate height and low sulphur diesel to be used in DG sets as well as in machineries. • Monitoring of air quality for PM_{10}, $PM_{2.5}$, SO_x, NO_x, and CO shall be carried out quarterly at construction sire	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	Construction camps and sites, batching plants, DG sets locations	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC
❖ Emissions at access road: avoidance of traffic Jams	• Efforts shall be made to move construction material early morning and late evening period. • Traffic regulators (Guard) shall be posted in habitat area and at key junction areas to avoid congestion • No construction, material, equipment or vehicle shall be stored or parked at any road	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981	Existing roads	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	or the non-project area • Transportation vehicle shall strictly adhere to the designated routes and timings and shall avoid the peak traffic hours • Parking space for dumpers shall be provided within the site so as to prevent parking of vehicles on road and other area and thus preventing traffic jams	and amendments thereof					
9. Noise and Vibration							
❖ Noise from construction vehicle, equipment and machinery.	• All equipment to be timely serviced and properly maintained to minimize its operational noise. • Construction equipment and machinery to be fitted with silencers and maintained properly. • Barricading the construction site to minimize the noise level outside the site boundary • Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines. • Speed control shall be enforced in habitat areas. The ambient noise level as per standard is 55 dB(A) and 45 db(A). Current level at habitat area meets the standard • Honking shall be prohibited at the project site • Hearing test for the workers shall be undertaken before employing them and thereafter shall be done after every six months • Job rotations should be practised for workers, working in high noise level areas • No noise generating activity shall be carried out between 6:00 AM to 10:00 PM. • Monitoring of Noise levels shall be carried out on monthly basis to check the level of	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Terminal site and accesses road.	During the Construction stage	Part of project Costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	pollutants and effectiveness of proposed EMP						
10. Land-use and Landscape							
❖ Loss of agricultural land and productive top soil	• Agricultural land shall not be selected for setting up construction camps, borrow area (if any), plant site or any other construction purpose 15 cm of top soil layer shall be stripped off prior to excavation and shall be stored separately in covered condition and used for landscaping purpose or shall be given to farmers in nearby areas, if required by them.	Design requirement	Around project site area and borrow area	During construction Stage	For signage and caution boards	Contractor	IWAI/PMU/PMC
❖ Soil erosion due to construction activities, earthwork	• The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Sedimentation tanks shall be provided with storm water drain to arrest the sediments and these sediments shall be removed and stored with remaining excavated soil • Provision of cross drainage structure like culverts shall be made in the access road if required to maintain the natural drainage pattern and prevent soil erosion. • Provision of side drain shall be made in access road if required to prevent water logging. • Shore protection works like stone pitching, geo-textile matting etc. along the bank and construction of stone apron in the river to prevent the scouring of banks shall be undertaken • Bio-turfing of embankments shall be made enhance the slop stabilization	Municipal Waste Rules, 2015, Hazardous Waste Rules, 2008	Access road, terminal site and river bank	During construction Stage	Part of project costs	Contractor	IWAI/PMU/PMC
• Compaction and contamination of soil due to movement of vehicles and	• Excavation and filling operation should be carried out in parallel so as to minimize the soil erosion. Unusable debris material should be suitably disposed off at pre designated disposal locations, with approval	Municipal Waste Rules, 2015, Hazardous Waste Rules, 2008	Terminal site	During Design & Construction stage.	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
equipment	of the concerned authority. • Compaction of soil shall be undertaken by sprinkling the water to minimize the surface runoff and erosion. • Remaining excavated soil shall be used for filling purpose and left over shall be stored in covered conditions for use in future for construction of approach road & railway connectivity and mine rehabilitation located at 4-5 kms from site. The soil storage location shall be identified in advance in consultation with PWD which is likely to construct the approach road. • Dredge soil shall also be either utilised for construction activity or disposed off along with excavated soil. • Fuel shall be stored in HDPE containers on paved surfaces with provision of catchment pit to prevent soil contamination from oil spillages. • Municipal waste likely to be generated at site shall be collected in segregated manner with the use of two bin system at site. It shall be segregated into biodegradable and non-biodegradable waste. Provision of bio composter shall be made at site. The biodegradable material shall be decomposed for production of compost for use at site. The non-biodegradable waste shall be disposed off to predefined land fill site nearby. The land fill site shall have provision of liners to prevent leachate to ground. • Septic tank or mobile toilets fitted with anaerobic treatment facility shall be provided at construction camp • Aggregates will be sourced from existing licensed quarries. Copies of consent/						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
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	approval / rehabilitation plan for a new quarry or use of existing source will be obtained by DBOT contractor and submitted to IWAI. • Geometric adjustment shall be made if required and technically safe to minimise cutting of the tree. Provision shall be made for additional tree plantation as feasible along the road while finalising the road alignment and rail alignment[4]. • Hazardous waste like used oil from DG sets shall be stored in HDPE containers and shall be stored on paved surfaces in isolated location to prevent its spillage and contamination of soil. Used oil shall be disposed off through authorized vendors only. • Movement of construction vehicles shall be restricted to the designated haulage roads only • Wash-off from concrete mixing tanks and wash from washing area shall not be allowed to enter the soil. This wash shall be collected through drains into tanks and concrete shall be settled, collected, dried and re-used in the site again.						
11. Water Resources							
❖ Depletion of Groundwater resources due to unregulated abstraction for construction purpose	• Preference shall be given to source water from rivers wherever feasible in the project area with due permission from authorities. • Temporary rain water storage structures should be provided at the site to store rain water and this water should be used for sprinkling and construction activities • No dumping of waste/wastewater in the	Water Act, 1972		During Construction stage	Part of project costs	Contractor,	IWAI/PMU/PMC

[4] Approach rroad construction is proposed to be undertaken by other agency PWD and road design shall be evolved by them only.

