ASSAM INLAND WATER TRANSPORT DEVELOPMENT SOCIETY
GOVERNMENT OF ASSAM

ENVIRONMENTAL AND SOCIAL ASSESSMENT STUDIES FOR ASSAM INLAND WATER TRANSPORT PROJECT

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ESIA REPORT FOR NORTH GUWAHATI TERMINAL

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ABBREVIATIONS & ACRONYMS

AIWCL	Assam Inland Waterways Corporation Limited
AIWTDS	Assam Inland Water Transport Development Society
AIWTP	Assam Inland Water Transport Project
AoI	Area of Influence
ASI	Archaeological Survey of India
CITES	Convention on International Trade in Endangered species.
CHMP	Cultural Heritage Management Plan
CPCB	Central Pollution Control Board
CTC	Crew Training Centre
DIWTA	Directorate of Inland Water Transport, Assam
DPR	Detail Project Report
DMP	Disaster Management Plan
EC	Environmental Clearance
EHS	Environment, Health, and Safety
ESIA	Environmental and Social Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EPA	Environmental Protection Act
ESMP	Environmental and Social Management Plan
EV	Electric Vehicle
FGD	Focus Group Discussion
GoA	Government of Assam
GoI	Government of India
GLSR	Ground Level Service Reservoir
IMD	India Meteorological Department
IUCN	International Union for Conservation of Nature
IWAI	Inland Waterways Authority of India
PAPs	Project Affected Persons
PIU	Project Implementation Unit
PMU	Project Management Unit
PWD	Public Works Department
NGO	Non-Government Organizations
NW	National Waterway
RPF	Resettlement Policy Framework
SPCB	State Pollution Control Board
SPL	Sound Pressure Level

Chapter 1 - INTRODUCTION

1.1 INTRODUCTION

Assam has approximately 1980 km of navigable waterways of which the most important for transport purposes are the Brahmaputra and Barak rivers. The river Brahmaputra is navigable for most of its length in India. The Brahmaputra River with a length of 891 km between the Bangladesh Border and Sadiya, was declared National Waterway - 2 by the Government of India in 1988 (Refer **Figure-1.1**).

Waterways are cost efficient and are an environment-friendly mode of transport. The development of National Waterway as a supplementary mode would enable diversion of traffic from over-congested roads and railways. This will ensure enormous gains in terms of economic growth, livelihood generation and prosperity, leading to political and social stability.

The Inland Water Transport departments of both the state and central governments of India are very keen to realize NW2's full potential for cargo and passenger transportation. River tourism is another key potential area which can hugely contribute to the economy of the North-eastern states.

The Directorate of Inland Water Transport, Assam (DIWTA), established in 1958 and part of the Assam Transport Department, is responsible for developing, maintaining, and regulating IWT services in the state. It also operates and maintains many of the passenger transport services, ferry terminals and navigation aids on both Brahmaputra and Barak Rivers.

The river Brahmaputra, running through the heart of the state of Assam, provides a vital link for both urban and rural ferry services which are the single most important transport mode for many sections of the population, especially for rural households in Assam. These ferry services are provided by the Directorate of Inland Waterway Transport Assam (DIWTA), and by country boat operators, who are – typically small independent and informal private ventures. In addition to the 106 ferry service routes designated by the Directorate of IWT, there are numerous routes licensed by the local Panchayat, Zilla Parishads and autonomous councils.

The state Government of Assam (GoA) has taken up a Project titled "Assam Inland Water Transport Project (AIWTP)" to improve the quality of inland water transport services and integrate high quality passenger and vehicle ferry services in river Brahmaputra. The World Bank is financing the GoA to achieve this objective. Assam Inland Water Transport Development Society (AIWTDS) has been formed by the GoA under Transport Department to implement the Assam Inland Water Transport Project (AIWTP) to modernize IWT in Assam.

Figure 1.1: Map showing Brahmaputra River System (NW 2)

1.2 NEED FOR THE PROJECT

The river Brahmaputra is a braided river system characterised by high sediment delivery and low sediment throughout. This is caused due to its very low gradients making it very sensitive to rapid geometry (boundary and channel) changes, channel baring and flooding. The river layout often changes significantly during and after floods. Most of the ferry terminals consist of moorings on the bank of the river, which require relocation with changing river conditions.

The facilities built at these terminals are not sufficient to meet the growing demand of traffic volume as they lack facilities for berthing, parking, storage areas and other essential facilities such as toilets, drinking water, safety features etc. They usually consist of one pontoon with shore connection for embarking and debarking passenger and cargo.

Thus, that there is an urgent need for improvement in passenger ferries and require upgradation of supporting infrastructure.

1.3 ESIA STUDY

AIWTDS has appointed WAPCOS Ltd. (A Government of India Undertaking) under aegis of Ministry of Jal Shakti to conduct the ESIA study of the proposed development of 13 Ferry Terminals, 1 Crew Training Centre (CTC) and 2 Slipway Facilities. The location details of the proposed project interventions under AIWT Project are given in **Table-1.1.**

Table 1.1: Location of the Terminals, Slipways and CTC

S No	Proposed Terminal	Location
1	Umananda	26°11'47.73"N, 91°44'42.73"E
2	Uzan Bazar	26°11'35.47"N, 91°45'6.73"E
3	Kurua	26°14'16.08"N, 91°49'23.57"E
4	Guijan	27°34'40.08"N, 95°19'29.16"E
5	Ghagor	27°14'3.72"N, 94°11'14.70"E
6	Kachari (Dhubri)	26° 1'8.08"N, 89°59'43.05"E
7	Goalpara	26°11'3.43"N, 90°37'53.70"E
8	Bahari	26° 14' 49.08", 91° 8' 21.64"
9	North Guwahati	26°11'10.05"N, 91°43'18.18"E
10	Aphalamukh	26°54'57.04"N, 94°17'54.07"E
11	Neamati Ghat	26°51'39.07"N, 94°14'32.16"E
12	Matmora	27° 9'54.90"N, 94°30'55.98"E
13	Disangmukh	27° 2'21.90"N, 94°30'59.90"E
S No	**Proposed Slipway**	**Location**
1	Dikhowmukh Slipway	26°59'58.00"N, 94°27'55.00"E
2	Dhubri Slipway	26° 1'23.03"N, 89°59'29.03"E
S No	**Proposed CTC**	**Location**
1	CTC at Pandu	26°10'19.05"N, 91°40'57.06"E

As suggested by AIWTDS, ESIA Reports are now being prepared for the priority terminals namely Umananda, North Guwahati, Neamati and Aphalamukh. This report is for the ESIA study of North Guwahati terminal.

1.4 SCREENING AND SCOPING STUDY

Screening and Scoping exercise has been done for North Guwahati terminal. The potential impacts on environmental and social attributes were identified based on the reconnaissance

survey, FGDs etc. The identified risks were evaluated qualitatively based on the significance of risks on a scale of 1 to 4 with the help of Scoping Matrix.
The screening exercise has identified the following potential positive and negative impacts from the project activities:

1.4.1 Positive Impacts

- Improvement in connectivity with North Guwahati
- Improvement in income and living standards due to increase in tourism.
- Improvement in local environmental and social conditions.
- Decrease in public health risk by reducing incidence of water borne and other disaster related diseases, and mental fears after project implementation
- Generation of employment opportunities for the local population

1.4.2 Negative Impacts

- River bank at the terminal location is stable, however morphological changes of the river bank shows approximate 200 m of erosion near the terminal location between 2010-2020.
- Anticipated natural hazards at site are floods, cyclone and earthquakes. Since the proposed interventions are planned along the river and as the site is prone to flooding, terminal should be designed considering the 50 years return HFL level of the river. To prevent flood hazard, off-shore and on-shore structures should be above the HFL level. It is also necessary to take into consideration in the design so that the structure can withstand earthquake of moderate to high intensity.
- Spillage of construction material into the river.
- Disposal of solid and liquid waste into the river is a major risk for contamination of river water. It may also hamper the aquatic ecosystem.
- Presence of Gangetic Dolphin in and around the project site which is a schedule I species as per Wildlife Act, Endangered species as per IUCN and Appendix I as per CITES. Site is located near known dolphin hotspot, 500 m from existing ghat towards Ashwaklanta temple Thus, the construction activities may pose threat to this valuable aquatic species.
- Proposed terminal is the upgradation of the existing IWT ghat adjacent to the construction site of upcoming bridge connecting North Guwahati and Panbazar over river Brahmaputra which is approximately 300 m downstream of the existing terminal. Cumulative impacts of these projects shall be studied and findings to be incorporated in the CIA report.
- North Guwahati is famous for Ashwaklanta temple and Doul Govinda temple. Ashwaklanta temple is an archaeological site protected under ASI. The site is significant with the presence of stone sculptures and idols erected in 11th and 12th Century. It was rebuilt by Bijay Duara Phukan in 1720 C.E. during the reign of Ahom King Swargadeo Siva Singla (1714-1744). Precautions followed for archaeologically protected monument should be followed for any construction planned near such site, permission need to be obtained from archaeological department. It is also proposed to report to IWT and ASI for any chance finding during the construction stage.
- Disturbances from construction works to the cultural and religious site near the proposed Terminal location and contractors lack of knowledge on cultural issues may cause social disturbances.
- Impact on livelihood of 5 vendors operating tea stall, selling fruits, drinking water etc. near the proposed site.

The Project activities at North Guwahati shall include piling works in a sensitive ecological hotspot of dolphins and other aquatic species which might have impacts on this habitat. It is thus considered Category A from the environment point of view. The social impacts are limited to 5 number of squatters so the project is considered as Category B. Based on the identified risks, the impacts could be significant and hence, the ESIA study shall be conducted with emphasis on following aspects:

- Assessment of physico- chemical parameters (Water, Soil, Air and Noise)
- Assessment of aquatic ecology with special emphasis on Dolphins
- Assessment of loss of livelihood of squatters
- Assessment of impacts on archaeological and historical monuments and Conservation and preservation plan.
- Preparation of Site-Specific Conservation Plan for Dolphins with budgetary provision for construction and operation phases
- Preparation of Livelihood generation plan for squatters with budget
- Preparation of Environment monitoring Plan of physico- chemical parameters for construction and operation phases with budgetary provision
- Preparation of Environment monitoring Plan of Biological parameters with special emphasis on Dolphin for construction and operation phases with budgetary provision
- Environmental and Social Management Plan (ESMP) for construction and operation phases with budgetary provision

1.5 OUTLINE OF THE REPORT

Chapter- 1	presents an overview of the need for the project, objectives and need for ESIA study, Scope of Work, Deliverables, etc.
Chapter- 2	project description of the terminal
Chapter- 3	describes the legal and policy framework applicable to the project.
Chapter- 4	describes the stakeholder consultation carried out during the study period
Chapter- 5	describes the environmental and social baseline status.
Chapter- 6	describes the impact assessment and mitigation measures.
Chapter- 7	describes the Risk Assessment & Disaster Management Plan for construction and operation phases
Chapter- 8	describes the Environmental & Social Management Plan (ESMP) and monitoring schedule.
Chapter- 9	describes the summary of ESIA study

Chapter 2 - PROJECT DESCRIPTION

2.1 INTRODUCTION

The present chapter gives the details of existing infrastructure facilities, issues at existing facilities, and the new proposed developments at North Guwahati Terminal.

2.2 DESCRIPTION OF THE TERMINAL

North Guwahati ferry ghat is located in the Majgaon area in the northern bank of river Brahmaputra and is one of the easiest and shortest way of transportation between North and South Guwahati. This ferry terminal is the busiest terminal and serves ferry services for passengers and two wheelers. North Guwahati is also famous for its two major temples i.e., Ashwaklanta and Doul Govinda temple. Ashwaklanta temple is also an archaeological site. It was constructed in 1720 AD, during the reign of Ahom King Shiva Singha. Janmastami and Ashokastami are two major festivals celebrated in this temple. Doul Govinda temple is dedicated to Lord Krishna. The temple is known for its Holi celebrations annually held between the months of February and March.

This ferry terminal is the busiest terminal located in the densely populated area. The Ghat is been operated by IWT and served through official vessels, which are operational from morning till late evening doing a total of 29 round trips a day. IWT vessels MV Puthimari, MV Jacob, MV Kameng and MV Sudarshan ferry passengers in this route especially regular office goers, traders, students, labours etc. With the introduction of night navigation facilities under the project, ferries currently ply regularly till 9:30 PM in this route. A bridge over river Brahmaputra is under construction connecting South Guwahati (Paan Bazaar) to North Guwahati, which is very near to the North Guwahati Terminal site. Once construction of the bridge is completed, it may affect the number of passengers using ferry for commutation in the near future.

At present the pontoon has limited waiting area and toilets are in a bad condition. The approach road from existing ferry terminal pontoon to nearest PWD road is about 100 m in length and 3 m wide which is narrow and Kachcha. This narrow road needs to be widened to avoid mishaps during rainy seasons. Operation of ferries from the current ghat location needs to change periodically due to variation in the availability of water depth. Thus, the terminal at North Guwahati ghat needs upgradation. The co-ordinates of North Guwahati terminal are N-26°11'10.05'', E-91°43'18.18'', and the location map is given in **Figure-2.1.**

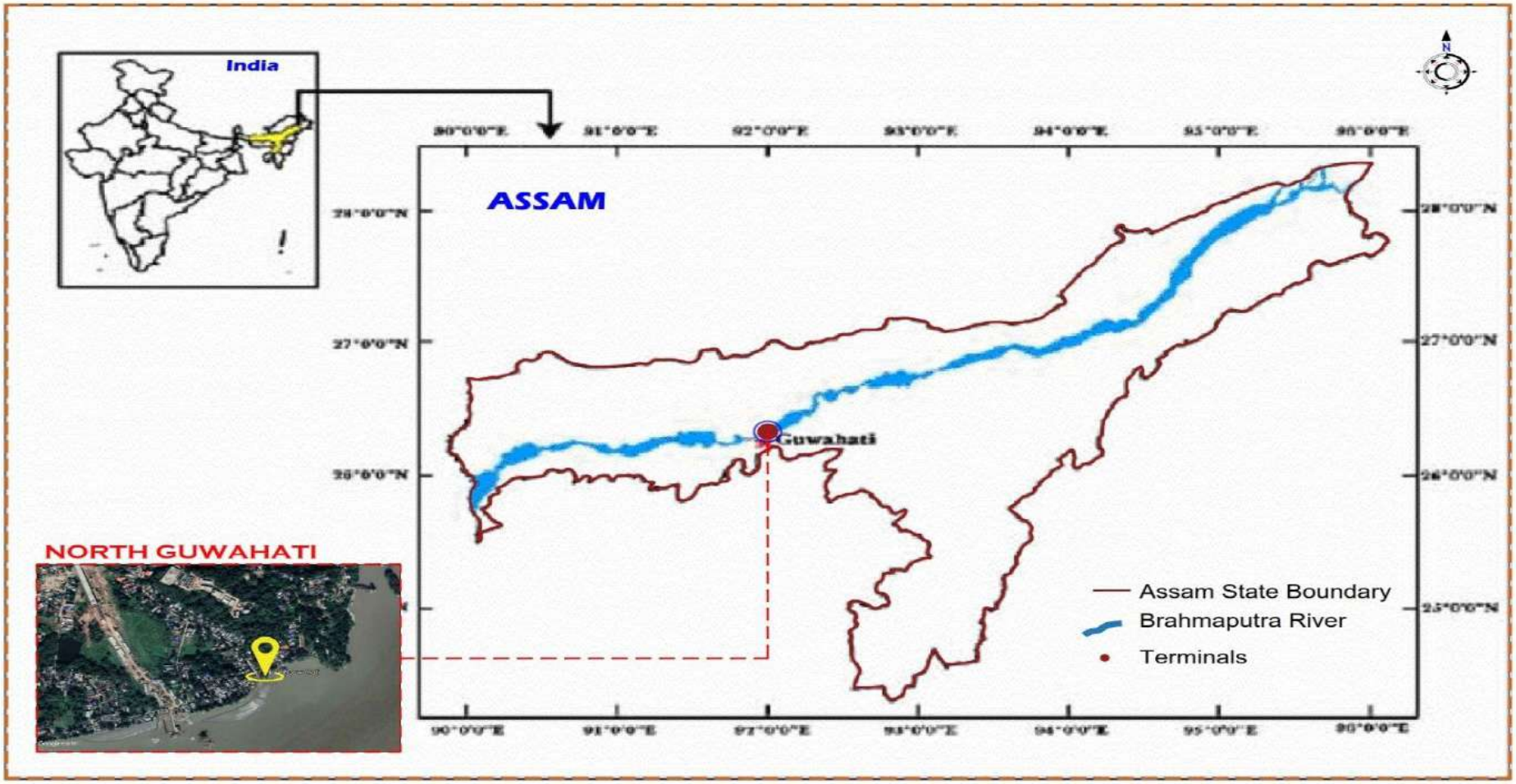


Figure 2.1: Location Map of North Guwahati Terminal

2.3 EXISTING FACILITY AT THE TERMINAL

The existing facilities at North Guwahati is as listed below-

a) Floating pontoon facility for berthing of vessels and boarding and de-boarding of commuters.
b) Bamboo/ wooden planks as access structure to reach the pontoon.
c) Approach road to reach pontoon is kaccha road.
d) Vessels plying to-from this location carries both passengers and two wheelers.
e) At the land side there is no terminal building, dedicated waiting areas and the ticketing counters etc. At this point of time the waiting area and the ticket counter are present in the pontoon itself.
f) Solid wastes generated in the ghat are stored in bins and handed over to the NGO, 'Pratyasha' assigned for collecting primary wastes under Town Committee for onward disposal in landfill located approximately 9-10 kms from the ghat.
g) Current water requirement is met by drawing river water by pump which is then stored in tank for usage in toilets, washing etc. For drinking purposes, water is then filtered by water purifier.
h) Electricity available in the pontoon. DG sets are used in ferries for power requirements.

The existing conditions at the North Guwahati Ghat is shown in **Figure 2.2.**

Figure 2.2: Existing condition at North Guwahati Terminal

2.4 PROPOSED UP-GRADATION

There is a need to develop a ferry terminal with all basic infrastructure and facilities. This ferry terminal shall be planned for the movement of passengers and the vehicular traffic especially two wheelers. The layout of the proposed North Guwahati Ghat Terminal is enclosed as **Figure-2.3.** As per DPR, Fixed multiple floating pontoon with fixed linkspan on floating platform has been planned for North Guwahati Terminal. HFL of 51.46 m and LWL of 40.54 m has been considered for planning and designing the terminal. Proposed ferry terminal will be at fixed location, the riverine infrastructure shall be provided at a depth where minimum water level is available throughout the year.

Based on the functional requirement and site conditions, two number of pontoons has been estimated for berthing of the vessels. Key elements of the terminal development work include

floating pontoons as the berthing facility, guide piles, linkspan, associated landside infrastructure, miscellaneous works, general and other items.

At North Guwahati, there shall be guide piles, floating pontoon, intermediate pontoons, linkspans and reinforced concrete piled deck connecting the landside facilities. The riverside facility consists of a series of floating pontoons (2 nos. of 35m long) that are restrained by guide piles thus allowing the pontoon to raise and fall in vertical plane. Next to the floating pontoons, a series of linkspans is planned supported by floating platforms locked between the piles with a bracket arrangement. The linkspan close to the landward end, rests on a concrete deck with piles which in-turn connects to the terminal side of the facility. The intermediate floating platforms are allowed to move with the water level variations up and down thus facilitating the linkspans to align their gradients with the water level variations. The cross-sectional view of the terminal is shown in **Figure-2.4.**

The pontoon shall receive Ro-Pax and catamaran vessels of capacity 100-150 passengers along with two wheelers. There is a provision of procuring green fuel vessels under the Project that shall ply in the South Guwahati (GGG)-North Guwahati ferry route for which 5 % of the parking space at the North Guwahati terminal shall be kept for EV charging facilities.

Following component have been planned to fulfil operational needs of the proposed terminal:

Landside Facilities:

- Terminal Building with Rest-Rooms,
- Ticketing Facility,
- Substation Building with Transformers,
- Panel Room, DG Set, etc.
- Firefighting Building with storage tank, pumps, etc.
- Vehicle Parking
- Internal Roads, Crossings, Service Routings,
- Markings and Furniture
- Boundary Walls
- External Utilities such as water supply,
- Sewage Management (Bio-digester), electricity, fire-fighting, etc.
- Storm-water Drainage
- Horticulture

Riverine Facilities:

- Fixed Approach Bund with concrete pavement and rails
- Floating Pontoons
- Linkspans

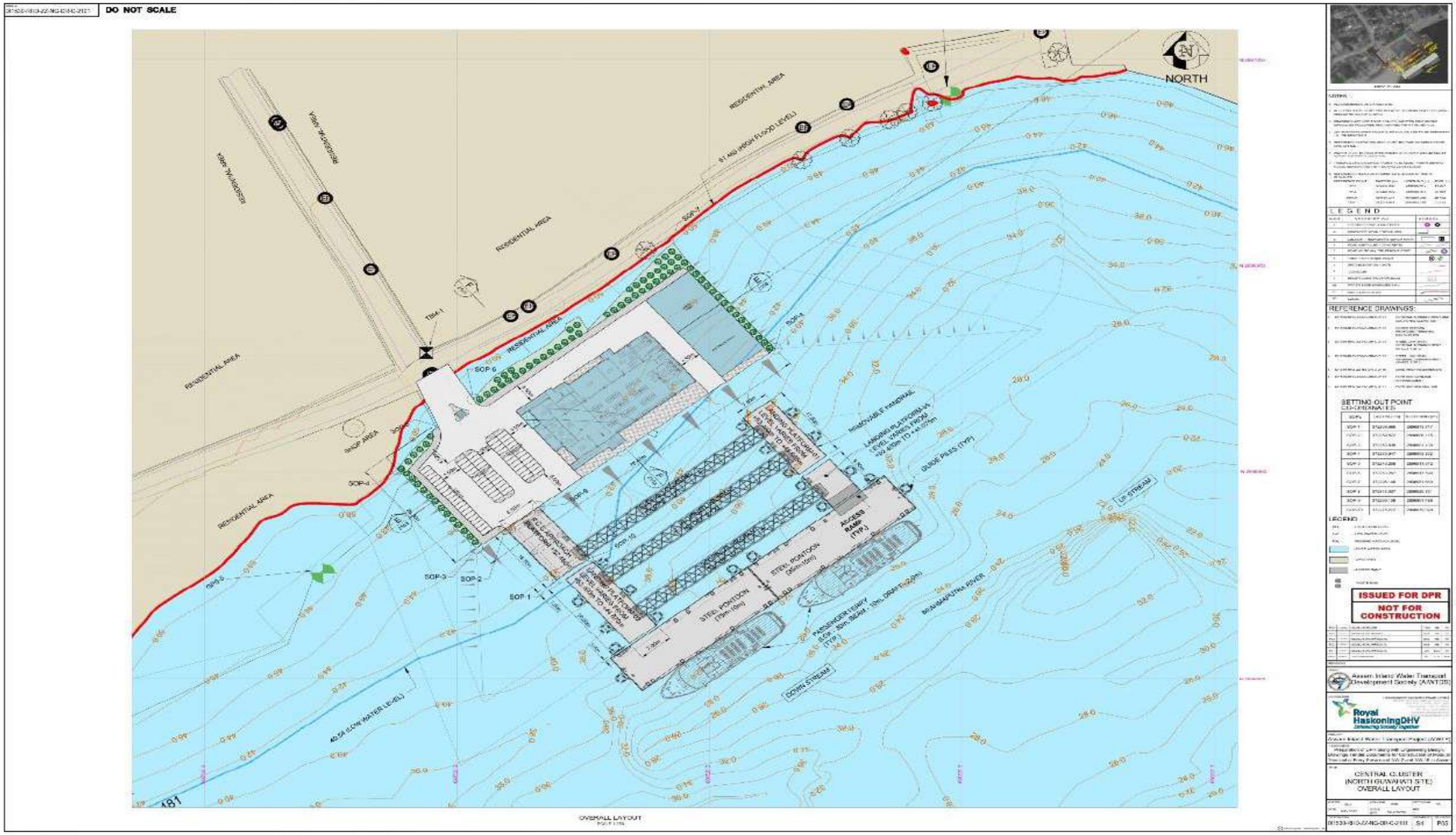


Figure 2.3: Layout of North Guwahati Ghat Terminal

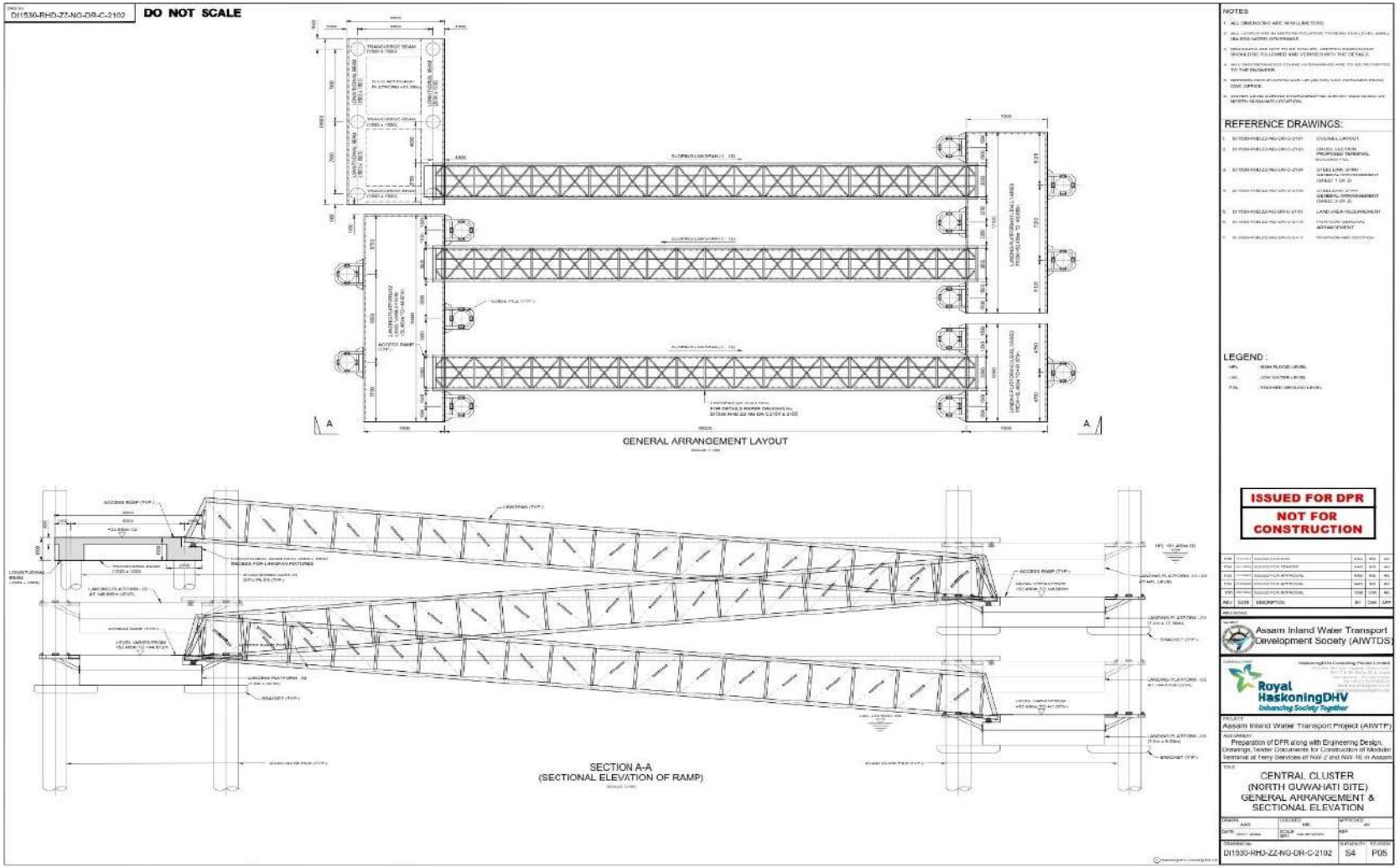


Figure 2.4: L-Section of North Guwahati Terminal

The summary of land and river components to be developed as a part of the project are given in **Table-2.1.** The typical arrangement of pontoon, ramp and approach bund is shown in **Figure-2.5.**

