Initial Environmental Examination (draft)

Project Number: 38412-033
March 2018

India: Assam Integrated Flood and Riverbank Erosion Risk Management Investment Program – Project 2

(Dibrugarh Subproject)
(2 of 2)

Prepared by the Flood and River Erosion Management Agency of Assam for the Asian Development Bank. This is an updated version of the initial environmental examination originally posted in March 2018 available on https://www.adb.org/sites/default/files/project-documents/38412/38412-033-iee-en.pdf.

This subproject has been categorized as B for environment in accordance with ADB SPS 2009 for which an Initial Environment Examination (IEE) is required. The report prepared by FREMAA refers to Environment Impact Assessment (EIA), however throughout the report, the terminology EIA is implied as IEE.

Photographs: Dibrugarh Subproject – Public Consultation

Public Consultation in Dibrugarh reach on 14th February, 2015

DETAIL OF THE STAKEHOLDER CONSULTATION FOR TRANCHE - 2

Date	Area	Topic of Discussion
14.02.15	Dibrugarh Reach, WRD office, Circle Office	1.Regarding any specific problem(s) related to environment as a result of flood & erosion of the Brahmaputra 2.If the proposed project will help in providing safety to the people , their property and environment of the area 3. Any significant negative impact of the project on the overall environment of the area 4. Possible impacts of the project on Agriculture, Wetlands, Drinking Water & Local Economy
Month of February, 2015	Different villages under Dibrugarh Reach on the south Bank	
July 2015	Effected villages within the benefited area of Dibrugarh Reach on the south Bank	
11th November, 2015	People from different villages came to Oakland School for public Hearing. Attended by School teachers, officers from the WRD, Bokakhat; FREMAA, PMC, Village headman, etc.	