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
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	ground. Hazardous waste or wastewater shall not be stored in unlined ponds • Permission shall be obtained from irrigation department in case river water is used and from CGWA/CGWB in case ground water is used.						
❖ Increase in water Siltation levels due to construction of terminal and contamination due to disposal of domestic waste	• Washing of vehicle and equipment shall not be carried out at river or any water body. Washing area should be provided with the storm water drains fitted with oil & grease trap. • Piling of the raw materials & debris shall be avoided at the site. Storage of debris and raw material shall be carried out in paved and covered areas. This will minimize interface of run-off with raw material and debris. • Site should be cleaned regularly • Septic tank/soak pit shall be provided at site for disposal of sewage from the toilets at site and from the labour camps. Adequate toilets & bathrooms shall be provided to prevent open defecation. Wherever septic tanks are not provided mobile toilets with anaerobic digestion facility shall be provided and no domestic waste shall be discharged to river. • Water use shall be minimized by using RMC, practicing curing by water sprinkling, maintaining flow of sprinklers, covering the water storage tanks to minimize water evaporation, creating awareness for water conservation and regular inspections at site to monitor the leakages in water storage area • In case RMC is not used then concrete transit mixer should be washed and cleaned daily. Wash from these mixers shall be collected in block work tanks which will allow	Water Act, 1972	Terminal Site	During Construction stage	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	settling of concrete, removal of aggregates and allowing the waste to wastewater drain. This collected waste concrete can be dried and used for various purpose at site like construction of temporary roads at site and labour colony • Wastewater generated from the washing/cleaning area after passing through oil & grease trap & curing area shall be re-used for water sprinkling and wheel washing • Fuel shall be stored in leak proof containers and containers shall be placed on paved surface Substructure construction should be limited to the dry season and cofferdams may be constructed and utilized to lift the spoil directly out of it and carried to the riverbank for land disposal. • Restoration of changes in the stream, if any, made during construction to its original level • The piling work in river shall be undertaken during low flow period. • Provision shall be made for collection and draining of water for the piling earth. It shall be used for embankment protection or road construction depending on its suitability. • Turbidity traps/curtains should be providing or Geo-Textile synthetic sheet curtain shall be placed around pilling and construction area to prevent movement of sediments and construction waste. • Sedimentation tanks shall be provided at the site so as run-off from site shall enter the sedimentation tanks before discharging into the river. Sedimentation tanks will trap the sediments in the run-off • Provision shall be made for geo Synthetic Screen for arresting silt flowing down stream.						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Proper collection, management and disposal of construction and municipal waste from site shall be made to prevent mixing of the waste in run-off and entering the water bodies • Natural Drainage pattern of area around shall be maintained • Dredged soil (1.5 lakh cum) shall be tested for toxicity & contamination, if toxic/contaminated shall not be disposed off back in water and should be send for disposal to TSDF • Monitoring of surface water quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP						
12. Accident and Safety Risks							
❖ Impact on Social life	• Separate SIA is being carried out and RAP and other social measures should be proposed under SIA and same should be followed. • People have sentiments associated with River Ganga so relocation should also be given near to River only • Skill training and assistance should be given to people so as they can get other jobs or get into other business. NGOs should be hired for this purpose • Small loans should be given to the farmers losing the land and wishing to start new business • Infrastructure development in form of small school, hospital, library etc. can be undertaken in the village as compensation to the disturbance caused • Any common property resources, if removed						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
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	should be relocated to the other location (should be a private land) as soon as it is removed and location should be acceptable to the local people • Site should be barricaded and should have entry guarded by security guard. Resister should be maintained for entry of outsiders. No unauthorized person should be allowed to enter the site especially village children • A board should be displayed at entrance of site displaying name of project, area and hazards associated with the site on entrance and activities prohibited within and near site area in local language • Non-productive lands, barren lands, raised lands; wastelands should be used for setting up labour camps, plant sites and debris disposal site. Agricultural land should be avoided. Land should be used for establishment of construction camps, debris disposal site and plant site only after obtaining consent from land owner. • Fishermen should be consulted prior restricting fishing activity in the activity area • Necessary permits should be obtained from concerned authorities in case any quarry site, batching plant, hot mix plant, WMM plant etc. is set up. • Labour camps, plant sites and debris disposal site should not be located close to habitations, schools, hospitals, religious places and other community places. A minimum distance of 500 m should be maintained for setting up such facilities. • Management, rehabilitation and closure of these sites should be as per the Management plans proposed for these sites. Records for starting, maintaining and						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	closure should be maintained and should be approved by site engineers						
❖ Accident risk from construction activities and health & safety of workers	• Adequate illumination should be provided at site during evening and night time till the work is being carried out • Rest area should be provided at site in which workers can rest after the lunch hours • Workers should wear the personal protective equipment like helmet, gum boots, safety shoes, safety jackets, ear plugs, gloves etc. while working • Noise level in the work zone should be maintained and followed as per OSHAS norms • Contractors should adopt and maintain safe working practices. SOPs should be prepared for each and every activity and all activities should be undertaken as per SOPs under supervision of site engineer • Training should be given to workers to handle the heavy equipment so as to prevent accidents • Training should be given to workers to handle emergency situation like fire, earth quake and flood • Complete medical check-up should be done for workers prior to joining and after six months of joining • First aid facilities, first aid room, first aid trained personnel and ambulance should be provided at the site 24 X 7. Also tie-ups with local hospital should be done to handle emergency case, if any • List of emergency nos., hospital contacts, ambulance contacts and doctors contacts should be displayed in first aid room, rest area and at all required location	Central Motor and Vehicle Act 1988 EP Act 1986 Noise Rules 2002	Construction sites	Construction period	Part of project costs	Contractor	IWAI/PMU/PMC

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Working hours of labour should not exceed than standard norms as per state factory law • Labour camps should be located at neat and clean location with no water logging issues and should be well ventilated with adequate illumination, kitchen and safe drinking water facility • Construction labour camps and site should be properly cleaned and hygiene should be maintained • Proper sanitation facility like toilet and bathing facility should be provided at site and labour camps. Wastewater generated from these facilities should be disposed off through septic tanks and soak pit • LPG should be provided as fuel for cooking to workers and open burning of fuel should not be allowed • Wastewater from construction site should not be allowed to accumulate at site as standing water may lead to breeding of mosquitoes. Septic tanks/soak pits should be provided for its disposal • Temporary storm water drainage system should also be provided at camp site and construction site so as to drain the storm water and prevent accumulation of storm water at site and thus breeding of mosquitoes/flies • Safety officers should be appointed at site so as to ensure all safety measures are taken at the site • All construction workers should be provided with personal protective equipments like helmet, gloves, gumboots, safety jackets etc. and fines should be imposed if found not wearing • Job rotation should be carried out for						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	workers exposed to high noise and dust areas • Activity like smoking and consuming liquor should be prohibited at the site • Awareness on AIDS should be spread among the workers • Traffic manager should be present at the site all the time to manage incoming and outgoing traffic to prevent accidents • Crèche facility should be provided for kids if female workers are employed • Regular inspection for hygiene and safety in labour camps should be done • Provision of cautionary and guiding signage in local and English language indicating the hazard associated with the site & activities. Usage of fluorescent signage, in local language at the construction sites • Speed limit of vehicles should be restricted at site to prevent any accidents and fines should be imposed on vehicles if same is not maintained. All construction vehicles should follow the designated routes & timings only. • Construction vehicle movement should be restricted to non-peak hours, i.e. late evening (7-12:00 pm) only. Villagers should also be given intimation of these timings. • Noise level in the work zone should be maintained and followed as per OSHA norm • Employment should be provided preferable to local & affected people • Dustbins should be provided at labour camps for collection of waste and waste should be regularly disposed off through the concerned agency • Arrangement of fire-fighting should be made						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	at site and workers should be trained to use the system in case of fire • Site should be barricaded and should have entry guarded by security guard. Resister should be maintained for entry of outsiders. No unauthorized person should be allowed to enter the site especially village children • A board should be displayed at entrance of site displaying name of project, area and hazards associated with the site on entrance and activities prohibited within and near site area in local language • All construction vehicles should be regularly serviced and maintained and carry pollution under control certificate • All proposed environmental pollution measures should be taken during construction of phase of terminal to minimize the harm to existing environmental quality of the area, which is being enjoyed by the residents of that area • Maintenance and repair of the village road should be carried out both before and end of construction by contractor. • Sprinkling of water should be carried out in village road also, so as to minimize dust generation due to movement of construction vehicles.						
❖ Shifting of community properties and utilities	• Any CPR, if removed shall be relocated at the earliest with consent of the villagers and the Gram Panchayat to suitable location in consent with the villagers		Project Area	Pre-Construction	Part of Project Costs	Contractor	IWAI/PMU/PMC

Table 1.3 : Environment Management Plan Sahibganj Terminal During Operation Phase- Phase I

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
OPERATION AND MAINTENANCE STAGE								
1. Climate								
1.1 Impact on Climate	• Ensuring survivability of already planted trees, minimum 70% survival rate and create additional GHG sink by planting additional trees • Adopting all energy efficiency measures e.g. the terminal building should have a platinum rated for Green building provisions • street lighting solar lighting provisions (on 1:3 ratio of minimal needs) along with solar power generation system should also be provided as to meet the other power requirements of the terminal thus reducing dependence on power grid supply.	Kyoto Protocol, National Water Policy, 2012, Forest Conservation Rules & National Forest Policy	Terminal site	Survival rate of trees and monitoring performance of energy conservation equipments	• Observations and inspection	Aftercare & Monitoring of Compensatory Plantation for 3500 trees	IWAI	IWAI
2. Bio-Diversity								
2.1 Dolphin Conservation	• Considering sensitivity of Dolphins, it is proposed to support Dolphin conservation activity. It is proposed to allocate a separate budget for this activity. This task may be undertaken through "The Vikramshila Biodiversity Research and Education	Project Requirement/ Wild life Protection Act, 1972	Dolphin Existence Areas	--	• Site Observation • Discussion with local People • Collection information from Forestry Department	Included in Operation / Maintenancecost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	Centre (VBREC)" together with the Whale and Dolphin Conservation Society (WDCS), the Environmental Biology Laboratory of Patna University, and T.M. Bhagalpur University, who has jointly initiated a project to improve the conservation value of Vikramshila Gangetic Dolphin Sanctuary.							
3. Air Quality								
3.1 Air pollution due to due to vehicular movement& loading and unloading areas	• Material shall be transported in covered vehicles • Transportation vehicle shall be properly serviced and maintain and shall carry PUC certificate • Thick green belt shall be developed as per the provision already made in the design and maintained all along the periphery and along the roads. The green belt shall be developed in canopy[5] shape with local species of broad leaf variety. • Species selected for development of green belt shall also be tolerant to expected pollutants and	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	Through out the project area	MI: Ambient air quality (PM_{10}, CO, SO_2 NO_x) PT: Levels are equal to or below baseline levels given in the EIA report	• As per CPCB requirements • Site inspection	Included in Operation / Maintenance cost	IWAI	IWAI