Table 2.1: Summary of land and river components for North Guwahati Ghat Terminal

Components	Nos.	Dimension	Remarks
A. Riverine structures			
I. Type of berthing arrangement	Fixed multiple floating pontoon with fixed linkspan on floating platform		
II. Floating pontoon	2	35x10 m	Steel pontoon with guide pile
III. Articulated floating pontoon	3		Guide piles with locking mechanism to cater to water level variation
IV. Linkspan	3	47m x 3m	3 m as clear width 2.4 m as clear height 1 in 12 to be maintained
V. Type of slope protection	-	0.5 m thick	Gabion mattress with aggregate as a filling material
VI. Type of bank protection	-	-	
B. Land side facilities			
I. Total land area		2280 Sqm	
II. Building area		900 sqm	
• No. of floors		G+1	

**Source: DPR, 2023*

Other amenities and facilities proposed at North Guwahati

- Surveillance System (CCTVs)
- Communication System
- Fire alarm and security system
- Internal HVAC
- Power
    - Power requirement: 200kVA

Source of power supply: In order to meet the total power demand for river Terminal, 11 KV power supply shall be provided by ASEB. The power tap-off location shall be in vicinity of Terminal building with a suitable breaker. The main electrical substation location shall be near the Terminal Building only. Cable work from power tap-off point to the substation and onward power transmission to the Terminal building area and all downstream distribution to Pontoons, pathways and associated facilities shall also be considered in present scope of work. A suitable rating of DG set shall also be considered for emergency and stand by power supply.

During the operation phase of the Terminal there is also provision for installation of a Grid Tied Solar Rooftop Photo Voltaic (SPV) power plant and solar exterior lights are suggested in the DPR.

Water

- **Demand**: Water demand of 38 KLD is estimated based on the unit demand norms as per average number of passengers (to and from) projected per day for design phases of development up to year 2045 in DPR. The water requirement for vendors and staff at ferry terminal is also considered

Source: Currently, there is no municipal water supply to the area, however, the state government will be providing municipal water connection till the site boundary under Jal Jeevan Mission(JJM) in the future. Till then, the water shall be sourced from the bore well planned near the water tank. Water shall be pumped to Ground Level Service Reservoir (GLSR). The Ground Level Service Reservoir (GLSR) will have one potable water compartment. The potable water compartment will have storage for 24 hours of demand i.e., 38 KL. From this GLSR, water will be pumped to the overhead tank (OHT) of the building using a submersible pump after requisite treatment. To prevent contamination of potable drinking water, the opening of the GLSR shall be above the HFL of 51.46 m.

Sewage Management

The sewage treatment at the site has been recommended via a bio-digestor tank. A bio-tank of 12 KL occupying 6 sqm (2m X 3m) is proposed for the terminal. The sewage from the terminal building will be conveyed to the bio-tank from the inspection chamber. The effluent from the bio-tank will be connected to the nearest municipal sewer network, with at least 1:250 slope to achieve self-cleaning velocity. The sludge from the Bio digestor tank will be removed and transported following all safety protocols.
The Sewage management plan and Design detail of bio-digester is enclosed as **Annexure-1.**

Storm Water Management- Storm water drains will be masonry channel drains with minimum width of 300/450 mm. The drains will be covered with steel grating cover trench grate covers. Storm water drains will have a slope of 1:500.

Solid Waste Management- In the terminal building the waste generated will be mainly Municipal Solid Waste. The 2-bin system of 240 litres for separating Wet and Dry waste will be placed at various locations throughout terminal building for convenience of users/commuters. The site will have designated waste collection area where all the waste will be collected daily and segregated for onward disposal in municipal land fill area. Currently, North Guwahati Town Committee has engaged an NGO named “Pratyasha”, for collecting and disposing the municipal wastes, in a similar way later on during the construction and operation of terminal, the same NGO shall be contacted for waste collection and disposal on payment basis. Moreover, during construction phase, the contractor shall clear away all debris and excess material accumulated at the site, failing which the same shall be done by Employer/Engineer at the Contractor’s risk and the cost of clean-up shall be deducted from the Contractor’s pro-rata bill, as per the contract terms and conditions

2.5 LAND REQUIREMENT AND OWNERSHIP STATUS

The land requirement for the proposed terminal at North Guwahati terminal as per DPR is given in **Table-2.2.**

Table 2.2: Land requirement for the North Guwahati terminal

S. No	Name of Terminal	Land Requirement (sq.m)	Ownership
1	North Guwahati	7000	Government land belongs to Revenue Department

Presence of sensitive archaeological Site & dolphins in the Site vicinity

During Screening and Scoping stag of the Project Ashwakranta temple and Doul Govinda temples have been identified which are protected by Archeological Survey of India. The site is significant with the presence of stone sculptures and idols erected in 11th and 12th Century. It was rebuilt by Bijay Duara Phukan in 1720 C.E. during the reign of Ahom King Swargadeo Siva Singla (1714-1744). Both temples are erected upon the remains of two earlier stone temple plinths. The Aswakranta or Anantasayi Visnu temple at the hilltop is *triratha* in plan and has a *mandapa*. This temple has figures of the *dasavatara* forms of Visnu on the outer walls and a few others in the inner walls of the *mandapa*.The Construction activities of the Project may cause risk damage to this monuments for which appropriate mitigation measures need to be taken as provided in **Annexure- 16**

Sensitive aquatic habitats identified within the site vicinity (500m) for dolphin habitat is known to be present in this stretch of the river Brahmaputra. Construction activities like piling is planned for the proposed construction in North Guwahati which might affect the aquatic ecology and the dolphins. Mitigation measures during the piling activity and throughout the construction and operation period is planned which may be seen at Table 8.1 and 8.3.

Construction plan should therefor be prepared w.r.t the above listed environmental sensitive locations- archaeiological site and dolphin habitat.

2.6 CONSTRUCTION PERIOD

The duration of construction phase is about 18 months including pre-tender activities.

2.7 COST ESTIMATE

The cost for construction of North Guwahati terminal is given in **Table-2.3.**

Table 2.3: Cost of the project

S. No	Name of Terminal	Cost (Rs. Cr.)
1	North Guwahati	36.5

**Source: DPR, 2023*

Chapter 3 – LEGAL AND POLICY FRAMEWORK

3.1 GENERAL

The Environmental and Social Impacts Assessment (ESIA) studies for the proposed AIWTP-Ph-2 have been carried out in accordance with applicable WB, National and requirements of GoA on environmental, health and safety management. The present chapter gives a brief review of the applicable legal and policy framework.

3.2 NATIONAL LEGAL AND POLICY FRAMEWORK

The national environmental legislations are broadly discussed here. The MoEF&CC, Central Pollution Control Board (CPCB), Dept. of Env. & Forest, GoA and State Pollution Control Board, Assam (SPCB) together form the regulatory authorities for implementation of provisions of environmental legislations. Other Ministries/Statutory Bodies/Departments responsible for ensuring environmental compliance and granting various clearances includes State Dept. of Environment, Regional offices of MoEF&CC and State Forests/Wildlife Departments.

Under the Environmental Protection Act (EPA), 1986, various rules/notifications/acts have been promulgated to control pollution and mitigate adverse impacts on the environment. The EIA Notification, 2006 and its subsequent amendments imposes certain restrictions and prohibitions on new projects or activities, or on the expansion or modernization of existing projects or activities based on their potential environmental impacts. These project categories are listed in the notification and clearance process defined based on their capacities to obtain prior environmental clearance.

Based on the preliminary review of documents, and scope of works within purview of this project, activities encapsulated under this project are mainly for transportation and navigation purposes. As per the OM dated 21st December 2017, Ministry of Environment, Forest and Climate Change, the proposed project does not require Environmental Clearance. However, NOC/Permissions are required to be obtained for specific activities like setting up Batch Mix Plant, Hot Mix Plant, Operation of DG sets, from respective agencies as indicated under legal and administrative framework. All permissions will have associated conditions that will be complied with by contractor/AIWTDS. None of these permissions required a detailed Environmental Impacts Assessment study. However, findings of the ESIA and proposed mitigation measures as a part of ESMP would be useful in obtaining permissions and for environmentally friendly construction and operation of the project. ESMP will be prepared separately for all components, and it will be part of contractor's agreement for implementation during the construction and operation stages.

A list of National and State level legislations and regulations that could have a bearing on the project during its pre-construction, construction, implementation, and monitoring stages is provided **Table-3.1.**

Table 3.1: Relevance of national and state level legislations to the project

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
1	National Environment Policy 2005	National Environment Policy deals with the issues related to the control and regulation of environmental degradation and underline the needs for water conservation for different use and appropriate management, including integrated water management considering ecological use as a means.	The Project should adhere to NEP principle of "enhancing and conservation of environmental resources and abatement of pollution". ESIA and ESMP to examine the provisions of this policy, examine the clauses that are attracted and suggest remedial measures.
2	• Environmental (Protection) Act, 1986, • Environmental Impact Assessment Notification, 2006 its amendments	• This Act empowers the Central Government to take necessary action to protect the environment and in the prevention of environmental pollution. • Construction of new projects or activities or the expansion or modernization of existing projects or activities listed in the Schedule to the notification under the Act will only be undertaken after the prior environmental clearance from the Central/State Government as applicable.	Environmental Clearance (EC) is not required for the proposed project.
3	The Biological Diversity Act, 2002	• This Act aims to integrate conservation, promotion and sustainable use of biological diversity into projects. The State Government can declare areas rich in biological diversity, or when biological resources are threatened by overuse, abuse or neglect, as areas of biological importance for preservation.	Not Applicable There is no such area in the vicinity of the project.
4	Water Prevention and Control of Pollution) Act, 1974, Amendment there of	To prevent and control water pollution.	Applicable. Effluents are expected to be generated during construction and operation phase of the project. The effluents would mmet the discharge standards specied in the Rules. The bid documents for civil works contracts shall mention that the contractor would comply with the standards mentioned in these rules.

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
5	Noise Pollution (Regulation and Control) Rules, 2000	A level of noise permitted in different areas, including those of vehicular traffic, generators, and construction activities is defined under these rules. During operation phase noise can be created during cruise operation.	The machicney and construction activities would comply with the standard specified in the reules. The bid documents for civil works contracts shall mention that the contractor would comply with the standards mentioned in this rules.
6	Air (Prevention and Control of Pollution) Act, 1981, its Rules and amendments	Prevention and control of air pollution. State PCBs have been set up to monitor and manage activities that would lead to air pollution in and around the project area. Under the Act air quality standards are to be maintained in residential, ecologically sensitive areas.	During construction phase, likely use of diesel generators, movement of heavy transport on unpaved or semi-paved roads may cause air pollution. Contractor is required to keep all his vehicles maintained and control all the construction activities so that ambient air quality remain within prescribed limit. The bid documents for civil works contracts shall mention that the contractor would comply with the standards mentioned in this rule. Necessary permits to be taken by the contractor for DG set and Batching plant if applicable.
7	Hazardous & Other Wastes Management and Trans boundary Movement) Rules, 2016	Proper handling storage and disposal of hazardous waste.	Project has potential to generate hazardous waste (Used Oil) during both construction and operation phases. The same shall be handled as per the applicable rules of the Act. The Bid document would include clauses to ensure that the Contractor has systems in place to comply with the Hazardous waste regulations During the Operationphase the Vesel Operators will also follow the procedures and comply with the rules

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
8	E- Waste Management Rules 2016	The e-waste especially unused cables, electrical switches may be generated during construction and unused computers, laptops, cables etc. during operation of terminal.	Provisions in the bid document be made for disposal of e-waste by contractor. During implementation project proponent will implement the provision of this Act for disposal of e-waste.
9	Plastic Waste Management 2016	The plastic waste like polythene, plastic bags, plastic bottles etc. during project construction and operation phases.	Bid document shall have clauses for ensuring single use plastics are not used in the project. In operation phase, project proponent will implement the provision of this Act for disposal of Plastic waste.
10	Battery management and handling rule 2010	The shipping boat needs different type of batteries for their operation.	Project proponent and boat operators must follow this Act/Rules. This is especially applicable during the operation phase for disposal of batteries.
11	Ancient Monuments & Archaeological Sites & remains (AMASR) Act, 1958 & Rules 1959	Ashwaklanta temple is an archaeological site protected under ASI which is located near the proposed terminal.	NOC for the construction of terminal has been received from Director of Archaeology, Assam. Copy enclosed as Annexure- 2
12	Labour laws	All legislations governing the labour including child and women labour, wages, and compensation, working condition and worker welfare will have a bearing on the project	The bid documents for civil works need to include adequate provisions to ensure strict compliance with India's labour laws and regulations
13	National Policy on Safety, Health, and Environment at Workplace	The policy aims to secure health of strength of employees and ensure humane conditions of work, including maternity relief to women	The provisions will apply to ensure that labour camps and working conditions are safe and humane.
14	National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	NIOSH has laid down criteria for a recommended standard: occupational noise exposure. The standard is a combination of noise exposure levels and duration that no worker exposure shall equal or exceed.	Internationally recognized environmental standards. Contractors are required to provide necessary measures to ensure safe working environment. Employee/ Project

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
			workers are also required to ensure that they do not carry out "unsafe act" or "unsafe practices" which jeaopardise the safety of himself or other workers. The Bid document will cary specific clauses on the planning and implementation of Occupational Health and Safety during implementation.
14	Solid Waste Management Rules, 2016	The provisions of the Act prevent littering and mandate proper segregation, collection, storage and disposal of municipal solid waste.	The project will have provisions to manage and dispose solid wastes generated during project construction and operation phases.
15	Construction and Demolition Waste Management Rules, 2016	Rules and regulation for construction & Demolition Waste	The project shall generate construction and demolition waste, which shall be handled as per applicable rules. The same shall be mandatorily included in the bid document for construction works.
16	Minimum Wages Act, 1948	The Act makes it mandatory for the employer to pay every employee in a scheduled employment under him wages at the rate not less than the minimum rates of wages fixed under the Act.	The project involves labour employment; the project will document and monitor paid wages and as far as possible discourage cash payments
17	Child Labour (Prohibition and Regulation) Act, 1986	The Act prohibits the engagement of children in certain employments and to regulate the conditions of work or children in certain other employments.	To prevent contractor from employing child labour who shall come under the purview of the Act; the project will include relevant provisions in the bid document for complying with this Act.
18	Right to Information (RTI) Act, 2005.	The Act provides for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, to promote transparency and accountability in the working of every public authority.	The provisions of this act are bearing on AIWTDS/ contractor etc. For providing the information to the public on their demand.

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
		Under the provisions of the Act, any India citizen may request information from a "public authority" (a body of Government) which is required to reply expeditiously or within thirty days.	
19	RFCTLARR ACT,2013	This Act may be called the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013. It extends to the pan India. The provisions of this Act relating to land acquisition, compensation, rehabilitation, and resettlement, shall apply, when the appropriate Government acquires land for its own use, hold and control, including for Public Sector Undertakings and for public purpose. Independent SIA (Social Impact Assessment) study needs to be conducted	Not Applicable, as the project land is government land.
20	Assam LAAR Rules 2015	This Act may be called the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules 2015.It extends to the whole state of Assam. Similar provisions for SIA (Social Impact Assessment) study also exist in this act.	Not Applicable as the project land is government land
18	Sexual Harassment at the workplace (Prevention, Prohibition and Redressal), 2013	Sexual harassment at the workplace is prohibited by law and can lead to disciplinary, civil, and criminal action. This means that an employer can act for a misconduct against an employee and can impose any penalty, including fines and dismissal, on any employee found guilty of sexual harassment.	AIWTDS has established an Internal Complaints Committee (ICC) on 16th September'2020 for redressal of sexual harassment complaints as per the requirements of this act.

3.2.1 Other Relevant Acts

There are certain acts which are applicable to this project directly or indirectly are listed below:

- The Employees' Provident Funds and Miscellaneous Provisions act, 1952: The record of Provident Fund deduction along with wages of labour given by contractor to be kept in record by the WRD. *(As per Appendix A, 18 B);*

- Equal Remuneration Act, 1976- Record of equal remuneration to men and women workers for similar nature of work needs to be maintained by contractor. *(As per Clause no. 4 & 8 of Act)*

- Inter-State Migrant Workmen's (Regulation of Employment and condition of services) Act, 1979-Record of registration of inter-State migrant workmen needs to be maintained by contractor. *(As per Clause no. 4 & 23 of Act)*

- Central Motor Vehicle Act, 1988 and Central Motor Vehicle Rules, 1989: Record of Vehicles used in project to be maintained like date of registration, insurance papers, fitness certificate, PUC etc. (As per Clause no. 115 & 139 of Act)

- Public Liability Insurance Act and Rules, 1991- Contractors shall undertake the public liability Insurance for their work for a value commensurate with work involved. (for immediate relief in case of any untoward incidence)

- The building and others construction workers (Regulation of Employment and conditions of services) Act, 1996: The record of welfare measures for labours, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace needs to be maintained by Contractors. *(As per Clause no. 30 of Act)*

3.2.2 Legislation Framed for Vessels Playing in Inland Waterways

There are certain legislations framed for vessels playing in Inland Waterways by IWAI and Ministry of Ports, Shipping and Waterways, GoI are given in **Table-3.2.**

Table 3.2: Regulations Applicable on Vessels Plying in Inland Waterways

Name	Key Requirements	Applicability
Prevention of Collision on National Waterways Regulations, 2002	Precautions required for vessels and crew members	Applicable for all the vessels plying in IWT
National Waterways, Safety of Navigation and Shipping Regulations, 2002	Ensuring safety during navigation on the national waterways	Applicable for all the vessels plying in IWT
The National Waterway Act, 1982	Regulation and development of rivers for navigation	Applicable for all the rivers under IWT
New Inland Vessel Act, 2015 & Rules Under IV Act	Economical and safe transportation through inland waters	Applicable for all the vessel plying in IWT
National Disaster Management Guidelines, Boat Safety, September 2017	NDMA prepared National Guidelines on Boat Safety. The guidelines include action points towards drawing procedures and regulatory elements by states to streamline the passenger boat navigation in the established waterways in the regions	Most of the boat tragedies were on account of overloading and various other factors. Project proponent and all boat operators needs to follow these guidelines.

3.3 WORLD BANK POLICIES AND REQUIREMENTS

The Project is being implemented through AIWTDS, Assam financed by World Bank and AIWTDS would comply with the Environmental and Social Framework of WB.

The WB environmental and social safeguards frameworks for this project include the following:

The Project will be subject to the provisions of the Access to Information Policy and other related World Bank requirements concerning the disclosure of environmental and social information. The proposed project is also subject to World Bank review and clearance prior to disclosure. The consultant will provide all required assistance to AIWTDS to meet these disclosure requirements. Key documents will be made available in both English and local language.

The World Bank has published a number of Safeguard Policies and Guidelines to ensure that all possible impacts are taken care of by implementing mitigation measures in the proposed project.

Project involves augmentation of navigation capacity of existing IWT by developing various facilities like terminals, jetties, navigation aids etc. The project is likely to occur impacts on quality of life, livelihood, social status, economy, terrestrial and aquatic ecology, air quality, water quality, noise levels etc. The anticipated impacts are both positive and negative but will be significant.

The Project activities at North Guwahati shall include piling works in a sensitive ecological hotspot of dolphins and other aquatic species which might have impacts on this habitat. It is thus considered Category A from the environment point of view. The social impacts are limited to 5 number of squatters so the project is considered as Category B.

Chapter 4 - STAKEHOLDERSCONSULTATION AND DISCLOSURE

4.1 INTRODUCTION

The stakeholder consultation process helps in positive support of general public and due to involvement of locals in the decision-making process. These consultations help to acknowledge the Project Affected Persons (PAPs), if any, about the project. The relevant information is exchanged, observations, suggestions given by the people are documented.

4.2 STAKEHOLDER MAPPING

Stakeholder could be an individual, group or organization those are likely to be impacted by the proposed project. Stakeholder mapping has been done to list the key stakeholders and classified under categories as detailed below:

Table 4.1: Stakeholder Mapping

Stakeholder	Rationale	Relevance to the project	Strategy for engaging the Stakeholder
Category-1- Ferry Operators			
Ferry operators (Government & Private Operators) Association	Livelihood & Service Delivery	Better quality of Service	FGDs
Category -2-Project Impacted Groups			
Local Panchayat Leaders	Facilitation Support	Opinion leaders	Questionnaire/ Interviews
Various ward level relevant officers	Data facilitation and supports	Providing village level information	Questionnaire/ Interviews
Category -3- Community leaders/ Panchayat level officers			
Panchayat Leaders	Facilitation Support	Opinion leaders	Questionnaire/ Interviews
Various Village level/ ward level relevant officers	Data facilitation and supports	Providing village level information	Questionnaire/ Interviews
Category -4-Government Offices			
Revenue Department	Details of land ownership/ transfer/ LA	Land details and transfer	Official communication
Public Works Department (PWD)	Valuation of Structures	Impacted structures to be valued as per PWD rates	Official communication
Forest Department	Where ever forest land impacted	Land transfer	Official communication
State Disaster management authority	Convergent functions	Supportive intervention	Consultations
Fisheries Department	Livelihood impact on PAPs	Mitigate supports/ suggestions	Consultations
Tourism department	Convergent functions	Supportive intervention	Consultations
Labour Welfare Department	Convergent functions	Supportive intervention	Consultations
Archaeology Department	Convergent functions	Supportive intervention	Consultations

State Pollution Control Board	Primary Support	Project facilitation	Consultations
Category-5- Civil society organizations, Academics and Media			
Non-Government Organizations (NGOs)	Project supports	Supportive interventions	Consultations
Educational Institutes	Project supports	Supportive interventions	Consultations
Media	Media Supports	IEC supports	Consultation/ contract
Category-6- Commuter and users			
Passengers/ Small Traders/ Business categories/ tourists	Primary stakeholder	Beneficiaries of the project	FGDs

4.3 MODE OF COMMUNICATION WITH STAKEHOLDERS

The stakeholder consultations were conducted in following order:

- **Formal consultations-**Formal consultations were taken up with formal communications and identified stakeholders.
- **Stakeholder Meeting** – These are the major stakeholder meetings inviting all important stakeholders.