Public hearing at Oakland school- Dibrugarh on 11.11.2015

APPENDIX 16: ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
Climate Change	increase in temperature and also due to construction activities and trees to be cut	Minimization of tree cutting while designing the embankment Compensatory tree plantation preferably on the basis of 3 trees plantation against each tree cut	Government of India action plan after Paris agreement.	Through out the stretch of reach	Throughout the construction period	--	Contractor with guidance of Social Forestry Department	WRD and FREMAA
Change in Land Use	Loss of agriculture land	Use of uncultivated areas near embankments only for storage and/or handling of construction materials	-	Construction sites and service areas throughout the reach	During design and construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Construction camps on uncultivated areas only with requisite facilities of drinking water supply, sanitation, waste collection and fuel supply		Identified locations of construction camps (4 to 5)		Included under soil contamination prevention costs	Contractor	WRD and FREMAA
		No dumping of construction waste on agricultural land					Contractor	WRD and FREMAA
		Adequate compensation for loss of land and/ or loss of crops	As per Social Assessment and R&R	Identified as per the social assessment		Included in R&R Cost	Contractor	WRD and FREMAA
		Land used for construction camps shall made reusable/ cultivable after closer of construction camp		Sites used as construction camp	After completion of construction	Included in construction cost	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		All efforts during the design stage shall be made to minimize the tree felling requirement.		Entire project area	During complete construction phase	Included in design engineering cost	Engineering Team/WRD Field Officer	WRD and FREMAA
	Loss of homestead plantation	Compensatory plantation shall be started during construction phase parallel to the construction activities (1:3)		Entire project area	During construction	800000	WRD-SIO	WRD and FREMAA
		Monitoring of tree felling (census of trees, their numbering etc. based on engineering design)		Entire project area	During complete construction phase	Included in the Monitoring Costs (refer Monitoring Plan)	Independent agency	WRD and FREMAA
Borrow area location and rehabilitation	Loss of agricultural land and homestead plantation due to borrowing earth from country side of embankment	Borrow pits shall be preferred on river side to embankment as these can get silted in the course of time or earth from retired Embankment	WRD guidelines	Identified locations for borrowing of earth	During complete construction phase	Included in construction cost	Contractor/WRD Field Officers	WRD and FREMAA
	Permanent disfiguration of land	Use of waste land or excavation or enlargement of existing lank or any hump above ground level for borrowing of earth		Identified locations for borrowing of earth	During complete construction phase	Included in construction cost	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
	Seepage to the foundations of embankment	Use of dredge material from River Kulsi/Jaljali		Banks of River Kulsi/Jaljali	During construction	Included in construction cost	Contractor	WRD and FREMAA
		Strictly following WRD guidelines with respect to borrow area location and rehabilitation		Entire project area	During construction phase as well as after construction	Included in construction cost	Contractor	WRD and FREMAA
Change in Land use and Borrow Area Rehabilitation	Encroachment on embankment for habitation and cultivation Cutting of embankment to create approach to river side Non-rehabilitation of borrow areas	Provision shall be made in the embankment design for providing access to river bank close to the habitats. Constructions contractors shall ensure rehabilitation of borrow areas before handling over the project.		Entire project area and Borrow Areas	Operation Phase	Included in construction cost	Contractor, WRD (Field Staff)	WRD and FREMAA
Construction material sourcing (Quarrying)	Illegal quarrying may lead to land use change, unstable rock formation, air and noise pollution	Aggregates required for construction of embankment and roads shall be procured from quarries approved by SPCB.	Environmental Protection Act and Rules, 1986; Water Act, Air Act	River and Hill Quarries approved by Assam Govt.	During complete construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Air and noise emissions from quarries shall be well within the prescribed limits for the protection of workers health		Quarrying sites	During complete construction phase	-	WRD	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		Stone crushers, if required, shall be set up only after consent from SPCB and taking adequate measures for air pollution control.		Location of stone crushers	During complete construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Land earmarked for dumping of construction waste shall be free from any social and R&R issue and away from settlements			During complete construction phase	Included in R&R Cost	Contractor	WRD and FREMAA
Soil erosion	Soil erosion from construction sites during monsoon season	Opening of borrow areas near the embankments shall not be done during monsoon season		Identified areas for borrowing earth	Except monsoon season during construction phase	Included in construction cost	Contractor	WRD and FREMAA
	Loss of topsoil	Identification of potential erosion zones during construction phase			Especially during monsoon season	Included in construction cost	Contractor	WRD and FREMAA
		Stabilization of soil around the approach roads/ slopes by turfing and tree plantation in ROW		Along the embankment and approach roads	Especially before monsoon starts	Included in construction cost	Contractor	WRD and FREMAA
		Slope stabilization measures on the embankment like selection of less eroding materials		As suggested by the engineering team	During the construction period	Included in construction cost	Contractor	WRD and FREMAA
	Net benefits due to construction of embankment and anti-erosion measures in river banks	Periodic checking of the stabilization measures		Project Benefit Area.	Post Operation Phase	included in Monitoring Costs. Water Shed Management to be initiated by WRD Separately	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
Soil compaction	Soil compaction around construction sites, haulage roads, construction camps, and workshops due to transportation of man, machine, and materials	Movement of construction vehicles, machinery and equipment in embankment site and pre-defined haulage road		Construction material dumping sites and construction sites	During the entire construction period	Included in construction cost	Contractor	WRD and FREMAA
	Construction waste handling	Adequate provision for approach roads capable of handling movement and haulage of heavy vehicles and machines		Approach roads used for material handling	During the entire construction period	Included in construction cost	Contractor	WRD and FREMAA
Soil contamination	Soil contamination around construction sites, machine maintenance areas, fueling stations, construction camps, hot mix plant and haulage roads	Fueling and maintenance of construction machinery and vehicles shall be carried out at designated place with proper arrangement of waste collection and disposal.		Fuel storage and workshop areas	During the entire construction period	6,20,000	Contractor	WRD and FREMAA
		Fuel storage and refueling sites to be kept away from drainage channels.		Fuel storage and workshop areas	During the entire construction period	Included in construction cost	Contractor	WRD and FREMAA
		Unusable debris to be dumped in designated places.		Identified inert material dumping sites	During construction phase	Included in construction cost	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		Provision of oil interceptors		At fuel handling and workshop areas	During construction phase	Included above	Contractor	WRD and FREMAA
		Waste oil shall be sold off to recyclers authorized by SPCB/ MoEF.		At fuel handling and workshop areas	During construction phase	Earnings from selling	Contractor	WRD and FREMAA
Site clearing, etc.	Contamination of soil from construction wastes and quarry materials	All spoils to be disposed of as desired and the site to be restored back to its original conditions before handing over.		Construction material handling areas and construction sites	After completion of construction phase	Part of Construction Costs	Contractor	WRD and FREMAA
		Non-bituminous wastes from construction activities to be dumped in borrow pits and covered with a layer of the conserved topsoil.		Inert material dumping sites	After completion of construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Bituminous wastes to be disposed of in identified dumping sites.		Identified dumping sites	After completion of construction phase	Included in construction cost	Contractor	WRD and FREMAA
Flood	Inundation during heavy flood	Adequate provisions of sluice gates shall be made.		In proposed embankment	During the construction phase	Included in construction cost	Engineering team and contractor/WRD Field Officer	WRD and FREMAA
		Natural drainage systems shall not be disturbed.		Country side of embankment in the buffer zone	During the construction phase as well as operation phase	Included in construction cost	Engineering team and contractor/WRD Field Officer	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		Adequate provisions shall be made in engineering design to withstand extreme meteorological and geo-physical events		Proposed embankment	During the detailed engineering design stage	Included in engineering design cost	Design Team and WRD	WRD and FREMAA
Drainage system	Embankment acts like a barrier for the drainage of accumulating country side water into the Brahmaputra during monsoon season.	Provision shall be made to the extent possible not to obstruct the natural drainage.		Entire project area	During the detailed engineering design stage	Included in engineering design cost	Engineering Team	WRD and FREMAA
Effect on flow velocity/ discharge intensities	No significant change due to project intervention	Monitoring of flow shall be carried out at regular intervals using field data as well as satellite remote sensing data.		At upstream and in between the reach	During the lifespan of the project	Part of Engineering Cost	Engineering Team	WRD and FREMAA
Silt deposition and bed level change	Prevention in silt deposition on agricultural land due to breach of embankments	Monitoring of anti-erosion and river training works at regular intervals		At upstream and in between the reach	During the lifespan of the project	WRD shall take initiative	WRD	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
Impacts from external factors such as climate change, upstream dam construction, and watershed development	Design Parameters has taken into account the CC impacts . However, it may need to be monitor over the years	Systematic monitoring of hydrology, morphology, and sediment transport with acquisition of data Establishment of information network of discharges from upstream reservoirs Developing capacities in WRD to cope with changes in environment		Subproject reach in particular, but also include basin wide information and tributaries	During the lifetime of the project	Included in data and knowledge development component of IFRERM ASSAM	WRD	WRD and FREMAA
Impacts of morphological changes to subproject areas	Upstream and downstream erosion process may affect the sustainability of subproject structures	Systematic monitoring of morphology and sediment transport, with establishment of short term prediction models Preparation and implementation of protection measures to prevent outflanking of structures		Subproject reach in particular, but also include basin wide information and tributaries	During the lifetime of the project	Included in data and knowledge development component of IFRERM ASSAM	WRD	WRD and FREMAA
Water quality	Impact on surface and ground water quality	Adequate supply of drinking water to workers.	The Water (Prevention & Control of Pollution) Act, 1974 and amendments thereof	At construction camps and construction sites	During construction phase	3,60,000	Contractor	WRD and FREMAA
	Contamination of water due to construction waste	Septic tanks shall be provided to treat the domestic sewage from construction camps.		At construction camps	During construction phase		Contractor	WRD and FREMAA
		Provision of mobile toilets for use at flood platforms		At high altitude areas	During Operation Phase	Included in construction cost	WRD Field Officer	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
	Contamination of water from fuel and lubricants	Construction work close to the channels or other water bodies to be avoided.			During construction phase	-	Contractor	WRD and FREMAA
		All necessary precautions to be taken to construct temporary devices to prevent water pollution due to increased siltation and turbidity.			During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Oil and grease traps to be provided at fueling locations, to prevent contamination of water.		Fuel handling and workshop areas	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Slopes of embankment leading to water bodies to be modified and screened so that contaminants do not enter the water channel/ water body.		Along the reach	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Water quality to be monitored as envisaged in the environmental monitoring plan.		As per monitoring plan	During construction phase	Included in the monitoring costs	Contractor And WRD	WRD and FREMAA
	Discharge of domestic effluents from nearby villages to the river	Sanitation facilities shall be provided		Entire Project Benefit Area	Operation Phase	WRD to Initiate with concerned civic authorities	contractor	WRD and FREMAA
Air Environment	Change in air quality due to construction activities	Approach roads shall be paved and widened	Environmental Protection Act, 1986; The Air (Prevention and	Approach roads to construction sites	At the start of construction activity	Included in construction cost	Contractor/ WRD	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		All slopes and embankments to be turfed as per best engineering practices to minimize the dust generation	Control of Pollution) Act, 1981 and amendments thereof	Construction area	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		All the machinery and plants to be placed at the downwind direction with respect to human settlements.			Construction period	Included in construction cost	Contractor	WRD and FREMAA
		All vehicles, equipment and machinery used for construction to be regularly maintained.		Workshop areas	Construction period	Included in construction cost	Contractor	WRD and FREMAA
		The hot mix plants, crushers and batching plants to be sited at least 500 m in the downwind direction from the nearest human settlement.			At the start of construction activity	Included in construction cost	Contractor	WRD and FREMAA
		Hot mix plants shall comply with applicable National/State Pollution Control Board Standards for emissions from hot mix plants.			Construction period	Included in construction cost	Contractor	WRD and FREMAA
		Fugitive emissions from handling of construction material, storage as well as from transportation shall be taken care.		Construction and storage sites	During the construction period	Included in construction cost	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		Dust Suppression by water sprinkling		Construction and storage sites	During the construction period	Included in construction cost	Contractor	WRD and FREMAA
		Monitoring of Ambient Air Quality		near sensitive locations/ human settlements near to construction sites, crushers and hot mix plants	During the construction period as per environmental monitoring plan	Included in the monitoring costs	WRD (Environmental Officer)	WRD and FREMAA
		Speed restriction, surface improvement and surface treatment shall be taken as options for control of emissions from unpaved roads.		Approach roads	During the construction period	Included in project cost	WRD	WRD and FREMAA
	Change in air quality due to traffic	Plantation along the embankment Turfing of the embankment slopes Regular maintenance of the road on the top of embankment as well as approach roads		Entire Project Area	Operation Phase	Included as part of regular Maintenance costs	WRD	WRD and FREMAA
Noise	Increase in sound pressure levels due to construction machineries, vehicles etc.	Options of noise control by site controls, scheduling of project activities	Noise Pollution (Regulation and Control) Rules, 2000 and amendments thereof	At all construction sites	During the construction period	Included in engineering cost	Contractor	WRD and FREMAA
		Protection devices (ear plugs or ear muffs) to be provided to the workers operating in the vicinity of high noise generating machines.		At all construction sites of high noise intensities	During the construction period	Part of Contractor Obligation	Contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
		Construction equipment and machinery shall be fitted with silencers and maintained accordingly.		Construction sites	At the start of construction activity and also during the construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Construction of temporary noise barriers near the sensitive areas, e.g. schools		At identified sensitive locations near the construction sites	Before start of construction activities near sensitive locations	Included in construction cost	Contractor	WRD and FREMAA
		Noise and vibration level monitoring as per monitoring plan.		As per monitoring plan	Once in every year	Included under Monitoring Costs	WRD	WRD and FREMAA
	Increase in sound pressure levels due to traffic	Adequate signage to restrict use of pressure horns particularly in noise sensitive locations Tree barriers between the road and village/ semi urban/ and urban areas. All the machineries used by contractor should obtain a clearance from state Pollution Board					**Contractor**	WRD and FREMAA
Disturbance to overall livings condition of the people living in the project areas	Increase traffic service construction works, limitation access due to location of construction work, danger areas for children	The contractor should provide clear signage for danger areas, and provide a safe passage for local communities to reach all basic services e.g. schools, clinics, religious worship places as well as market. The contractor should rehabilitate to at least at the level where communities can continue their convenient living conditions prior to project works. The rehabilitation should not limited in areas used for their working camps, storage areas, and parking areas .	During the construction period	Entire project site where construction works taking place		Part of construction cost	contractors	WRD and FREMA
Disturbance to vegetation	Cutting of trees in	Minimization of tree cutting while designing		Entire project site	During complete	-	Contractor in close	WRD and FREMAA