[5] Canopy shape green belt design includes three row of trees with middle tree species gore more in height compared to inside and outside tree species. Each of tree will have wider leaf which forms like a curtain and acts as beerier to dust spread. Dust accumulated over leaf falls down within the site boundary. Similarly external dust gets prevented from entering the terminal site. http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	shall have the ability to adsorb the pollutants. Suggested species are suitable for different areas are also listed under CPCB guidelines for green Belt development[6]. • Water sprinkling should be carried out during all loading and unloading activities and storage period. Further dust suppression measures should be taken at the site like vaccum collectors at dust generation areas. • More frequent water sprinkling shall be carried out at coal yard during summer season to prevent spontaneous fire. • Mechanical conveying system with provision of dust collection connected with beg filter is proposed to be provided for coal and stone chips transfer from its stock yard to barge loader to prevent dust generation and contamination of river water. In case mechanise system is not feasible in phase I due to economy of scale, then water sprinkling frequency							

[6] CPCB guidelines for green Belt development http://cpcb.nic.in/upload/Publications/Publication_513_GuidelinesForDevelopingGreenbelts.pdf

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	shall be increased at barge loading activities. Possibility of installation of portable dust collector shall be made additionally. • Monitoring of air quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP • It is recommended to provide mechanical conveying system with provision of dust collection system for loading/unloading material from barges. Pneumatic transfer only should be preferred for flyash transportation • Minimizing free fall of materials to reduce the dust generation • Minimizing dry cargo pile heights and containing piles with perimeter walls • Removing materials from the bottom of piles to minimize dust re-suspension • Regularly sweeping docks and handling areas, truck / rail storage areas, and paved roadway surfaces • Keeping transfer equipment (e.g. cranes, forklifts, and trucks) in good working							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	condition7 • Upgrading the land vehicle fleet with less-polluting trucks and vehicles, and using alternative fuels and fuel mixture							
4. Land and Soil								
4.1 Soil erosion at embankment during heavy rainfall.	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures etc. • Necessary measures to be followed wherever there are failures	Project requirement	Along river bank and embankment	MI: Existence of soil erosion sites Number of soil erosion sites PT: Zero or minimal occurrences of soil erosion	On site observation	Included in Operation / Maintenance cost	IWAI	IWAI
4.2 Soil contamination	• Fuel shall be stored in HDPE containers on paved surfaces only to prevent spillage of fuels on the soil and thus soil contamination • Dustbins shall be provided at all the required locations at the site for collection of recyclable and non-	Project requirement	Terminal site, access road, railway alignment and along	MI: Existence of soil erosion sites Number of soil erosion sites	On site observation	Included in Operation / Maintenance cost	IWAI	IWAI

[7] IFC Environmental, Health & Safety Guidelines-Ports, Harbors and Terminals

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable waste shall be disposed off through authorized agencies and shall not be dumped in open. • Used oil from DG sets and other equipment shall be stored in HDPE containers in isolated location on paved surfaces and shall be disposed through authorized vendors only and shall not be dumped in open. • Room shall be provided for storage of E-waste at site and this waste shall be sold to authorized vendors periodically and shall not be dumped in open. • Bio- medical waste likely to be generated at first aid centre shall be disposed of following the bio medical waste disposal rules • Dredged soil (30,000 cum/annum) shall be tested for toxicity prior disposal, if toxic it shall not be disposed off back in water and should be send for disposal to TSDF. Dredged soil (30,000 cum/annum) shall not be dumped onto the terminal		river bank	PT: Zero or minimal occurrences of soil erosion				

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	site or in open. • Municipal waste generated at terminal should either be sent for landfilling through authorized agencies or shall be composted within the terminal site and manure should be used for maintaining the green area within the site • Vessel waste reception facility should be available at the terminal site incase maintenance facility is not in place. The waste should be received from the vessel in proper segregated and packed form.. This waste should be treated and disposed within the terminal site only but in case it is not feasible, tie ups with Government and authorized private agencies can be made for handling, treatment, storage and disposal of this waste. Also fee can be imposed on the vessel operator for letting them dispose their waste at terminal/maintenance facilities.							
5. Water resources/Flooding and Inundation								
5.1 Siltation	• Regular checks shall be made for soil erosion and turfing conditions of river	Project requirement	Near surface	MI: Water quality	Site observation	Included in	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	training structures for its effective maintenance.		Water bodies	PT: No turbidity of surface water bodies due to the terminal activity		Operation/ Maintenance cost		
5.2 Water logging due to blockage of drains, culverts or streams	• Regular visual checks and cleaning of drains shall be done along the alignment to ensure that flow of water is maintained through cross drains and other channels/streams. • Drains shall be regularly cleaned and de-silted • Monitoring of water borne diseases due to stagnant water bodies • Storm water drains provided in parking & road areas shall be provided with oil & grease traps • Regular checks shall be made for soil erosion and turfing conditions of river training structures for its effective maintenance	Project requirement	Near surface Water bodies	MI: Presence/ absence of water logging along the approach road/terminal area PT: No record of overtopping/ Water logging	Site observation	Included in Operation/Maintenance cost	IWAI	IWAI
5.3 Waste Water treatment and conservation	• Toilets to be provided with running water facility to prevent open defecation. • Sewage generated at terminal site shall be treated in house. STP of 40 KLD	Project requirement	Project area	MI: proper treatment PT: treated water quality	Treatment parameter, ph., BOD, TDS etc.	Included in Operation/Maintenance	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	shall be provided for treatment of sewage and treated water shall be reused in green belt development and dust suppression • Storm water drainage system (3.05 km drain length) should be provided at the site. Arrangement shall be made to collect the roof water from the building separately into a tank so as this water can be used for horticulture activity. Storm water from other areas like storage yards, stock piles and roads shall be directed into a dump pond. Storm water shall be retained in pond so as to allow the settling of dust and suspended particles in the water, this water should be used for cleaning and dust suppression. Sludge from the dump pond shall be sent for disposal along with other municipal waste • Water conservation fixtures shall be installed in toilets and kitchen area. Some of the water conservation fixtures which can be installed are dual flushing cisterns, sensor taps, low			check		cost		

