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 - 7:
Environmental Management Plan (EMP)
for
Farakka Lock

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Chapter 1. EMP FOR FARAKKA LOCK

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 Varanasi is proposed under this project to enhance the navigation facility of the NW-1. Proposed terminal site abuts River Ganga and is located near village Ralhupur, Ramnagar, Varanasi, Uttar Pradesh. Location map of the project is given in **Figure 1.1** below.

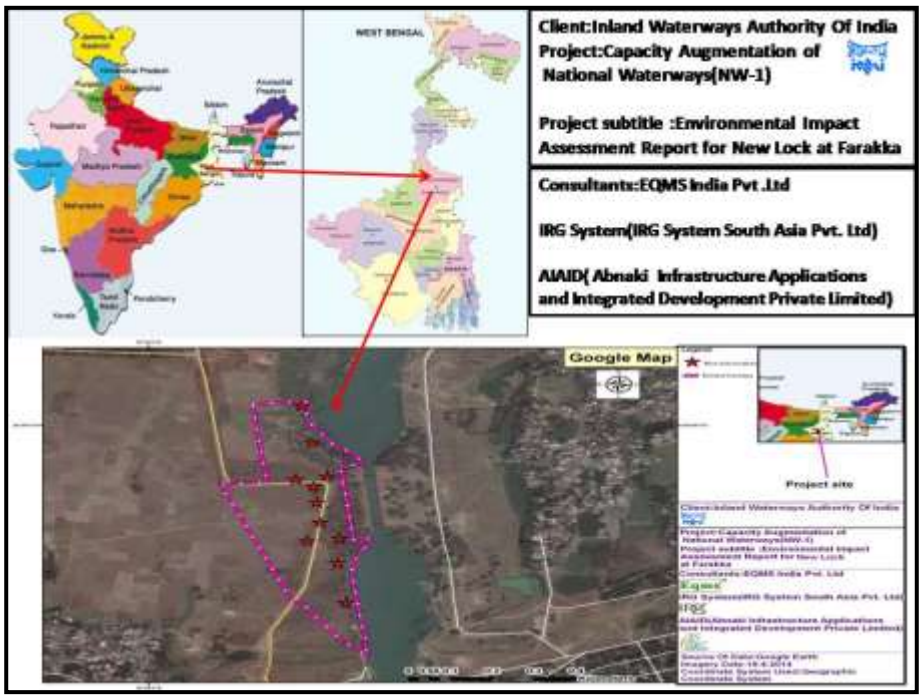

Figure 1.1 : Location Map

1.2. Brief On Farakka Navigational Lock

New Farakka Lock is proposed to be developed at Farakka, District Murshidabad, West Bengal on River Ganga. Proposed project would be set up in 14.4 ha of transferred land of Farakka Barrage Project. Proposed site is being used for agricultural purpose by nearby villagers. Site is almost flat with gentle slope and elevation varies from 25-31m amsl. Project involves construction of lock which requires excavation of earth. Also levelling of site will be done to achieve finished level of 21 m which again will require earth cut and fill operations. It is estimated that 11.76 lakh cum of earth will be cut and out of this 4.13 lakh cum of earth will be filled and remaining of the soil requires to be disposed off in safe manner to prevent environmental pollution. Site is connected to NH-80 the road passing along western boundary of the proposed lock gate.

Lock is proposed to facilitate the movement of barges/vessels across the river with the significant level difference. There is no unloading and loading of material associated with lock facility. Components of the lock facility include counter fort retaining wall, inlet/outlet structure and base slab. Other developments include realignment of road connecting Farakka town to Rajmahal (FBP inspection road) of 675 m, boundary wall of length 1180 m and 2.4 m high around the lock site, internal roads and control room building.

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 lock site has been designated as comprehensive impact zone and 2 Km radius as the most potential impact zone for EIA study. Primary and secondary data has been collected for both zones however; focus of primary data generation has been more for zone within 2 Km radius. The prevailing environmental base line data have been generated by following the monitoring plan approved by IWAI and World Bank in line with prescribed TOR by IWAI. The Salient Environmental Features of New Farakka Lock Project within 500m, 2 Km and 10 Km radius is summarised at **Table 1.1.**

Table 1.1 Salient Environmental Features of New Farakka Lock Site

S. No.	Environmental Features	Within 500 m area around Proposed Lock gate site	Within 2 km area around Proposed Lock gate site	Within 10 km area around Proposed Lock gate site
1	**Ecological Resources**			
A	Presence of Wildlife Sanctuary/ National Park/Biosphere Reserves	None	None	None
B	Reserved /Protected Forests Wetland of state and/or of national/international importance	None None	None None	None None
C	Migratory route for wild animals	None	None	None
D	Presence of Schedule-I Terrestrial Fauna	None	None	None
E	Presence of Schedule-I Aquatic Fauna	None	None	None
F	Tree cover	Few trees in the site. Mainly herbs and shrubs are present	Yes Typical road side plantation	Yes Typical sparse vegetation road side plantation.
G	Major Industries	None	None	NTPC thermal Power -3.6 km SSW and Ambuja Cement Ltd.- 4.2 km SW
2.	**Physical Environment**			