	core zone during project intervention	the embankment			construction phase		coordination with Forest Department	
		Compensatory tree plantation preferably on the basis of 3 trees plantation against each tree cut		Entire project site and nearby areas	Starting from construction phase	Already indicated above	Contractor	WRD and FREMAA
Animal distribution/ migratory route Endangered Species	Impact on Dolphin breeding sites No Adverse Impact of Endangered Species	Construction activities shall be restricted during Dolphin breeding period (May to August) at breeding sites. Due to sensitivity of Dolphins with polluted water, construction waste should not dumped near the river bank		Identified breeding sites	During construction phase		WRD guide the contractor	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implementation	Supervision
Fishing activities/ productivity, Migratory Route	Impact on boat Ghats (un-official fish landing places).	Adequate provision shall be made in the design to ensure access to the fish landing sites/ boat ghats Contractor has to put signage to guide fishing boat not to land in the construction areas		Temporary boat ghats identified along the reach (because locations have always changed depend on the convenient of the fisherfolks)	During construction phase itself	Included in engineering design cost	Engineering team and Contractor	WRD and FREMAA
Spawning and Breeding Grounds/Pond Fisheries	Disturbance on breeding and spawning grounds. No Adverse Impact on Pond Fisheries	Restriction of construction activities near the identified breeding and spawning grounds during the breeding period of April to august Fish productivity can be improved substantial with use of better fish culture and increasing the capacity of fish pond		At identified spawning and breeding grounds	During April to august in construction phase	-	Contractor	WRD and FREMAA
Habitat fragmentation	Inappropriate opening of the sluice gate	Appropriate management to be made for the operation of the sluice gates		Project Benefit Area	Operation Phase	-	WRD	WRD and FREMAA

Activity	Environmental Issue/ Component	Remedial Measures	Legislative Requirement/ Framework	Approximate Location	Time Frame	Mitigation Cost (₹)	Institutional Responsibility	
							Implement ation	Supervision
Socio-economic impact	Impact on fish landing sites	Training programmes for agriculture and fish production improvement		Project buffer zone	During construction phase	Already included above	WRD	WRD and FREMAA
		Guidance will be given to the fisherfolk to land their boat so the construction works will not affect their livelihood so that economic activities of the fishermen can not disturb during project intervention		Identified fish landing sites	During construction phase	Included in construction cost	Contractor/ WRD	WRD and FREMAA
Safety	Risk of accidents and safety due to narrow roads and encroachment of people near construction areas	Adequate lighting and fluorescent signage shall be provided at construction sites.		Construction sites and approach roads	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Signage in local language		Construction sites and approach roads	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Setting up of speed limits and speed breakers	Included in construction cost	Construction sites and approach roads	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Personal protective equipment for workers	Included in construction cost	At construction sites	During construction phase	Included in construction cost	Contractor	WRD and FREMAA
		Health check-up camps for workers	4,50,000	At construction camps	During construction phase	4,50,000	Contractor	WRD and FREMAA

APPENDIX 17. GOOD PRACTICES: HEALTH & SAFETY, AND MANAGEMENT OF BORROW AREAS, QUARRY, LABOR CAMP, AND TOP SOIL

GUIDELINE: LABOUR AND WORKER'S HEALTH AND SAFETY

1. INTRODUCTION

The safety and health concerns of the workers and the community are impacted due to the hazards created during the construction of road. **Box: 1** gives the safety concerns during construction. This Guideline describes the hazards and measures that need to be taken to mitigate the impacts.

2. PROJECT PLANNING AND DESIGN STAGE

To address health and safety concerns, the DPR shall contain selection criteria for setting up:

- Construction Camps (as per guideline);
- Borrow Areas (as per guideline); and
- In case of opening new quarry areas (as per guideline).

To address the safety concerns to road user during operational phase, the DPR shall contain the following:

- Selection and location of regulatory as well as informatory signs as per IRC: 67-2001, depending upon the geometry of the road.

Box 1: Safety Concerns during Construction

Community due to:

- Improper scheduling of construction activities especially near the settlements and sensitive areas;
- Parking of equipments and vehicles at the end of the day likely to cause accidents to the general public especially during night hours;
- Transportation of uncovered loose material or spillage of material increases the chances of accidents to road users and surrounding settlements.

Workers due to:

- Improper handling of materials like bitumen, oil and other flammable material at construction sites, likely to cause safety concerns to the workers;
- Lack of safety measures such as alarm, awareness and safety equipment result in accidents, especially working with or around heavy machinery / equipments.

PRE-CONSTRUCTION STAGE

In order to incorporate public health and safety concerns, the PIU and the Contractor shall disseminate the following information to the community:

- Location of construction camps, borrow areas and new quarry areas;
- Extent of work;
- Time of construction:
- Diversions, if any;
- Precaution measures in sensitive areas;
- Involvement of local labors in the road construction;
- Health issues - water stagnation, exposure to dust, communicable disease: and
- Mechanism for grievances.

Health Concerns are adversely impacted.....

Public due to:

- Unhygienic conditions due to water logging, (improper drainage of waste water), either by improper decommissioning of Construction Camps and parking lots, or improper disposal of construction wastes, leading to the breeding of vectors that are likely to impact the health of the general public
- Interaction between workers and host community is likely to increase the risk of spread of communicable diseases.

Workers due to:

- Low quality drinking water as well as inappropriate storage of drinking water likely to cause water borne diseases among workers.
- Absence of proper sanitary facility likely to act as a breeding ground for vectors raising health concerns among workers.

The information dissemination could be through the local newspaper, billboards, panchayats meetings, etc. The Contractor must educate the workers to undertake the health and safety precautions. The contractor shall educate the workers regarding:

- Awareness on HIV/AIDS awareness and usage of safety measures such as condoms;
- Awareness on hygienic sanitary practices;
- Personal safety measures and location of safety devices;
- Interaction with the host community;
- Protection of environment with respect to:
  - Trampling of vegetation and cutting of trees for cooking;
  - Restriction of activities in forest areas and also on hunting;
  - Water bodies protection:
  - Storage and handling of materials:
  - Disposal of construction waste.

FIRST AID FACILITIES

- First Aid Kit, distinctly marked with Red Cross on white back ground and shall contain minimum of following:
  - 6 small sterilized dressings
  - 3 medium and large sterilized dressings
  - 1 (30 ml.) bottles containing 2 % alcoholic solution of iodine
  - 1(30 ml) bottle containing salvolatile
  - 1 snakebite lancet
  - 1 pair sterilized scissors
  - 1 copy of first-aid leaflet issued by the Director General, Factory Service & Labour Institute, Government of India
  - 100 tablets of aspirin
  - Ointment for burns
  - A suitable surgical antiseptic solution
- Adequate arrangement shall be made for immediate recoupment of the equipments, whenever necessary.
- A trained personnel incharge of first aid treatment to be readily available during working hours at construction site
- Suitable transport to the nearest approachable hospital should be made available.
- Tetanus injection must be made compulsory for all workers every 6 months.

3. CONSTRUCTION STAGE

During the progress of work, following are the safety requirements that need to be undertaken by the contractor at the construction site:

- Personal Protective Equipment (PPE) for the workers. **Table 1** gives the safety gear to be used by the workers during each of the construction activities.
- All measures as per bidding document shall be strictly followed.
- Additional provisions need to be undertaken for safety at site:

- Adequate lighting arrangement;
- Adequate drainage system to avoid any stagnation of water;
- Lined surface with slope 1:40 (V:H) and provision of lined pit at the bottom, at the storage and handling area of bitumen and oil, as well as at the location of generator (grease trap); and
- Facilities for administering first aid.