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	water urinals etc. • No wastewater shall be received from vessels and vessels should not be allowed to discharge their wastewater and solid waste in river • No waste/wastewater shall be discharged in river or dumped into the ground • Fuel shall be stored in leak proof containers and containers shall be placed on paved surfaces • Dredged soil (30,000 cum/annum) shall be tested for toxicity, if toxic shall not be disposed off back in water and should be send for disposal to TSDF. • Monitoring of surface water quality shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP • Oil should be stored in leak proof containers and storage area should be provided with facility of collecting the oil in case of spillage. The storage facility should be so designed that spilled oil shall not enter the storm water and sewage drains or storm water storage pits. Oil							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	storage facility should be contained. Oil & grit seperators should be provided in the storm water drains in these areas. • Fueling of vessels is not proposed at terminal facility but in case fueling is carried out then Fuel dispensing equipment should be equipped with "breakaway" hose connections that provide emergency shutdown of flow.. Fueling equipment should be inspected daily to ensure all components are in satisfactory condition							
6. Flora& Fauna								
6.1 Vegetation 6.2 Dolphin protection	• Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness • Propeller shall have net system to avoid any accident with dolphins, international practices shall be adopted. • No wastewater or waste shall be disposed of in river from terminal site or from vessel into the water. Penalty shall be imposed on	Forest Conservation Act 1980, Wild Life Protection Act, 1972	Project tree plantation sites. Dolphin movement locations	MI: Tree/plants survival rate PT: Minimum rate of 70% tree survival	Records and field observations. Information from Forestry Department	Operation/ Maintenance Cost	IWAI/Forest Department	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	the vessels reported of disposing waste/wastewater in the river • Run-off from stockpile area, storage yards, parking areas & roads shall enter a dump pond first. Run-off should be allowed to retain for some time in the pond to allow the settlement of dust contained in it. The clear run-off shall be used for dust suppression and other activities • Run-off from building should be collected separately and should be used for plantation and dust suppression • STP should be provided at site for treatment of sewage generated. Treated water from STP should be reused completely at site and should not be discharged into river • Dredged sand (30,000 cum/annum) shall not be disposed off in river especially during breeding spawning seasons of aquatic organisms • Dredging shall be avoided during the breeding and spawning seasons • Nesting grounds, breeding							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	&spawning grounds shall be identified and project activities shall be minimized in those areas • Instruction should be given to all vessels and all employee and staff that no dolphin or any other endangered species shall be harmed due to any reason • Instruction shall be given to vessel operator that in case any accident with dolphin occurs that should be reported immediately to terminal authority • Time schedule and the quantity of material allowed shall be strictly checked and monitored for each ship. This will prevent overcrowding of the vessels at terminal site and thus no obstruction will be there on movement of the aquatic organisms due to ships. • Waiting time of ships shall be reduced at the terminal by providing the adequate loading and unloading equipment and vehicles. • Ships shall be instructed for not using sharp lights and sounds as they may disturb aquatic organisms • Ship speed should be							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	controlled especially in dolphin habituated stretch to minimize dolphin kill and the design of vessel and acoustic treatment should be done for vessel so as to minimize the sound exposure of dolphins. • No developments shall be brought up on other bank of river opposite to terminal site so as to provide the ground to aquatic organisms for their activities • Dust suppressors shall be used at site and at barge while loading & unloading of material to suppress the dust level. • Quick clean-up operations shall be carried out in case of accidents. Vessel owner shall be responsible for paying the clean-up expenses in case of the accidents and pollution of river water quality							
7. Noise & Vibration								
7.1 Increased noise due to material handling and vehicular movement	• Earplugs should be provided to workers involved in unloading operations • Provision of thick green belt along the boundary and roads which will act as noise buffer • Timely maintenance and	Noise Pollution (Regulation and Control) Rules, 2000	Access Road & Terminal Site	MI: Noise levels at the site and access road PT: No accidents due	Visual inspection Check accident	Included in operation/Maintenance cost	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	servicing of transportation vehicles and the machinery/pumps to be used during operation phase to reduce the noise generation due to friction and abrasion • Honking shall be prohibited at the project site • Hearing test for the workers shall be undertaken before employing them and thereafter shall be done after every six months • Job rotations should be practised for people, working in high noise level areas • No noise generating activity shall be carried out between 6:00 AM to 10:00 PM • DG sets shall be provided with acoustic enclosure • Monitoring of Noise levels shall be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP			to vegetation growth	records			
8. Safety								
8.1 Accident Risk due to uncontrolled growth of vegetation	• Efforts shall be made to make shoulder of approach road (to be developed by PWD) completely clear of vegetation. • Regular maintenance of	Project requirement	Access Road	MI: Presence and extent of vegetation growth on either side of road. Number	Visual inspection Check	Included in operation/Maintenance	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	plantation along the roadside • No invasive plantation near the road. • Separation of people from vehicles and making vehicle passageways one-way, to the extent practical. • Existence of spill prevention and control and emergency responsive system at the site. Preparation of spill control and management plan for the terminal facilities & jetties • Locating means of access to ensure suspended loads do not pass overhead, to the extent practical • Constructing the surface of terminal areas to be: of adequate strength to support the heaviest expected loads; level, or with only a slight slope; free from holes, cracks, depressions, unnecessary curbs, or other raised objects; continuous; and skid resistant • Providing safe access arrangements suitable for the sizes and types of vessels calling at their facilities. These access arrangements should include guard rails and / or			of accidents. PT: No accidents due to vegetation growth	accident records	cost		

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	properly secured safety nets to prevent workers from falling into the water between the vessel side and the adjacent quay. • Inspecting and approving all slings before use • Clearly marking (indicating its own weight) all lifting beams and frames, vacuum lifting, or magnetic lifting device which does not form an integral part of a lifting appliance and every other item of loose gear weighing more than 100 kilograms (kg) • Inspecting disposable pallets and similar disposable devices before use and avoiding re-use of such disposable devices, Equipping lifting appliances with means of emergency escape from the driver's cabin and a safe means for the removal of an injured or ill driver • Risk of free fall of materials should be minimized by installing telescoping arm loaders and conveyors • Materials handling operations should follow a simple, linear layout to reduce the need for multiple							

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	transfer points							
8.2 Accident risks associated with traffic movement.	• Traffic control measures, including speed limits should be forced strictly. • Further encroachment of squatters within the ROW will be prevented. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained • Movement of traffic shall be restricted to designate hours and routes Adequate illumination should be provided at the site during evening	IRC: SP:55	Throughout the Project route	MI: Number of accidents Conditions and existence of safety signs, rumble strips etc. on the road PT: Fatal and non-fatal accident rate is reduced after improvement	Review accident records Site observations	Included in operation /Maintenance cost	IWAI	IWAI
8.3. Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system • Emergencyplan for vehicles carrying hazardous material	-	Throughout the project stretch	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Review of spill prevention and emergency response plan Spill accident records	Included in operation/Maintenance cost.	IWAI	IWAI
8.4 Accidents Risks Due to Movement of Vessels and other	• Implementation of the environment management plan as proposed to prevent the environmental pollution	-	Throughout the project	MI: Status of emergency system –	Review of spill prevention	Included in operatio	IWAI	IWAI

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
hazards associated with site	during operation phase • Ships should comply with safety norms and should maintain the speed so as to prevent the accidents. In case of accidents, ship owner should be responsible for clean-up operations • Employment should preferably be given to local people. Women should be given equal opportunity for work. • Safety norms should be followed for all operational phase activities at terminal • Development activities should be carried out in the village and nearby areas for development of area • Fishing activity should not be restricted in the river. Alternate provision for fishermen should be given in case fishing activity is restricted. • Fishing activity should not be restricted in the river. Alternate provision for fishermen should be given in case fishing activity is restricted • Safety training should be given to the terminal staff for managing the floods, earthquake, fire, ship		stretch	whether operational or not PT: Fully functional emergency system	and emergency response plan Spill accident records	n/Maint enance cost.		

Environmental Issue/ Component	Avoidance/Mitigation/ Compensation Measures	Reference to laws/ guideline	Location	Monitoring indicators (MI)/ Performance Target (PT)	Monitoring Methods	Mitigation Costs	Institutional Responsibility	
							Implementation	Supervision
	accidents like situation. Emergency collection area should be designated at the site which is safe. All workers should be directed to collect at this area in case of emergency. • Firefighting facility should be provided at site and trained personnel should be available at site who can operate the fire extinguishers and other fire-fighting equipment.							