S. No.	Environmental Features	Within 500 m area around Proposed Lock gate site	Within 2 km area around Proposed Lock gate site	Within 10 km area around Proposed Lock gate site
H	Critically Polluted Area	None	None	None
I	Rail connectivity	None	None	Farraka railway Station -2.6 km towards South and Champagram Railway station-6 km towards East
J	Defence Installation	None	None	None
K	Densely Populated Area	None	Farakka town	Many as depicted in 10 km radius map
L	Topography	Almost flat with elevation ranging between 25-31 m amsl as per GIS mapping	Mainly flat with elevation ranges between 19-45 meters amsl as per GIS mapping	Mainly flat with elevation ranges between 17-56 meters amsl as per GIS mapping
M	Seismicity	Falls in Zone-II moderate risk zone	Falls in Zone-II moderate risk zone	Falls in Zone-II moderate risk zone
N	Surface Water Resources (Rivers)	Existing Lock	Ganga River - 1.2 km Et of the Lock gate	Feeder Canal -2.3 km Farakka Barrage-2.4 km towards Southeast
O	Groundwater Zone	Safe	Safe	Safe
P	Soil and Land-use	Clay loam Land use in 500m of site is under existing lock and agriculture. Land for the proposed lock belongs to FBP.	Clay loam Land use in 2 km area of site is under road, existing lock, agriculture and village settlements.	Clay loam As per the land use analysis about 57.5% of the land is under agriculture, about 11.02% of the land is under water bodies, about 9.13% land is under vegetation, 8.30% land is under settlement and rest of the land is under other uses
3.	**Social Environment**			

S. No.	Environmental Features	Within 500 m area around Proposed Lock gate site	Within 2 km area around Proposed Lock gate site	Within 10 km area around Proposed Lock gate site
Q	Physical Setting	rural	rural	Urban & Rural
R	Physical Sensitive Receptors	None	Yes (Temples, School)	Yes (Temples, Schools, College, Hospital)
S	Archaeological Monuments	None	None	None

Meteorology: The predominant wind direction during winter and summer season is from East/South-east and North/Northwest direction respectively. The wind speed was mostly between 2.4 – 4.7 km/hr for all the months. The maximum humidity during rainy season is 77% and minimum was 73%. February and March are driest with relative humidity between 61-40%. Daily mean minimum temperature of area is around 11.8^{o}C (winters) and daily mean maximum temperature is around 36.9^{o}C (summer). The annual total rainfall is 1315.3 mm.

Air Quality: $PM_{2.5}$, PM_{10}, SO_2, NO_2 and carbon monoxide were monitored at 3 locations in the study area. Monitoring was done at upwind direction and downwind directions of the project as per CPCB norms. The projected emission sources being either ground based or of low-level height the focus of in-situ field monitoring was up to 2km zone. PM_{10} within study area varies from 44 to 74 µg/m^3. $PM_{2.5}$ levels vary from 18 to 36µg/m^3 whereas SO_2 ranges from 4.5 to 7.5 µg/m^3. The NO_x levels are also low within the NAQS and are found ranging from 9.0 to 13.6 µg/m^3. CO was not detected at any of sampling location in the study area. The baseline air quality levels of all parameters are found to be within the NAQS prescribed for residential and industrial area.

Noise Quality: Noise level monitoring was done in 3 locations including within the project site, besides, at the connecting road and at the nearest habitation. The baseline noise levels of all the locations are found to be well within the National Standards for residential area.

Water Quality: The Ganga water quality near Lock gate site is meeting the Class D of BDU Criteria of CPCB for its suitability for Wild life and fisheries. The Physico-chemical characteristics of the ground water samples are also within the safe limits of IS: 10500 except hardness which are slightly higher than the presceived desirable limit but well within the permissible limit. As regards heavy metals, only Fe and Zn are found but the concentrations are quite lower in concentration whereas, the presences of other heavy metals are in traces. Hence, the GW within the most potential impact zone is found neither contaminated nor high with respect to metallic contamination even from any natural underground sources.

Soil Quality: The texture of soil is primarily clay loam. The organic matter, nitrogen, potassium and phosphorus content of the soil ranges between low-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 adjoin stretch of River Ganga at upstream and downstream locations of the Lock gate site do not show the presence of any contamination including pesticides. However, the low order contamination of Lindane, alpha Endosulfan and total DDT (being used for agriculture applications) are observed. The concentration of these compounds is 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 under agriculture applications.

Land Use and Flora & Fauna: Land use of the study area is primarily of agriculture nature and no significant presence of wildlife is observed in the designated impact zone.

No reserved or protected forest is present within 2 kms radius zone of project site. The vegetation within the 2 kms or even within 10 km radius area of the Lock gate is primarily of agriculture fields. Taad and khajur trees are predominantly grown in the study area. Other trees found include Simul, Neem, Amlaki, Tal, Bat, Asvattha, Delbergia, Sirish, Bans, Arjun, Ber, Gulmohar, peacock flower, Aam. Shrubs whereas, the herbs include Lantana, *Ipomea cornea*, Ghentu, *Cassia tora*, Malabar nut, Tulsi, *Cannabis sativus,* Dumur, *Parthenium grass* (exotic species), *Argemon maxicana* besides few other grasses species. Mango and Litchi plantation are also found common within the study area.

. Mammals observed during study area include commen rural habitat as squirrel, rat & mongoose etc. The typical mammals found in study zone includes rat, hare, langur, squirrel, field mouse, bat, fox, Mongoose, Jungle cat, Indian Porcupine etc. As regards reptiles found in study area include snakes like Cobra, Common Krait & Rat Snakes, Chameleon, Garden Lizard and Russell viper. Amphibians observed in the study zone are toads & frogs. Farakka is an important migratory bird century. Migratory birds visit this area during winter season. Migratory bird species visiting bird sanctuary of Baraka Lock site includes Y*thya baeri* (Baer's Pochard), *Aythya fuligula* (Tufted Duck), *Dendrocygna bicolor* (Fulvous Whistling-Duck), *Gyps bengalensis* (White-rumped Vulture), *Gyps indicus* (Indian Vulture), *Leptoptilos javanicus* (Lesser Adjutant) and *Rynchops albicollis* (Indian Skimmer). The common avifauna of the study area include jungle crow, house crow, common babbler, red-vented babul, robin, black drongo, weaver bird, common mayna, pied mayna, house sparrow, India cuckoo, koel, parakeet, bee-eater, kingfisher, hornbill, hoopoe, owl, pariah kite, pigeon and dove duck, lapwing, along with several varieties of egret and heron.