Table 1: Worker Safety Measures

Sl	Activity	Safety Requirement
1.	Setting out and levelling	• Luminous jackets; • Helmets; • Boots for protection against insect bite; and Dust Mask
2.	Tree cutting	• Helmet Boots • Luminous safety jackets
3	Reinforced yard/ carpentry/ reinforcement cutting/ bending work.	• Hand gloves
4.	Shuttering work	• Goggles Hand gloves
5.	Plant and Machinery	• Hand gloves • Boots • Helmets • Dust Mask
6.	Material handling	• Hand gloves • Dust mask
7.	Batching plant	• Goggles • Hand gloves • Dust mask
8.	Weeding	• Goggles
9.	Binding reinforcement	• Safety belt • Boots
10.	Manual concrete laying	• Gum boots • Hand gloves • Helmet
11.	Piling	• Helmet • Hand gloves, gumboots.

The following measures need to be adopted by the contractor to address public safety concerns:

(i) The Contractor shall schedule the construction activities taking into consideration factors such as:
(ii) Sowing of crops;
(iii) Harvesting;
(iv) Local hindrances such as festivals etc.;
(v) Availability of labor during particular periods;
(vi) All the cautionary signs as per IRC: 67-2001 and traffic control devices (such as barricades, etc.) shall be placed as soon as construction activity get started and shall remain in place till the activities get completed;
(vii) Following case specific measures need to be followed during the progress of the activity:

(viii) In case of blasting, the Contractor must follow The Explosives Rules, 1983;
(ix) In case of construction activity adjoining the water bodies, measures shall be taken as per measures suggested in Guideline on “Water Body”;
(x) If construction of road is within the settlement, the contractor must ensure that there shall not be any unauthorized parking as well as storage of material, adjacent to road; and
(xi) Approved chemicals should be sprayed to prevent breeding of mosquitoes and other disease-causing organisms, at all the water logging areas.

The PIU shall carry out periodic inspections in order to ensure that all the measures are being undertaken as per the guideline.

4. POST-CONSTRUCTION STAGE

During this stage a major concern is on road user safety. Following are the measures that need to be undertaken by the PIU to ensure safer roads:

(i) Inspection and maintenance of installed regulatory and informatory signs.
(ii) Ensure that the location of signage does not obstruct the visibility
(iii) In case of hill roads, maintenance of parapet wall as well as of overtaking zones.

The PIU must ensure that during the maintenance operation of road, road materials are stored at a location such that they shall not create any risk to road users.

The construction site shall be cleaned of all debris, scrap materials and machinery on completion of construction for the safety of public and road users, as per the measures given in Guideline on “Construction and Labor Camp” and “Waste Management and Debris Disposal.”

GUIDELINE: QUARRY MANAGEMENT

1. INTRODUCTION

This guideline pertains to the measures to be taken to address environmental concerns in quarry areas. The general practice adopted is to procure materials from existing quarries operating with the requisite permits. The measures to be taken for operation and management for quarries during all stages of construction have been discussed in this Guideline.

2. PROJECT PLANNING AND DESIGN STAGE

The PIU shall provide in the DPR / bid document, a list of licensed quarries operating within the district and adjoining districts. In addition, the DPR shall contain the following: (i) Quantity of materials available in quarries (ii) Lead from the various existing quarries and (iii) Adequacy of materials for the project in these quarries. **Table 1** and **2** give the format for preparing a list of quarries.

Table 1 Details of Sand Quarry

Sample No.	Source of Sand	Name of quarry area	Site Identification/ Location			Approximate Quantity (cum)	Approximate basic cost of the material (₹)	Remarks
			Nearest Chainage (Km.)	Left/Right	Offset from nearest chainage (km)			

Table 2 Details of Quarry Area for Aggregates

Sample No.	Chainages(Km.)	Left/Right	Name of Quarry Area	Name of Crusher	Lead from nearest chainage (Km.)	Basic cost of the material (₹)	Available land/terrain	Surrounding land Terrain	Remarks

Only in the event of non-availability of existing quarries, the Contractor shall open a new quarry in accordance with Mines and Minerals (Development & Regulation) Act, 1957. The bid document shall include the exhaust quarry reclaim plan per needs of the landowner / community.

3. PRE-CONSTRUCTION STAGE

The Contractor shall select an existing licensed quarry identified in DPR for procuring materials. The Contractor shall establish a new quarry with the prior consent of the PIU only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the PIU.

The construction schedule and operations plans to be submitted to the PIU prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

4. CONSTRUCTION STAGE

4.1 Development of Quarry Area

To minimize the adverse impact during excavation of material following measures are need to be undertaken:

(i) Adequate drainage system shall be provided to prevent the flooding of the excavated area
(ii) At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff.
(iii) Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
(iv) The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
(v) In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

4.2 Setting up of Crushers and other equipment

The following measures shall be undertaken for setting up of crushers are other equipment.

- The contractor shall obtain "No Objection Certificate (NoC)" from the Assam State Pollution Control Board.
- All vehicles must possess Pollution Under Control (PUC) Certificate and shall be renewed accordingly
- All machinery, equipment, and vehicles shall comply with existing CPCB noise and emission norms.
- The PIU must ensure that contractor shall submit the copy of NoC and PUC Certificate before the start of work.

4.3 Quarry operations

The followings precautions shall be undertaken during quarry operations. vii) Overburden shall be removed and disposed as per **Guideline 8** "Waste Management and Debris Disposal".

(i) During excavation slopes shall be flatter than 20 degrees Guideline 8 on to prevent their sliding
(ii) In case of blasting, the procedure and safety measures shall be taken as per The Explosive Rules, 1983
(iii) The Contractor shall ensure that all workers related safety measures shall be done as per measures for, "Labor and Workers Health and Safety" (**Guideline 12**).
(iv) The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.
(v) Stockpiling of the excavated material shall be done as per stockpiling of topsoil explained in **Guideline 4**, "Topsoil Salvage, Storage& Replacement."
(vi) During transportation of the material, measures shall be taken as per **Guideline 11** "Construction Plants and Equipment Management" to minimize the generation of dust and to prevent accidents
(vii) The PIU and the concerned authority shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

5. POST CONSTRUCTION STAGE

A quarry redevelopment plan shall be prepared by the Contractor. All haul roads constructed for transporting the material from the quarries to construction site shall be restored to their original state.

The PIU and the concerned authority shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan.

The plan shall include:

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipment, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site
- Safety measures during quarry operation
- Design for redevelopment of exhaust site.

Two options for redevelopment of quarry areas are given below:

Option A: Revegetating the quarry to merge with surrounding landscape. This is done by conserving and reapplying the topsoil for the vegetative growth.

Option B: Developing exhausted quarries as water bodies. The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/ natural drainage slopes towards it.

GUIDELINE: BORROW AREAS

1. INTRODUCTION

Embankment fill material is to be procured from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, pre-construction, construction stage and post construction stage. Borrow areas are related only to road construction activities.

2. PROJECT PLANNING AND DESIGN STAGE

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. Borrow area siting should be in compliance with IRC: 10-1961. The DPR shall contain (i) Guidelines for locating site of borrow areas (ii) The arrangements to be worked out with the land owner/community for the site and (iii) Sample designs for redevelopment of borrow areas.

3. PRE-CONSTRUCTION STAGE

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the PIU. Borrowing to be avoided on the following areas:

(i) Lands close to toe line.
(ii) Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles. The subsequent Guidelines discuss in detail the conservation of topsoil.
(iii) Grazing land.
(iv) Lands within 0.8km of settlements.
(v) Environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands (including beel). Also, a distance of 500 m should be maintained from such areas.
(vi) Designated protected areas / forests.
(vii) Unstable side-hills.
(viii) Water-bodies.
(ix) Streams and seepage areas.
(x) Areas supporting rare plant/ animal species;
(xi) Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

3.1. Arrangements for Borrow Area

The Contractor will work out arrangements for borrowing with the land owner/concerned department. The arrangements will include the redevelopment after completion of borrowing. The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project. The Engineer of PIU shall approve the borrow area after inspection of the site to verify the reclamation plan and its suitability with the contractor and landowner. The contractor shall commence borrowing soil only after the approval by the PIU. The contractor shall submit to the PIU the following before beginning work on the borrow areas.

(i) Written No-objection certificate of the owner/cultivator;
(ii) Estimate extent of earth requires;
(iii) Extent of land required and duration of the agreement;
(iv) Photograph of the site in original condition; and
(v) Site redevelopment plan after completion.