Table 1.4 : Environment Monitoring Plan of Sahibganj Terminal for Construction and Operation Phase

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
Construction Period						
1.	Air Quality (Ambient & Stack)	PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO	Three Locations including project site, once in two months	• Fine Particulate Samplers for $PM_{2.5}$ • Respirable Dust Sampler fitted PM_{10} • Respirable Dust Sampler fitted with Gaseous sampling arrangements for SO_2 and NO_x, CO analyser; TO-14A, TO-15, USEPA method for sampling	Contractor	IWAI & PMC

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
2.	Surface Water Quality	Physical, chemical and biological	River Ganga Once a month (upstream & downstream)	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for labour camps Once a month	Grab sampling and analysis by using standard methods	Contractor	IWAI & PMC
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Construction labour camp, construction site and nearest village Once a month	Noise meter	Contractor	IWAI & PMC
5.	Soil Quality & River Bed Sediment	Soil texture, type, Electrical conductivity, pH, infiltration, porosity, etc.,	Construction site, labour camps and debris disposal site Once in 6 months	Collection and analysis of samples as per IS 2720	Contractor	IWAI & PMC
6.	Plantation	Plantation survival rate	Terminal site	Survey, counting, recording & reporting	Contractor	IWAI & PMC
7.	Plantation	Plantation survival rate	Compensatory plantation site (if carried out)- Once in year	Survey, counting, recording & reporting	IWAI	IWAI & PMC
8.	Soil Erosion	---	Upstream & downstream of project site near river bank-- Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
9.	Aquatic ecology	Phytoplankton, Zooplankton	River Ganga Six monthly	Plankton net of diameter of 0.35 m, No.25 mesh size 63 and analysis by using standard methods.	Contractor	IWAI & PMC
10.	Integrity of embankment	---	Upstream & downstream of terminal Site-Once a month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	Contractor	IWAI & PMC
Operation Phase						
1.	Air Quality (Ambient	PM_{10}, $PM_{2.5}$, SO_2, NO_2,	Three Locations	• Fine Particulate Samplers for	NABL accredited	IWAI

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
	& Stack)	HC and CO	including project site, once in two months - Six monthly	$PM_{2.5}$ • Respirable Dust Sampler fitted PM_{10} Respirable Dust Sampler fitted with Gaseous sampling arrangements for SO_2 and NO_x, CO analyser; TO-14A, TO-15, USEPA method for sampling	Lab to be contracted by IWAI	
2.	Surface Water Quality	Physical, chemical and biological	River Ganga Once in quarter (Upstream & Downstream)	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
3.	Drinking water Quality	Physical, chemical and biological	Drinking water for Staff- Once a quarter	Grab sampling and analysis by using standard methods	NABL accredited Lab to be contracted by IWAI	IWAI
4.	Noise Level	Day time and night time noise level (max, min & Leq levels)	Two locations: Project site & nearest habitation -Once in quarter	Noise meter	NABL accredited Lab to be contracted by IWAI	IWAI
5.	Wastewater Management	Physical, chemical and biological of sewage and STP treated water	Terminal site, testing of sewage and STP treated water Once in quarter	--	NABL accredited Lab to be contracted by IWAI	IWAI
6.	Plantation	Plantation survival rate of 70%	Terminal site and compensatory plantation site- Once in year	Survey, counting, recording & reporting	IWAI	IWAI
7.	Soil Erosion	---	Upstream & downstream of project site near river Bank- Monthly	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI
8.	Aquatic ecology	Phytoplankton,	River Ganga-Six	Plankton net of diameter of 0.35	IWAI	IWAI

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
		Zooplankton	monthly	m, No.25 mesh size 63 and analysis by using standard methods.		
9.	River Bed Sediments	Physio-Chemical Parameters	Once in Six Month at Terminal Site Area	Depth Sampler	IWAI	IWAI
10.	Integrity of embankment	---	Upstream &downstream of terminal site- Once in six month	Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI

Annexure 1.1: Green Belt Development Plan

1.0 Introduction

Site for terminals/jetty/lock may support vegetation such as trees, shrubs herbs etc. Sahibganj site is the one out of four sites selected for terminals/locks support significant vegetation, i.e. mango orchards and other trees. Remaining sites supports some trees which may be required to cut or can be retained. Other sites which are not finalized may also support the vegetation which will be required to remove. Tree cutting shall be required at such sites and it should be carried out only after obtaining clearance from forest department. Only identified & permitted tree species shall be cut.

As per state forest policy compensatory afforestation should be carried out in ratio of at least at 1:2 ratios. Compensatory afforestation shall be carried out by forest department. It is preferable that compensatory afforestation is carried out in nearby land patch. Survival rate of the afforestation carried out by forest department shall be monitored by IWAI.

Apart from above compensatory plantation as part of environmental management, it is proposed to develop 15-20 m thick green belt all along the site boundary and along the roads within the site. Green belt shall be developed as per the following guidelines

1.1 Selection of Tree Species

The Project involve movement of vehicle for transportation of material Thus emissions like particulate matter, SO_2, NO_x& CO shall be generated at site. Also there is potential of generation of coal dust while unloading the materials at stock piles. Thus the plantation species tolerant to these pollutants and mitigate these from air shall be planted. Species selecting criteria is given below:

1. Tolerant to expected pollutants at site
2. Longer duration of foliage
3. Freely exposed foliage (adequate height of crown, openness of foliage, big leaves, small stomata apertures, stomata well exposed)
4. Leaves supported on firm petioles

1.2 Recommended Plant species

Based on nature of pollutants following tree species are recommended to be planted

S. No.	Plant Species	Common Name	Habit
1.	Termanilia catappal	Jagali Badam	Tree
2.	Anthocephalus cadamba	Kadam	Tree
3.	Ficus bengalensis	Badh	Tree
4.	Magnifera indica	Aam	Tree
5.	Tectona grandis	Teak	Tree
6.	Ficus religiosa	Peepal	Tree
7.	Hibiscus rosa sinensi	Hibiscus	Shrub
8.	Wrightia arboriea	Dudhi	Shrub
9.	Tabernaemontana	Chandani	Shrub

S. No.	Plant Species	Common Name	Habit
	divaricata		
10.	Bougainvillea glavra	Bougainvillea	Shrub
11.	Codium variegates	Cockscomb	Herb
12.	Celosia argentea	Croton	Herb
13.	*Ilex rotunda*	Kurogane holly	Tree
14.	*Cassia surattensis*	Golden Senna	Tree
15.	*Cinnamomum camphora*	Camphor tree	Tree
16.	Lagerstroemia flos-reginae	Lagerstroemia	Tree
17.	Alstonia scholaris	Devil tree	Tree
18.	Cassia fistula	Golden shower	Tree
19.	Delonix regia	Gulmohar	Tree
20.	Pongamia pinnata	Indian beech	Tree
21.	Terminalia arjuna	Arjun	Tree
22.	Terminalia belerica	Baheda	Tree
23.	Butea superb	Tesu	Tree
24.	Cassuarina sp.	Cassuarina	Tree
25.	Bahunia acuminate	White orchid green	Tree
26.	Swetania mohogini	Cuban Mahagony	Tree
27.	Azadiracta indica	Neem	Tree
28.	Artocarpus integrifolia	Jackfruit	Tree
29.	Gmelina arborea	Gamhar	Tree
30.	Putranjiba roxburghii	Putranjiba	Tree

1.3 Plantation Methodology

Components of green belts on roadside fence should be both absorbers of gases as well as of dust particles, including even lead particulates. Thus the choice of plants should include pollution tolerant shrubs of height 1 to 1.5 m and trees of 3 to 5m. The intermixing of trees and shrubs should be such that the foliage area density in vertical is almost uniform. For effective removal of pollutants, it is necessary that (i) plants should grow under conditions of adequate nutrient supply, (ii) absence of water stress and (iii) plants are well exposed to atmospheric conditions (light & breeze).