4.4 FOCUS GROUP DISCUSSIONS (FGDs)

In addition to the Stakeholders Consultation Meeting a series of Focus Group Discussions (FGDs) were also organized at terminal site with Commuters, Traders, Ferry Operators and members of influential Bodies.

4.4.1 Approach and Methodology

The Focus Group Discussions (FGDs) were organized with key stakeholders to get their views and suggestions on proposed terminal locations. Daily commuters, tourist, nearby shopkeepers/ vendors, ferry operators, members of union/ temple committee were purposively selected for the discussions. The team members were trained enough to ensure that all participants are comfortable and engaged with the discussions, and that their opinions were noted down.

4.4.2 Tools Used

A semi structured schedule **(Annexure- 3)** was used to collect the first-hand information from the selected groups. A team comprising both male and female including the personnel well versed in local vernacular language and culture were engaged in organizing the FGDs at nearby and proposed terminal locations.

4.4.3 Focus Group Discussions (FGDs) at Priority Terminals

Focus Group Discussions (FGDs) with different groups of people were conducted in the month of May'2022 (05.05.2022 & 06.05.2022) to ascertain views of the participants on the proposed project. The Concerns raised in the Focus Group Discussions (FGDs) organized at North Guwahati Terminal are presented below:

Table 4.2: Focus Group Discussions (FGDs) Details

Focused Group	Concerns Raised	Response & mitigation Measures
Regular Commuters (Temple priest, vendors)	• Concessional monthly ticket card to save money and time • Electronic Display systems at terminals • Approach road needs to be widened • Separate corridor for two wheelers for boarding and de-boarding ferry • Preference for elderly and physically challenged • Child care facilities • Washroom facility at terminals/ pontoon • Drinking water facility	• New structure to have wider approach road and corridor • Special design to cater the elderly and physically challenged people • Digital display system proposed at terminal sites • Drinking water facility are also proposed
Occasional Commuters (Tourist and Devotees of all age groups including youth, women, aged persons and children)	• Increase in number of ferry rounds during festive seasons • Washroom facility at ferry/ terminals/ pontoon specially for women	• Digital display system proposed at terminal sites • Construction of new and proper washrooms and drinking water facility are also proposed
Shopkeepers	• -	-
Ferry Operators	• Approach road to the ghat becomes slippery and dangerous during rainy seasons • Parking area must be well developed • Deployment of security personnel at the Ghats as the passengers sometimes become unruly • Member of the samiti requested to make diversion arrangements from construction site, so that entry of customers to shops must be free from all obstacles.	• Up gradation will be beneficial to ferry operators as well as commuters

4.5 CONSULTATION MEETINGS

The several consultation meetings with different stakeholders and officials of line departments were done during site visits. Specific details of the meetings are presented in section below:

4.5.1 Vessel Operators

Inland Water Transport Officials (Date: on 8th May 2022)

The vessels mainly operated by IWT, is responsible for the vessel operation, vessel maintenance, managing the ticketing system and the daily commuters.

Terminal is also operated and maintain by the IWT department and is responsible for operation of the terminal as a whole. This includes cleanliness of the area around the terminal, managing the crowd, handling the crisis situations, and also looking after the safety and security of the travellers.

Consultation meeting with Operators (IWT) on 8th May 2022

During the consultation officials pointed out some difficulties they faced while operating are as follows:

- Shifting of the existing Ghats during rainy seasons/dry season.
- Lack of proper operating space
- Limitations of the existing facilities and expressed need for better facilities and services.
- Modified pontoon with space for office & ticket counter
- Mandatory to wear safety jackets to all before boarding
- Creche/ baby care facilities
- Deployment of additional security personnel on the boat to look after the passenger's safety and security.

4.5.2 Relevant Department Officials on 7th May 2022

Consultation meetings were also done with officials of other relevant departments to get their views and concerns over the proposed development project.

Consultation Meetings with Relevant Department Officials on 7th May 2022

Concern Raised

- Terminals should be modified in the way that urban as well as rural commuters can avail the services with ease
- Oil spillage
- Waste management
- Safety norms for passengers and staff
- Online and offline ticket availability
- Separate entry and exit for women commuters
- River Bank protection done by Brahmaputra Board with Geobags.

4.5.3 Vendors on 6th May 2022

Interaction and formal meetings with the vendors sited in the proposed project were also done, with the support of Divisional IWT officials at terminal site. The access/ approach road to terminal sites has 05 (five) vendors who are earning their livelihood through temporary shops will be affected. However, it must be noted that the above given number of squatters are tentative. The actual numbers of squatters to be affected due to proposed terminal will be finalized after detailed census survey by land/ revenue department.

4.5.4 Institutional Stakeholders Consultation on 7th May 2022

Stakeholder's consultation was carried out as an integral part of the social and environmental assessment process of the project with an objective to inform and educate stakeholders about the proposed actions and to receive and record perceptions about the project. It assisted in identification of the likely issues and problems associated with the project as well as the needs and concerns of the population likely to be impacted. This participatory process helped in reducing the concerns in general and enabling participation of the line departments in particular in development process. The summary of interaction with institutional stakeholders and participants list are enclosed as **Annexure- 4.**

Stakeholder meetings were held at different venues and time:

- **Conference hall of Hotel Lily, Guwahati on May 7, 2022.**
  A stakeholders consultation meeting was organized on 07.05.2022 at conference hall, hotel Lily Guwahati, Assam by AIWTDS. The details about the project were presented by AIWTDS and safeguards consultants explained about the different kind of studies and safeguard measure planned for proposed project.

4.5.5 Conference hall of AIWTDS, Guwahati on February 6, 2023

A stakeholders' consultation to present DPR and draft ESIA findings for North Guwahati and Umananda Ghat was organized by AIWTDS at conference hall, AIWTDS on 06.02.2023 under the Chairmanship of State Project Director, AIWTDS and Honorary Advisor, AIWTDS. The official of AIWTDS, invitees from line departments, temple committee members attended the meeting. The photographs of FGDs are given in **Annexure-5**.

4.5.6 Stakeholder Suggestions and Design Considerations

The project proponents assured that the feasible suggestions given by stakeholders will be incorporated into the design/planning and implementation of the project. Details of the stakeholder suggestions and its considerations are presented in **Table-4.3.**

Table 4.3: Stakeholder Suggestions and Design Considerations

S No.	Key Findings/ Project Considerations	Design/ Implementation Inclusions
1	Need for widening of approach road	Standard Ramp with protective hand rail for barrier free entry- design consideration (ramp configuration, width, slope and landings, handrail, surface and tactile markings) for access to wheelchair users and people with mobility problems
2	Separate entry and exit points	Segregation of departure and arrival points and split between pedestrian movement and vehicular movement
3	Proper displays and announcements at the jetty locations is essential	Provision of signage of appropriate visibility and provision for audio announcements
4	Provision of better facilities	Appropriate waiting areas and entrance lobbies, shops, room, restaurants, storage area, nursing rooms, security & toilets. Provision of at least one water drinking tap suitable for people with disabilities.
5	Facilities for disabled and elderly passengers	Barrier free environment for differently abled and elderly
6	Medical/ First aid	Provision of first aid Services

S No.	Key Findings/ Project Considerations	Design/ Implementation Inclusions
7	Toilets	Provision of clean, gender segregated, well-lit wheelchair accessible toilets.

4.6 PLANNED INFORMATION DISCLOSURE

The PMU will ensure that relevant information about environmental and social safeguard issues are made available in a timely manner, in an accessible place, and in a form and language(s) understandable to the public and other stakeholders. The purpose of such disclosure is that the public can provide meaningful inputs into project/subproject design and implementation.

This ESIA/ESMP will be disclosed at the state level in the project website. Printed copies will be made available upon request at the AIWTDS. Further, the executive summary of this ESIA will be available in English and translated to the local language, Assamese. This will also be available as an easy-to-download document in the project website. The website disclosure will be kept up-to-date throughout project implementation. In addition, the ESIA/ESMP (in hard copy) will be made available for public access at the Panchayat office, Block office, local body offices and District administration and also at the existing/ temporary terminal location. The documents will also be circulated to all stakeholder departments.

Chapter 5 - ENVIRONMENTAL AND SOCIAL BASELINE STATUS

5.1 GENERAL

Before the start of any Environmental and Social Impact Assessment (ESIA) study, it is necessary to identify the baseline levels of relevant environmental parameters which are likely to be affected because of the construction and operation of the proposed project.

5.2 STUDY AREA

Based upon the area likely to be affected either directly or indirectly by project component, including ancillaries and linked activities, as well as unplanned induced developments. The Area of Influence (AoI) is the area within 500m radius considered for collection of baseline data. Whereas the area within 10 km radius from the proposed terminal is considered as study area. The primary and secondary data has been collected for various environmental components of the study area to establish the baseline environmental status. The study area maps of North Guwahati are shown in **Figures 5.1.**

The baseline status has been categorized as follows:

- Physico-Chemical Aspects
- Ecological Aspects
- Socio-economic Aspects

5.2.1 Monitoring Period

Most of the environmental monitoring was carried out during summer season (March to May) 2022, how study of aquatic ecology was carried out in September 2022 and air quality monitoring was carried out in August 2022, depending on availability of non-rainy days. Monitoring for various aspects was done as per the details given below:

- Physico-Chemical Aspects
    - Soil quality - 30th March 2022
    - Water quality - 30th March 2022
    - Air quality - 2nd August to 29th August 2022
    - Noise - 4th August 2022
- Ecological Aspects
    - Terrestrial Ecology - 8th March 2022
    - Aquatic Ecology - 5th September, 2022
- Socio-economic Aspects
    - Social Aspects - 8-11th May 2022

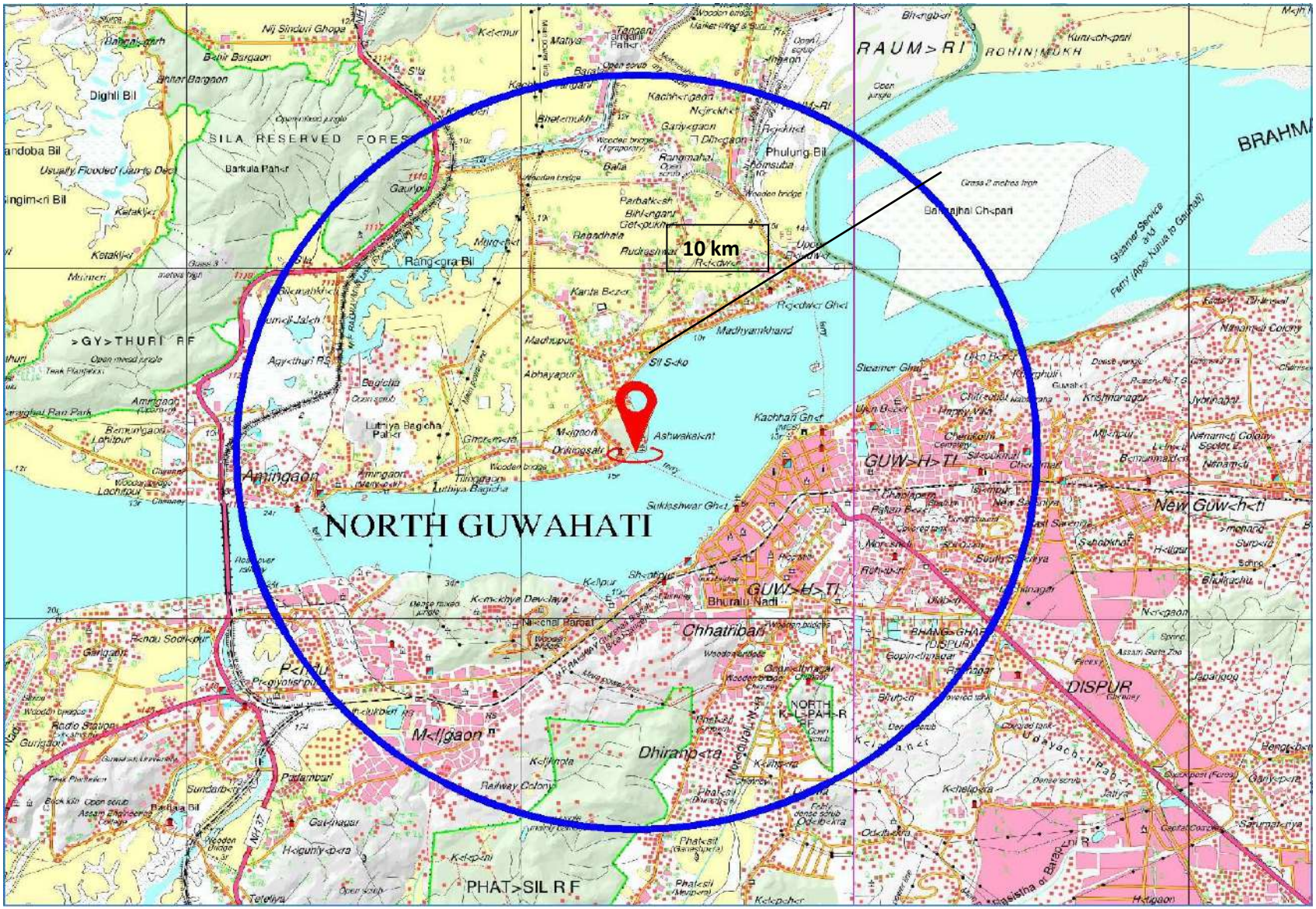


Figure 5.1: Study area map of North Guwahati terminal

5.3 PHYSICO-CHEMICAL ASPECTS

Meteorology

The project area is within sub-tropical humid climatic zone. It is characterized by hot and wet summer and dry and cool winter. The annual rainfall is reported as 1751.8 mm. The mean monthly temperature ranged from 19.8°C to 29.5°C, and the relative humidity is generally high throughout the year, with highest during south-west monsoon months. With the retreat of south-west monsoons, there is a marginal decrease in humidity. The lowest humidity is observed for the period from February to April.

Geology

In the surroundings of Guwahati, several hillocks arise from the flat alluvial plain. The Study area is also hillock rather consists of old gneissic rocks. Series of similar hillocks and hills that rise from the Brahmaputra plain can be found on several places along the plain on either side of the river. They all are continuations of the Shillong plateau which mainly consists of gneissic rocks from the Precambrian eon that have inhomogeneous appearance and colour variation and that sometimes expose minerals in form of bands or spots. Rocks of this type were developed by a metamorphic process under high temperature and pressure conditions when the originally igneous or sedimentary rocks are deeply covered under other layers of rocks. The layers of original rocks are reflected by foliation called “gneissic banding”. Later on, gneissic rocks can appear at the surface when the covering layers are all eroded away and the low layers are lifted by tectonic forces.

North Guwahati project site falls into central cluster as per geological location. The soil/ rock deposits encountered have been grouped into different soil/ rock units as given in **Tables 5.1 and 5.2.**

Table 5.1: Summary of soil layers w.r.t. land borehole

Unit	Description	Depth below GL m
Soil Unit 1	Firm to stiff silty CLAY	0 – 10.5
Soil Unit 2	Not encountered	-
Soil Unit 3	Medium dense to very dense SAND	10.5 – 13
Rock Unit 1	Completely weathered Granite ROCK	13 – 28

***Source:** DPR- 2023*

Table 5.2: Summary of soil layers w.r.t. river borehole

Unit	Description	Depth below GL m
Soil Unit 1	Not encountered	-
Soil Unit 2	Not encountered	-
Soil Unit 3	Medium dense to very dense SAND	0 - 2
Rock Unit 1	Completely weathered Granite ROCK	2 – 17

***Source:** DPR-2023*

Seismicity

Assam is among the most seismically active parts of India. Geomorphologically, northeast India is located in an earthquake prone zone (zone V) of the Indian subcontinent as per Seismic Zoning Map of the country given in IS 1983 (part I): 2002.

Land use Pattern

The land use pattern of the study area has been studied through digital satellite imagery data. Sentinel data has been used to describe the present Land Use pattern of the Area. The category wise details of Land use pattern of North Guwahati terminal are given in **Table 5.3** and **Figure 5.2.**

Table 5.3: Land use Pattern of North Guwahati Terminal

S. No	Category	Area (m^2)	Percentage (%)
	North Guwahati		
1.	Built Area	421158.89	53.59%
2.	Waterbodies	364753.67	46.41%

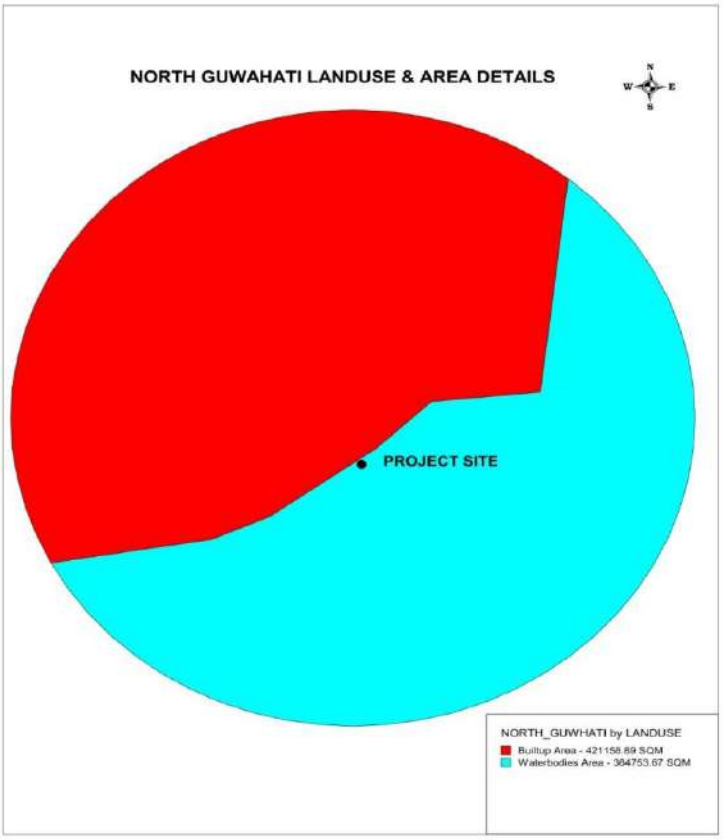


Figure 5.2: Land use pattern of North Guwahati Terminal

Soil Quality

As a part of field studies, soil samples were collected at 2 locations from upstream and downstream of proposed terminal location in the study area. Sampling location is first cleared of surface litter. Auger was driven to a depth of 15 cm below the ground and soil sample was drawn. Soil samples were then carefully packed and labelled. Samples were then analysed at the NABL accredited laboratory. Sampling locations of North Guwahati Terminal are listed in **Table 5.4**. The sampling location map is enclosed as **Figure 5.3.**

Table 5.4: Details of Soil Sampling Locations

Sampling Code	Location	Coordinates
SNG1	North Guwahati (150 m u/s of terminal)	26°11'12.31"N 91°43'21.82"E
SNG2	North Guwahati (150 m d/s of terminal)	26°11'7.37"N 91°43'14.92"E

The analysis of soil sampling was conducted as per IS 2720 and results are given in **Table 5.5**. Laboratory monitoring reports for soil testing are enclosed as **Annexure- 6**. The pH was in the range of 7.54 to 7.81 which indicates that neutral range having slight alkalinity. The EC values are ranging between 423 to 469 µS/cm. The soil type of the area is sandy clay loam.

Table 5.5: Results of soil sampling analysis of study area for North Guwahati terminal

S. No	Parameters		SNG1	SNG2
1.	pH (1:5 suspension)		7.81	7.54
2.	Electrical Conductivity @ 25^0C (1:1 suspension)		469	423
3.	Calcium (As Ca)		1578	1376
4.	Magnesium (As Mg)		365	325
5.	Sodium (as Na)		139	153
6.	Available Potassium (as K)		271	283
7.	Salinity @ 25^0C (1:1 suspension)		245	228
8.	Organic Matter		0.74	1.05
9.	Sodium Absorption Ratio		1.01	1.03
10.	Nitrogen		0.12	0.11
11.	Available Phosphorus (As P_2O_5)		86	115
12.	Bulk Density		1.21	1.18
13.	Organic Carbon		0.43	0.61
14.	Particle Size Distribution	a. Sand	59.4	58.2
		b. Clay	22.1	18.6
		c. Silt	18.5	23.2
15.	Exchangeable Sodium Percentage		4.75	3.69

Figure 5.3: Soil sampling Location map of North Guwahati terminal

Water Quality

The proposed terminals are located on the banks of river Brahmaputra. As a part of the field studies, water samples were collected at 2 suitable locations in the study area for each terminal. Sampling from the river was done at mid depths. Glass containers were filled completely and closed in such a way that there is no air above the sample. Samples were then labelled and analysed at the NABL accredited laboratory for physic-chemical parameters. Details of sampling locations are listed in **Table 5.6.** The sampling location map is enclosed as **Figures 5.4.**

Table 5.6: Details of Water Sampling Locations

Sampling Code	Location	Co-ordinates
WNG1	North Guwahati (150 m u/s of terminal)	26°11'12.31"N 91°43'21.81"E
WNG2	North Guwahati (near terminal site)	26°11'9.91"N 91°43'18.98"E
WNG3	North Guwahati (250 m d/s of terminal)	26°11'5.52"N 91°43'12.93"E

The analysis of water samples was conducted as per IS:3025 and results of the analysis are given in **Table 5.7**. Laboratory monitoring reports for water quality are enclosed as **Annexure-7**. The results of water quality monitoring have been compared with Drinking water standards **Annexure- 8**.

The Electrical Conductivity (EC) in water samples ranged from 218 to 258 μS/cm and total hardness ranged from 49.0 to 60.0 mg/l. Dissolved oxygen values ranges from 6.4 to 6.7 mg/l.

The BOD and COD levels at all the terminals are quite low and DO levels are quite good, which indicates the absence of organic pollution loading. This is mainly due to the low population density and absence of industries in the area. The heavy metal concentration in the study area is below the permissible limit used for drinking purposes. It can be concluded that water quality was observed to be quite good, as parameters are well below the permissible limits specified for meeting drinking requirements.

Figure 5.4: Water sampling Location map of North Guwahati terminal

Table 5.7: Water quality in the study area for North Guwahati terminal

S. No	Parameters	WNG1	WNG2	WNG3
1.	pH	7.68	7.80	7.64
2.	Colour	<5.0	<5.0	<5.0
3.	Electricity Conductivity	258	228	218
4.	Turbidity	<1.0	<1.0	<1.0
5.	Total Hardness (As $CaCO_3$)	58.0	49.0	60.0
6.	Fluoride (as F)	0.28	0.19	0.22
7.	Dissolve Oxygen	6.7	6.6	6.4
8.	Chloride (as Cl)	26.0	26.0	32.0
9.	Calcium (as Ca)	13.0	15.0	17.0
10.	BOD (3 days at 27^0C)	<2.0	<2.0	<2.0
11.	Nitrate (as NO_3)	1.5	1.2	2.6
12.	Total Dissolved Solid	168	148	142
13.	Sulphate (As SO_4)	2.8	3.5	4.0
14.	Magnesium as Mg)	6.2	2.8	4.3
15.	Phosphate (as P)	<0.05	<0.05	<0.05
16.	Sodium (as Na)	1.6	2.0	2.5
17.	Potassium (as K)	<1.0	<1.0	<1.0
18.	COD (as O_2)	6.0	4.0	6.5
19.	Residual Sodium Carbonate	Nil	Nil	Nil
20.	Total Chromium (as Cr)	<0.05	<0.05	<0.05
21.	Iron (as Fe)	0.11	0.12	0.14
22.	Manganese (As Mn)	<0.10	<0.10	<0.10
23.	Copper (As Cu)	<0.05	<0.05	<0.05
24.	Zinc (as Zn)	0.09	0.13	0.17
25.	Arsenic (as As)	<0.01	<0.01	<0.01
26.	Cadmium (as Cd)	<0.01	<0.01	<0.01
27.	Cyanide (As CN)	<0.01	<0.01	<0.01
28.	Lead (As Pb)	<0.01	<0.01	<0.01
29.	Selenium (as Se)	<0.01	<0.01	<0.01
30.	Mercury (Hg)	<0.001	<0.001	<0.001

Ambient Air Quality

Air pollutants are added in the atmosphere from variety of sources that change the composition of atmosphere and affect the biotic environment. Air pollution in India is mainly caused from three sources namely vehicles, industrial and domestic sources. The concentration of air pollutants depends not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions.