The depth of excavation should be decided based on natural ground level of the land and the surroundings, and rehabilitation plan. In case higher depth of excavation is agreed with backfilling by

unsuitable excavated soil (from roadway), then filling should be adequately compacted except topsoil, which is to be spread on the top most layer (for at least 20 m thick). The guidelines for location, depth, size and shape of the borrow areas are available in the following:

(i) Clause 305.2.2.2 of MoRTH specification for roads and bridge works of IRC;
(ii) Guidelines for environmental impact assessment of highway projects, Indian Roads Congress, 1989: (IRC: 104-1988);
(iii) IRC: 10-1961-Recommended practice for borrow pits for road embankments constructed by manual operations, as revised in 1989;
(iv) IRC SP: 58-2001 guideline for use of fly ash in road construction;
(v) EIA manual of MoEF, 2001;
(vi) MoEF notification on utilization of fly ash dated 27 August 2005.

3.2. Documentation of Borrow Pit

The contractor must ensure that following data base must be documented for each identified borrow areas that provide the basis of the redevelopment plan.

(i) Chainage along with offset distance;
(ii) Area (m^2);
(iii) Photograph of the pit from all sides;
(iv) Type of access/width/kutcha/pucca, etc. from the carriageway;
(v) Soil type;
(vi) Slope/drainage characteristics;
(vii) Water table of the area or identify from the nearest well, etc.;
(viii) Existing land use, for example barren/agricultural/grazing land;
(ix) Location/name/population of the nearest settlement from borrow area;
(x) Present usage of borrow area; and
(xi) Community facility in the vicinity of borrow pit.

3.3. Redevelopment Plans for Borrow Pits

The following checklist provides guidelines in order to ensure that redevelopment of borrow areas must comply with MoRTH, clause 305.2.2.2 and EMP requirement. Borrow areas can be developed as:

(i) Ponds (various types) (e.g.: Drinking Water only; Washing and for other Domestic Chores; Only for Cattle; Mixed Uses etc.) (a large pond can be divided into two parts - each having a defined use)
(ii) Farmland
(iii) Water Recharging Zones
(iv) Pastureland
(v) Fish Ponds (pisciculture)
(vi) Waste disposal Sites (depending upon the location, distance from settlements, pollution risks, safety, associated environmental risks and hazards, regulations/ permissions of appropriate authority and other such factors)
(vii) Plantation Zones
(viii) Recreational Zones (depending upon location, size, potential of the site, willingness of the local bodies to develop it)
(ix) Wildlife Refuge and Drinking Area (applicable only in case of sensitive environs with appropriate planning and understanding including regulation of depth for safety of animals etc.)

The rehabilitation measures for the borrow areas shall be dependent on the following factors:

(i) Land use objectives and agreed post-borrowing activities;
(ii) Physical aspects (landform stability, erosion, re-establishment of drainage);
(iii) Biological aspects (species richness, plant density,) for areas of native re vegetation;
(iv) Water quality and soil standards; and

(v) Public safety issues.

Rehabilitation should be simple and maintenance free. Depending on the choice of the individual land owner/community, the contractor shall prepare redevelopment plans for the borrow areas. The options can be: (i) Restoring the productive use of the land (ii) Development of detention ponds in barren areas.

Option I: Suitable in locations with high rainfall and productive areas

Topsoil must be placed, seeded, and mulched within 30 days of final grading if it is within a current growing season or within 30 days of the start of the next growing season. Vegetative material used in reclamation must consist of grasses, legumes, herbaceous, or woody plants or a combination thereof, useful to the community for the fuel and fodder needs.

Plants must be planted during the first growing season following the reclamation phase.

Selection and use of vegetative cover must take into account soil and site characteristics such as drainage, pH, nutrient availability, and climate to ensure permanent growth. The vegetative cover is acceptable if within one growing season of seeding, the planting of trees and shrubs results in a permanent stand, or regeneration and succession rate, sufficient to assure a 75% survival rate.

Option II: In barren land, the borrow areas can be redeveloped into detention ponds.

These will be doubled up as water bodies and also for removal of sediment from runoff flowing through the ponds. Design of the detention basin depends upon the particle size, settling characteristics, residence time and land area. A minimum of 0.02 mm size particle with a settling velocity of 0.02 cm/sec (assuming specific gravity of solids 2.65) can be settled in the detention basin.

Following parameters are to be observed while setting up a detention pond:

(i) Pond should be located at the lowest point in the catchment area. Care should be taken that the horizontal velocity should be less then settling velocity to prevent suspension or erosion of deposited materials.
(ii) Minimum Effective Flow Path: 5 times the effective width
(iii) Minimum Free Board: 0.15 m
(iv) Minimum Free Settling Depth: 0.5 m
(v)
(vi) Minimum Sediments Storage Depth: 0.5 m
(vii) Maximum interior slope: 2H : 1V
(viii) Maximum exterior slope: 3H : 1V
(ix) The inlet structure should be such that incoming flow should distribute across the width of the pond. A pre-treatment sump with a screen should provide to remove coarse sediments. Settled sediment should be removed after each storm event or when the sediment capacity has exceeded 33% of design sediment storage volume. Accumulated sediment must be disposed of in a manner, which will prevent its re-entry into the site drainage system, or into any watercourse.

1. CONSTRUCTION STAGE

No borrow area shall be operated without permission of the Engineer. The procurement of borrow material should be in conformity to the guidelines laid down in IRC: 10-1961. In addition, the contractor should adopt precautionary measures to minimize any adverse impacts on the environment. Checklists for monitoring borrow areas operation and management has been prepared (**Table 1**).

Table 1: Checklist for Monitoring Borrow Area Operation and Management

Attributes	Requirements
Access Road	Access road shall be used for hauling only after approved

Attributes	Requirements
Top soil preservation	To soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line of the proposed embankment.
Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the Engineer.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the engineer of the PIU.
Dust Suppression	Water should be sprayed on kutcha haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

2. POST CONSTRUCTION STAGE

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the PIU after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that “the land is restored to his satisfaction”. The final payment shall be made after the verification by PIU.

3. CHECKLIST FOR INSPECTION OF REHABILITATION AREA

Inspection needs to be carried out by the PIU for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the PIU is given below.

(i) Compliance of post-borrowing activities and land use with the restoration plan;
(ii) Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
(iii) Levelling of the bottom of the borrow areas;
(iv) In case the borrow area is on private property, the contractor shall procure written letter from landowner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement “no responsibility of R&BD on contractor in the event of accident.
(v) Condition of the reclaimed area in comparison with the pre-borrowing conditions.

GUIDELINE: CONSTRUCTION AND LABOUR CAMPS

1. INTRODUCTION

The scope of this guideline pertains to the siting, development, management and restoration of construction and labor camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the size of contract, number of laborers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labor camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

2. PRE-CONSTRUCTION STAGE

Identification of site for construction and labor camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the PIU. **Table 1** gives the lands that could be avoided for construction camps and conversely those that could be preferred.

Table 1: Selection Criterion for Construction Camps.

Avoid the following …	Prefer the following …
• Lands close to habitations. • Irrigated agricultural lands. • Lands belonging to small farmers. • Lands under village forests. Lands within 100m of community water bodies and water sources as rivers. • Lands within 100m of watercourses. • Low lying lands. • Lands supporting dense vegetation. • Grazing lands and lands with tenure rights. • Lands where there is no willingness of the landowner to permit its use.	• Waste lands. • Waste Lands belonging to owners who look upon the temporary use as a source of income. • Community lands or government land not used for beneficial purposes. • Private non-irrigated lands where the owner is willing. • Lands with an existing access road.

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

(i) photograph of the proposed camp site in original condition;
(ii) activities to be carried out in the site;
(iii) environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;
(iv) detailed layout plan for development of the construction and labor camp that shall indicate the various structures to be constructed in the camp including temporary, drainage and other facilities (**Figure 1** gives a layout plan for a construction camp); and
(v) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the PIU to enable redressal of grievances at a later stage of the project.