Multiple rows of green belt shall be developed. Green belt should be pyramidal in shape. Plantation pattern shall be kept as given below:

- Short trees and tall shrubs shall be planted as first row (from road) followed by tall tree plantation which will be followed by another row of medium and small trees and tall shrubs.
- Planting of trees should be in appropriate encircling rows, each rows alternating the previous one to prevent further fanning and horizontal pollution dispersion;

- Since tree trunks are normally devoid of foliage, it would be appropriate to have small shrubs in front and in between the tree spaces;
- The open areas between the process installations where trees cannot be planted should be covered with lawn grasses for effective trapping and absorptions of air pollutants.
- Fast growing trees with thick canopy and perennial foliage should be selected so that the effective tree height with envisaged objective will be attained in minimum span of time

1.4 Plantation Pattern

A standard horticultural practice involving planting of saplings in pits of substantial dimensions i.e., 1m × 1m × 1m for big trees and along half of these dimensions for smaller trees and shrubs. The pits are then filled with earth, sand, silt and manure in pre-determined proportions. Saplings planted in such pits are watered liberally during dry months.

1.5 Time of Plantation

Plantation of the tree sapling should be done only after the first shower during the rainy season. The best time for plantation is after 15 days from the day of first shower during rainy season.

1.6 Protection of Tree saplings

Circular tree guard should be placed after the plantation of the saplings for the protection of these young plants from the ravages of cattle, sheep and goat and other animals. If tree saplings died or damage occur after placing the circular tree guard, timely replacements of damaged plant and thereafter care is important.

1.7 After Care & Monitoring

The growing plants are cared at least for the first two years under favourable conditions of climate and irrigation. Nutrients in pits are supplemented and the juveniles provided protection.

Thinning shall start after the stand is 3-4 years old and repeated every 4 years until the stand is 15 years old. Between 15-25 years old, thinning should be conducted every 5 years and after 25 years old, thinning shall be done after every 10 years. When the canopy closes, at about 6 years, 30-40% of the stems shall be thinned to selectively remove suppressed, diseased and badly formed trees.

Periodic assessment shall be carried for survivability of the trees. Minimum 70% survival rate shall be achieved.

1.8 Records Keeping & Reporting

The following records shall be maintained:

1. Record of Tree plantation

2. Record of Survivability rate

Inspection shall be carried out at site to know the survival rate of the plantation. The tree plantation and survivability report shall be prepared every six monthly.

1.9 Responsibility

Compensatory plantation shall be carried out by forest department. Survival rate of plantation shall be inspected of the by IWAI. Plantation within the terminal/jetty/lock site shall be carried out by IWAI and shall be monitored by IWAI.

Annexure 1.2: Occupational Health & Safety Management Plan

1.0 INTRODUCTION

Many emergencies can occur on any construction site and need to be effectively handled. The environmental and occupational health and safety aspects and related emergency can include incidence such as Collapse / subsidence of soil / Fire / Explosion / Gas Leak, Collapse of Building / Equipment and other Occupational Accidents. On site and off site emergency management plan shall be developed to effectively handle them.

Thus every contractor shall have an approved on-site emergency plan. The contractor should submit a copy of this plan to PIU and Supervision consultant before the start of the work. Contractor shall develop the onsite emergency plan considering the potential environmental, occupational health and safety emergency situation at site and activities involved. This plan shall include a list of these potential emergency situations in the onsite emergency preparedness & response plan. Contractor shall get the plan approved from IWAI/PMC

1.1. ANTICIPATED EMERGENCIES AT CONSTRUCTION SITE

The potential emergency situations have been defined below for guidance purposes. The contractors can follow these for developing site specific on site emergency preparedness plan.

Emergency conditions / situations	Sources
Collapse / subsidence of soil	▪ Civil structures
Bulk spillage	▪ Hazardous substance / inflammable liquid storage ▪ Vehicular movement on highway
Fire and explosion	▪ Inflammable Storage Areas ▪ Gas Cylinder Storage Areas ▪ Electrical Circuits ▪ Isolated Gas Cylinders (LPG / DA) ▪ Welding / Gas Cutting Activity
Electrical Shock	▪ HT line ▪ LT distribution ▪ Electrically Operated Machines / Equipment / Hand Tools / Electrical Cables
Gaseous Leakage	▪ Gas Cylinder Storage Areas ▪ Gas Cylinder used in Gas Cutting / Welding Purposes
Accidents due to Vehicles	▪ Heavy Earth Moving Machinery ▪ Cranes ▪ Fork Lifts ▪ Trucks ▪ Workman Transport Vehicles (cars / scooters / motor cycles / cycles) ▪ Collapse, toppling or collision of transport equipment

Emergency conditions / situations	Sources
Slips & Falls (Man & Material)	▪ Work at Height (Roof Work, Steel Erection, Scaffold, Repair & Maintenance, Erection of equipment, Excavation etc.) ▪ Slips (Watery surfaces due to rain) ▪ Lifting tools & Tackles (Electric Hoist & Forklifts)
Collision with stationary/ moving objects	▪ Vehicular movement
Other Hazards	▪ Cuts &Wounds ▪ Confined Space (under & inside machinery etc.) ▪ Hot Burns ▪ Pressure Impacts (Plant contains several Pressure Vessels & pipefitting containing CO_2, air, water, product & steam, which can cause accidents & injuries to person around.)

1.2. Design of 'On-Site Emergency Plan'

The 'On-site emergency plan' to be prepared by contractor and shall include minimum the following information:

- Name & Address of Contractor
- Updation sheet
- Project Location
- Name, Designation & Contact Numbers of the organization, nearby hospitals, fire agencies etc. and key personnel including their assigned responsibilities in case of an emergency.
- The roles and responsibilities of executing personnel
- Site Layout Diagram showing location of fire extinguishers, emergency collection area and fire alarm
- Identification of Potential Emergencies Situations/ preventive measures / control & response measures
- Location of Emergency Control Centre (or designated area for emergency control / coordination) with requisite facilities.
- Medical services / first aid
- List of emergency equipment including fire extinguishers, fire suits etc.

1.3. Emergency Control Centre

The emergency control centre shall be equipped with following facilities

- Copy of current on-site emergency plan
- Display of the name of site emergency controller
- Two numbers of artificial respiratory sets
- Two numbers of Stretchers
- Vehicle for 24 hours (for large construction sites)
- Inter personnel/section telephone (2 numbers)

- Site layout diagram with entry and exit routes / Assembly points
- Directory of internal / external emergency phone Numbers
- A set of fire extinguishers (DCP type / Foam Type / CO2)
- List of fire extinguishers installed in the construction site including maintenance record
- A set of personal protective equipment (PPE)
- Two numbers of first-aid boxes with prescribed first-aid medicines
- List of competent first-aiders
- List of fire trained personnel
- Two numbers of blankets
- Drinking water
- Two numbers of rescue ropes
- Two numbers of high beam torches
- Two numbers of gas leak detectors
- Life boat & jackets (if working in or near water course)

1.4. Records

The following records shall be maintained:

1. Record of emergency preparedness plan with emergency contact numbers
2. Mock drill/emergency preparedness exercise records
3. Corrective preventive action record after emergency is occurred

1.5. Reporting

The accident and incident records and emergency preparedness drill reports shall form part of quarterly report to EA

1.6. Responsibility

Contractor shall be responsible to handle emergency condition and shall be liable to compensate the damage against accident, if any occurs at site.

Annexure 1.3: Construction Debris Management Plan

INTRODUCTION

Waste will be generated from the construction site and labour camps during the construction phase. Type of the waste to be generated during construction phase is given below.

Excavated Soil

Site is undulating and thus will require cut & fill for levelling. Finished level of the soil will be 37 m. Top excavated soil of 15 cm shall be stripped and shall be stored separately under covered sheds. This soil shall be used for green belt plantation.

Lower layers of excavated soil shall be re-used within the site for flling purpose, construction of approach & internal roads & railway link. If any extra soil is remained, then that should be disposed of to the approved debris disposal site

Dredged Material

Dredging shall be carried out in the river for construction of off-shore structures like jetty & berths (pilling) and navigation channels. Dredged soil shall not be disposed along the river bank as they are sensitive habitat for various aquatic species and provide as the spawning and breeding grounds also. Dredged material shall be tested for its quality. If non-toxic then should be disposed at disposal site but if toxic & contains heavy metals, then it should be disposed to TSDF site.