Ambient air quality monitoring is conducted to assess the existing quality of ambient air from the active construction site. It helps us to understand the impact of emissions, from on-going/up-coming projects, on surrounding environment of the area. On the basis of these findings, mitigation measures suggested to minimize the impact and to keep the environment healthy.

As a part of field studies, ambient air quality was monitored at three locations (on the basis of wind direction i.e., North-East (NE) - 1 each in windward, leeward and crosswind direction) for each terminal in the study area. The ambient air quality monitoring was conducted twice a week on 24

hourly basis for four consecutive weeks. Monitoring was done following CPCB guidelines. The sampling locations are shown in **Figure 5.5.** The ambient air quality monitoring stations are given in **Table 5.8**.

Table 5.8: Ambient Air Quality Monitoring Stations

Sampling Code	Location	Coordinates
AAQ-NG1	North Guwahati	26°11'12.48"N 91°43'21.57"E
AAQ-NG2	North Guwahati	26°11'2.16"N 91°42'53.39"E
AAQ-NG3	North Guwahati	26°11'19.77"N 91°42'43.57"E

Ambient Air Quality monitoring results are given in **Tables 5.9** to **5.12.** Laboratory monitoring reports for air quality are enclosed as **Annexure- 9**.

Figure 5.5: Air sampling Location map of North Guwahati terminal

Table 5.9: Ambient air quality monitoring at North Guwahati terminal (AAQ-NG1)

S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)	O_3 (µg/m^3)	NH_3 (µg/m^3)	Pb (µg/m^3)	Ni (ng/m^3)	As (ng/m^3)	Benzene (µg/m^3)	Benzo(a) pyrene (ng/m^3)
NAAQ standards		**100**	**60**	**80**	**80**	**02**	**100**	**400**	**1.0**	**20**	**06**	**05**	**01**
1	02.08.2022	55.7	34.8	6.4	18.1	0.46	22.7	11.3	<0.01	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	60.3	33.5	6.9	19.6	0.54	21.3	10.6	<0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	48.1	28.3	<6.0	15.7	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	52.4	27.6	<6.0	16.3	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	63.1	31.6	7.2	21.5	0.74	24.1	12.0	0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	59.2	34.8	6.4	18.4	0.62	20.5	10.3	<0.01	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	54.3	25.9	<6.0	15.6	0.44	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	64.1	35.6	<6.0	16.3	0.48	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5

**Source: Primary survey*

Table 5.10: Ambient air quality monitoring at North Guwahati terminal (AAQ-NG2)

S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)	O_3 (µg/m^3)	NH_3 (µg/m^3)	Pb (µg/m^3)	Ni (ng/m^3)	As (ng/m^3)	Benzene (µg/m^3)	Benzo(a) pyrene (ng/m^3)
NAAQ standards		**100**	**60**	**80**	**80**	**02**	**100**	**400**	**1.0**	**20**	**06**	**05**	**01**
1	02.08.2022	53.1	33.2	6.4	19.6	0.44	21.7	10.8	<0.01	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	48.7	27.1	<6.0	15.1	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	46.3	27.2	<6.0	15.7	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	51.7	27.2	6.2	17.6	0.48	20.3	10.2	<0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	53.8	26.9	6.8	20.3	0.46	23.1	11.5	<0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	52.5	30.9	<6.0	16.8	0.54	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	46.8	22.3	<6.0	15.7	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	44.7	24.8	<6.0	14.3	0.34	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5

**Source: Primary survey*

Table 5.11: Ambient air quality monitoring at North Guwahati terminal (AAQ-NG3)

S.N.	Date	PM_{10} (µg/m3)	$PM_{2.5}$ (µg/m3)	SO_2 (µg/m3)	NO_2 (µg/m3)	CO (mg/m3)	O_3 (µg/m^3)	NH_3 (µg/m^3)	Pb (µg/m^3)	Ni (ng/m^3)	As (ng/m^3)	Benzene (µg/m^3)	Benzo(a) pyrene (ng/m^3)
NAAQ standards		**100**	**60**	**80**	**80**	**02**	**100**	**400**	**1.0**	**20**	**06**	**05**	**01**
1	02.08.2022	73.1	45.7	7.4	23.1	0.76	24.3	12.1	0.02	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	68.7	38.2	6.9	19.6	0.64	21.8	10.9	0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	74.8	44.0	7.7	24.7	0.78	25.7	12.8	0.02	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	67.5	35.5	<6.0	16.8	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	65.3	32.7	<6.0	15.9	0.66	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	74.1	43.6	7.4	21.3	0.54	23.5	11.8	0.02	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	67.8	32.3	6.2	18.1	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	72.5	40.3	<6.0	15.2	0.52	22.7	11.3	0.01	<5.0	<1.0	<4.2	<0.5

**Source: Primary survey*

Table 5.12: Summary of ambient air quality monitoring for North Guwahati terminal (Unit: □g/m3)

Station	Minimum	Maximum	Average	98 percentile
Particulate Matter less than 10 micron (PM_{10})				
AAQ-A1	48.1	64.1	57.2	64.0
AAQ-A2	44.7	53.8	49.7	53.7
AAQ-A3	65.3	74.8	70.5	74.7
Particulate Matter less than 2.5 micron ($PM_{2.5}$)				
AAQ-A1	25.9	35.6	31.5	35.5
AAQ-A2	22.3	33.2	27.4	32.9
AAQ-A3	32.3	45.7	39.0	45.5
Sulphur dioxide (SO_2)				
AAQ-A1	6.4	7.2	6.7	7.2
AAQ-A2	6.2	6.8	6.5	6.8
AAQ-A3	6.2	7.7	7.1	7.7
Nitrogen dioxide (NO_2)				
AAQ-A1	15.6	21.5	17.7	21.2
AAQ-A2	14.3	20.3	16.9	20.2
AAQ-A3	15.2	24.7	19.3	24.5
Carbon Monoxide (CO)				
AAQ-A1	0.4	0.7	0.5	0.7
AAQ-A2	0.3	0.5	0.4	0.5
AAQ-A3	0.5	0.8	0.6	0.8
Ozone (O_3)				
AAQ-A1	20.5	24.1	22.2	24.0
AAQ-A2	20.3	23.1	21.7	23.0
AAQ-A3	21.8	25.7	23.6	25.6
NH_3				
AAQ-A1	10.3	12.0	11.1	12.0
AAQ-A2	10.2	11.5	10.8	11.5
AAQ-A3	10.9	12.8	11.8	12.7
Lead (Pb)				
AAQ-A1	0.01	0.01	0.01	0.01
AAQ-A2	<0.01	<0.01	<0.01	<0.01
AAQ-A3	0.01	0.02	0.01	0.02
Nickel (Ni)				
AAQ-A1	<5.0	<5.0	<5.0	<5.0
AAQ-A2	<5.0	<5.0	<5.0	<5.0
AAQ-A3	<5.0	<5.0	<5.0	<5.0
Arsenic (As)				
AAQ-A1	<1.0	<1.0	<1.0	<1.0
AAQ-A2	<1.0	<1.0	<1.0	<1.0
AAQ-A3	<1.0	<1.0	<1.0	<1.0
Benzene				
AAQ-A1	<4.2	<4.2	<4.2	<4.2
AAQ-A2	<4.2	<4.2	<4.2	<4.2
AAQ-A3	<4.2	<4.2	<4.2	<4.2
Benzo(a) pyrene (ng/m3)				
AAQ-A1	<0.5	<0.5	<0.5	<0.5

Station	Minimum	Maximum	Average	98 percentile
AAQ-A2	<0.5	<0.5	<0.5	<0.5
AAQ-A3	<0.5	<0.5	<0.5	<0.5

The results of air quality monitoring have been compared with National Ambient Air Quality Monitoring Standards **(Annexure- 10)**

It is observed from **Table 5.12** that average concentration of PM_{10} at various monitoring stations ranged from 49.7 to 70.5 $\mu g/m^3$. The highest PM_{10} value was recorded as 74.8 $\mu g/m^3$. The PM_{10} values monitored during the field survey were well below the permissible limit of 100 $\mu g/m^3$ for industrial, residential, rural and other areas.

The average concentration of $PM_{2.5}$ at various monitoring stations monitored ranged from 27.4 to 39.0 $\mu g/m^3$. The highest $PM_{2.5}$ value was recorded as 45.7 $\mu g/m^3$. The $PM_{2.5}$ values monitored during the field survey were well below permissible limit of 60 $\mu g/m^3$ for industrial, residential, rural and other areas.

The average concentration of SO_2 at various stations monitored ranged from 6.5 to 7.1 $\mu g/m^3$. The highest SO_2 value was recorded as 7.7 $\mu g/m^3$. The average concentration of SO_2 at various stations in the study area was well below the prescribed limits of 80 $\mu g/m^3$ specified for industrial, residential, rural and other areas.

The average NO_2 concentration at various sampling stations ranged from 16.9 to 19.3 $\mu g/m^3$. The average concentration of NO_2 at various stations in the study area was observed to be well below the prescribed limit of 80 $\mu g/m^3$ specified for industrial, residential, rural and other areas.

The average concentration of Ozone (O_3), Ammonia (NH_3), Lead, Nickel, Arsenic, Benzene, Benzo(a) pyrene are well below the prescribed limits specified for industrial, residential, rural and other areas. Ambient air quality is thus found to be within the standards.

Ambient Noise Levels

Baseline noise data has been measured using a weighted sound pressure level meter. The survey was carried out in calm surrounding. Sound Pressure Level (SPL) measurement in the outside environment was made using sound pressure level meter. Hourly noise meter readings were taken at various sites. The noise levels were monitored continuously from 6 AM to 9 PM at each location and hourly equivalent noise level was measured. The sampling location map is shown in **Figure 5.6.**

The hourly ambient noise levels monitored and day time equivalent noise levels estimated for terminals are given in **Table 5.13**. The day time and night time equivalent noise level at various sampling stations is given in **Table 5.14**. Monitoring reports for noise quality are enclosed as **Annexure- 11**. The results of noise quality monitoring have been compared with Ambient Noise Standards **(Annexure-12).** The day time equivalent noise level at various sampling stations ranged from 47.02 to 46.72 dB(A). The noise levels were observed to be well within permissible limit (55 dB(A) specified for residential area and (65 dB(A)) specified for commercial area. Thus the baseline ambient noise level is found to be within the standards.

Figure 5.6: Noise sampling Location map of North Guwahati terminal

Table 5.13: Hourly equivalent noise levels- North Guwahati terminal (Unit: dB(A))

Location	N-NG1	N-NG2	N-NG3
6-7 AM	44	43	44
7-8 AM	47	46	45
8-9 AM	47	47	47
9-10 AM	46	45	48
10-11 AM	48	47	49
11-12 Noon	48	48	48
12 noon – 1 PM	47	46	48
1-2 PM	48	47	48
2-3 PM	49	48	49
3-4 PM	49	48	49
4-5 PM	50	49	48
5-6 PM	49	48	48
6-7 PM	48	48	47
7-8 PM	47	47	47
8-9 PM	45	46	45

**Source: Primary survey*

Table 5.14: Day and night-time equivalent noise levels – North Guwahati terminal

S. No.	Location	Co-ordinates	Zone	L_{eq} day (dB(A))	L_{eq} night (dB(A))	Permissible Limit
1.	N-NG1	26°11'12.48"N 91°43'21.57"E	Commercial	47.92	46.8	65
2.	N-NG2	26°11'2.16"N 91°42'53.39"E	Residential	47.08	47.1	55
3.	N-NG3	26°11'19.77"N 91°42'43.57"E	Residential	47.80	46.4	55

5.4 TERRESTRIAL ECOLOGICAL ASPECTS

The baseline setting for Ecological aspects have been covered in this Chapter following floral, faunal and aquatic accounts of the area. Flora is categorized into three groups as herbs, shrubs and trees. Fauna is divided into two groups i.e., terrestrial fauna includes insects (butterflies), reptiles, birds and mammals. As a part of the ESIA study, ecological survey was conducted at different sites in March, 2022, Terminal Proposed AIWTP Guwahati (Assam). The objectives of the ecological survey were to:-

- Prepare a checklist of flora in the study area.
- Listing the rare/endangered species economically important species.
- Determine frequency, density, abundance and IVI of different vegetation components.
- Calculate species diversity indices of different plant communities in the study area.
- Identification of economically important species like medicinal plants, timber, fuel wood etc. and listing accordingly.
- To inventorize the faunal diversity in the study area

5.4.1 Methodology adopted for field survey

Floristic survey and quantitative analysis of vegetation

For assessing the floral diversity in the study area both floristic survey and quantitative analysis of vegetation were undertaken. The quantitative analysis of vegetation was done by using quadrats as sampling units. The quadrats were laid randomly in identified sites (as per project impact). The vegetation analysis was undertaken by collecting numerical community data for trees, shrubs and herbs from the randomly laid quadrats. Quadrat size of 10 m x 10 m was used to enumerate trees, 5m x 5m was used to enumerate shrubs and herbs were enumerated through 1m x 1m quadrats. The numbers of quadrats laid for different vegetation components at different sampling sites are listed in **Table 5.15.**

Table 5.15: Number and size of quadrats laid at different sites at the North Guwahati Terminal

Sites	Vegetation components	Number of quadrats laid	Size of quadrat
North Guwahati Terminal (Bharlu village and adjoining areas)	Tree Shrub Herb	25 25 25	10m x 10m 5m x 5m 1m x 1m

The total basal area was calculated from the sum of the total diameter of immerging stems. In trees, poles and saplings, the basal area was measured at breast height (1.5 meters) and by using the formula πr^2. The importance value index (IVI) for different trees species were determined by summing up the Relative Density, Relative Frequency and Relative dominance. The Relative Density and Relative Frequency values were used to calculate the IVI of shrubs and herbs. The importance value index is a measure of the relative contribution of a species to the community.

5.4.2 Results

Floristic composition

During the floristic survey, a total of 128 plant species were recorded from North Guwahati site. Of these, Herbs (39), Tree (35), Shrubs (26), Climbers (6), Bamboo (4), and Grass (18) species recorded. The graphical analysis is shown in **Figure 5.7.**

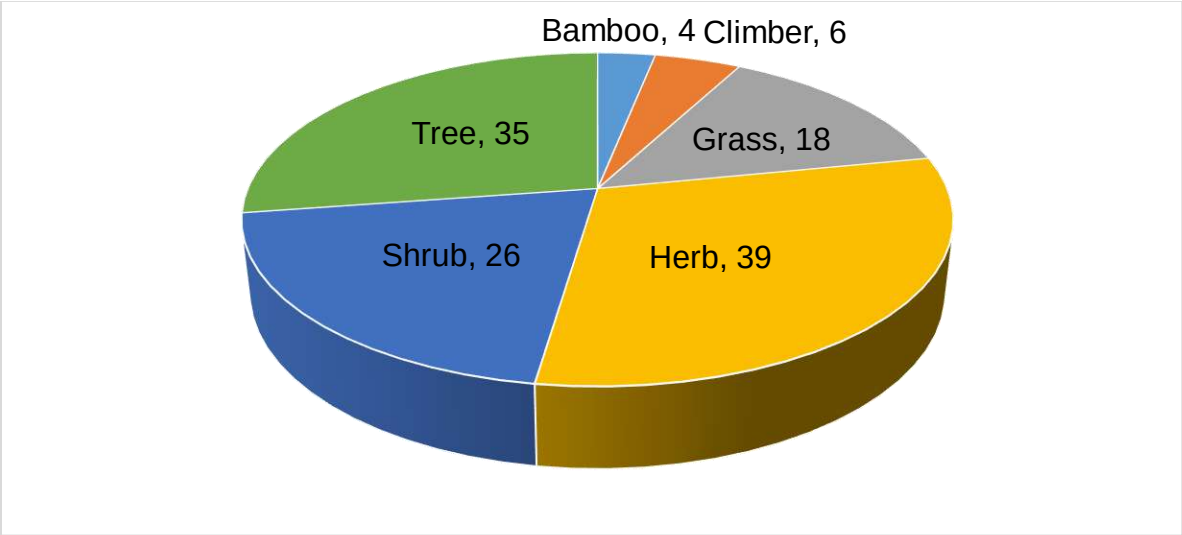


Figure 5.7: Graphical analysis of total number of trees, shrub, herb, grass, and climber

The checklist of the plant species, IUCN status etc. at North Guwahati site, is enclosed as an **Annexure- 13.**

Total of 128, plant species were recorded from North Guwahati were dicot (101), Gymnosperm (1) and monocotyledon (26), belonging to 50 families were recorded in the study area (Ref: **Figure 5.8**). The most dominant families recorded in the study sites were- Poaceae (19), followed by Asteraceae (9), Fabaceae (8), Apocynaceae (6) and Amaranthaceae, Arecaceae, Lamiaceae, Malvacea, Moraceae, Myrtaceae, Polygonaceae, Rutaceae,and Verbenaceae (4) (Ref: **Figure 5.9**).

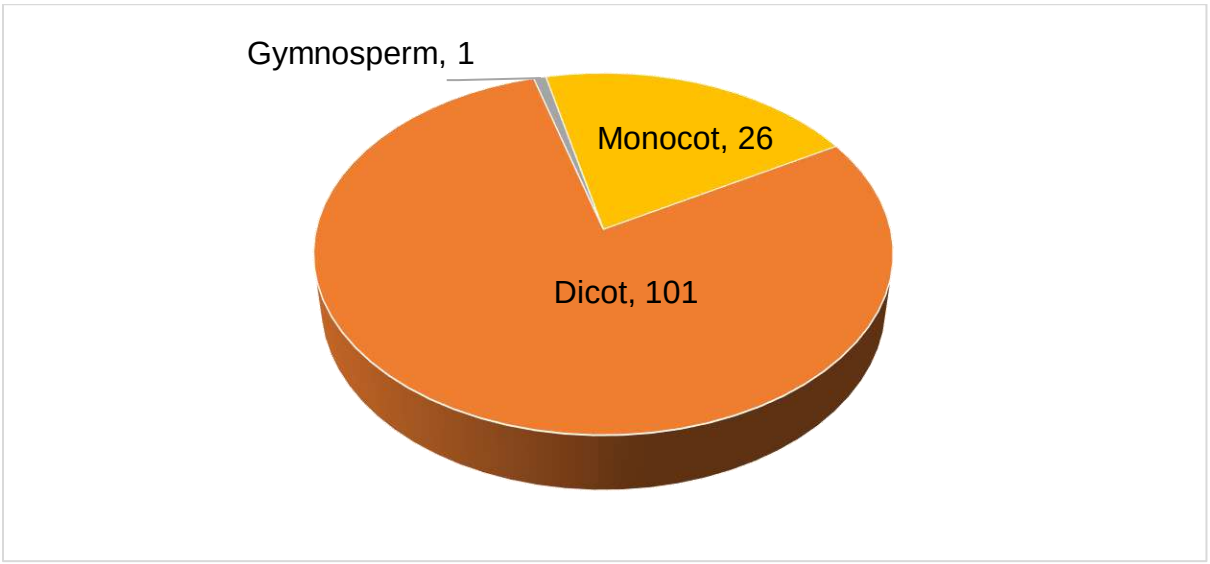


Figure 5.8: Graphical analysis number of Dicot, Gymnosperm and Monocot species

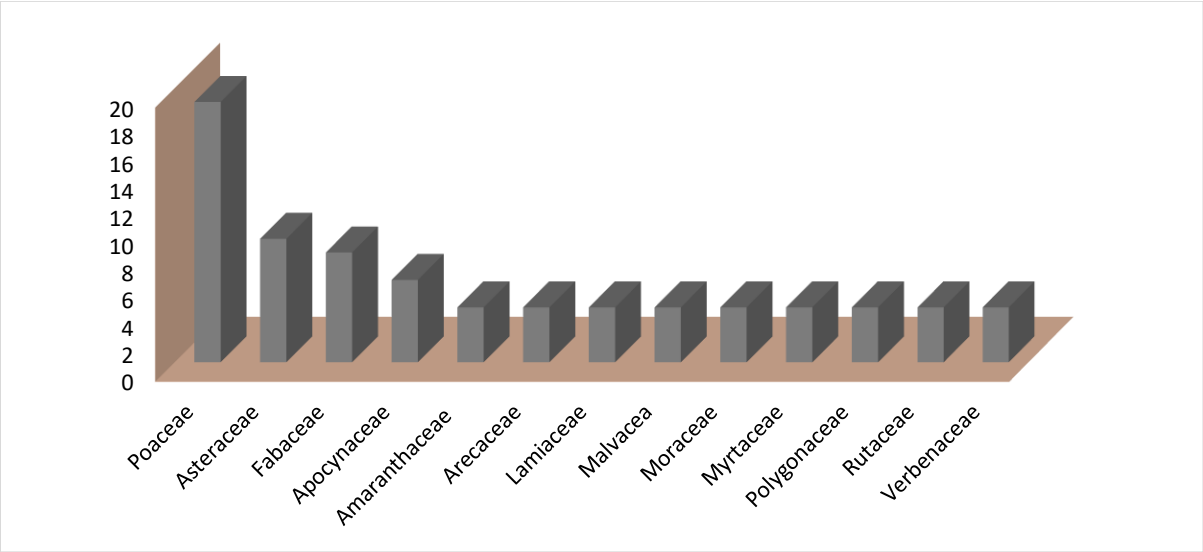


Figure 5.9: Graphical analysis of dominant family, recorded from North Guwahati site

Economically important plant species

The list of some economically important plant species is enumerated in **Table 5.16.**

Table 5.16: Economically important plant species recorded from North Guwahati site

Botanical name	Local name	Usage
Acacia nilotica (L.) Delile	Babool	Fuel wood
Albizia procera (Roxb.) Benth.	Safed siris	Fuel wood/Construction
Albizia saman (Jacq.) Merr.	Rain tree	Fuel wood/Construction
Alstonia scholaris (L.) R. Br.	Devil's tree	Ornamental
Araucaria heterophylla (Salisb.) Franco	Christmas tree	Ornamental
Areca Catechu L.	Tamul	Fruit edible
Artocarpus heterophyllus Lam.	Kothal	Fruit edible
Bambusa arundinacea (Retz.) Willd.	Bara bans	Construction
Bauhinia variegata L.	Kanchan	Ornamental
Bombax ceiba L.	Semal	Ornamental
Callistemon lanceolatus (Sm.) Sweet	Bottlebrush	Ornamental
Carica papaya L.	Papaya	Fruit edible
Cocos nucifera L.	Coconut	Fruit edible
Corymbia citriodora (Hook.) K.D.Hill & L.A.S.Johnson	Safada	Construction/fuel wood
Cyperus rotundus L.	Coco-grass	Fodder
Delonix regia (Hook.) Raf.	Gulmohar	Timber/fuel wood
Dendrocalamus strictus (Roxb.) Nees	Bijuli	Construction
Digitaria ciliaris (Retz.) Koeler	Crabgrass	Fodder
Ficus religiosa L.	Peepal	Religious

Botanical name	Local name	Usage
Mangifera indica L.	Aam	Fruit edible/fuel wood
Musa × paradisiaca L.	Kala	Fruit edible
Neolamarckia cadamba (Roxb.) Bosser	Kadam	Construction/fuel wood
Phyllanthus emblica L.	Amla	Fruit edible
Poa annua L.	-	Fodder
Polygonum hydropiper L.	Marsh pepper	Fodder
Saccharum spontaneum L.	Wild sugarcane	Fodder
Saraca asoca (Roxb.) Willd.	Ashok	Ornamental
Shorea robusta Gaertn.	Sal	Timber
Syzygium cumini (L.) Skeels	Borjamu	Construction/fuel wood
Tectona grandis L.f.	Teak	Timber

***Source:** Prmiary field survey and secondary data (Discussions with local people)*

Medicinal Plant recorded in the study area

The list of medicinal plant observed in study area in different sites enumerated in **Table 5.17.**

Table 5.17: Medicinal Plant species recorded from North Guwahati site

Botanical name	Local name	Usage
Azadirachta indica A. Juss	Neem	Used for curing leprosy, intestinal worms, loss of appetite, skin ulcers, cardiovascular disease, fever, diabetes, gum disease (gingivitis), and liver problems.
Calotropis gigantea (L.) Dryand.	Mudar	Used for diarrhea, somatic, sinus fistula, and skin disease.
Cassia fistula L.	Sonaru	Treatment of inflammatory swellings and as a cleaning agent for ulcers and wounds.
Datura metal L.	Dhatura	Treatment of asthma, cough and cold and painful conditions.
Eclipta prostrata (L.) L.	Bhringraja	Treatment of hepatitis, snake venom poisoning, gastritis, and respiratory diseases such as a cough and asthma.
Cynodon dactylon (L.) Pers.	Dub	Used as a laxative, coolant, expectorant, carminative and as a brain and heart tonic.
Euphorbia hirta L.	Dudhi	Used for female disorders, respiratory ailments (cough, coryza, bronchitis, and asthma), dysentery, jaundice, pimples, gonorrhea, digestive problems, and tumors.
Ocimum sanctum L.	Tulsi	For the treatment of bronchitis, bronchial asthma, malaria, diarrhea, dysentery, skin diseases.
Achyranthes aspera L.	Apamaranga	Used in treatment of cough, bronchitis and rheumatism, malarial fever, dysentery, asthma, hypertension and diabetes.
Lantana camara L.	Lantena	Used as antimicrobial, fungicidal and insecticidal properties.