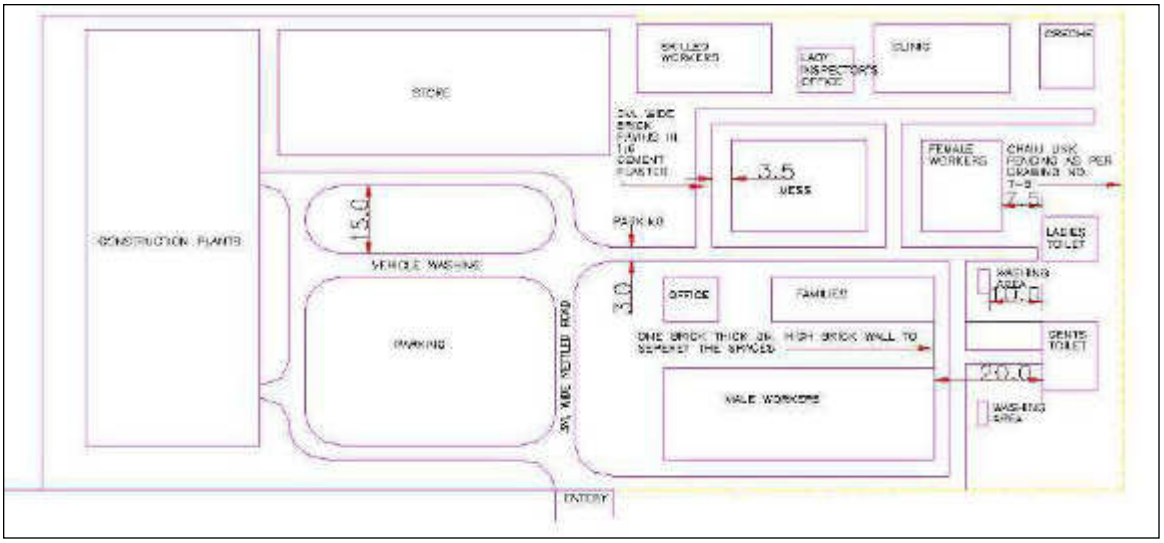


Figure 1: Layout Plan for Construction Camp

2.2 Setting up of labor camp

The contractor shall provide, free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him for complete construction/maintenance work is in progress. A minimum area of 6 m^2 per person shall be provided. The rooms of labor shall be well lighted and ventilated. The facilities to be provided for the labor are discussed below:

a) Drinking Water

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following provisions:

(i) The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.

(ii) The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.

(iii) Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.

(iv) A pump shall be fitted to covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.

b) Washing and Bathing Facilities

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

c) Toilets Facilities

Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:

(i) A latrine for every 15 females or part thereof (where female workers are employed).

(ii) A latrine for every 10 males.

(iii) Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.
(iv) Where workers of both sexes are employed, there shall be displayed outside each block of latrine and urinal, a notice in the language understood by the majority of the workers “For Men Only” or “For Women Only” as the case may be.
(v) The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system;
(vi) Water shall be provided in or near the latrines and urinals by storage in suitable containers.

d) Waste Disposal

(i) Disposal of sanitary wastes and excreta shall be into septic tanks.
(ii) Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
(iii) Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.

e) Medical and First Aid Facilities

Medical facilities shall be provided to the labor at the construction camp. Visits of doctor shall be arranged twice a month wherein routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

- First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital. The first aid box shall contain the following.

(i) 6 small sterilized dressings
(ii) 3 medium size sterilized dressings
(iii) 3 large size sterilized dressings
(iv) 3 large sterilized burns dressings
(v) 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
(vi) 1 (30 ml) bottle containing sal volatile
(vii) 1 snakebite lancet
(viii) 1 (30 grams) bottle of potassium permanganate crystals
(ix) 1 pair scissors
(x) Ointment for burns
(xi) A bottle of suitable surgical antiseptic solution

In case, the number of labor exceeds 50, the items in the first aid box shall be doubled.

f) Provision of Shelter during Rest

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

g) Crèches

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realization. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

2.2 Storage of Construction Material in Construction Camps

For storage of Petrol/Oil/Lubricants, brick on edge flooring or sand flooring will be provided at the storage places of Petrol/Oil/Lubricants to avoid soil and water contamination due to spillage. These should be kept away from labor residential areas. The storage of cement shall be at Damp-proof flooring, as per IS codes. All materials shall be stored in a barricaded area. In case of electrical equipment, danger signs shall be posted. The batch mix plant is to be located away from the residential area and not in the wind direction. Separate parking areas for vehicles and also workshop areas need to be provided.

2.2 Firefighting arrangement

(i) The following precautions need to be taken:
(ii) Demarcation of area susceptible to fires with cautionary signage;
(iii) Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations in the event of fire;
(iv) Contractor shall educate the workers on usage of these equipment.

2.2 Interactions with host communities

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to laborers and residents of construction camps.

3. CONSTRUCTION STAGE

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies. The following precautions need to be taken in construction camps.

(i) Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
(ii) Wastewater should not be disposed into water bodies.
(iii) Regular collection of solid wastes should be undertaken and should be disposed off safely.
(iv) All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
(v) The debris/scrap generated during construction should be kept in a designated and barricaded area.

The PIU will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the period of the contract.

4. POST CONSTRUCTION STAGE

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

(i) Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
(ii) Soak pits, septic tanks shall be covered and effectively sealed off.
(iii) Debris (rejected material) should be disposed off suitably (Refer **Guideline - 10** on “Waste Management and Debris Disposal”).
(iv) Ramps created should be levelled.
(v) Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
(vi) If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.
(vii) Proper documentation of rehabilitation site is necessary. This shall include the following: −Photograph of rehabilitated site;
(viii) Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
(ix) Undertaking from contractor; and
(x) Certification from Engineer in-charge of the PIU.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

APPENDIX 17: ENVIRONMENTAL MONITORING PLAN (EMoP)

Environmental Component	Project stage	Parameter	Standards	Location	Duration / Frequency	Cost (₹)	Implementation	Supervision
Fisheries	Construction Stage	Water quality monitoring	Water quality for fish production	Flood plains, beels, rivers and ponds	Once in a year throughout the construction phase	1,50,000	Survey by Fisheries Experts	WRD and FREMAA
Air Quality	Construction Phase	SPM, RSPM, SO_2, NOx, CO, Pb	National Ambient Air Quality Standards	Within 100 m of Hot mix plant, construction camp, crusher and near sensitive locations/ settlement	Continuous 24-hourly, twice a week, for two weeks once every year (summer)	250,000 (₹83,333/ year for three years)	Independent Environmental Laboratories approved by SPCB/MoEF&CC	WRD and FREMAA
Hydrology	All phases	Water level, discharge, river cross sections	Central W. Commission	As per CWC guidelines	As per CWC guidelines	Data and knowledge components	WRD	WRD and FREMAA
Morphology	All phases	Bank line profiles, sediment transport, velocity, float tracking	Same as above	Same as above	Same as above	Same as above	WRD	WRD and FREMAA
Surface Water Quality	Construction Stage	pH, BOD,COD, TDS, TSS, DO, Oil & Grease	As per CPCB Water Quality Criteria	Brahmaputra River and wetlands/ ponds	Once during the dry season.	100,000 (₹33,000/year for three years)	Independent Environmental Laboratories approved by SPCB/ MoEF	WRD and FREMAA

Environmental Component	Project stage	Parameter	Standards	Location	Duration / Frequency	Cost (₹)	Implementation	Supervision
Groundwater and Drinking Water Quality	Construction Stage	pH, BOD, DO, total coliform, As, Cd, Mn, and groundwater levels	As per IS10500:1991	Construction site, Rehabilitation site, service areas,	Once at the start of construction	15,000	Independent Environmental Laboratories approved by SPCB/ MoEF&CC	WRD and FREMAA
Noise and Vibration	Construction Phase	Noise Level in dB (A)	As per National Standards for Noise	Near the construction sites and sensitive locations close to embankment	One day hourly measurement, once in six months	15,000	Independent Monitoring Agency	WRD and FREMAA
Soil Erosion (inland erosion) and siltation	Construction Phase	Visual check for Soil erosion and siltation	-	River bank and River training Structure	After first precipitation	Part of routine action of engineering team	Independent monitoring agency	WRD and FREMAA
	Operation Phase	Study of Soil erosion and siltation	-	River Training Structure, Upstream and Down Stream of the reach	Once during operation of 1st year	Part of routine action of engineering team	Engineering Team	WRD and FREMAA
Drainage Congestion	Construction Phase	Visual check	-	Project benefit area	After one year of construction.	Part of routine action of Engineering Team	Engineering Team	WRD and FREMAA