The proposed new lock is parallel to the existing lock. Ganga river water transparency recorded is 32cm, temperature: 28.2^{0}C, water depth: about 4 meters with velocity of 0.50 m/s near the lock site. Aquatic ecology of Study area (River Ganga & canal) near lock site includes variety of planktons, fishes & benthos. The most important commercial fishes of Ganga at Farakka are *Labeo* sp., *Catla catla*, *Notopterus* sp., *Hilsa* sp., *Rita rita*, *Clarias* sp., *Mystu*s sp., *Osteobram*a sp., *Chandanama*, *Puntius* sp., *Heteropneustes fossilis*, *Cyprinus carpio*, *Cyrhinus mrigala*, *Wallago attu*, etc.

Land use: As per the land use analysis carried out within the 10 km radius zone the finding includes: about 57.51% of the land under cultivation, about 11.02% of the land under water bodies, about 9.13% land under vegetation, 8.30% land under settlement and rest of the land falls under various other uses.

Sensitive Ecological Resources: No sensitive eco-system such as national parks, wildlife sanctuaries, migratory routes of wildlife, Biosphere reserve, tiger reserve, elephant reserve, wetlands under "Ramsar Convention" are present within 10 km radius of the project site.

Socioeconomic Data: Administratively the villages and settlements with in 10 km area around the proposed site falls under administration of two districts namely Sahibganj district of Jharkhand and Murshidabad District of West Bengal. One town having municipality and 56 villages fall under district Sahibganj, Jharkhand whereas 47 villages fall under district Murshidabad. According to 2011 census report the total population within 10 km study zone including Sahibganj and Murshidabad districts is 238470 comprising of 121523 males and 116947 females with sex ratio of 962.

- **Area Fraction under Sahibganj District:** Total SC population within this fraction belonging to Sahibganj district is 5411 comprising of 2809 males and 2602 females whereas the total ST population is 6084 comprising of 3058 males and 3026 females. Out of the total population t the SC and ST fractions are 40.01% and 44.99% respectively. About 23% are actual workforce, 22% are marginal employed and 55% are non-employed

- **Area Fraction under Murshidabad District:** As mentioned earlier there are 47 villages fall under Murshidabad district with total SC population in of 26998 comprising of 14044 males and 12954 females. Total ST population in study area of the site is 4115 comprising of 2086 males and 2029 females. Out of the total population the SC and ST fractions are 15.82% and 2.41% respectively. About 31% are actually deployed as workers, 12% are marginal employed and 57% non-employed.

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 analyse

the report and notify the corrective action if any required to contractor under intimation to IWAI.

Table 1.2 Environment Management Plan of Farakka Lock During Design and 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	• No tree cutting shall be carried out without obtaining permission from Forest department • Greenbelt should be developed all around the boundary of the project. 1 ha of land will be reserved for green area at the site. 900 trees should be planted within the project site. Trees at the site shall be retained as green belt. • Provision of alternative energy options like solar energy • Adoption of best practices to cut down resources and energy requirement like adoption of water conservation measures, energy conservation measures etc.	Kyoto Protocol, National Water Policy, 2012 & National Forest Policy	Construction site	During Design, and construction stage.	Green belt Plantation For 900 trees	Contractor,	IWAI/PMU/PMC[1]
2. Natural & Man-made Hazard							
❖ Earthquake-Seismic Zone –	• Adoption of Relevant IS codes while designing the civil onshore & off-shore structures to sustain the earthquake of	NBC, 2005, local building bye laws, state factory rules,	Construction site& Navigation	During Design and construction	Part of Project Costs	Contractor	IWAI/PMU/PMC

[1] It is proposed to set up Social and Environmental Management 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
III damage risk zone[2] ❖ Risk of flood	moderate to high magnitude. • Designing of structures above the HFL (High Flood Level) of river/canal • Preparation of emergency preparedness and response plan for natural and man-made hazards like earthquake, floods, fires, shocks, explosion of hazardous materials etc.	Petroleum Rules and MSIHC Rules, 1989	Channel	stage.			
3. Site Preparation: Levelling Lock Gate Site, Construction Camp, Construction Works							
❖ Levelling of lock gate site & Removal of vegetation	• Tree cutting is not anticipating at present however if any tree cutting required, it should be carried out only after obtaining NOC from forest department. • Excavation and filling operations should be carried out in parallel so as to minimize the soil erosion • 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	Municipal Solid Wastes (Management and Handling) Rules, 2015 Construction & Demolition Waste Rules, 2015 Social Impact Assessment requirements Forest Act, 1927	Construction site	During design and Construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC

[2] *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
	the slide slopes covered with grass. Excavated soil should be used within the site for filling purpose and and for realignment of the existing road. Any surplus soil should be disposed off to safe location/identified debris disposal site approved by IWAI within 5 kms of project site. • Contractor should submit a plan prior excavation to the IWAI for management and disposal of the surplus earth. • Green belt 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 • Safety guidelines as per operation, health & safety management plan **(Annexure 1.2)** should be followed **Municipal Solid Waste Management:** • Excavated soil should be stored in covered conditions only • 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	&Amendments					