Botanical name	Local name	Usage
Boerhavia diffusa L.	Puruni	For treatment of intestinal colic, kidney disorders, cough, hemorrhoids, skin diseases, alcoholism, insomnia, eye diseases, asthma and jaundice

***Source:** Prmiary field survey and secondary data (Discussion with local people)*

Agricultural and Horticulture Crops

Agriculture is the chief occupation in the study areas. Rice (*Oryza sativa*) is the predominant crop. The other crops grown are Wheat (*Triticum aestivum*), Maize (*Zea mays*), Onion (*Allium cepa*), Coriander (*Coriandrum sativum*), Mustard (*Brassica nigra, B. hirta*), Pea (*Pisum sativum*), Potato (*Solanum tuberosum*), Brinjal (*Solanum melongena*), Chillies (*Capsicum annuum*), Garlic (*Allium sativum)*, Turmeric (*Curcuma longa*) and Ginger (*Zingiber officinale*). In horticultural crops are- Bel (*Aegle marmelos*), Tea (*Camellia sinensis*), coconut (Cocos nucifera), Papita (*Carica papaya*) Tamul (*Areca Catechu*), Kathal (*Artocarpus heterophyllus*), Tulsi (*Ocimum sanctum*), Peepal (*Ficus religiosa*), Ashok (*Saraca asoca*), Neem (*Azadirachta indica*), Mango (*Mangifera indica*), Kala (*Musa × paradisiaca*), Jamun (*Syzygium cumini*) and Bamboo species grown in the North Guwahati site.

Quantitative Analysis of North Guwahati site

Riparian habitat of Brahmaputra at North Guwahati

River bank vegetation is ecologically termed as riparian flora, and is highly dynamic. It links terrestrial and aquatic habitat, under the influence of waterways such as riverbanks. It is represented by a particular type of vegetation that grows along the sides of rivers, which are called the river's riparian zone (Dutta et al., 2011). Riparian plant habitats and communities are characterized by hydrophilic plants. Riparian vegetation consists of macrophytes, native grasses, sedges, climbers, shrubs and trees (Dutta et al., 2011). Riparian vegetation performs an important ecosystem functions, and provides a range of environmental services which include soil erosion control, thermal regulation of water bodies, filtration and retention of nutrients, maintenance of water quality, provision of food and habitat for wildlife and also provides aesthetic and recreational resources for human society.

The important riparian plant species in the project areas of Nemati terminal are given in following table.

Table-: Riparian plant species: North Guwahati terminal

Scientific name	Family
Ageratum conyzoides	Asteraceae
Alternanthera sessilis	Amaranthaceae
Amaranthus hybridus	Amaranthaceae
Arundo donax	Poaceae
Chromolaena odorata	Asteraceae
Convolvulus arvensis	Convolvulaceae

Scientific name	Family
Cynadon dactylon	Poaceae
Cyperus brevifoilus	Cyperaceae
Eclipta prostrate	Asteraceae
Ipomoea aquatica	Convolvulaceae
Ipomoea carnea	Convolvulaceae
Nymphaea nouchali	Nympheaceae
Parthenium hysterophorus	Asteraceae
Persicaria maculosa	Polygonaceae
Phragmites karka	Graminae
Poa annua	Poaceae
Ranunculus sceleratus	Ranunculaceae
Rumex maritimus	Polyganaceae
Saccharum spontaneum	Poaceae
Scirpus articulatus	Cypherceae
Senecio viscosus	Asteraceae
Solanum surattense	Solanaceae
Xanthium strumarium	Asteraceae

Tree

A total of 15 tree species (≥ 5 cm dbh or ≥16 cm GBH) were recorded from North Guwahati, during the field study. The density of tree species recorded was 232 individuals (ha^{-1}). In terms of density, *Shorea robusta* were the dominant tree (26 individuals ha^{-1}) followed by *Delonix regia* (22 individual's ha^{-1}). The total basal area of tree recorded were 134.02 $m^2 ha^{-1}$ from site-3. In terms of basal area *Shorea robusta* has maximum basal area as compared to other tree. In terms of importance value index (IVI), *Shorea robusta* was the dominant tree (IVI= 37.25) followed by *Delonix regia* (IVI= 29.75) in **Table 5.18**.

Table 5.18: Frequency, density, basal area, abundance, IVI and volume for tree Sps.

Botanical Name	Frequency (%)	Density (Individual ha^{-1})	Basal Area (m^2ha^{-1})	IVI	Volume (m^3)	Abundance
Albizia lebbeck (L.) Benth.	16	10	4.9	13.09	0.34	1.25
Artocarpus heterophyllus Lam.	28	18	7.56	22.37	0.60	1.29
Artocarpus chama Buch.-Ham.	12	8	3.12	9.62	0.19	1.33
Azadirachta indica A.Juss.	16	14	6.58	16.07	0.53	1.75

Botanical Name	Frequency (%)	Density (Individual ha^{-1})	Basal Area (m^2ha^{-1})	IVI	Volume (m^3)	Abundance
Cocos nucifera L.	32	20	7.8	24.70	0.78	1.25
Corymbia citriodora (Hook.) K.D.Hill & L.A.S.Johnson	20	14	7.14	17.77	0.64	1.4
Dalbergia sissoo DC.	16	14	6.72	16.18	0.47	1.75
Delonix regia (Hook.) Raf.	32	22	13.42	29.75	1.07	1.38
Ficus religiosa L.	8	6	6.66	10.12	0.53	1.5
Mangifera indica L.	20	16	14.24	23.93	1.00	1.6
Phoenix sylvestris (L.) Roxb	20	12	9.24	18.48	0.55	1.2
Psidium guajava L.	12	16	7.2	16.12	0.36	2.67
Shorea robusta Gaertn.	28	26	22.88	37.25	1.60	1.86
Syzygium cumini (L.) Skeels	24	18	7.74	21.23	0.54	1.5
Tamarindus indica L.	28	18	8.82	23.31	0.53	1.29
Total	**312**	**232**	**134.02**	**300.00**	**9.74**	**23.00**

***Source:** Prmiary field survey*

Shrub

A total of 27 shrub species were recorded from North Guwahati site, during the field study. The density of shrub species recorded was 764 individuals (ha^{-1}). In terms of density, *Lantana camara* were the dominant shrub species (56 individual's ha^{-1}) followed by *Calotropis gigantea* (54 individual's ha^{-1}). In terms of importance value index (IVI), *Lantana camara* was the dominant shrub species (IVI= 14.25) followed by *Calotropis gigantea* (IVI= 13.73) in **Table 5.19.**

Table 5.19: Frequency, density IVI and abundance for shrub species

Botanical name	Frequency (%)	Density (Individual ha^{-1})	IVI	Abundance
Bambusa arundinacea (Retz.) Willd.	4	4	1.29	1
Ipomoea indica (Burm.) Merr.	20	28	7.51	1.4
Marsdenia tinctoria R. Br.	16	20	5.69	1.25
Smilax zeylanica L.	12	12	3.88	1
Stephania glabra (Roxb.) Miers	8	12	3.11	1.5
Vallaris solanacea (Roth) Kuntze	16	28	6.74	1.75
Alpinia nigra (Gaertn.) Burtt	12	20	4.93	1.67
Areca Catechu L.	20	36	8.56	1.8
Boehmeria macrophylla Hornem.	20	28	7.51	1.4
Boerhaavia diffusa L.	32	44	11.91	1.38
Calotropis gigantea (L.) Dryand.	36	52	13.73	1.44
Carica papaya L.	24	28	8.28	1.17
Dendrocalamus strictus (Roxb.) Nees	16	20	5.69	1.25
Cascabela thevetia (L.) Lippold	20	32	8.03	1.6

Botanical name	Frequency (%)	Density (Individual ha^{-1})	IVI	Abundance
Citrus limon (L.) Osbeck	16	28	6.74	1.75
Clerodendrum glandulosum Lindl.	20	36	8.56	1.8
Hibiscus rosa-sinensis L.	16	20	5.69	1.25
Ipomoea carnea Jacq.	32	44	11.91	1.38
Isodon ternifolius (D.Don) Kudô	8	12	3.11	1.5
Lantana camara L.	36	56	14.25	1.56
Musa × paradisiaca L.	28	28	9.05	1
Ocimum sanctum L.	12	20	4.93	1.67
Parthenium hysterophorus L.	16	28	6.74	1.75
Ricinus communis L.	28	44	11.14	1.57
Solanum virginianum L.	16	28	6.74	1.75
Thespesia lampas (Cav.) Dalzell	20	36	8.56	1.8
Vitex negundo L.	16	20	5.69	1.25
Total	**520**	**764**	**200.00**	**39.62**

***Source:** Prmiary field survey*

Herb

A total of 50 herb species were recorded from North Guwahati site, during the field study. The density of herb species recorded was 136800 individuals (ha^{-1}). In terms of density, *Leucas aspera* were the dominant herb species (4800 individual's ha^{-1}) followed by *Euphorbia hirta* (4000 individual's ha^{-1}). In terms of importance value index (IVI), *Leucas aspera* was the dominant herb species (IVI= 6.86) followed by *Plantago major* (IVI= 5.85) in **Table 5.20.**

Table 5.20: Frequency, density IVI and abundance for the herb species

Botanical name	Frequency (%)	Density (Individual ha^{-1})	IVI	Abundance
Cymbopogon martini (Roxb.) W. Watson	16	2000	3.14	1.25
Sida acuta Burm.f.	12	2000	2.72	1.67
Solidago gigantea Aiton	20	2800	4.14	1.4
Stellaria media (L.) Vill.	16	2400	3.43	1.5
Tridax procumbens (L.) L.	12	2000	2.72	1.67
Cynodon dactylon (L.) Pers.	16	2800	3.72	1.75
Cyperus rotundus L.	20	3600	4.72	1.8
Digitaria ciliaris (Retz.) Koeler	16	2800	3.72	1.75
Echinochloa colona (L.) Link	20	3200	4.43	1.6
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	20	3600	4.72	1.8
Oplismenus compositus (L.) P. Beauv.	12	2000	2.72	1.67
Panicum paludosum Roxb.	20	2800	4.14	1.4
Paspalum dilatatum Poir.	24	3600	5.14	1.5

Botanical name	Frequency (%)	Density (Individual ha^{-1})	IVI	Abundance
Persicaria barbata (L.) H. Hara	8	1200	1.71	1.5
Poa annua L.	16	2000	3.14	1.25
Saccharum spontaneum L.	20	2800	4.14	1.4
Setaria verticillata (L.) P. Beauv.	16	2000	3.14	1.25
Stenotaphrum secundatum (Walter) Kuntze	24	2800	4.56	1.17
Senecio viscosus L.	16	2000	3.14	1.25
Achyranthes aspera L.	28	3200	5.27	1.14
Ageratum houstonianum Mill.	12	2000	2.72	1.67
Amaranthus spinosus L.	20	2800	4.14	1.4
Biophytum reinwardtii (Zucc.) Klotzsch	16	2400	3.43	1.5
Catharanthus roseus (L.) G. Don	16	2800	3.72	1.75
Commelina benghalensis L.	20	3200	4.43	1.6
Convolvulus arvensis L.	20	2800	4.14	1.4
Cyanthillium cinereum (L.) H. Rob.	24	3600	5.14	1.5
Desmodium triflorum (L.) DC.	8	1200	1.71	1.5
Diplazium esculentum (Retz.) Sw.	16	2000	3.14	1.25
Eclipta alba (L.) Hassk.	20	2800	4.14	1.4
Euphorbia hirta L.	28	4000	5.85	1.43
Glinus lotoides L.	20	2800	4.14	1.4
Gomphrena globosa L.	24	3200	4.85	1.33
Argemone mexicana L.	20	2800	4.14	1.4
Lasia spinosa (L.) Thwaites	28	3200	5.27	1.14
Leucas aspera (Willd.) Link	32	4800	6.86	1.5
Adiantum proliferum Roxb.	20	2800	4.14	1.4
Melilotus indicus (L.) All.	12	2000	2.72	1.67
Mikania micrantha Kunth	24	2800	4.56	1.17
Mimosa pudica L.	16	2000	3.14	1.25
Oldenlandia diffusa (Willd.) Roxb.	28	3200	5.27	1.14
Oxalis corniculata L.	20	2800	4.14	1.4
Perilla frutescens (L.) Britton	20	2800	4.14	1.4
Plantago major L.	28	4400	6.15	1.57
Polygonum hydropiper L.	16	2000	3.14	1.25
Polygonum microcephalum D. Don	20	2800	4.14	1.4
Portulaca oleracea L.	20	2800	4.14	1.4
Ranunculus sceleratus L.	24	3600	5.14	1.5
Rumex patientia L.	12	2000	2.72	1.67
Sesamum indicum L.	20	2800	4.14	1.4
Total	**956**	**136800**	**200.00**	**72.50**

***Source:** Prmiary field survey*

5.4.3 Diversity Index

Species diversity index can be considered as a measure of environmental quality and indicates the well-being of any ecosystem. To assess diversity of floral elements and structure of the plant community in different study sites, various diversity indices were computed. A diversity index is mathematical measures of species diversity in a community. They provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account. Three species diversity indices viz., Shannon index of general diversity (H), dominance index (D) and Evenness index (e) were computed using PAST software.

Shannon-Wiener Diversity Index

Shannon Weinner index (H′) is an index used to measure diversity in categorical data. In a basic sense, it is the information entropy of the distribution in a given area treating species as symbols and their relative population sizes as the probability. The diversity index takes into account the number of individuals as well as number of taxa. Value of Shannon Weinner index (H′) more than 2 is indicates higher species diversity while its value around 1 or less than 1 indicates low diversity. Higher values of Shannon index also indicate that a particular community has more information. Diversity index (H) increases in value as the number of species increases. Thus, higher the value of (H) the greater is the species diversity in the community is shown in **Table 5.21.**

Table 5.21: Shannon-Wiener Diversity Index

Project Sampling Site	Shannon-Wiener Diversity Index		
	Tree	Shrub	Herb
North Guwahati Terminal	2.651	3.197	3.877

Value of Shannon Weinner index (H′) as seen from the **Table- 5.2.1** is 2.6 which indicates higher species diversity. Higher values of Shannon index i.e more than 2 also indicate that a particular community has more information. Diversity index (H) increases in value as the number of species increases. Thus, higher the value of (H) the greater is the species diversity in the community.

Dominance Diversity Index

Dominance index is always ranges from 0 - 1, indicates species dominance within community gives greater weight to common species. It tries to quantify the dominance of one or few species in a community. In addition, the value of Dominance closer to 1 indicates areas dominated by single or few species. The value of Dominance had followed an opposite trend of diversity is shown in **Table 5.22**.

Table 5.22: Dominance Diversity Index

Project Sampling Site	Dominance Diversity Index		
	Tree	Shrub	Herb
North Guwahati Terminal	0.07387	0.044	0.02137

Gibsons Evenness Diversity Index

The distribution of individuals among the species, referred to as evenness. Evenness compares the similarity of the population size of each of the species present. As species richness and evenness increase, so diversity increases. It indicates is shown in **Table 5.23.**

Table 5.23: Buzas and Gibsons Evenness Diversity Index

Project Sampling Site	Gibsons Evenness Diversity Index		
	Tree	Shrub	Herb
North Guwahati Terminal	0.945	0.906	0.966

The photographs of common plant speices observed during the study are enclosed as **Annexure-14.**

Terrestrial Fauna

Faunal Diversity in and around North Guwahati site were identified by direct observation during field survey and signs of their pellets, scats, pugmarks and claw marks were also considered. A binocular (10 X 50) was used for bird watching and the important features were noted. The identification of avian fauna was made on the basis of available literature (Ali 1962, Gasten 1978 and Grimmett et al, 2000). Discussion with the villagers and local people were also made to generate information about wild animals and avian fauna. The secondary data and reported list of wildlife were also consulted. On the basis of on-site observations as well as secondary data, a check list of wild animals was prepared. The ecological status of the wild animals was categorized following IUCN Red Data Book, 1994. The terrestrial fauna in the study site is represented by mammals, birds, reptiles, butterflies and amphibians.

Mammal

A complete checklist of the species is several fauna documented which is listed in **Table 5.24**.

Table 5.24: List of mammals (Fauna) recorded from North Guwahati site

Zoological name	Local name	Family	IUCN/IWAP, 1972Status
Sus scrofa	Wild boar	Suidae	Least Concern/Schedule III
Herpestes edwardsii	Nevala	Herpestidae	Least Concern/Schedule IV
Macaca mulatta	Rhesus Macaque	Cercopithecidae	Least Concern/Schedule II
Rhizomys pruinosus	Hoary bamboo Rat	Spalacidae	Least Concern
Mus musculus	Common mouse	Muridae	Least Concern/Schedule V
Lutra lutra	Common otter	Mustelidae	Near Threatened / Schedule II
Oryctolagus cuniculus	Indian rabbit	Leporidae	Endangered/Schedule IV
Mus rattus	Indian rat	Muridae	Schedule V
Bandicota bengalensis	Field rat	Muridae	Least Concern/Schedule V

Avifauna

Avifauna observed is given in **Table 5.25.**

Table 5.25: List of avi-fauna

Zoological name	Local / Common name	IUCN / WPA, 1972 Status
Acridotheres ginginianus	Myna	Least Concern / Schedule IV
Clamator jacobinus	Pied cuckoo	Least Concern / Schedule IV
Columba livia	Rock pigeon	Least Concern / Schedule IV
Coracias benghalensis	Indian roller	Least Concern / Schedule IV
Fulica atra	Common coot	Least Concern / Schedule IV
Rallus aquaticus	Water rail	Least Concern / Schedule IV
Lophura leucomelanos	Kalij pheasant	Least Concern / Schedule IV
Aythya fuligula	Tufted duck	Least Concern / Schedule IV
Anas crecca	Common teal	Least Concern / Schedule IV
Ardeola grayii	Indian pond heron	Least Concern / Schedule IV
Ardea cinerea	Grey heron	Least Concern / Schedule IV
Phalacrocorax carbo	Great cormorant	Least Concern / Schedule IV
Tachybaptus ruficollis	Little Grebe	Least Concern / Schedule IV
Passer domesticus	Indian house sparrow	Least Concern / Schedule IV
Coturnix coturnix	Common or grey quail	Least Concern / Schedule IV
Ceryle rudis	Pied kingfisher	Least Concern / Schedule IV
Psittacula krameri	Rose ringed parakeet	Least Concern / Schedule IV
Grus grus	Common crane	Least Concern / Schedule IV
Eudynamys scolopaceus	Koel	Least Concern / Schedule IV
Nettapus coromandelianus	Cotton pigmy goose	Least Concern / Schedule IV
Corvus splendens	House crow	Least Concern / Schedule IV
Dicrurus macrocercus	Black drongo	Least Concern / Schedule IV
Anthus rufulus	Paddyfield pipit	Least Concern / Schedule IV
Coracias benghalensis	Indian roller	Least Concern / Schedule IV
Motacilla cinerea	Grey wagtail	Least Concern / Schedule IV

Source: Prmiary field survey and secondary data (Discussion with local people)

Migratory Birds:

Migratory Birds from Siberia visit during winter season. They arrive at Deepar Beel, which is a RAMSAR site and is more than 15 kms away from the proposed location. Local migratory birds from Upper Assam also migrate to the Deepar Beel due to abundant availability of food. These birds also forage near the river bank at North Guwahati. Birds like Spot billed Pelican, Pala's sea eagle, Siberian crane, Greater Adjutant Stork are seen setting at the edge of water bodies to hunt fishes and water insects.

Butterfly

The floral biodiversity itself indicates the species of butterflies that can be predicated in that area. During the survey total of 13 species of butterflies belonging to 4 families were recorded and listed in **Table 5.26.**

T

able 5.26: List of butterflies recorded from North Guwahati

Zoological name	Common name	Family	IUCN / WPA, 1972 Status
Papilio demoleus	Lime	Papilionidae	Schedule IV
Junonia orithya	Blue pansy	Nymphalidae	Least Concern / Schedule IV
Papilio polytes	Common mormon	Papilionidae	Schedule IV
Appias albina	Common albatross	Pieridae	Schedule IV
Junonia lemonias	Lemon pansy	Nymphalidae	Schedule IV
Junonia hierta	Yellow pansy	Nymphalidae	Least Concern / Schedule IV
Neptis hylas	Common sailer	Nymphalidae	Schedule IV
Eurema libythea	Small Grass yellow	Pieridae	Schedule IV
Precis iphita	Chocolate pansy	Nymphalidae	Schedule IV
Papilio paris	Paris peacock	Papilionidae	Schedule IV
Neptis hylas	Common sailer	Nymphalidae	Schedule IV
Hestina nama	Circe	Nymphalidae	Schedule IV
Acytolepis puspa	Common hedge	Lycaenidae	Schedule IV

***Source:** Prmiary field survey and secondary data (Discussions with local people)*

Herpetofauna

A complete checklist of Herpetofauna is listed in **Table 5.27.**

Table 5.27: List of herpetofauna recorded from North Guwahati site.

Zoological name	Local / Common name	IUCN / WPA, 1972 Status
Polypedates leucomystax	Tree frog	Least Concern
Hoplobatrachus tigerinus	Indian bull frog	Least Concern
Fejervarya limnocharis	Common pond frog	Least Concern
Clinotarsus alticola	Assam hills frog	Least Concern
Hylarana garoensis	Water frog	Least Concern
Bungarus fasciatus	Banded krait	Least Concern / Schedule IV
Hemidactylus frenatus	House gecko	Least Concern
Calotes versicolor	Indian garden lizard	Least Concern
Urosaurus ornatus	Tree lizard	Least Concern / Schedule II
Herpetoreas pealii	Assam keelback	Schedule IV

***Source:** Prmiary field survey and secondary data (Discussions with local people)*

5.4.4 Protected and Eco-sensitive areas

The list of eco-sensitive protected areas and its distance from the proposed North Guwahti Terminal is depicted in **Table 5.28**

Table 5.28: Protected and Eco-sensitive areas- North Guwahati

Protected and Eco sensitive area	Aerial Distance within 10 kms from Proposed Project Site
Assam States Zoo cum Botanical garden	6.5
Deepor Beel a Ramsar site	10.5
Borsola Beel	3.0

Deepor Beel a Ramsar site

The Ramsar convention has designated Deepor Beel a Ramsar site in 2002 to undertake conservation measures on the basis of its biological and environmental importance for sustaining a range of aquatic life forms besides 219 species of birds. It also spelt as Dipor Bil is a permanent freshwater lake, to the south of the main river. It is an open lake basin connected with a set of inflow and outflow channels. Beel means wetland or large aquatic body in Assamese. It has both biological and environmental importance. Considered as one of the largest beels and important riverine wetlands in the Brahmaputra valley of Lower Assam. However, it is more than 10 kms aerial distance from the North Guwahati terminal.

5.5 AQUATIC ECOLOGY

5.5.1 Methodology

A literature review of all the available information on river dolphin management, conservation was conducted. Primary Survey along the stretch of River Brahmaputra was primarily focused on estimating abundance of dolphin population besides characterizing the habitat and anthropogenic covariates. Primary field data was collected through survey of the river stretches of 1 km of both sides around the project locations from river bank. Direct Count Method as suggested by Smith and Reeves (2000) for the river dolphin survey was followed during the study. Simultaneously, other fauna observed during the survey were also recorded. This includes different species of fishes, sightings and evidence of presence of herpetofauna, birds, and mammals if any around the vicinity of proposed project locations. The time and location of sightings, habitat features (viz. water-depth, channel type, channel width, bank type), the distance of dolphin for the nearest bank, and human activity were also be recorded. River width was estimated using a handheld range finder at the proposed project sites as provided by WAPCOS. All the spatial data generated from the field fed into a hand-held GPS (Garmin Inc.) and were plotted in a map using GIS with the help of computer. The results obtained were statistically analysed.