Environmental Component	Project stage	Parameter	Standards	Location	Duration / Frequency	Cost (₹)	Implementation	Supervision
	Operation Phase	Visual check	-	Project benefit area	Once during operation of 1st year	Part of routine action of Engineering Team	Engineering Team	WRD and FREMAA
River Hydrology, Morphology and Sediment Transport	Construction Phase	Scientific techniques applicable to the monitoring of these components	-	Entire sub-project area	Regular	Part of routine action of Engineering Team	Engineering Team, WRD	WRD and FREMAA
	Operation Phase	Scientific techniques applicable to the monitoring of these components	-	Entire sub-project area	Regular	Part of routine action of Engineering Team	Engineering Team, WRD	WRD and FREMAA
Tree Plantation	Construction Phase	Survival monitoring of tree felling	The survival rate should be at least 70%, below which replantation should be done.	Entire Subproject area	During site clearance in construction phase	3,00,000	Forest Department in coordination with WRD	WRD and FREMAA

Environmental Component	Project stage	Parameter	Standards	Location	Duration / Frequency	Cost (₹)	Implementation	Supervision
	Operation Phase	Survival rate of trees success of re-plantation	The survival rate should be at least 70% below which the plantation shall be done.	Entire stretch of the project reach	Every year for 3 years	3,00,000	WRD Field Officers with the help of Social Forestry Programme	WRD and FREMAA
Total Costs of monitoring construction stage						**₹8,30,000**		
Total Costs of monitoring operation Stage						**₹3,00,000**		
Transportation for sample collection, contingencies and other logistic support (₹2,00,000 per year)						**₹6,00,000**		
Total cost of monitoring						**₹17,30,000**		

FREMAA- Flood and River Erosion Risk Management Agency of Assam,
CWC- Central Water Commission, dbA- Decibel, IS- Indian Standard,
SIO- Subproject Implementation Office, SPCB- State Pollution Control Board,
WRD- Water Resource Department, Govt. of Assam.

APPENDIX 18: TRAINING*

No.	Target group	Subject(s)	Method	Time Frame
Planning, and Construction Phase[2]				
1	All WRD program staff	**Environmental Overview:** Environmental regulations and national standards, process of impact assessment and identification of mitigation measures, importance of EMP and monitoring, and monitoring methodology (Refresher training)	Lectures (by consultants and local training institutes)	Before implementation of the Tranche-2
2	Environmental engineers, field officers, contractors, supervision consultants	**Implementation of EMPs:** Basic features of an EMP, planning, designing and executing of environmental mitigation and enhancement measures, monitoring and evaluation of environmental conditions during construction and operation	Workshops and seminars (by in tranche 2 consultants and trained PMU staff)	Before the construction begins
3	Environmental engineers, field officers, contractors, supervision consultants	**Environmentally Sound Construction Practices:** Soil conservation; vegetation protection; waste management and minimization in construction; pollution control at construction camps, construction sites, hot mix plants, and material transportation; devices and methods for construction sites and equipment; environmental clauses in contract documents and their implications; environmental monitoring during construction	Seminars, lectures and site visits (by consultants and trained PMU staff)	Before the construction begins in tranche 2
4	Environmental engineers, field officers, contractors, supervision consultants	**Monitoring Environmental Performance during Construction:** Monitoring air, water, soil erosion, noise, and their effect on vegetation and fisheries; evaluation and review of results; performance indicators and their applicability; possible corrective actions; reporting requirements and mechanisms	Lectures, workshop, and site visitsin tranche 2 (by consultants and trained PMU and SIO staff)	During initial phases of construction
5	Construction laborers	**Waste Handling and Sanitation at Construction Sites and Construction Camps:**	Workshops and signage (by in tranche 2 consultants and trained SIO staff)	During initial phases of construction

* The training programs are to be conducted through in house trainers and hired consultants/professionals. The train the trainer mode delivery may also be considered for in house training capacity development.
During construction phase training/awareness programs will be organized twice a year. During operational phase one workshop/awareness program should be organized every year for the first 3 years. This workshop should highlight the details of environmental condition monitored and tips for environmental protection.

No.	Target group	Subject(s)	Method	Time Frame
During Operation Phase				
6	Environmental engineers, field officers, contractors	**Long-Term Environmental Issues in Program Management:** Designing and implementing environmental surveys for ambient air, noise, biological, and water quality; data storage, retrieval, and analysis; contract documents and environmental clauses; risk assessment and management; contingency planning and management; and value addition	Workshops and seminars (b y consultants and local trainint institutes	During implementation of the program
7	Farmers of the area program benefit area, fishers associated with beel and pond fisheries	Cropping Pattern and high yielding crop production techniques	Workshops and seminars (b yin tranche 2 consultants, and resource persons from research institutes and line departments)	Construction and operations phase
8	Public	Environmental protection awareness program	Workshops and seminars (b yin tranche 2 consultants and trained PMU and SIO staffs)	Construction and operations phase

Besides above Emphasis must be given on :

1. Training of the SIOs or their representatives who will monitor the environmental safeguards are the key to the achievement of the proper execution of EMPs in the site, particularly the frequency of the tests of the ambient environment. Training on ADB's environmental Safeguards before the start of the actual execution of the physical works under each package are to be carried out by PMC and FREMAA. It was learnt from the Tranche 1.
2. Employment of the environmental Inspector by each of the contractors before the initiation of the contract package and their training on ADB's SPS, 2009 to be strictly followed.

EMP = environmental management plan, PMU = program management unit, SIO = subproject implementation office, WRD = Water Resources Department.

Source: Water Resources Department, State Government of Assam.

APPENDIX 19: ENVIRONMENTAL BUDGET–DIBRUGARH SUBPROJECT
(ESTIMATED BUDGET)

Component	Item	Unit	Quantity	Rate	Amount (million ₹)
Construction Phase					
Technical Support	Preparation of environmental guidelines and performance indicators		Lumpsum	₹0.25 million	0.25
Flora	Clearing of plantation	km	Covered in engineering costs		
	Compensatory afforestation (minimum 1:3) (plantation and maintenance for 1 year) (1,439 in Dibrugarh reach)	No of tree	Total 1,439 trees will be affected. (Plantation 1,439 X 3 times) = 4,317	₹20 per sampling and ₹1,000 for maintenance for 5 years	4.4
Tree survival monitoring			₹100,000 per year for 3 years		0.3
Drainage Congestion	Provision of adequate opening		Covered in engineering cost		
Navigation	Adequate lighting and signals		Covered in engineering cost		
Erosion and Sedimentation	Riverbank protection measures		Covered in engineering cost		
Land	Compensation against land acquisition and development of rehabilitation sites		Covered in R&R Budget		
Soil	Maintenance cost in soil conservation		Covered in engineering cost		
Noise	Provision for noise		Covered in engineering cost		

Component	Item	Unit	Quantity	Rate	Amount (million ₹)
	barriers				
Water	Installation of oil and grease traps at construction sites and wastewater collection and disposal system		Covered in engineering cost		
	Construction of soak pits at construction sites		Covered in engineering cost		
Dust Management during Construction	Water sprayer and watering		Covered in engineering cost		
Construction Safety	Accident risks in construction activity		Covered in engineering cost and insurance		
	General safety (provision of PPE, e.g., ear muffs, gloves etc.)		To be part of contractors costs		
Health	Health check-up camps for construction workers. AIDS awareness camp	camps	1 camp per 6 months	₹0.05 million per camp for 3 years	0.45
Environmental Monitoring in the Construction Phase	Terrestrial and aquatic fauna including fisheries		Cost as mentioned in monitoring plan. For Dibrugarh reach		0.53
	Ambient air quality				
	Surface water quality				