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	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 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)**						
❖ 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:** • 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 • Preventive medical care to be provided to workers • Segregated, collection and disposal of solid waste on regular basis at identified municipal solid waste disposal location. If municipal solid waste site not available than	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 camp for sanitation and health facilities.	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 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						
❖ Setting up construction Camp: Concert Mix Plant, Hot Mix Plant, Mechanical Workshop, Fuel storages, Lubricant storages	• All these facilities should be installed at proposed lock gate site itself. In case these are to be set up away from site than these should be located at minimum distance of 500 m from habitation, water bodies. • All maintenance facilities, hot mix plant and concrete mixing plant should be established with prior consent to establish to be obtained from SPCB. • All such equipment/plant should be fitted with air pollution control system and should comply with condition of consent to establish. • Periodic monitoring should be carried as per consent conditions.	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 camp sanitation a health facility.	Contractor.	IWAI/PMU/PMC
4. Site Preparation: Power supply, Water Supply, and Drainage, disposal of muck and debris							
❖ Power supply and Energy Conservation: Air Pollution, energy loss	• Power should be sourced from State electricity board in the area during construction stage as well operation phase. • DG sets should be used only in case of power failure • Back-up power should 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 should be used in the project. • Energy Conservation Building Code should 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	• Supply water shall be used for drinking water.	Central Ground Water Board,	Construction Sites and	During design and	For construction	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
effluent discharge	• Water required for construction should be sourced from river for which necessary permission should be obtained. • Caution sign should be placed at site for optimal use of water • Garland storm water temporary drains should be developed around the site to prevent any direct discharge of contaminated or soiled water to river. It should be passes through de-siltation chamber and water collection pit. Collected water should be used for construction purposes. • 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 should be used for dust separation and green belt development. This water should not be discharged to river at all.	Water (Prevention and Control of Water Pollution) Act, 1974	Labour Camp Locations	construction stage	of grease traps and de-siltation chambers		
❖ Disposal of excavated earth, muck and debris: uncontrolled disposal may lead to increased sedimentation of the river.	• Provision should be made for collection and draining of water from the excavated earth. It should be used for embankment protection or road construction depending on its suitability. • Provision should be made for geo Synthetic Screen for arresting silt flowing down stream.	Solid Waste (Management & Handling) Rules, 2015	River Bank along the lock gate site	Pre-Construction and construction Stage	Part of Project Costs	Contractor.	IWAI/PMU/PMC
5. Embankment Design and Construction, Drainage Pattern							
❖ Navigational channel Bank Erosion Protection:	• Stone pitching should be provided on left bank of the River for protection • The river bank slope of U/S and D/S approach channel should be provided with	Water (Prevention and Control of Water Pollution) Act, 1974	1500-meter stone pitching River Bank along the lock	During design, Pre-Construction and	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
Construction of Embankment and construction of inlet and out let structure: may lead to accumulation of sediments on the up drift side and erosion of the down drift side. Contamination of river water quality and land may happen due to river bed material	two layers of pitching with PCC blocks of size of 1 m x 1m x 0.6 m. 6 m wide. • Guide walls on U/S and D/S of the lock are tied to those of existing lock and cut offs to a depth of 5 m have been provided for protection against scour • During block pitching, the block should be placed at suitable distance and should not by dropping from height. Block should be placed by making grid in pitching area. • Erosion monitoring should be carried out periodically downstream as well. • River Bed material/dredged soil if any should be tested for contaminants before its use or disposal for land fill site. If any level of heavy metal contamination is found than it should be disposed off in a secure manner to TSDF.		gate site & 40 m apron inside the river	construction Stage			
❖ Drainage Pattern	• Natural Drainage pattern of area around should be maintained. • Storm water management drains should 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)	As surplus soil is available from excavation of the site, no borrow area may be required.	IRC Guidelines on borrow areas EIA Notification 2006(under Environmental Protection Act and Rules, 1986;)	-	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
❖ Quarries for sourcing stone and aggregates (loss of productive land, land degradation, air pollution. Any illegal quarrying may lead to land use change, unstable rock formation)	• Aggregates required for embankment stone pitching and roads should be procured from licensed quarries. • It should be ensuring 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 should be obtained from the quarry owner and submitted to IWAI. • Material should be transported under covered trucks only. • No new quarry should be opened without due permissions. If new quarry is opened, then it is requiring to obtain environment clearance from MoEFCC/SEIAA • Each Quarry should be visited prior to its selection to ensure its compliance with lease conditions, EC and consent conditions.	EIA Notification 2006(under Environmental Protection Act and Rules, 1986)	Quarry Site	During design and construction stage	Part of Project Costs	Contractor	IWAI/PMU/PMC
7. Protection of Flora and Fauna							
❖ Protection of impact on aquatic Fauna & Flora due to Increased sedimentation downstream of construction site	• To avoid the siltation in water 100m distance has been kept between existing and proposed lock gate. • No breeding ground is noticed around the project site. However, construction activity should be restricted during spawning & breeding period of fishes, i.e. June to August • To avoid the construction debris wash or blown into the water the construction area shall be surrounded by silt screens. • The screens should also be placed around storage areas, to prevent waste from blowing awayand to prevent sediment run-	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
	off into the river. • All the material and debris shall be stored 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. • Run-off from site should pass through oil/grease traps and sedimentation tank before its reuse. All efforts shall be made for its reuse to avoid its discharge to river. • Construction activities shall be carried out rapidly. Culvert construction should not be carried out during breeding and spawning season means during rainy season. • Maintaining equipment in good condition to prevent leaks or spills of potentially hazardous materials like hydraulic fluid, diesel, gasoline and other petroleum products • Positioning water borne equipment in a manner that will minimize damage to fish habitat. • Turbidity traps/curtains should be provided or Geo-Textile synthetic sheet curtain shall be placed around the construction area to prevent movement of sediments and construction waste. • Excavation activities onshore shall not be undertaken during monsoon season so as to minimize sediment load of run-off. • 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						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	should not be directed into river but should be disposed off through septic tank/soak pit. • Engineering controls modify the equipment or the work area to make it quieter. Examples of engineering controls are: use of quieter equipment; retro-fitting equipment with damping materials, mufflers, or enclosures; erecting barriers; and maintenance. • Aquatic ecology monitoring shall be carried out prior start of construction and after completion of construction so as to assess the impact of construction activities on aquatic life. • Soil stabilization works in the bank must consider implications on changes in hydrological flow, current and behaviour of the river. Such changes may create new problems such as change of river course, erosion of river embankment, change in erosion and inundation pattern of the bank etc. which will inturn impact the habitat of aquatic life • Sedimentation and siltation should be prevented to maintain productivity of aquatic ecosystem and availability of food such as aquatic fauna, vegetation to the avian fauna. • Green belt should be developed all around the project periphery. 1 ha of area is reserved as green area. App. 900 trees should be planted within the 1 ha of area to be provided at the site.						
❖ Impact on Avifauna including	• Hunting, poaching and harming any animal (especially avi -fauna) by any worker or project related person shall be strictly	Wild Life (Protection) Act	Around Project Site	During design and construction	Part of project costs	PMU	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
Migratory birds	prohibited and monitored. • The designated imported bird area is located more than 4 km from the lock site, however it is recommended that to conserve the local biodiversity (migratory birds of Farakka barrage area) the construction activities may be stop during migratory periods of the birds if required.			stage			