5.5.2 Study by WWF

Mitigation measures suggested in the study for dolphin conservation in Brahmaputra River with reference to the proposed project are some of the best practices that are being implemented for river dolphin conservation and management in different parts of the world based on drawing insights, lessons learnt, and best practices from the wealth of resources and approaches being used to conserve rivers, river biodiversity and river dolphins as suggested in the report, 'An in-

depth study on global best practices for effective and conservation of the Ganges river dolphin (Platanista gangetica) commissioned by the World Bank and WWF.

5.5.3 Study by ZSI

Zoological Survey of India, Kolkata a premier Govt. of India Organization, has undertaken the study "Aquatic Ecology and Comprehensive Study of the Gangetic Dolphin in the River Brahmaputra"**.** ZSI has been assigned this study by WAPCOS as a part of the ESIA study of Modular Terminals. The survey was carried out along the Brahmaputra River, Assam to document the aquatic faunal diversity and the presence and absence of the **Ganges river dolphin** (***Platanista gangetica gangetica***) near proposed terminals, CTC and slipways.

The detailed report of ZSI is being submitted separately. The highlights of the study including primary and secondary data is described in the following paragraphs.

Dolphins are reported to occur within 500m - 2km stretch of the river Brahmaputra near the Ashwaklanta Temple. However, there was no sighting of dolphin during the survey was conducted by ZSI. This may be due to the fact that since the survey was only for one day and water current in the Brahmaputra River was heavy during the time of the survey as a result of which the dolphins if inhabiting in the area have moved to shallower areas away from the Ghat. The findings from the present study corroborate the observations and results of study conducted through AIWTDS during 2019. Therefore, precautionary measures should be adopted by the Contractor as well as the project proponent during the construction and operation phase of the project especially during the course of piling activity which shall take place for the construction of proposed terminal at North Guwahati.

Planktons are a group of mostly microscopic organisms, plants and animals, which are found in all forms of aquatic ecosystems. They are so small and delicate that they are always at the mercy of the water current or tide for their movement. So, in running waters like streams and rivers, their diversity and density is relatively less in comparison to stagnant aquatic bodies like ponds, lakes etc. Though, they are microscopic in size, plankton play a very important role in the function of aquatic ecosystems. They occupy the base of the pyramid of energy and are the basis of the aquatic food chain. Phytoplankton account for about half of the photosynthesis on the planet, making them one of the world's most important producers of oxygen. Phytoplankton rely on nutrients found in their surroundings, such as phosphate, nitrate, and calcium, to thrive. Zooplankton, on the other hand feeds on phytoplankton and detritus and are being eaten by secondary consumers like crustaceans, fishes etc.

5.5.4 Methodology, preservation, and Identification of Planktons

For collect the samples standard methods were followed (Lind O., 1979 and Wetzel R.G., 1975). Random sampling technique has been applied in to study aquatic ecology collection procedure. The samples were collected from the different habitats of the study sites. Aquatic community specimens growing on moist cemented walls, stones, bark of trees, soil, and sand, in temporary

and permanent water bodies like ditches, running water and ponds were selected for the study. The phytoplankton and zooplankton were collected by filtering 30 to 50 litres of water at each site the help of planktonic mesh net (pore size- 10µ), while epiphytic forms were collected by squeezing the submerged plants. The residue left in the sieve was collected in a 50 ml vial. Three replicates were taken for each community and pooled for further analysis. Phytoplankton samples were preserved using Lugol's solution. The samples were stored in sterile plastic bottles and recorded with GPS points. On return to the laboratory, they were washed thoroughly with water. No preservative was added in zooplankton samples.

Benthos samples were collected from each site by scraping the boulder surfaces of known quadrat area (5cm x 5cm). These samples were then preserved and analysed in the same way as described for the plankton. Further analysis was conducted in laboratory.

The samples are acid digested, centrifuged and thoroughly rinsed to get the cleared samples. Semi-permanent slides were prepared from each sample for the identification of various taxa and observed under trinocular research microscope. For treatment of samples, the standard method was followed (APHA, 2005). To count and identify the benthos, Pennak (1953) and Edmondson (1959) were followed.

Phytoplankton

The phytoplankton population comprised of representative elements from three groups namely- Bacillariophyceae, Chlorophyceae and Cyanophyceae. The most common species were- *Bacillaria* sp., *Noctiluca* sp., *Chlorella vulgaris*, *Cladophora glomerata*, *Spirogyra singularis*, *Zygnem*a sp., *Anabaena* sp. *Oscillatoria* sp. *Achnanthes* sp. *Cymbella* sp. etc.

Zooplanktons

Zooplankton community comprised of Cladocera, Copepoda, Euglenophyceae, Protozoa and Rotifera. The most domianat species of zooplankton in study area were- *Daphnia* sp., *Euglena sp., Keratella* sp., *Moina* sp. *Synedra pulchella, Arcella* sp., *Cyclops* sp., *Fragilaria* sp., *Navicula* sp., etc.

Benthos

The benthos of River Brahmaputra comprised mainly of Gastropods, Bivalves, Oligochaets, Chironomids and aquatic insects. The quantitative abundance of benthos was found to range from 32/sqm to 365/sqm in different stretches of the river Brahmaputra (Pathak *et* al., 2000).

Ichthyofauna

The list of major ichthyofauna observed is given in **Table 5.29**

Table 5.29: List of the ichthyofauna with their IUCN status

Zological name	Family	Local name	IUCN Status
Amblypharyngodon mola	Cyprinidae	Moa	LC
Chanda nama	Ambassidae	Chanda	LC

Gudusia chapra	Clupeidae	Karoti	LC
Monopterus cuchia	Synbranchidae	Rice eel	LC
Mystus tengara	Bagridae	Tingara	LC
Parambassis ranga	Ambassidae	Chanda	LC
Puntius sophore	Cyprinidae	Puthi	LC
Puntius terio	Cyprinidae	Puthi	LC
Rita rita	Bagridae	Catfish	LC
Xenentodon cancila	Belonidae	Kakila	LC

5.6 SOCIO-ECONOMIC ASPECTS OF PROJECT INFLUENCE AREA

Socio-Economic survey was carried out within radius of 500 meters from the proposed terminal site. The survey involves one person from each structure within the study area having indirect impact. The outcome of the details recorded during study are presented in following section.

District	Development Block	Tehsil	Number of Structure	Number of Families
Kamrup Metro	North Guwahati	Kamrup Metro	49	49

**Source: WAPCOS Social Survey*

Category of Structure

Among the surveyed structure, category of structure is presented in **Table 5.30** and depicted in **Figure 5.10**. Out of the total 49 nos. structures, 39 structures are used as residential and 10 for commercial activities. These structures may be indirectly impacted during construction period of the proposed project.

Table 5.30: Category of Structure

S No.	Type of Structure	Numbers
1	Residential	39
2	Commercial	10
3	Residential + Commercial	-
4	Government	-
5	Others	-

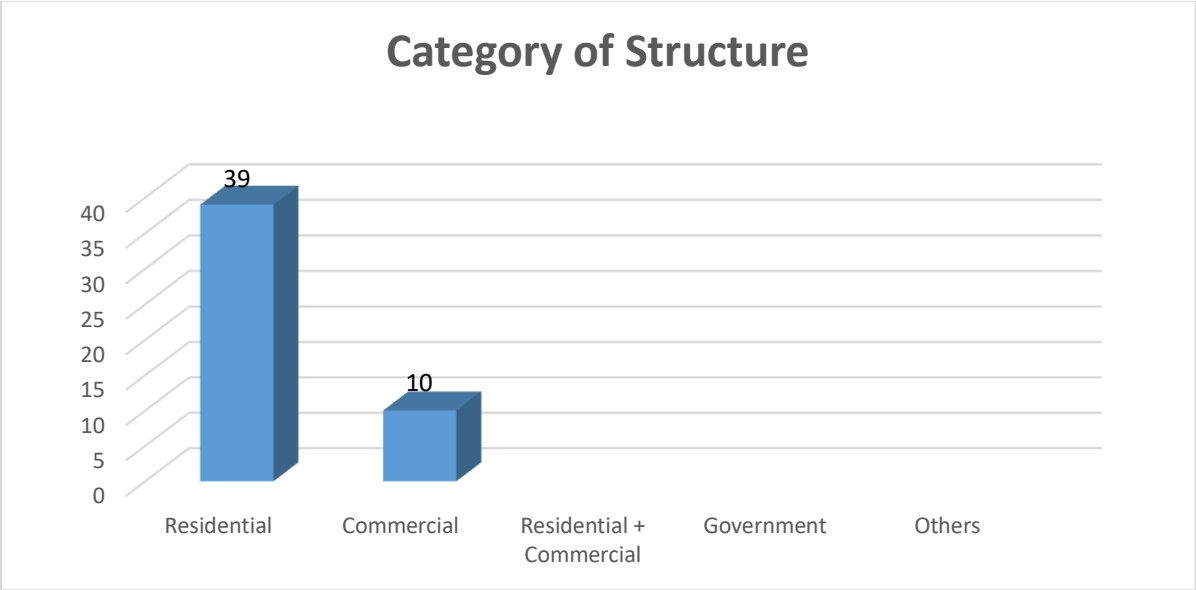


Figure 5.10: Category of Structure

Type of Ownership

Table 5.31 and **Figure 5.11** presents ownership of the structure falling within study area that will be indirectly impacted. Out of the total 49 structures, 44 are titleholders and 5 are squatters.

Table 5.31: Type of Ownership

S. No.	Type of Structure	Titleholder	Encroacher	Squatter	Govt.	N/A	Total
1	Residential	39	-	-	-	-	39
2	Commercial	5	-	5	-	-	10
3	Residential + Commercial	-	-	-	-	-	-
4	Government	-	-	-	-	-	-
5	Other	-	-	-	-	-	-
Total		**44**	**-**	**5**	**-**	**-**	**49**

**Source: WAPCOS Social Survey*

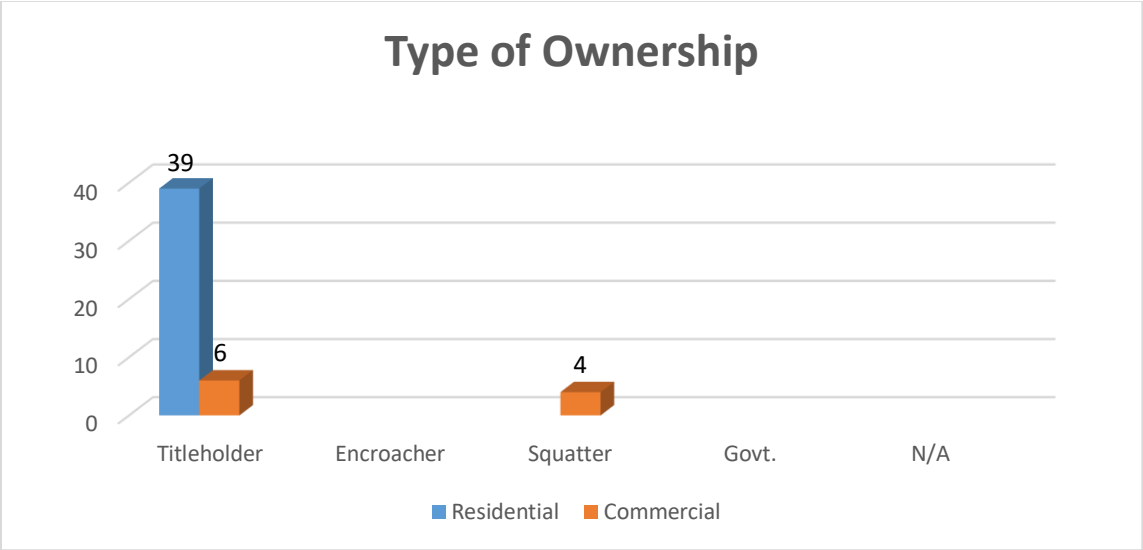


Figure 5.11: Type of Ownership

Type of Construction

Table 5.32 and **Figure 5.12** presents types of construction of the structures falling within study area. Out of total, 36 structures are categorized as permanent, 7 as semi-permanent and 6 are of temporary nature.

Table 5.32: Type of Construction

S. No.	Construction Type	No. of Structure	Percentage
1	Temporary	6	12.24%
2	Semi-Permanent	7	14.29%
3	Permanent	36	73.47%
Total		**49**	**100%**

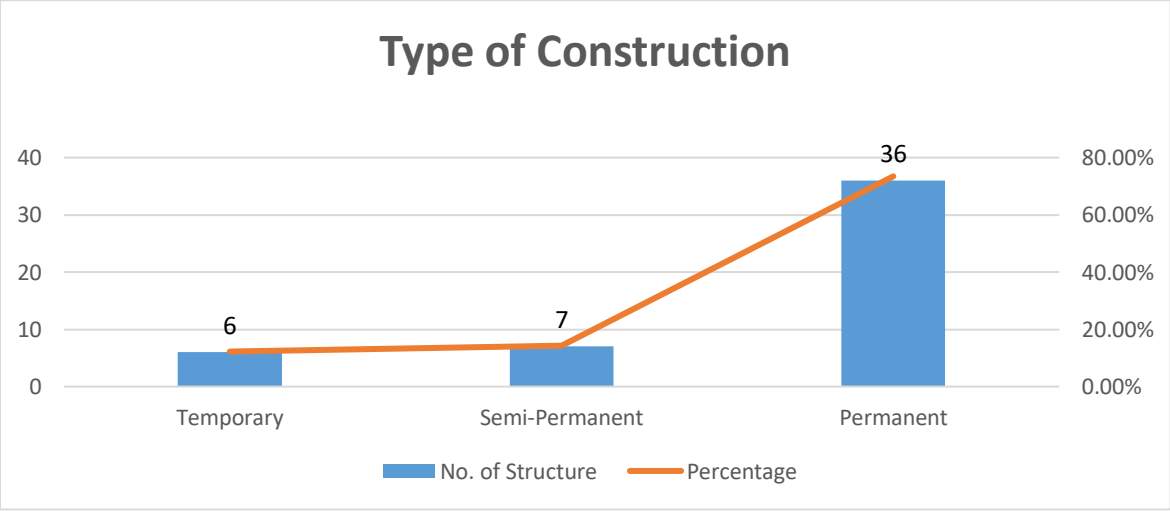


Figure 5.12: Type of Construction

Religious Categories of the Surveyed Persons

Among the surveyed persons majority number of the surveyed households belong to Hindu religion. The details are presented in **Table 5.33** and depicted in **Figure 5.13.**

Table 5.33: Social Categories of the Surveyed Persons

S. No.	Description of the Religion	No. of Households	% age
1	Hinduism	48	98%
2	Islam	1	2%
3	Others	-	-
Total		**49**	**100%**

*Source: WAPCOS Social Survey

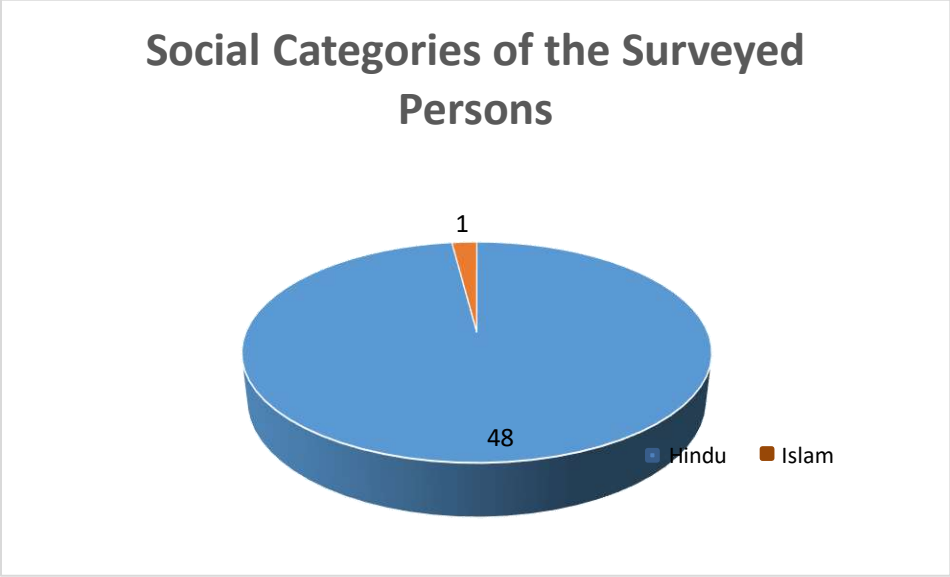


Figure 5.13: Religious Categories of the surveyed persons

Caste Composition Profile

The distribution of population in study area on the basis of caste is summarized in **Table 5.34** and presented in **Figure 5.14.**

Table 5.34: Caste Composition Profile

S. No.	Description of the Religion	No. of Households	% age
1	General	2	4.08%
2	Scheduled Caste	47	95.92%
3	Scheduled Tribe	-	
4	Others	-	
5	OBC	-	-
Total		**49**	**100%**

*Source: WAPCOS Social Survey

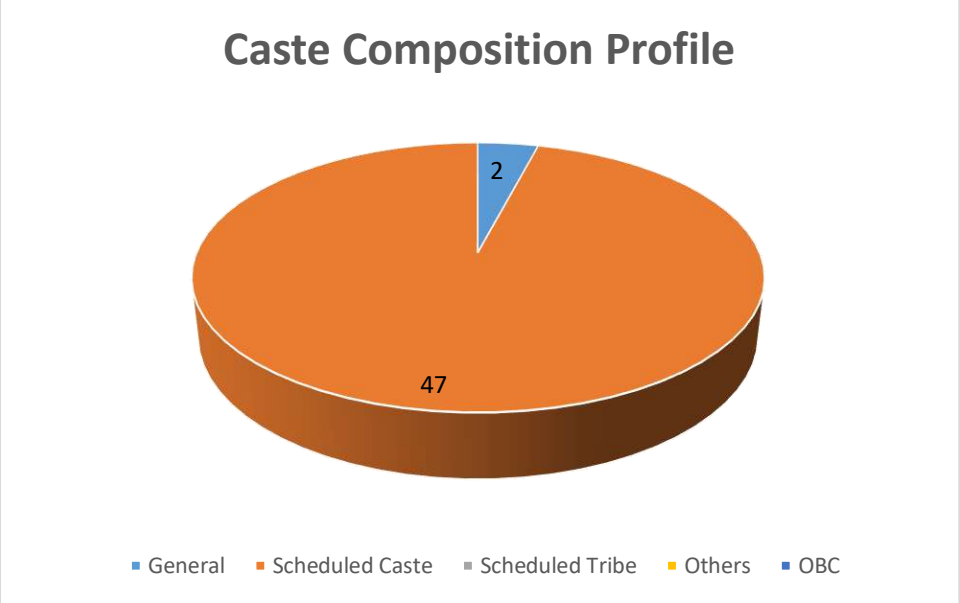


Figure 5.14: Caste Composition profile in the study area

Educational Status

Among the sample Households, only 1 of the adults was found to be illiterate, 48 are educated of which 17 have studied below metric, 27 up to metric and 4 are graduates. The details are presented in **Table 5.35** and depicted in **Figure 5.15.**

Table 5.35: Educational Status

Educational						
Illiterate	Literate	Up to Middle	Below Metric	Metric	Graduate	Above
1	48	-	17	27	4	-

**Source: WAPCOS Social Survey*

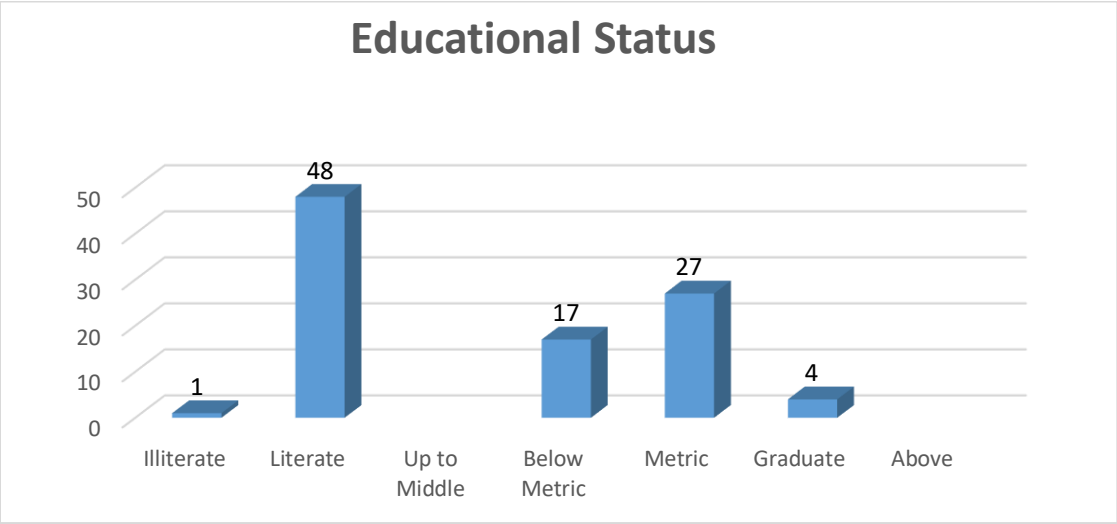


Figure 5.15: Educational status in the study area

Occupation by head of household

The details on occupational profile in the study area are given in **Table 5.36**. As per the data presented in the table, it is observed that 87.76% of the surveyed population are engaged in some form of economically productive activity or vocational activity, and have been designated in business category. The Occupational profile in the study area is shown in **Figure 5.16**.

Table 5.36: Occupation by head of household

S. No.	Type of Occupation	No. of Person	Percentage
1	Service	-	-
2	Business	43	87.76%
3	Agriculture	-	-
4	Study	-	-
5	Housewife*	3	6.12%
6	Labour	1	2.04%
7	Unemployed	2	4.08%
8	Professional	-	-
	Total	**49**	**100%**

Women headed household

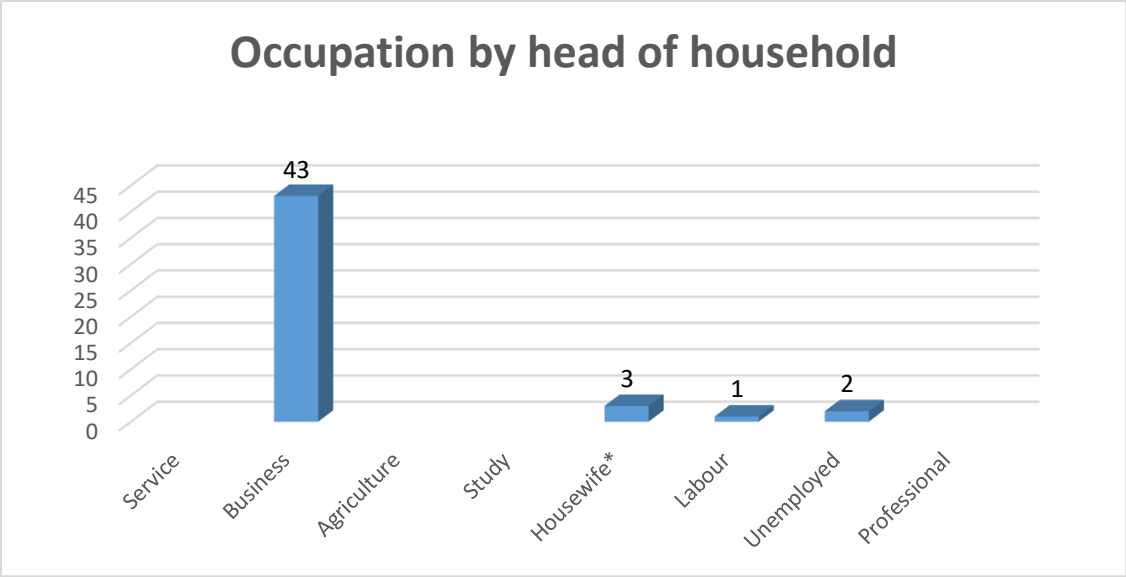


Figure 5.16: Occupational by head of household (North Guwahati)

Income of Households

Family's income was counted considering income from all sources. Major portion of surveyed families earn in the range of 5000-10000 and are almost above half of the surveyed proportion. The details are shown in **Table 5.37.**

Table 5.37: Income of Households (North Guwahati)

No. of HH	Income	No. of Income
49	Below 5000	2
	5000-10000	30
	10000-20000	11
	Above 20000	6
	Not want to disclosed	-

**Source: WAPCOS Social Survey*

Details of PAPs

As per the findings of social survey and FGDs, 5 numbers of vendors operating tea stall, fruit, drinking water etc. near the proposed site. The livelihood of these persons may be affected during construction of the terminal. **Table 5.38**, presents details of Project Affected Persons.