Component	Item	Unit	Quantity	Rate	Amount (million ₹)
	Groundwater and drinking water quality				
	Noise quality				
	Soil erosion and siltation				
	Drainage congestion				
	Monitoring tree felling and plantation				
	Additional monitoring by FREMAA, SIO (if required)				0.2
		SUB TOTAL (CONSTRUCTION STAGE)			6.13
Operations Phase					
Erosion Control and Landscaping	Reserve Fund for Erosion Control and Embankment Protection	Lump sum	To be part of regular maintenance and operation costs		
Tree survival	Survival monitoring and Provision of additional tree plantation	Lump sum	Costs towards survival monitoring are included in the monitoring budget.		2.0
Monitoring of performance indicators	Terrestrial and aquatic fauna		Cost as mentioned in the monitoring plan. Monitoring costs considered on an average same for each reach (@ ₹0.5 million per reach for entire construction period)		0.5
	Ambient air quality				
	Surface water quality				

Component	Item	Unit	Quantity	Rate	Amount (million ₹)
	Groundwater Quality and levels				
	Levels of noise				
	Soil erosion and siltation				
	Drainage congestion				
	Monitoring of Plantation				
		SUB TOTAL (OPERATION PHASE)			2.5
EASTABLISHMENT AND TRAINING					
Establishment	Construction stage - Environment Inspector, Safety Inspector, Nurse	36 man-months each	36 man-months each	@ 0.05 million per reach per month (0.05 X 36 months)	1.8
	Fuel storage and workshop areas				0.62
	Operation Stage	12 man months	12	₹75,000 per person/ month	0.9
Training	Environmental training and awareness	Lump sum		As per training details	1.0
Management Information system, Documentation		Lump sum			1.0
Transportation for sample collection				₹200,000 per year for 3 years	0.6

Component	Item	Unit	Quantity	Rate	Amount (million ₹)
		SUB TOTAL (Establishment and Training)			5.92
Subtotal (Establishment & Training)					5.92
Subtotal (Construction, and Operation and Mobilization)					8.63
Contingencies @ 10 % on total environmental costs					1.4
GRAND TOTAL					**15.95**

PPE = personal protective equipment, R&R = resettlement and rehabilitation.
Source: Water Resources Department, State Government of Assam

PHOTOGRAPH 1: DIBRUGARH SUBPROJECT

Public Consultation in Dibrugarh reach on 14 February 2015

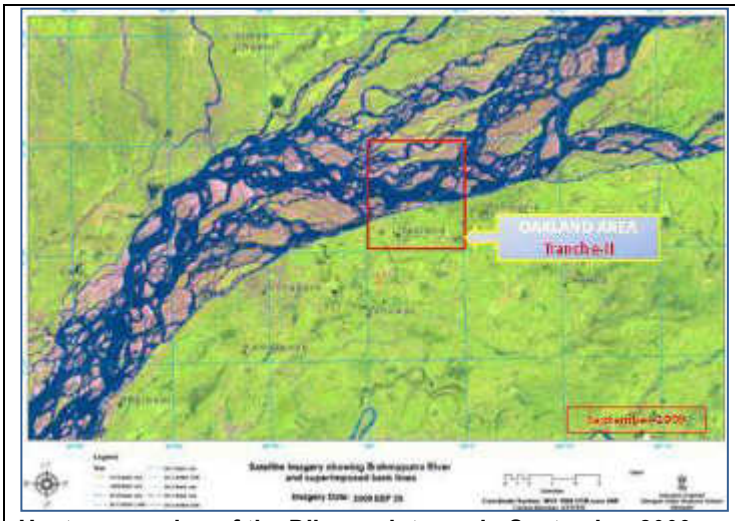
Public hearing at Oakland school- Dibrugarh on 11.11.2016

Plate 3: Existing Spur and Dibrugarh Town Protection Embankment

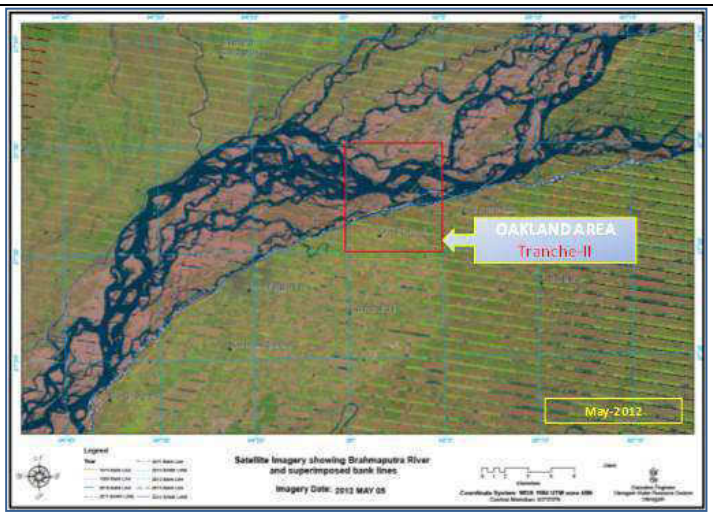
Plate 4: Existing Spur near Dibrugarh Town Protection (Damaged Spur Head)

Plate 5: Maijan Beel Confluence (Fish Breeding Site)

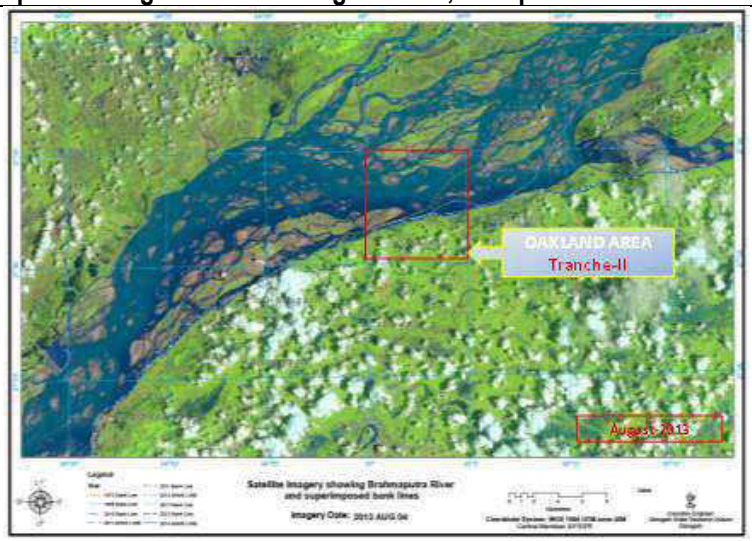
Plate 6: Riverbank Erosion upstream of Maijan Beel



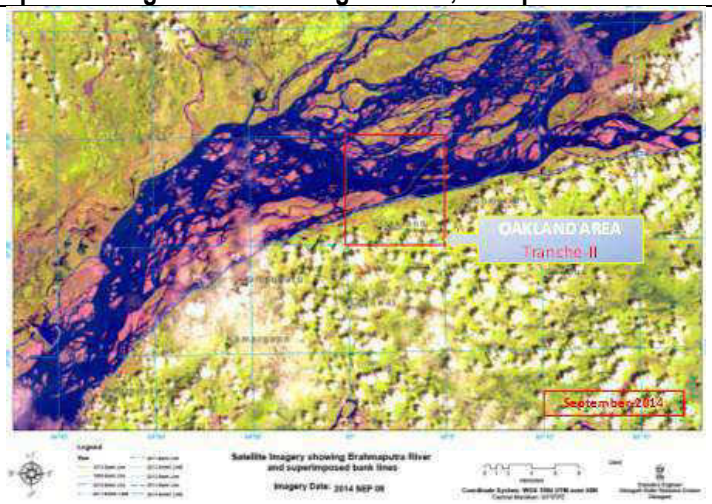
Upstream region of the Dibrugarh town, in September 2009.



Upstream region of the Dibrugarh town, in September 2012



Satellite Image of the river, in the upstream region of the Dibrugarh town, in September 2013



Satellite Image of the river, in the upstream region of the Dibrugarh town, in September 2014

Satellite-based riverbank alignments, at different years, along the southern bank of Brahmaputra, at Dibrugarh sub-project area.

End-monsoon 2013, over the upstream part of the Dibrugarh Town.