❖ Impact on Terrestrial Flora & Fauna	• There are very few trees and some agricultural land scattered around the location, besides the green meadows around. Development of a green belt has been proposed all along the lock gate boundary. This would help in settlement of dust and keep atmospheric humidity under check. • As far as possible the existing trees present at site shall be retained under greenbelt • Permission should be obtained from forest department prior tree cutting if any. • Thick green belt should be developed around the periphery of the lock site. App. 900 trees will be planted at the site. Green belt should include native tree species like Pepal, Bargad, Arjun, Sheesham, Kaner, Neem etc. Green belt should be developed as per the CPCB guidelines proposed above climate section • 70 % survival rate for plantation shall be ensured. • Hunting, poaching and harming any animal (especially avi -fauna) by any worker or project related person shall be strictly prohibited and monitored. • The designated imported bird area is located more than 4 km from the however it is recommended that, to conserve the local	Wild Life Protection Act	In and Around Project 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
	biodiversity (migratory birds of Farakka barrage area) the construction activities may stop for migratory periods of the birds if required. • Construction activities should be restricted to 6:00 Am-10:00 Pm especially noise generating activities • Illumination at the site shall be reduced during the night time (if no activity is going on) as it may disturb the nocturnal animals. • Noise generating activity shall not be undertaken during night time to minimize disturbance to animals. • Noise levels shall be maintained within the prescribed CPCBs limits to the extent possible during the day time. • No hazardous material or waste should be disposed off in the other land or nearby area as it may harm the animals, if consumed accidently • Regular water sprinkling shall be done in dust prone areas and haul roads. • Construction site shall be barricaded to reduce the dust and noise generation. • Speed limit will be for construction vehicle shall regulate to control noise and dust emission. • Regular maintenance of the dumper and construction machineries shall be done • No timber usage should be allowed for cooking or any other purpose at site during design, construction phase of the project. Clean fuel like LPG should be used						
8. Air Quality							
❖ Fugitive Dust Generation due to construction	• Barricading the site to prevent dust dispersion to nearby areas • Excavation and filling should be carried out	Environmental Protection Act, 1986 and	Construction sites, Loading areas, storage	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
activities	in parallel. Excavation and filling should be carried out in phases • Excavated soil should 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 should be paved and widened. • Water spraying on earthworks, unpaved haulage roads, other dust prone areas and construction yard. • 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 should be provided at exit points of the site • Monitoring of air quality should be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP. • Development of green belt at the site efficient for arresting the particulate matter • Mixing Plant, crushers and batching plant should 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 • Low sulphur diesel should be used for operating DG sets and construction equipment.	amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	areas,				
❖ Exhaust gas emissions from machinery and	• Regular maintenance should be carried out of machinery and equipment. • Diesel Generating (DG) sets should be fitted	Environmental Protection Act, 1986 and	Construction camps and sites, batching	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
vehicular traffic.	with stack of adequate height as per regulations (Height of stack = height of the building + 0.2 √ KVA.)	amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	plants, DG sets locations				
❖ Emissions at access road: avoidance of traffic Jams	• Efforts should be made to move construction material early morning and late evening period. • Traffic regulators (Guard) should be posted in habitat area and at key junction areas to avoid congestion • No construction, material, equipment or vehicle should be stored or parked at any road or the non-project area • Transportation vehicle should strictly adhere to the designated routes and timings and should avoid the peak traffic hours	Environmental Protection Act, 1986 and amendments thereof; The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof	Existing roads	During the Construction phase	Part of project Costs	Contractor	IWAI/PMU/PMC
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 • Timely maintenance and servicing of construction equipment and vehicles to reduce the noise generation due to friction and abrasion • Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	Lock gate 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
	machines. • Honking should be prohibited at the project site • All safety measures and Job rotations should be practiced for workers, working in high noise level areas. • No noise generating activity should be carried out between 6:00 AM to 10:00 PM. • Hearing test for the workers prior to deployment at site and high noise areas followed by periodic testing every six months. • Monitoring of Noise levels should be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP.						
10. Land-use and Landscape							
❖ Land use Change and Loss of productive/top soil	• Efforts should be made to improve the Aesthetic of the area. No construction waste or other wastes should be dumped at unidentified areas. • Caution board in local language should be placed at different locations to prevent dumping of Municipal solid waste and other waste all around the project site areas which is happening substantially at present. • About 15 cm of top soil layer should be stripped prior to excavation and stored separately in covered condition and should be used for landscaping of the lock gate site. • The remaining excavated soil should be used for filling of site and road realignment. Excess earth, if any shall be disposed off at the locations designated by the authorities or to the debris disposal site identified for the project	Design requirement	Around project site area and borrow area	During construction Stage	For five caution boards	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
	• Land earmarked for dumping of construction waste, setting up of construction camps, plant sites etc should be free from any social and R&R issue and away from settlements.						
❖ Soil erosion due to construction activities, earthwork	• Excavation and filling operations should be carried out in parallel so as to minimize the soil erosion. Unusable debris material should be suitably disposed off at pre designated safe disposal sites, but with prior approval of the concerned authority. • Provision of cross drainage structure should be made in the access road if required to maintain the natural drainage pattern and prevent soil erosion • Provision of side drain should be made in realigned road if required to prevent soil erosion • Provision of geo-textiles matting, stone pitching, retaining wall, apron etc should be made to prevent the erosion of bank and scouring of bed during operation phase • Bio-turfing of embankments should be made enhance the slop stabilization.		Access road and river bank	During construction Stage	Part of project costs	Contractor	IWAI/PMU/PMC
❖ Soil erosion at earth stockpiles	• The earth stockpiles to be provided with gentle slopes to prevent soil erosion. • Provision of geo-textiles matting, stone pitching, retaining wall, apron etc should be made to prevent the erosion of bank and scouring of bed during operation phase • Soil compaction at the site should be undertaken by regulated water sprinkling to minimize any surface runoff or soil erosion		At earth stockpiles	During construction Stage	Part of project costs	Contractor	IWAI/PMU/PMC
❖ Compaction and contamination of soil due to movement of	• Fuel and lubricants to be stored at the predefined storage location. • Storage area should be paved with gentle slope to a corner and connected with a		lock gate 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
vehicles and equipment	chamber to collect any spills of the oils. • Provision of "oil interceptors" at wash-down and re-fuelling areas. • Oil and grease spill and oil soaked materials are to be collected and stored in labelled containers (Labelled: WASTE OIL; and hazardous sign be displayed) and sold off to SPCB/ MoEF authorized vendors. • Movement of construction vehicles, machinery and equipment should be restricted to the designated haulage route.						
11. Water Resources							
❖ Depletion of Groundwater resources due to unregulated abstraction for construction purpose	• Water required for construction should be sourced from rivers with due permission from authorities. • Water required for domestic uses should be sourced from supply water. • Efforts to restrict water intensive activities during summer period (April, May, June) • No dumping of waste/wastewater in the ground. waste or wastewater should not be stored in unlined ponds			During Construction stage	Part of project costs	Contractor,	IWAI/PMU/PMC
❖ Increase in water Siltation levels due to construction of lock due to disposal of domestic waste	• Restoration of changes in the stream, if any, made during construction to its original level. • Mobile toilets with anaerobic digestion facility should be fixed at construction site. No domestic waste should be discharged to river. • Excavation activity should not be carried out during monsoon season • Garland drains should be provided around excavated area so as to prevent entry of run-off to the excavated pits • Excavated areas should be covered to the extent possible to prevent entry of rainfall		Lock gate 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
	run-off in case of rains • The storm water drain should be connected to a collection cum sedimentation pond to collect the surface run of the construction area. The collected rain water should be used for dust suppression purposes at construction material handling area. Storm water drains should be provided for the parking areas also and these drains should be provided with oil & grease trap • No waste should be disposed off in river and ground while filling and excavating. • Washing of vehicle and equipment should not be carried out at river or any waterbody. Washing area should be provided with the storm water drains fitted with oil & grease trap. • Monitoring of surface water quality should be carried out on monthly basis to check the level of pollutants and effectiveness of proposed EMP • Storage of debris and raw material should be carried out in paved and covered areas. This will minimize interface of run-off with raw material and debris. • Water use should 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 should be collected in block work tanks which will allow						