Construction Waste

Construction waste will comprise of broken bricks, dry cement, discarded timber, metal piece, cement bag, dry asphalt/bitumen, glass, paint/varnishes box etc. These wastes should be segregated into recyclable and non-recyclable waste. Recyclable waste shall be stored in the covered area and shall be sold to authorized vendors regularly. Non-recyclable waste shall be disposed at approved debris site in covered vehicles.

Municipal Waste

Municipal waste will be generated from labour camp. Dustbins for recyclable and non-recyclable waste shall be provided in labour camp area. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be disposed through authorized agency in area responsible for waste collection and management.

Waste generated requires proper management so as to minimize the negative impacts on environment. Concept of reduce, re-use and recycle shall be followed at site. The rejected waste should be disposed in a secured manner. Thus a site should be identified for disposal of the rejected waste.

1.1 SELECTION OF DISPOSAL SITES:

The locations of Disposal sites have to be selected such that:

- Disposal sites are located at least 1000 m away from sensitive locations like settlements, water body, notified forest areas, wildlife/bird/dolphin sanctuaries or any other sensitive locations.
- Disposal sites shall not contaminate any water sources, rivers etc so the site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the village/local community is to be obtained for the Disposal site selected.
- Environment Engineer of PMC and Executive Engineer of Contract Management Unit must approve the Plan before commencement of work.

1.2 PRECAUTIONS TO BE ADOPTED DURING DISPOSAL OF DEBRIS / WASTE MATERIAL

The Contractor shall take the following precautions while disposing off the waste material.

- During the site clearance and disposal of debris, the Contractor will take full care to ensure that public or private properties are not affected, there is no dwellings around the dumpsite and that the traffic is not interrupted.
- The Contractor will dispose debris only to the identified places or at other places only with prior permission of Engineer-in-Charge of works.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer-in-Charge of works.
- The Contractor will at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.
- Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not the loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Engineer-in-Charge of works.
- During the debris disposal, Contractor will take care of surrounding features and avoid any damage to it. The debris should not be disposed along the bridges & culverts and near the water bodies.
- While disposing debris / waste material, the Contractor will take into account the wind direction and location of settlements to ensure against any dust problems.
- Contractor should display the board at disposal site stating the name of project, usage of the site and type of debris being disposed.
- A guard shall be kept at disposal site to prevent any unauthorized disposal of waste at the debris disposal site
- Material should be disposed through covered vehicles only
- No contaminated/hazardous/e-waste shall be disposed at the debris disposal site

1.3 RECORD KEEPING

Site approved by site engineer only can be used as disposal site. Record of all such site should be maintained along with the area of disposal site, type & quantity of material disposed daily and capacity of disposal site.

1.4 GUIDELINES FOR REHABILITATION OF DISPOSAL SITES

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines below and to be decided by the Engineer and the supervision consultant.

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.
- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Closure of the disposal site should be upto the satisfactory level of site engineer

1.5 PENALTIES

Stringent action & penalties should be imposed off on contractor for dumping of materials in locations other than the pre-identified locations. Grievance Redressal mechanism should be in place for taking note and action on such complaints.

Annexure 1.4: Construction and Labour Camp Management Plan

1.0 Objective of the Plan

The objective of this plan is to provide guidance to the contractor or other agency involved in setting up of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp. This plan is prepared in reference to the Workers accommodation: processes and standards (A guidance note by IFC and EBRD). The plan aims to promote "safe and healthy working conditions, and to protect and promote the health of workers."

2.0 Selection and layout of construction camp

Labour camps, plant sites and debris disposal site shall not be located close to habitations, schools, hospitals, religious places and other community places. A minimum distance of 500 m shall be maintained from the habitations, sensitive locations like temple, school & hospitals, forest areas and other eco-sensitive zones for setting up such facilities.

3.0 Facilities at workers' camps

During the construction stage of the project, the construction contractor will construct and maintain necessary (temporary) living accommodation, rest area and ancillary facilities for labour. Facilities required are listed and elaborated below.

- Site barricading
- Clean Water Facility
- Clean kitchen area with provision of clean fuel like LPG
- Clean Living Facilities for Workers
- Sanitation Facilities
- Waste Management Facilities
- Rest area for workers at construction site
- Adequate Illumination & ventilation
- Safe access road is required at camps
- Health Care Facilities
- Crèche Facility & Play School
- Fire-fighting Facility
- Emergency Response Area

3.1 Attendance& Working hours

Supervisor of the camp should take the attendance of the employee at each camp twice in a day (morning and evening) and should maintain the record. Further work hours of the workers should be maintained in accordance to the labour law and as mentioned in the labour licence. All workers should be provided with ID card and entry to the site should be through ID card only and should be ensured by security guard.

3.2 Site Barricading

Site should be completely barricaded from all the sides to prevent entry of outsiders and animals into the site. Entry gate should be provided at the site and labour camp which should

be guarded by security guard. All workers should be issued ID cards and entry of outsiders shall be maintained in the register at the gate. Board should be displayed at the site and the labour camp, the name of project, capacity of project, authority carrying our projects, restriction of entry without authorization, no smoking zone and associated risks. Plant operation shall be restricted to 6:00 Am to 10:00 PM

3.3 Clean Water Facility

Potable water shall be provided for construction labour for drinking & cooking purpose. Clean water shall be provided for bathing, cleaning and washing purpose. Water quality testing for drinking water provided for workers shall be carried out on monthly basis. Water dispensers should be cleaned on monthly basis. Adequate water per person should be provided at site for drinking, cooking, barhing, cleaning and other use purpose

3.4 Clean Kitchen Area

Provision of clean kitchen area for cooking and storage of eatables shall be provided. Clean fuels like LPG shall be provided for cooking purpose. Burning of firewood, garbage, paper and any other material for cooking or any other purpose shall strictly be prohibited at the site. Separate utensil washing area should be provided with proper drainage system. Kitchen waste should be daily cleaned and disposed off. Water storage facility at kitchen should be covered and cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathing area.

Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

3.5 Clean Living Facility for the Workers

Workers should be provided with proper bedding facility. Single bed should be provided to each workers and each bed should be atleast 1 m apart from another. Double deck bedding should be avoided, in case provided, adequate fire-fighting facility should be provided. Bed linen should be washed regularly and should be applied with repellent and disinfectants so as to manage the diseases caused due to pests. Facilities for storage of personal belongings for workers should be provided in form of locker, shelf or cupboard. A separate storage area for the tools, boots, PPE should be provided. Proper ventilation through mechanical systems and lighting system should be ensured in construction camps.

3.6 Sanitation Facilities

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided should have running water availability all the time. Bathing, washing & cleaning areas shall be provided at the site for construction labour. Washing and bathing places shall be kept in clean and drained condition. Adequate nos. of bathing & toilet facility should be provided at site and should not exceed 1 unit per 15 person. Toilets and bathing facility should be closed to the camps. Workers shall be hired especially for cleaning of the toilets and bathing area. Septic tanks and soak pits shall be provided at site for disposal of the sewage generated. The toilets should be cleaned on daily basis. These tanks should be evacuated through authorized vendors if filled and at the time of closure. Pest management should be carried out at the camps if the

area is infected by any pests. Adequate lighting should be ensured in camp area especially during night time. The area should be guarded by security guard to minimize the crime and thefts.

3.7 Waste Management Facilities

Waste generated should be segregated at the site by providing the different colour bins for recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be handed over to authority responsible in area for waste management. Waste management for construction site shall be as per waste management plan proposed in EMP. Waste management area should be cleaned on regular basis to avoid germination of flies, mosquitoes, rodents and other pests.

3.8 Rest Area for Workers at Site

A rest area/shelter shall be provided at the site for construction workers where they can rest after lunch time and shall not lay down at site anywhere. The height of shelter shall not less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 1.0 Sq. m per head.

3.9 Adequate Illumination & Ventilation

Construction worker camps shall be electrified and adequately illuminated. Illumination level shall be maintained after 5.30 P.M. at the site to minimum 200 lux. Labour camps shall be adequately ventilated. Fans shall be provided for ventilation purpose.