Table 5.38: Details of PAPs

S. No.	Type of Shop	Gender of PAPS		Total
		Male	Female	
1	Temporary with make shift arrangement	4	1	5

Source: WAPCOS Social Survey

Chapter 6 – ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

6.1 INTRODUCTION

Based on the project details and the baseline environmental status, potential impacts that are expected to accrue as a result of the proposed project have been identified. The assessment for quite a few disciplines is subjective in nature and cannot be quantified. Wherever possible, the impacts have been quantified. However, for non-tangible impacts, a qualitative assessment has been done so as to formulate appropriate management measures for them as well. This Chapter deals with anticipated positive as well as negative impacts due to the construction and operation of the proposed project and strategies to mitigate them.

Limitations of the ESIA

The ESIA has been developed based on the Detailed Project report. The Technical assessment in the Detailed Project Report has not been reassessed. The ESIA has adopted these technical assessments in good faith. It further assumed that there will be no dredging activity for the development of the proposed terminal at North Guwahati. Therefore, any changes would require an updating of the ESIA.

The following section describes the various impacts and mitigation measures suggested to minimize the impacts due to the proposed project.

6.2 ASSESSMENT OF IMPACTS

6.2.1 Impacts During Construction Phase

The impacts during construction phase will be localized and short-term and primarily related to civil works and erection of equipment. The duration of impact will be limited to the construction phase only which is considered 18 months. The following activities may cause environmental impacts during construction of the proposed project:

- Site preparation
- Excavation and backfilling
- Hauling of earth materials
- Piling, cutting and drilling.
- Erection of concrete and steel structures
- Noise from heavy equipment operation
- Road construction
- Painting and finishing
- Clean up operations.
- Landscaping and Green belt development

The details of activities and probable impacts during construction phase are depicted in **Table-6.1.**

Table 6.1: Identification of Activities & Probable Impacts during Construction Phase

Activities	Sector	Anticipated Impacts
Site clearing and	Air	Fugitive dust emission
		Air emission from construction equipment and machinery
	Water	Run off from grass stripped area.
	Land	Loss of fertile topsoil
		Change in drainage pattern.
	Ecology	Loss of vegetation
Transportation and storage of construction material/ equipment	Air	Air emission from vehicles
		Fugitive dust emission due to traffic movement
	Water	Spilling of construction material and flow into streams.
		Run off from storage areas of construction material
	Soil	Deposition of spilled construction material and flow into streams
	Public utilities	Increased flow of traffic will lead to congestion on road
Civil construction	Air	Fugitive dust emission due to various construction activities
	Water	Run off from erection areas containing oils, paints Sewage from labour camps
		Can induce auditory damage at shorter distances and behavioural disturbance at longer distances in dolphins
	Culture & Heritage Resources	Temporary diversion of access towards cultural resources, temples; Safety issues to devotees during the construction stage various construction activities etc. Chances of vibration impact to these cultural resources during the construction work
	Socio-economic	Increase in employment
Influx of labours	Socio-economic	Stress on infrastructure
		Stress on social relation

6.2.2 Impacts due to pre-construction activities

During the pre-construction activities at the existing terminal, there will be a requirement for the clearing of the debris. Even though none of the workers would be staying at the site, basic facilities, e.g., toilets, have to be prepared in case construction of labour camp is done in some other location. In case of rented building for labour camp, the Contractor shall take up all the mitigation measures with regard to waste management, adequate toilet facilities and other basic amenities need to be provided.

- **Design Review**

The design review should be undertaken to ensure that the terminal is resilient to floods and natural calamities. It should also be ensured that the design is friendly to different categories of passengers especially elderly, women and children and specially-abled people.

Mitigation Measures: These activities would generate some impacts, but they would not be significant given that the scale of activities is low. However, it is suggested that the Contractor would implement the following mitigations

- The design of the ramps, staircase etc should conform to the Harmonized Guidelines & Standards for Universal Accessibility in India – CPWD, 2021.
- The Bio-toilets of adequate numbers should be installed at the site before any activity is carried out.
- Waste Management system, as described later, should be in place. Arrangement should be made for segregation of wastes into recyclable and non-recyclable wastes. Non-recyclable wastes to be disposed regularly through authorised agency. Recyclable wastes should be sold to authorized vendors.
- .
- The review should ascertain that mitigation measures which have to be implemented later during the Constrction activities are incorporated in the design and the constrction planning.
- The Occupational Hazard Risk Assessment has been carried out and the Occupational health Safety Plan is in Place for the implementation. Similar activities should also be carried out for Community Health Safety.

6.2.3 Impacts due to Construction activities

- **Impact on Land Environment**

➢ **Impacts due to transfer of land**

The proposed project envisages construction of passenger jetties. The total land requirement for North Guwahati terminal has been estimated as 7000 m^2. The total land majorly belongs to government land. This is Un-surveyed Government Land. Since private land acquisition is not envisaged and hence no impacts due to transfer of land.

Mitigation measures: As the land belongs to government, it shall be transferred to AIWTDS from Govt. of Assam. As per present level of investigation, no private land is proposed to be acquired, hence no mitigation measures are required.

➢ **Impact of Sourcing of material**

Most of the construction materials will be sourced from outside North Guwahati. Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. It is essential to assess the impact of quarrying. The EIA Notification 2006 assess the impact during the award of the Environment clearance to quarries (Stone and sand). The construction material would only be sourced from sites which have prior environmental clearance to prevent all these impacts.

- **Impact on land Environment**

The terminal would be built on piles and no land reclamation is envisaged in the case of North Guwahati Terminal. Moreover , the sentimantation at this lcaotion ahs stabilised. Thus, impact on land environment is not envisaged.

Mitigation measures:

- The material extracted due to site preparation shall be used to the maximum possible on the proposed sites for levelling and reclamation (if any)
- No exclusive quarries are proposed to be opened for these projects
- Construction material will be procured from sources which have valid environmental clearance. The Contractor shall submit the required documents (copy of the environmental clearance, CTO) to the PMU for verification and obtain approval from the PIU before procuring any material
- Submit to PMU monthly documentation of sources of materials.
- If the contractor is purchasing ready mix concrete, asphalt/macadam and aggregates from a third party, the contractor will ensure that all the parties/ suppliers have CTE/CTO from ASPCB and will collect a copy of these certificates and submit to PIU/consultants

- **Impact on noise environment**

- **Due to the movement and operation of the Plant and Machinery**

The noise during construction phase is due to operation of various construction equipment. The noise levels generated by various construction equipment are given in **Table- 6.2.**

Table 6.2: Average noise levels generated by the operation of various construction equipment

Equipment	Noise level (dB(A))
Transit mixer	75
Winch-7.5 t capacity	75
Generator	85
Hydraulic Rig	85
Compressor	80
Hydra 12/15t	80
Wibro hammer	80
Concrete mixer	75
JCB-3D	85
Trailor	85
Excavator	80
Dumper	85
EoT cranes	80
Ordinary cranes	75

Under the worst-case scenario, considered for prediction of noise levels during construction phase, it has been assumed that equipment required during construction phase is operating at a common point. Likewise, to predict the worst-case scenario, attenuation due to various factors too has not been considered during noise modelling.

Modelling studies were conducted to assess the increase in noise level due to operation of various construction equipment's, and the results of this exercise are given in **Table- 6.3.**

Table 6.3: Predicted noise levels due to the operation of various construction equipment

Distance (m)	Ambient noise level (dB(A))	Increase in noise level due to construction activities (dB(A))	Noise level due to construction activities (dB(A))	Increase in ambient noise level due to construction activities (dB(A))
30	45	70	70	25
50	45	66	66	21
100	45	60	60	15
200	45	54	55	10
500	45	46	49	4
1000	45	36	46	1
1500	45	36	45.5	0.5
2000	45	34	45	-

It is clear from **Table- 6.3,** that at a distance of 1 km from the construction site, the increase in noise levels will be only 1 dB(A). There are residential areas near the proposed terminal location, although no adverse impacts are envisaged, however there shall be temporary impact during the construction phase.

It would be worthwhile to mention here that in absence of the data on actual location of various construction equipment, all the equipment has been assumed to operate at a common point. This assumption leads to over-estimation of the increase in noise levels. Also, it is a known fact that there is a reduction in noise level as the sound wave passes through a barrier.
Walls of various houses or other structure will attenuate at least 30 dB(A) of noise. In addition, there is noise attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric in-homogeneities
- Vegetal cover

No increase in ambient noise level is anticipated, as a result of various activities, during project construction phase due to the following:

- Assumption that all equipment is operating from a common point led to over-estimation of increase in noise level
- Attenuation of 30 dB(A) of noise by wall of any structure
- Noise attenuation due to various factors.

As mentioned earlier, there will be significant attenuation due to various factors, e.g., absorption by construction material, air absorption, atmospheric in-homogeneities, and vegetal cover. Thus, no significant impact on this account is anticipated.

- **Exposure to workers**

The effect of exposure of high noise levels on the workers operating the various construction equipment is likely to be harmful. It is known that continuous exposure to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, has to be avoided. To prevent the adverse impacts, the exposure to high noise levels should be restricted as per the exposure period outlined in **Table- 6.4.** Workers operating in the high noise areas shall be provided with ear plugs.

Table 6.4: Maximum Exposure Periods specified by OSHA

Maximum equivalent continuous Noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2
105	1
110	½
115	¼
120	No exposure permitted at or above this level

- **Noise Control Measures**

Measures to control noise from construction equipment are as follows:

- Noise from air compressors could be reduced by fitting exhaust mufflers and intake mufflers.
- Chassis and engine structural vibration noise can be dealt by isolating the engine from the chassis and by covering various sections of the engines.
- Noise levels from the drillers can be reduced by fitting of exhaust mufflers and the provision of damping on the steel tool.
- Exposure of workers near the high noise levels areas can be minimized. This can be achieved by job rotation/automation, use of ear plugs, etc.

- **Control of Noise due to DG Sets**

The following Noise Standards for DG sets are recommended for the running of DG sets during the construction:

- Noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.

- The Acoustic Enclosure should be made of material of appropriate thickness and structural/ sheet metal base. The walls of the enclosure should be insulated with fire retardant foam.
- The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side.
- The DG set should also be provided with proper exhaust muffler.
- Proper efforts to be made to bring down the noise levels due to the DG set, outside its premises, within the ambient noise requirements by proper siting and control measures.
- A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.
- The construction activities shall be limited to day time. Suitable barriers shall be provided around construction sites.
- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible

Provision for Noise control measures shall be kept as a part of project. Various measures listed above shall be made mandatory in the Tender Specifications for construction of the project

- **Impacts due to quarrying**

The proposed site needs to be levelled for construction of jetty and backup facilities. The construction material shall be sourced from nearby quarries and markets. The source and quantity of construction material is given in **Table 6.5**.

Table 6.5: Source and Quantity of Construction Material

S. No.	Name of Jetties	Quantity (m^3)	Source and distance from Site
1	North Guwahati	70000	Maikhuli-20 km Pilingkata-25km

Source: DPR, 2023

Mitigation measures: The material extracted due to site preparation shall be used to maximum possible on the proposed sites shall be used for levelling and reclamation. No exclusive quarries are proposed to be opened for these projects and construction material will be procured from the existing places.

- **Impact on Ecology**

- **Impact on Dolphins from underwater construction noise**

Anthropogenic noise can have a range of effects on aquatic life. Richardson et al, (1995) identified four zones of influence: The zone of audibility, in which the animal might hear the noise; the zone of responsiveness, within which the animal reacts behaviourally or physiologically; the zone of masking, in which the noise interferes with other sounds such as those used in communication, echolocation, prey, predator or other natural sounds from the environment; and the zone of injury, where the noise results in damage to the auditory (or other) system. Additionally, the noise could mask sound cues

from predators, prey or conspecifics, which may reduce the animal's fitness or its chance of finding a mate. These impacts are difficult to measure but may lead to important population impacts, particularly for vulnerable populations like dolphins. The zone of masking due to pile-driving noise was investigated for bottlenose dolphins (David 2006), who found that communication whistles may be masked up to 40 km from the piling source and echolocation clicks up to 6 km. No studies have specifically investigated the zone of masking. Since there is no scientific established zone of masking and it is known that the areas around North Guwahati are known habitats of dolphins these would be considered as safe limits for the dolphins. Detail Dolphin Conservation Plan is enclosed at **Annexure-21.**

Mitigation Measures

The following mitigation measures are suggested.

- Construction Planning must be carried out so that No-construction Period (stop the construction activities in the water part between Mid- March to Mid-June)
- Effect of piling during the construction period will be managed by the adoption of vibratory piling
- The river area in which the piling is planned advisable to carefully determine drop sites before anchor placement to ensure that Dolphin and fish communities that could locally still be present in the area are not unnecessarily damaged
- Dolphin Watch must be carried out in the river for one hour before piling starts. Piling must commence if dolphins are not spotted for half an hour prior to the start of the activity
- Before starting piling, allow some time for aquatic fauna to displace from the piling area.
- Piling must be stopped for some time if any dolphin/turtle/RET species are sighted in the activity area
- Noise-reducing devices like mufflers, enclosures baffles must be fitted with the equipment as much as feasible.
- Usage of bubble curtains locally fabricated by Contractor based on field requirement under the guidance of biodiversity expert to disperse the fauna and reduce the noise level shall be taken
- Fish exclusion devices must be installed in the water column around the pile driving area to prevent fish access
- Geo Textile synthetic sheet curtains & turbidity traps must be placed around piling and construction areas to prevent the movement of sediments and construction waste
- Aquatic ecology monitoring must be carried out before the start of construction and after completion of construction to assess the impact of construction activities on aquatic life.
- If, despite the introduction of preventive measures, fish kills or impact on aquatic life is observed, then the work will be stopped immediately, and the methods will be reviewed and corrected.
- All equipment will be adequately maintained to prevent potentially hazardous or toxic products from leaking or spilling. This includes hydraulic fluid, diesel, gasoline and other petroleum products.
- The piling activities must be carried out in the shortest possible timeframe.
- Use of polymer instead of bentonite as drilling fluid along with safe disposal of residue after usage.

- The Contractor shall engage a wildlife/biodiversity expert during the construction activities in the water part.
- Formation of Emergency Rescue Committee for accidental injury/trap of dolphins at site with members from Forest Dept, IWT, biodiversity expert and IWT.
- Signages for no-go areas, emergency helpline numbers of concerned officials for dolphin safety shall be displayed in the site.
- Dolphin safety measures shall be a part of the tool-box talks and regular awareness building of contractor staff, labours under the supervision of TSSC shall be undertaken.

➢ **Impact on Fisheries**

Discussion with the local fisherman, site observations indicated that there are no fishing activities in the vicinity of the North Guwahati site. No significant impact is envisaged on the fisheries from the proposed project. Suitable management measures have been suggested to check the disposal of oily waste and collection of spillage oil in case of accidental oil spillage from the boats.

Mitigation measures: Various measures recommended to minimise the impacts on aquatic life are given as below.

- Discharge of effluents from concrete mixers etc, without treatment is prohibited.
- Turbidity, DO and salinity will be monitored once every week at 3 locations: near the Berth, channel and records of monitoring will be maintained. If DO level goes 4.0 mg/l, then its causes will be investigated, and corrective actions will be taken.
- Spillage of material (sediment) from the vessel bucket to the surrounding water will be minimized by using trained operators
- Turbidity traps/curtains/ Geo-Textile synthetic sheet curtains would be placed around piling and construction areas to prevent sediments and construction waste movement.

- **Impacts on Ambient Air Quality**

Up-gradation of existing roads and construction of new roads approaching the proposed site involves cutting and filling of the earth. Within the project site, cutting and levelling activity would be required for Jetty.

The potential source of air quality impact arising from the establishment/ construction of the proposed project is fugitive dust generation. The dust, measurable as PM_{10} and $PM_{2.5}$ would be generated as a result of construction activities. The potential dust sources associated with the construction activities are loading and unloading of the materials, topsoil removal, etc.

The construction activities that contribute to the environmental impacts are broadly given below:

- Dust generation during levelling of earth.
- Dust generation due to the movement of vehicles on unpaved roads
- Emission of pollutants from vehicular exhaust
- Unloading of raw materials and removal of unwanted waste material from site
- Accumulation of excavated earth material

The impacts will be for short duration and confined within the project boundary and is expected to be negligible outside the plant boundaries. However, the project site is cordoned off by a high boundary wall and planned green belt; such impacts will be confined only within the project site.

- **Impacts due to fugitive emissions**

The major pollutant in the construction phase is SPM being air-borne due to various construction activities. The vehicular movement generates pollutants such as NOx, CO and HC. But the vehicular pollution is not expected to lead to any major impacts. The soils in the project area are sandy in texture and are likely to generate dust as a result of vehicular movement. However, the fugitive emissions generated due to vehicular movement are not expected to travel beyond a distance of 200 to 300 m. The impact on air environment during construction phase is not expected to be significant, since there are no habitations in the vicinity of the site.

- **Impacts due to construction equipment**

The combustion of diesel various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. The fuel utilization rates of various equipment expected to be in operation during construction phase is given in Table-5.6. Under the worst-case scenario, it has been considered that equipment used for construction of berth and earthwork at each site, are operating at a common point.

Table 6.6: Fuel combustion during construction

Equipment	Fuel consumption rate (lph)	No. of Units	Total fuel consumption (lph)
Dumpers	30	1	30
Generators	30	2	60
Dumpers	20	2	40
Loaders and unloaders	25	1	25
Excavators	25	1	25
Water tanker	8	2	16
Total			196

The major pollutant likely to be emitted due to construction of diesel in various construction equipment shall be SO_2. The short-term increase in SO_2 concentration has been predicted using Gaussian plume dispersion model. The results are summarized in **Table- 6.7**.

Table 6.7: Short-term (24 hr.) increase in concentration of SO_2 ($\mu g/m^3$)

Wind Speed (m/s)	Distance (km)			
	0.1	0.2	0.3	0.4
0.2	0.47×10^{-34}	2.3×10^{-11}	1.15×10^{-6}	9.4×10^{-5}
0.85	2.8×10^{-8}	5.3×10^{-4}	4.4×10^{-4}	4.2×10^{-5}
1.53	7.4×10^{-5}	1.75×10^{-4}	4.2×10^{-5}	2.2×10^{-4}
2.78	1.09×10^{-4}	1.23×10^{-4}	2.6×10^{-5}	8.1×10^{-6}
4.30	9.4×10^{-5}	1.23×10^{-4}	2.6×10^{-5}	8.1×10^{-6}

5.98	7.1×10^{-5}	6.4×10^{-5}	1.28×10^{-5}	5.8×10^{-5}
7.00	6.8×10^{-5}	5.5×10^{-5}	1.09×10^{-5}	5.0×10^{-6}

It is evident from **Table 6.7** that the maximum short-term increase in SO_2 is observed as 0.00053 $\mu g/m^3$, which is at a distance of 200 m from the emission source. The incremental concentration is quite low and does not require any specific control measure. Thus, the operation of construction equipment is not expected to have any major impact on the ambient air quality as a result of the project.

Mitigation measures

The following measures are recommended to control air pollution:

- Construction equipment shall be fitted with internal devices i.e., catalytic converters to reduce CO and HC emissions.
- The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

The measures to control emissions due to DG sets are recommended as below:

- Location of DG sets and other emission generating equipment should be decided keeping in view the predominant wind direction so that emissions do not affect nearby residential areas.
- Stack height of DG sets to be kept in accordance with CPCB norms, which prescribes the minimum height of stack to be provided with each generator set to be calculated using the following formula:

$H = h+0.2x \sqrt{KVA}$

H = Total height of stack in meter

h = Height of the building in meters where the generator set is installed

KVA = Total generator capacity of the set in KVA

To minimize issues related to the generation of dust during the construction phase of the project, the following measures have been identified:

- Identification of construction limits (minimal area required for construction activities).

- When practical, excavated spoils will be removed as the contractor proceeds along the length of the activity.
- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed and/or mulched.

Contractors will be required to cover stockpiled soils and trucks hauling soil, sand, and other loose materials (or require trucks to maintain at least two feet of freeboard).

- Regular spray of water over unpaved areas.
- Contractor shall ensure that there is effective traffic management at site. The number of trucks/vehicles to move at various construction sites to be fixed.
- The construction area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

Various measures listed above shall be made mandatory in the Tender Specifications for construction of the project.

- **Impacts on Socio-Economic Environment**

The project aims to bring several positive and adverse social developmental impacts due to the modernisation of North Guwahati terminal through infrastructure development and better ferry services.

Positive Impacts

- Increased facilities and ferry services will add to the increased trading and economic development of the area. Enhancement of better and reliable access to work places, markets, religious places, educational and health facilities.
- Reduction of overall transport and travel times, and improved regional cohesion by affordable transport across the rivers at socially affordable conditions.
- From the Gender angle, it shall have positive impacts on mobility of women to and from North Guwahati , better job opportunities, entertainment facilities etc. Overall enhancement in socio-economic status.

Adverse Impacts

North Guwahati terminal shall be developed on Government land and hence land acquisition is not an issue as per DPR. However, following adverse impacts has been assessed:

- Based on the FGDs findings, 05 (five) vendors earning their livelihood near the existing terminal site will be affected/ displaced during construction period. They are squatters/encroachers and are eligible for entitlements to non-titleholders vide the provisions made in approved Resettlement Policy Framework of the project.
- Due to increased connectivity from various parts of the state and country can lead to an increase in anti-social activities, unless adequate precautionary measures are taken.
- Labour influx management will be an issue to be sorted out appropriately during construction phase.

- Spreading of viral / communicable diseases including STDs due to influx of people from other places is another negative impact for which appropriate surveillance measures needs to be taken.

Mitigation and Enhancement Measures

Mitigation and enhancement measures are required to be planned appropriately to minimize the negative impacts and maximize the positive impacts of the Project from the social point of view.

- During the construction phase alternate arrangements will be made to ensure safe access to the river and connecting transport facilities both inland and water.
- All safety and security systems will be alerted to safeguard the interest of the travellers including women. To resolve the complaints related to such issues as part of the project AIWTDS has already formulated Grievance Redressal Mechanisms (GRM).
- Surveillance measures to control spreading of communicable diseases and AIDS control etc. will strengthened in these areas, by strengthening the Health Surveillance systems.
- Potential impacts on gender and Indigenous people needs further in-depth analysis which will be done in further course of the study in consultation with the affected persons. First round of screening shows that there are no Indigenous people living in clusters within the project locations but are part of the main stream society, leading a main stream life.
- The status of women varies across the places which needs a close analysis and consultation to make further analysis and interpretations.

➢ **Labour Influx**

The influx of workers, including jobseekers and squatters, can lead to adverse social and environmental impacts on local communities, especially the communities located along the terminal and labour camp sites. Adverse impacts may include increased demand and competition with existing social and health services, and goods and services. This can lead to price hikes, increased volume of traffic with higher risk of accidents, increased demands on the ecosystem and natural resources, social conflicts within and between communities, increased risk of spread of communicable diseases, and increased rates of illicit behaviour and crime.

Gender Based Violence and Harassment

Construction, particularly of major infrastructure projects, can be a high-risk environment for GBVH affecting community members, workers and service users. GBVH risks can intensify within local communities when there are large influxes of male workers from outside the area. This may pose a risk in terms of sexual harassment and violence. AIWTDS has signed a MoU with State Commission for Women to address GBV issues. A copy of MoU is enclosed as **Annexure- 15.**

➢ **Impact on Livelihood**

The access/ approach road to terminal sites has some squatters who are earning their livelihood through temporary shops will be affected. Based on the site visit, FGDs and interaction with IWT officials, it is observed that about 05 squatters are likely to be affected at North Guwahati Terminal.

Mitigation Measures

Livelihood and Income Restoration Plan

The strategies for restoring the income of squatters includes providing the PAPs with adequate compensation prior to relocation/vacating the premises, as per approved RPF of the Project.

The due consideration be given to the skills of PAPs and the project related employment opportunities during the construction phases of the project.

The livelihood and income restoration plan for 5 (five) squatters has been prepared based on the RPF of this project and submitted separately as a RAP.

Income Generating Strategies

The long-term income generating strategies for the PAPs, Government of India along with state governments, various poverty alleviation programmes are considered.

Some of the schemes which can be accessed by the PIU/ PMU along with NGO to benefits the impacted project affected persons includes:

- **Impacts on Archaeology and Heritage**

North Guwahati is a famous for Ashwaklanta temple, and Doul Govinda temple. Ashwaklanta temple archaeological sites is significant with the presence of stone sculptures and idols. Thus, construction activities may cause risk of damage or theft.