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. • Wastewater generated from the washing/cleaning area after passing through oil & grease trap & curing area should be re-used for water sprinkling and wheel washing • Turbidity traps/curtains should be providing or Geo-Textile synthetic sheet curtain should be placed around pilling and construction area to prevent movement of sediments and construction waste. • Septic tank/soak pit should be provided at site for disposal of sewage from the toilets at site and from the labour camps. Adequate toilets & bathrooms should be provided to prevent open defecation. • Fuel should be stored in leak proof containers and containers should be placed on paved surfaces. • Proper collection, management and disposal of construction and municipal waste from site to prevent mixing of the waste in run-off and entering the water bodies • Natural Drainage pattern of area around should be maintained.						
12. Accident and Safety Risks							
❖ Accident risk from construction activities and health and safety of workers	• Contractors to adopt and maintain safe working practices. • Usage of fluorescent safety and cautionary signage, in local language at the construction sites • Training should be provided to workers, especially machinery operators, on safety procedures and precautions. • The Contractors to appoint a safety officer	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
	mandatory. • At every work place, a readily available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff, and doctor to be provided. • Required PPE should be provided to workers. • Periodic medical check-up should be carried of the workers. • 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 • Rest area should be provided at the site where labour can rest after lunch and should not lie on site anywhere • Adequate illumination should be maintained in the working area, in labour camps and plant site. • Working hours of labour should not exceed than standard norms as per state factory law • 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 labour camps. Wastewater generated from these facilities should be disposed off through septic tanks and soak pit • Safety officers should be appointed at site so as to ensure all safety measures are taken at the site • Activity like smoking and consuming liquor should be prohibited at the site						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Awareness on AIDS should be spread among the workers • Regular inspection for hygiene and safety in labour camps should be done • Speed limit of vehicles should be restricted at site to prevent any accidents. • Noise level in the work zone should be maintained and followed as per OSHAS 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 at site and workers should be trained to use the system in case of fire						
13. Shifting of Common Property Resources and Pressure on Existing Resources in Study Area							
Shifting of community properties and utilities	• Any CPR, if removed should be relocated at the earliest with consent of the villagers and the Gram Panchayat		Project Area	Pre-Construction	Part of Project Costs	Contractor	IWAI/PMU/PMC
Pressure on Existing resources	• Non-productive lands, barren lands, raised lands; wastelands should be used for setting up labour camps, plant sites and debris disposal site. The above sites will be located more than 500 m away from the settlement and other sensitive location. • Land should be used for establishment of construction camps, debris disposal site and plant site only after obtaining consent from land owner. • Necessary permits should be obtained from concerned authorities in case any quarry site, batching plant, hot mix plant, WMM plant etc. is set up.						