3.10 Safe Access Road for Labour Camps

Temporary paved surface shall be constructed to approach the labour camp from the site. Movement shall not be hampered during monsoon season due to water logging and muddiness.

3.11 Health care Facilities:

First aid box, first aid room and personnel trained in first aid (certified first-aider) shall be available at labour camp and site all the time (24X7). Equipment in first-aid box shall be maintained as pet State Factory's Law. Ambulance/ 4 wheeler motorized vehicle shall be available at the site for carrying injured to the nearby hospital. Tie-ups should be made with nearby hospital to handle emergency, if any. Nos. of ambulance, doctors and nearby hospital s hall be displayed in first-aid room, site office & labour camps. List of contact nos. of emergency personnel, hospitals, fire brigade and other emergency contact should be displayed at camp site, guard's room and first aid room. Workers shall be made aware about the causes, symptoms and prevention from HIV/AIDS through posters and awareness programs. Workers shall have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.

3.12 Crèche Facility & Play School

Crèche facility and play school should be constructed at the site temporarily so as children of construction labour can be kept there. Care takers should be hired for taking care of children. Attendance records of children shall be maintained. Children should not be allowed to enter active work areas.

3.13 Fire-Fighting facilities

Fire-fighting facility such as sand filled buckets and potable fire-extinguishers shall be provided at labour camps and at site. Fire-extinguishers shall be provided as per NBC norms. Personnel trained in handling fire-fighting equipment should be available at the site. Fire evacuation plan should be displayed at the site and should be communicated to all the workers and other staff at camp site.

3.14 Emergency Assembly Area

Area shall be demarcated as emergency collection area near the gate where all the workers shall be guided to collect in case of any emergency like fire, flood and earthquake.

4.0 Activities prohibited at site

Activities which should be strictly prohibited at site shall include

- Open burning of wood, garbage and any other material at sit for cooking or any other purpose
- Disturbance to the local community.
- Adoption of any unfair means or getting indulgence in any criminal activity
- Non-compliance of the safety guidelines as communicated be safety officials and during the trainings
- Adoption and proper usage of PPEs all the time as required
- Operation of the plant and machinery between 10 pm to 6 am unless approved by team leader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in any condition at site and nearby areas
- Cutting of tree without permission of team leader/authorized person
- No indigenous population shall be hurt or teased

5.0 Guidelines for night time working at the site.

No activity generating noise shall be carried out at the site after 10:00 PM. Night working protocol should be followed (if required) as per guidelines prepared by IWAI. Site should be well illuminated to maintain minimum illumination level of 200 lux. Personnel working shall obtain permit to work from the team leader prior carrying out any work in night time and the record of such working shall be maintained in register. Any accidents, if occurs at site during night time working shall be immediately reported and recorded. Penalty shall be imposed on the contractor for the accident. Analysis shall be carried out to find the reason for such accidents for future learning.

6.0 Record keeping & Maintenance

Record of entry/exit of the people in the construction site and labour camp area shall be maintained in register at gate. Record of material coming in and going out from site also shall be maintained.

7.0 Auditing & Inspection

Conditions of labour camp and site shall be inspected and audit report shall be submitted to IWAI on monthly basis.

8.0 Grievance readressal System

CA complaint register and a complaint box should be provided at the site so any person from local community can register their complaint, if any due o the camp, workers and other facilities. The system shall be communicated to local communities through consultations. Open house meetings should be conducted with workers on monthly basis to identify their problems and issues if any related p health, hygiene, safety, comfort and other issues.

9.0 Security System

Site should be barricaded and should be guarded by security guards at all the gates. Security guards should allow only authorized personnel to the campsite. Guards should be available during both morning and night time. Guard should allow entry of workers to the site only be seeing the ID cards. Guard should report if any unusual or unfair practise happening at site and nearby area. Guards should be trained to handle emergency situations like fire-fighting and should be responsible to contact the emergency personnel in case of any emergency.

10.0 Closure of the Construction Site and Construction labour Camps

Construction site and labour camps shall be restored back to the original site conditions. Following measures are required to be taken during closure

1. Septic tanks/soak pits should be dismantled
2. Any temporary/permanent structure constructed shall be dismantled
3. Construction/demolition waste, hazardous waste and municipal waste at site and labour camp site shall be disposed as per waste management plan in EMP
4. The site shall be cleaned properly
5. Tree plantation to be carried out, if any required for stabilizing the area
6. Any pit excavated shall be filled back
7. Closure of the site and labour camp shall be approved by authorized person.

Annexure 1.5: Borrow Area Management Plans

1.0 Introduction

Borrow areas will be finalized as identified by Contractor as agreed by the PMC and IWAI as per the requirements of the contract. Environment clearance under EIA Notification, 2006 from competent authority and NOC from state pollution control board under Air Act, 1981 as applicable shall be obtained by contractor prior excavation. Consent from land owners and DC of the area shall also be taken prior undertaking any excavation. The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations. Contractor should submit borrow area establishment plan along with the locations marked in map and the environmental settings of the planned area to PMC/IWAI for approval of the "Engineer" through RFI.

1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
2) The borrow pits should not be located along the roads, close to project site
3) The loss of productive and agricultural land should be minimum.
4) The loss of vegetation is almost nil or minimum.
5) Sufficient quality of soil is available.
6) The Contractor will ensure the availability of suitable earth.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density. The Contractor shall submit the following information to the Engineer for approval at least 7 working days before commencement of compaction.

- The values of maximum dry density and optimum moisture content obtained in accordance with ARE: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use.
- A graph of density plotted against content from which, each of the values in (i) above of maximum dry density and optimum moisture content are determined.

After identification of borrow areas based on guidelines and full filling the following requirements are to be fulfilled

- Quantification of Earth
- Land Agreement
- Clearance from local authorities
- Environmental Clearances from SEIAA should be obtained. All EC conditions are to be followed by contractor and contractor should submit EC to IWAI/PMC/PMU

After receiving the approval Contractor will begin operations keeping in mind following:

- Haulage of material to the areas of fill shall proceed only when sufficient spreading and compaction plants are operating at the place of deposition.

- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Contractor should be permitted to remove acceptable material from the site to suit his operational procedure, then be shall make good any consequent deficit of material arising there from.
- Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carryout the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

1.1 Borrow Area Management

Borrow areas located in different land will require different management. Management measures to be taken in different land types are given below.

1.1.1 Borrow Areas located in Agricultural Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of earth will not be done continuously throughout the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper then 1:4 (Vertical: Horizontal).

1.1.2 Borrow Areas located in Agriculture Land in un-avoidable Circumstances:

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

1.1.3 Borrow Areas located on Elevated Lands

- The preservation of topsoil will be carried out in stockpile

- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At location where private owners desire their fields to be levelled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields.

1.1.4 Borrow Areas near Riverside

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is more.

1.1.5 Borrow Areas near Settlements

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If un-avoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.
- Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF&CC/CPCB guidelines.

1.1.6 Borrow Pits along the Roads

- The preservation of topsoil will be carried out in stockpile
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pits along the road shall be discouraged.
- If permitted by the Engineer; these shall not be dug continuously.
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitate drainage.
- The depth of the pits shall be so regulated that its bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.
- Minimum distance from road/ railway should be 50 metres.

1.1.7 Re-development of Borrow Areas

The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit approximately to the road level.

Re-development plan will be prepared by the Contractor before the start of work in line with the owner's will and to the satisfaction of owner.

The Borrow Areas will be rehabilitated as follows

- Borrow pits will be backfilled with rejected construction wastes (unserviceable materials) compacted and will be given a turfing or vegetative cover on the surface. If this is not possible, then excavation slope should be smoothened and depression is filled in such a way that it looks more or less like the original ground surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post-use restoration and Environment Expert of Supervision Consultant will certify the post-use redevelopment.
- The Contractor will keep record of photographs of various stages i.e. before using materials form the location (pre-project), for the period borrowing activities (Construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.