Environmental Issue/ Component	Remedial Measure	Reference to laws and Contract Documents	Approximate Location	Time Frame	Indicative / Mitigation Cost	Institutional Responsibility	
						Implementation	Supervision
	• Management, rehabilitation and closure of these sites should be as per the Management plans proposed for these sites. Records for starting, maintaining and closure should be maintained and should be approved by site engineers • Top soil should be stripped off from these sites prior to usage and should be sprayed back at the time closure. Top soil should be stored in covered condition • Entrance to any road/structure should not be blocked for construction of lock gate. • Site should be barricaded and should have entry guarded by security guard. Register 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 proposed environmental pollution measures should be taken during construction of phase of lock gate 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 road should be carried out both before and end of construction by contractor. • Sprinkling of water should be carried out in road also, so as to minimize dust generation due to movement of construction vehicles						

Table 1.3 Environment Management Plan of Farakka Lock During Operation Phase

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. Air Quality								
1.1 Air pollution due to Barrage /vessel movement	• Use of low sulphur fuel by barges. • Regular maintenance of barges. • Electronic charting for proper scheduling of the inland traffic • Diesel Generating (DG) sets should be fitted with stack of adequate height as per regulations (Height of stack = height of the building + 0.2 √ KVA.) • Maintenance of green belt and maintaining survival rate of trees to minimum 70%	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	project area	MI: Ambient air quality (PM_{10}, CO, SO_2 NO_x)	• As per CPCB requirements	Included in Operation/ Maintenance cost	Contractor	IWAI/PMU/ PMC L
2. **Noise Level**								
2.1 Increased noise due to barge movement 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	Realigned Road & Lock Site	MI: Noise levels at the site and access road PT: No accidents due to	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 • Noise generation activities shall also be restricted during migratory period of the birds, i.e. Winter season as it may impact their activities • DG sets shall be provided			vegetation growth	records			

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
	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							
3. Water Quality								
3.1 Siltation	• Regular checks should be made for soil erosion and turfing conditions of channel/ river bank structures for its effective maintenance.	Project requirement	Near banks of the navigation channel	MI: TSS monitoring of water	Site observation	Included in Operation/ Maintenance cost	Contractor	IWAI/PMU/ PMC L
3.2 Waste Water treatment and conservation	• Sewage generated from site should disposed off in soakpit and septic tank. • Storm water drainage system should be provided with jute filtration at the siteWater conservation fixtures should be installed in toilets. Some of the water conservation fixtures which can be installed are	Project requirement	Project area	MI: Proper treatment				

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
	dual flushing cisterns, sensor taps, low water urinals etc. • No wastewater should be received from vessels and vessels should not be allowed to discharge their wastewater and solid waste in river. • No waste/wastewater should be discharged in river or dumped into the ground • Fuel should be stored in leak proof containers and containers should be placed on paved surfaces • Monitoring of surface water quality should be carried out on six monthly basis to check the level of pollutants and effectiveness of proposed EMP							
4. Land and Soil								
4.1 Soil erosion due to barge movement and soil contamination due	• Periodic checking to be carried to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures	Project requirement	Along banks and embankment	MI: Existence of soil erosion	On site observation	Included in Operation/ Mainten	Contractor	IWAI/PMU/ PMC L

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
to waste spillage	etc. • Necessary measures to be followed wherever there are failures. • Two separate waste bins should be placed to collect the daily waste as organic and inorganic. All plastic materials would be sold to secondary users for recycling. Biodegradable waste could be compost and later use as fertilizer. • Adequate numbers of sanitary latrines with septic tank and soak pit will be installed for the workers during the operational phase.		slopes and other probable soil erosion areas.	sites Number of soil erosion sites PT: Minimal occurrences of soil erosion		ance cost		
5. Flora & Fauna								
5.1 Impact on terrestrial and aquatic flora & fauna due to water pollution and barge movement and bank erosion	• Green belt as trees, shrubs, and grasses to be properly maintained • No wastewater or waste shall be disposed off in river from project site or from vessel into the water. Penalty shall be imposed on the vessels reported of disposing waste/wastewater in the	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 and observations	Records and field observations. Regular monitoring	Operation/ Maintenance Cost	Contractor/Forest Department	IWAI/PMU/ PMC L

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
	river • Sewage generated from the site shall be disposed in soak pit and septic tank. • Precautionary measures viz., use of better/ fool proof handling equipments, transportation of coal in closed barges to be strictly followed to ensure zero spillage of coal particles during loading, transport and unloading. In addition, strict measures to be implemented to prevent spillage/leakage of oil and grease at filling, handling and servicing points of vessels in order to protect environment, and biota. Care should be taken so that the sewages and garbage generated are disposed at designated sites only after necessary treatment. • During night operations, the barges should use powerful search lights and horns so as to warn the							

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
	fishers of the incoming barges well in advance at least from 500 m away. • Standard Operating Procedures (SOPs) to prevent spillage of oil/ fuel/ grease will be followed. • Reducing speed of barges in the curved and narrow stretches from its normal speed of 7-8 nautical miles/h to 5-6 nautical miles/h is recommended for reducing the wave action and thereby minimizing possibilities of bank erosion. • To prevent bank erosion, the vessels should navigate only through the designated navigation. • In case of damage of fishing nets, fishing crafts and other gears of fishers, arising due to barge operation, appropriate and quick compensations may be given to the aggrieved fishers • Preparation and publishing barge							

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
	movement schedule, pre-signalling of movement, fixed timing, generation of awareness on barge movement among public, specifically the fishers and ferry operators may be made. • Instruction should be given to all vessels and all employee and staff that no aquatic fauna shall be harmed due to any reason • Quick clean-up operations should be carried out in case of accidents. Vessel owner should be responsible for paying the clean-up expenses in case of the accidents and pollution of river water quality							
6. **Safety**								
6.1 Accident Risk due to uncontrolled growth of vegetation	• Regular maintenance of plantation along the internal roads • No invasive plantation to be carried out near the road	Project requirement	Access Road	MI: Presence and extent of vegetation growth on either side of road. Number	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
				of accidents. PT: No accidents due to vegetation growth	records			
6.2. Transport of Dangerous Goods	• Existence of spill prevention and control and emergency responsive system • Emergency plan 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.	Contractor	IWAI/PMU/ PMC L
6.3 Accidents Risks Due to Movement of Vessels and other hazards associated with	• Implementation of the environment management plan as proposed to prevent the environmental pollution during operation phase • Ships should comply with	-	Throughout the project stretch	MI: Status of emergency system – whether operational or	Review of spill prevention and emergency response	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
site	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 • Provision of hooters and sensors in ships to prevent the collisions • Safety norms should be followed for all operational phase activities at site • Safety training should be given to the site staff for managing the floods, earthquake, fire, ship 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			not PT: Fully functional emergency system	plan Spill 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
	fire-fighting equipment.							
6.4 Welfare of Society	• Employment should preferably be given to local people. Women should be given equal opportunity for work. • Development activities should be carried out in the village and nearby areas for development of area	-	Through out the project stretch	MI: CSR Activities PT: CSR Action Plan	Review of CSR Activities through NGO accident records	Included in operation/Maintenance cost.	IWAI	IWAI

Table 1.4 Environment Monitoring Plan of Farakka Lock for Construction & Operation Phase (Phase 1)

S. No.	Aspect	Parameters to be monitored	No of sampling locations & frequency	Standard methods for sampling and analysis	Role & Responsibility	
					Implementation	Supervision
Design &Construction Period						
1.	Air Quality (Ambient & Stack)	PM_{10}, $PM_{2.5}$, SO_2, NO_2, HC and CO	Three Locations including project site, labour camp and nearest habitation-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_2, CO analyser /portable CO meter for CO portable HC meter or tubes for HC; TO-14A, TO-15, USEPA method for sampling and analysis of	Contractor	IWAI & PMC

				VOCs in ambient air		
2.	Surface Water Quality	Physical, chemical and biological	River Ganga-upstream &Downstream-Once a month	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, Erosion & Siltation	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.	Greenbelt development	Plantation survival rate	Lock gate premises	Survey, counting, recording & reporting	Contractor	IWAI & PMC
7.	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
8.	Aquatic ecology	Phytoplankton, Zooplankton	River Ganga Six monthly	Species diversity index.	Contractor	IWAI & PMC
9.	Integrity of embankment	---	Upstream & downstream of lock gate 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 & Stack)	PM_{10}, $PM_{2.5}$, SO_2, NO_2, HC and CO	Two locations-project site, and nearest habitation Six monthly	• 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_2, CO analyser /portable CO meter for CO portable HC meter or	NABL Lab to be contracted by IWAI	IWAI

				tubes for HC; TO-14A, TO-15, USEPA method for sampling and analysis of VOCs in ambient air		
2.	Surface Water Quality	Physical, chemical and biological	River Ganga- Once in quarter (Upstream & Downstream)	Grab sampling and analysis by using standard methods	NABL 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 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, and nearest habitation Once a quarter	Noise meter	NABL Lab to be contracted by IWAI	IWAI
5.	Greenbelt	Plantation survival rate	Site premises	Survey, counting, recording & reporting	IWAI	IWAI
6.	Soil Quality, Erosion& Siltation	---	Upstream & downstream of project site near river channel Bank-Monthly	Physio chemical parameters of soil Survey & observation; Extent and degree of erosion; Structures for controlling soil erosion	IWAI	IWAI
7.	Aquatic ecology	Phytoplankton, Zooplankton	River Ganga-Six monthly	Species diversity index	IWAI	IWAI
8.	Integrity of embankment	---	Upstream &downstream of lock gate site- Once a 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

	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
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

Emergency conditions / situations	Sources
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 people. 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.