The Cultural Heritage Management Plan (CHMP) has been suggested as a part of the ESMP. The Cultural Heritage Management Plan (CHMP) has been prepared and enclosed with the Report as **Annexure- 16**.

6.2.4 Impacts During Project Operation Phase

- **Impact on Land Environment**
  - Impacts on Land Use Pattern of the Area

The Project is proposed near the existing terminal used by the water transport in Assam. The land required for these projects falls within periphery of the river and belongs to the government. The project will not interfere with natural drainage in the area. The operation of the proposed terminal will provide an impetus to the mushrooming of secondary and tertiary activities in the area. The project would stimulate lot of ancillary developments like shops, restaurant, repair shops, etc. in and around the terminal. This will lead to conversion of barren land into commercial use near the terminal.

- Impacts due to Generation of Solid Waste

The solid waste generation is envisaged during operation phase could be the disposal of garbage or solid waste generated from various sources. The solid waste generated shall mainly comprise of packaging, polythene or plastic materials etc. Therefore, a system needs be devised whereby undue quantity of garbage is not permitted to accumulate in the jetty area and the same could be disposed-off at designated sites in a proper manner.

Mitigation Measures: Adequate facilities for collection, conveyance and disposal of solid waste will be developed. Provisions shall be made to separately store the degradable and non-degradable solid waste. The solid waste will be disposed at the designated landfill sites.

Various aspects of solid waste management include:

- Reuse/Recycling
- Refuse storage
- Collection and Transportation
- Disposal

- Reuse/Recycling

Project proponent will explore opportunity to recycle the waste generated at the project site, in this context project will identify authorized vendors and send used batteries, used oil, and used oil filters for recycling. The municipal solid waste will be disposed by landfilling at a suitable site. Impact on Water Environment

6.3.2 Impacts due to Generation of Wastewater

For major jetties, an average of 450-500 persons per day are expected in each jetty depending on their capacity. Thus, the total daily demand is 38 KLD. The washing & wiping is to be done manually using powered low pressure portable washer jets and using organic detergents (phosphate free & bio degradable materials) & soft sponge, so that the channel waters are not polluted. Fire demand would be a dead storage and will be used only if there are any fire hazards at the terminals. Water demand in each terminal is given in **Table 6.8.**

Table 6.8: Water Requirement in operation phase

Name of terminal	Number of passenger expected	Water Requirement (KLD)	Bio-digester capacity (KLD)
North Guwahati	450-500	38	12

Mitigation Measures: Suitable waste water treatment measures will be provided for the treatment of domestic sewerage from the jetty premises. Biodigestor shall be provided at North Guwahati terminal to treat the sewage generated.

A part of the treated sewage will be reused in horticulture. The balance treated sewage shall be disposed in river. It shall be ensured that the treated sewage meets the standards specified for disposal of effluents in inland waters.

- Impacts of Boat Movement

During the operational phase with additional facilities there will be increased activities of boat movement in the region. The boats will be Diesel-electric. Possible sources of such impacts on aquatic environment would be, disposal of waste water from boats etc. Environmental implications during routine operations at the jetty could be due to release of wastes generated from the boats including garbage, solid waste as well as sewage, washing of boats etc. Sringent measures will be applied to the disposal waste from boats. Thus, movement of boats have insignificant impacts.

Mitigation Measures

Procedures to dispose- off waste in safe and ecologically friendly environment should be included in the waste management manuals in order minimize river pollution. Wastes such as plastic, metals, glass, batteries, medical wastes, oily rags, sludge, waste oils, etc. will be properly segregated before disposal. Solid and liquid waste will be disposed at the facilities provided at terminal after treatment.

- **Impact on Aquatic Ecology**

- Impacts on Fisheries

The fishing activities are very limited near the terminal site. As there are no significant impacts are envisaged in the vicinity of the proposed terminal

- Impacts on Dolphins Due to Operations

As a precautionary measures to safeguard the aquatic flora and flora as well as wildlife in and around the aquatic environment, any water base development work suggested to be refrained from interfering with the natural flow regime and also to avoid constructing barriers to animals and sediment movement. The concerned should manage the water developmental activities in ways that will minimize the harm to aquatic life including dolphins and other aquatic species inhabiting the area.

The Gangetic River Dolphins mostly depend on eco-location to find their food and they are very sensitive to the impact of the sound as they are basically blind. Equilibrium between sediment erosion and deposition is necessary to maintain essential habitat features. Therefore, access to floodplains should be preserved to ensure natural spawning and rearing habitat for fishes which are prey base of the dolphin and there should have the provision for fish ways.

Dolphins are social mammals that communicate through squeaks, whistles and clicks. They also use echolocation in order to locate food and other objects. Therefore, anthropogenic noise coming from drilling and piling can severely impact their well-being.
Noise can also disrupt 'echolocation', the sensory ability of dolphins to find food, socialise, and navigate underwater. In extreme cases, it can even cause physical harm, including temporary hearing loss, according to the study conducted by World Wide Fund (WWF).

Mitigation Measures

Reducing waterways intensification like downscaling vessel traffic to limit underwater noise. Apart from these technological improvements like improving propeller efficiency to cut down cavitation noise could be useful. Moreover, technological improvements may not only help reduce production of cavitation noise, but also improve fuel efficiency for vessels.
Assessing trade-offs between efficiency, vessel capacity, and technological improvements is thus essential to reduce and mitigate risks to river dolphins from vessel traffic.

- For conservation of dolphin, instruction should be given to all vessels' operators and all employee and staff that dolphins or any other endangered species should not be harmed due to any reason.
- Instruction should be given to vessel operators for maintaining a safe distance and speed if dolphins are spotted, in case of accidental injury to dolphins it should be reported immediately to terminal authority for informing the emergency rescue team.
- Vessel operators should be instructed for not using sharp lights and sounds as they may disturb the aquatic fauna.
- Provision for propeller guards should be provided for all the vessels to minimize the propeller inflicted injuries and scars.
- Regulation of vessel speed in Dolphin habited area.
- Sub-surface aquatic disposal is required, minimum one meter below the water surface. Careful mapping of sensitive areas directly affected by the dredge;
- Preventative maintenance of equipment to mitigate negative environmental impacts such as leakages and spillages
- The mess size of the iron wire to be used to fix the boulders below the steps at Ghats close to the water line or river edge should be four inches instead of eight inches.
- Any plantation if required, species identification should be done carefully with local people, experts natural amphibious/aquatic grasses of riparian zone of the river grow which should not be disturbed.
- There should be minimum or no noise under the water during implementation of the project.
- If any mechanized boat is used during implementation of the project, the same may have provision for propeller guards.
- Support for promoting fish productivity through setting up or supporting existing fish nurseries as a part of enhancement measures. Also providing training and awareness support through reputed institutes or experts like Central Inland Fishery Research Institute (CIFRI) for better fishing techniques. Provision of supporting studies for conservation and safety of dolphins should be made during the course of the Project for documenting the best practices as well as updating the conservation/management plan.

➢ <u>Impacts on Aquatic Ecology</u>

During operation phase, there could be less noise levels due to operation of boats. As the boats are modern facilities, no adverse impacts on noise environment are anticipated during operation phase of proposed project.

- **Impact on Air Environment**

During project operation phase, major activity would be passenger service. The propulsion of the boats will be diesel-electric. At normal operating speeds, the boats would operate with the help of batteries and there would not be any fuel consumption. The boats will operate on diesel only when batteries are completely discharged.

The key source of air pollution in the proposed project is due to the increased vehicular movement and Boat movement in the project are.

Mitigation measures: The following management plan would reduce the impact of such emissions on the general environment.

- All equipment shall be properly maintained to minimize exhaust.
- Vehicles will be turned off when not used for extended periods of time.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.

- **Impacts on Socio-Economic Environment**

The following impacts are envisaged in the project operation phase:

- In addition to direct employment, operation phase would also lead to generation of direct and indirect employment opportunities and would increase the income levels of the local population.
- In the operation phase, project would lead to mushrooming of various allied activities. This will lead to marginal improvement in the employment scenario, which is a positive impact.
- Improvement in communications and transportation facilities.

Development in transportation facilities will help the people to access the health, education and market facilities in the adjoining areas. This will be a positive impact

Chapter 7 – RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1 INTRODUCTION

The present chapter outlines the Risk Assessment and Disaster Management Plan to be implemented in the event of an emergency in the proposed priority terminal at North Guwahati. This Disaster Management Plan also sets out the procedures and measures to be taken into account in the event of loss of containment and consequence thereof in the proposed project.

7.2 RISK ASSESSMENT

The risk assessment has been conducted following the guidelines underlined in the Environmental Impact Assessment Guidance Manual for Ports & Harbours by the MoEF&CC as well as the IS: 15656, Hazard Identification and Risk Assessment.

The objective of the risk assessment study is to identify potential credible hazards arising out of the operations and maintenance of waterways passenger terminal facilities that manage the transport of passengers and goods from one terminal to another, to mitigate severity and to aid in preparing effective emergency response plans by delineating a disaster management plan to handle inland and riverine emergencies.

Risk Analysis, therefore, is the process of identifying the probability of occurrence of an accident and its consequence, when ports handle hazardous cargo or involve risky operations. Risk Analysis involves identification of hazards and the associated risks, if any, involved in these operations. Hazards could possibly originate either from within the or from sources outside the port boundary i.e., the operating area

However, as the facility based on operation of passenger vehicle in a waterway, suitable measures have been suggested based on the specific case and situation.

7.2.1 Risk Assessment for North Guwahati Terminal

The risk assessment for the North Guwahati terminal has been designed considering the following assumptions.

- The passenger ferry terminal would cater to a both passengers and two wheelers.
- The passenger ferry terminal would consist of structures as per the relevant IS or acceptable international codes pertaining to the construction of such structures.
- The passenger ferry terminal would consist of several structures for passenger amenities including general office, waiting block, ticketing and sales office, public conveniences and

medical or first aid facilities. The terminal would also house a firefighting section or provisions thereof.

- The facility would have provisions for biodigester for sewerage treatment.

- The facility would be designed as per the hydro-geomorphology of the region as well as with bank erosion protection.

- North Guwahati has been considered as category-3 under soil erosion. This implies stable conditions as per the technical assessment carried out during the preparation of the DPR. The riverbank at the terminal site locations experiencing stable conditions is grouped under this category. The time history satellite images show moderate shift of riverbank at terminal sites due to water level. For these terminal sites, riverbank protection is both technically and economically viable. Due to the stability in the riverbank, fixed terminal operation facility will be considered as a suitable solution.

- In terms of traffic categorisation, North Guwahati has been considered under Category B- Catamaran vehicles with two wheelers & foot passengers.

- Under this category, the ferry terminals shall be planned with consideration of safe and efficient movement of the two-wheeler vehicles and foot passengers on the catamaran vessels. The berthing facility will have all the basic infrastructure that is needed for mooring the vessel and roll on and roll of vehicles. The access ramp shall be planned in straight line for the easy movement of the four wheelers. In such situation where there is a constraint for planning the straight access ramp, curved access shall be planned with safe turning radius provisions.

- The passenger ferry terminal would provide necessary safety services to the passengers including public announcements and briefing as and when necessary.

- Safety boundaries as per the demarcation of HTL and LTL in the ferry is essential for ensuring overall safety of the passengers and vessels operating at the Passenger Ferry facility. Water level variation between high and low flows is in the range of 8-10m

- The passenger ferry service would also house a suitable weather station for alerts and warnings as and when required.

- The site is protected by providing adequate security round the clock.

- The passenger terminal is based on flexible and mobile options for riverine infrastructure, exposed rock also observed due to hill outcrop. Considering this available condition, it is proposed that no ground improvement is required.

a) Hazard Identification

The hazards conceived for the passenger ferry facility and its operations could be classified as two major categories.

- Technology and human induced.
- Natural or Climate induced.

In the first part of technology and human induced hazards, the hazards could arise both during construction and in operations. This also includes the malfunction of the passenger transport vessel and any on-site maintenance required thereof.

The risk of collision with other transport vehicles could pose a hazard to the passengers and environment. However, this risk assessment covers the terminal and on land facilities and therefore the risks during the transfer of goods and passengers in the river is beyond the scope of this chapter.

7.3.1 Technology and human induced

a) Hazards during construction

During construction, there is a fair probability of mechanical, civil, and electrical hazards due to human errors.

The present site conditions at North Guwahati could act as a gauge for hazards during constructions. The existing site conditions of North Guwahati reveal that there is a path for traversing motorised two wheelers as well as passengers on feet. There is a temporary bamboo rail mud pathway to pontoon. However, during construction a clear demarcation of the traffic flow and construction plan for workers as well as personnel should be worked out. There should be a separate arrangement for maintaining the construction inventory, which does not hinder the movement of material and machines.

Before construction, stability of the soil as well as load bearing capacities should be investigated. Temporary arrangements for construction management/site office should be built without any disruption to the emergency evacuation routes.

The construction stage is divided into three major activities,

- **Mobilization and Site set-up**

  The mobilization and site set-up are the most critical start-up activities to set the pace for timely construction of the terminal. Considering the accessibility of the planned North Guwahati terminal, a mobilization period of 2 months has been allowed for the site set-up.

- **Construction of riverine facilities**

The other activity that dictates the project schedule is the lead time for procurement and delivery of the pontoon and linkspan. The estimated time taken for delivery of the pontoon and linkspan is about 10 months and a further 2-month period is foreseen for the installation of the same. The completion of the terminal largely depends on this activity as all other activities can be expedited with the deployment of additional resources

- **Landside development**

  A total of 12 months has been allotted for the construction of the landside facilities at North Guwahati. This includes a period of 2 months for the area development and about 10 months for the terminal building including other utilities and finishing. A single ramp for two-wheelers and passengers has been planned at North Guwahati and hence a period of 9 months has been considered for the same.

b) Hazards during operations

There could be several situations which could lead to safety issues. These can be classified as mechanical, electrical, and structural.

The structural hazards refer to the failure of civil components installed in the facility. One of the situations which could occur over long time period is the de-stability of the concrete slabs placed over the deck. (Concrete slab of 350 mm is provided which acts as a concrete deck over which the vehicular or passenger movement occurs). The mechanical and electrical hazards are typical of the installation such as short circuits, power failure, mechanical glitches such as the failure of winch (Winch or the necessary mechanical arrangement shall be used for the movement of linkspan to cater to seasonal water level variation), etc. During operations, maintenance would be important aspect for preventing short term and long-term hazard conditions.

c) Structural Aspects

Riverbank Protection

There is a need to protect the riverbank from the erosion and stabilise the riverbank to have the terminal operational. The proposed ferry terminal infrastructure will be under risk without proper bank protection measures. There are various methods available for the riverbank protection and the same can be achieved by having reno mattress or fabric form mattress.

Other hazards anticipated at the terminal

- Hazards arising from passenger movements during peak hours
  This would cause stress to the physical structure at the terminal.

- Hazards arising from malfunction of the vessel.
  This could cause a more held up of the passengers at the terminal as well as prevent other passenger vessel for mooring.

- Hazards arising from passenger behavioural aspects on-board vessel and during transport
  This could cause a safety and security concern.

- Hazards operating from fuel leakages
  This situation could lead to the release of quantity of oil in the river environment.

d) Hazards due to ramp structures

For North Guwahati a minimum gradient of 1:12 with landings at every 5 meters of ramp run is considered. This could lead to slips of passengers especially the disabled or senior citizens. Other type of hazards such as noise hazards would be prevalent during the operational hours of the vessels.

7.3.2 Natural hazards

The challenges in navigating through the site during construction, also raise a fair hazard possibility for the construction team.

- Bank failures are rampant and seem to be function of the hydraulic character of the flow and the engineering properties of the bank material.
- Flooding is normal in Brahmaputra. Therefore, it is essential to develop adequate systems for ensuring safety of the terminal and its assets during these times.
- The hazards during construction would be slips and trips due to navigation on different soil conditions. It is essential that proper soil conditions and their stability be communicated to the project implementation team.
- Hazards could arise due to shifting of the riverbank changes.
- Hazards would also arise due to varying weather conditions and due to establishment of temporary structures. Based on the topographic survey information, ground surface along the proposed jetty location is varying between +23m in the river to +51m at the landside.

Risk Matrix

A simplified risk matrix based on the most probable incidents which could occur during the operations of the terminal has been depicted in **Table 7.1**. The risk matrix provides the severity in four major categories in accordance with the IS:15656 as well as a probability of the incidents from frequent to 1 in a million days of operations.

Table 7.1: Simplified Risk Matrix

Probability	**Severity**			
Days of operation	Minor (1)	Major (2)	Critical (3)	Catastrophic (4)
Frequent to 1/100 (1)	Very minor to minor faults			
1/100 to 1/10,000 (2)	Collision with terminal at low speed	Major fault at the terminal- suspension of operation		

	Slips, trips and falls			
1/10,000 to 1/1,000,00 (3)	Collision with terminal at high speed	Fuel Leakage scenario at terminal		
1/1,000,00 to 1/10,000,00 (4)		High speed Collision with fuel leakage		Major attacks or sabotage

The Risk Assessment and Disaster Management Plan for both Construction and Operation phases of the proposed North Guwahati Terminal is given at **Annexure-20.**

Traffic safety management

The terminal has developed a passenger movement plan for ensuring that no untoward incident such as stampede or any crowded hot spot develop inside the premises. The traffic flow has been depicted in **Figure 7.1.**

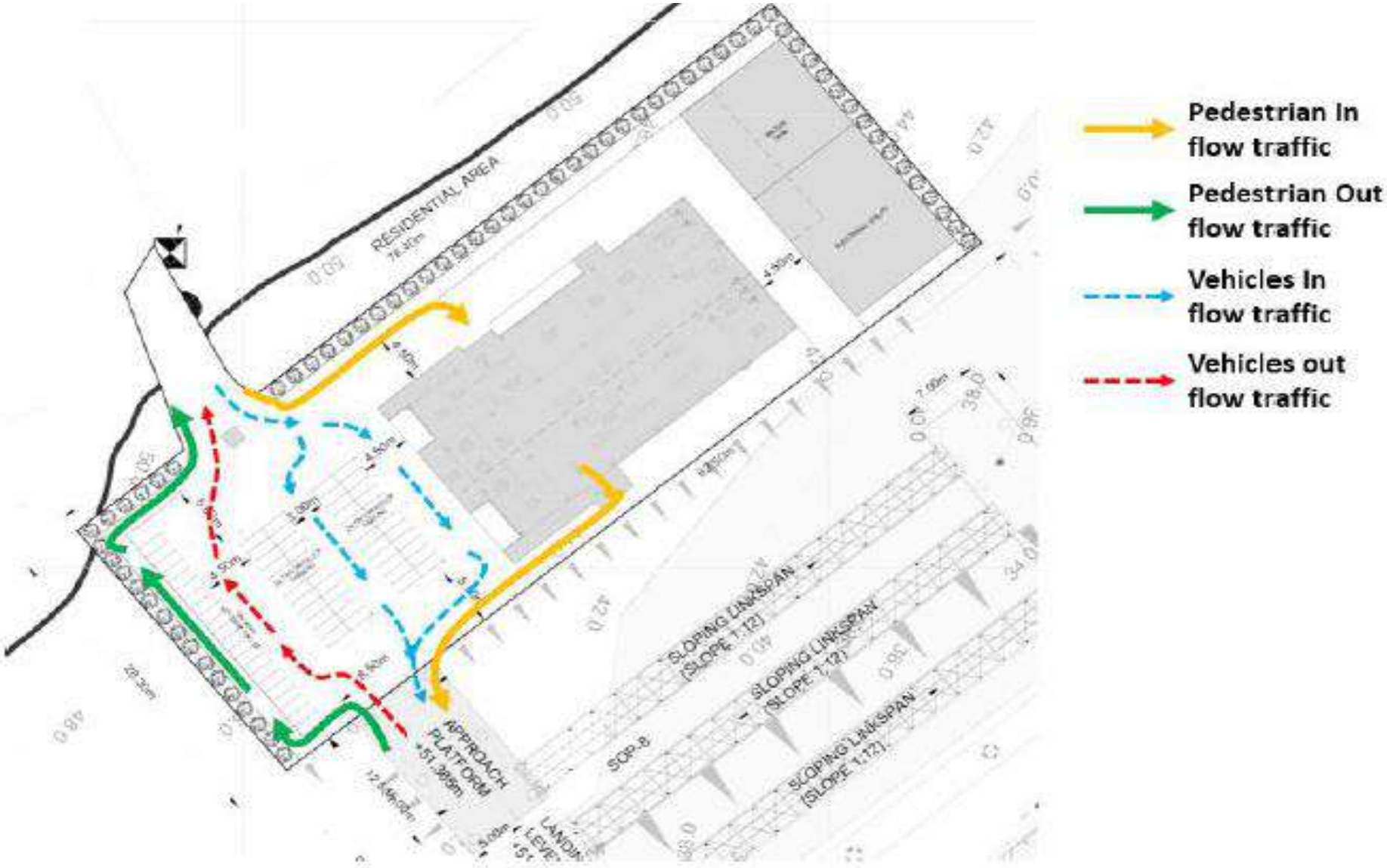


Figure 7.1: Traffic Safety Management Plan

Chapter 8 - ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN AND MONITORING PROGRAMME

8.1 GENERAL

The Environment and Social Management Plan (ESMP) is required to ensure sustainable development of the proposed terminal on river Brahmaputra both during the construction as well as operational phases. The ESMP is site and time specific. In order to effectively implement ESMP, an institutional framework has been developed and roles and responsibilities of various relevant agencies have been worked out. Capacity development program are also identified and part of the ESMP.

In general, Assam Inland Water Transport Development Society (AIWTDS), (with assistance from Contractor ,Third Party Monitoring Consultant /Technical Support & Supervision Consultant) is the responsible entity for ensuring that the mitigation measures as suggested in the ESMP are carried out. A detailed ESMP has been prepared for North Guwahati terminal. The list provides reference implementing organisation and responsible entity.

COMPONENTS OF EMP

Key components of the EMP are summarized below and explained in detail in the following subsections:

- Mitigation Measures
- Monitoring Measures
- Institutional Arrangement
- Reporting Requirements
- EMP Budget

Site-specific environment and social riverine infrastructure along with the roles and responsibilities of the key persons involved at different phases of the proposed development are described below:

The Environmental and Social Management Plan for North Guwahati Terminal for both construction and operational phase is detailed in **Table 8.1 to 8.3.**

Table 8.1: Environment Management Plan (Construction Phase)

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation	Supervision
Design					
Development of the Final Design	The design of the infrastructure must be resilient to the Floods	The design must take into consideration the projected rainfall levels as in the Assam State Action Plan on Climate Change (2015- 2020). The Annual rainfall is likely to increase by 10-25 %, and the extreme rainfall days will increase by 5-38%, with the extreme rainfall increase projected to increase between 25 and 150 mm.	Assessment of Design for Resilience	Contractor	TSSC & PMU (AIWTDS+GC)
	Collection and Treatment of Solid and Liquid Waste	The design of bio-digesters at the Terminal must be an adequate size to meet the regular passenger demand. Additional space needs to be made available for setting up additional bio-toilets for the pilgrim / festival. Adequate space must be made available to store municipal solid waste.	Assessment of Capacity of Bio-Digestor Assessment of space for the setting up bio-toilets, Adequate space for storage of Municipal Solid waste	Contractor	TSSC & PMU (AIWTDS+GC)
	Energy Efficiency	Energy-efficient measures in the terminal buildings will be implemented; Solar power will be used in potential area	Use of Energy efficient Fitting and fixtures	Contractor	TSSC & PMU (AIWTDS+GC)
Pre-Construction Activities					
Field Verification Surveys	Requirement for felling of trees	**Permission of tree(s) removal from non-forest area** -The GC/ PMU and the Contractor will carry out joint field verification to ascertain whether any tree would be affected and needs to be felled either for the construction activities or for safety purpose. In case any tree must be felled. -Permissions must be obtained from the Forest Department, Government of Assam. No tree would be felled without permission. At present there is no requirement for felling of trees for the proposed construction at North Guwahati	Copy of the Permit of the Forest Department, Government of Assam	Contractor	PMU (AIWTDS+GC) and TSSC
Assessment of Impacts due to Changes/Additions in the Project	Additional Impacts	**Site-specific EMP before the commencement of construction** -In case of any change in the event of changes/revisions (including addition or deletion) in the project's scope of work or	Approved copy of the C-EMP	Contractor	PMU (AIWTDS+GC) and TSSC

		change in the site condition. the impacts of the changes need to be assessed. **-**The Contractor will also prepare site-specific EMP to address these additional impacts. The Site Specific EMP has to be submitted to the PMC for approval. The Construction activities must not start before the approval of site-specific EMP by the PMC.			
Setting up of Plant and Machinery (Batching Plants or concrete mixer location)	Potential source of pollution (air quality, water quality, soil)	**Location of Batching Plants** -Batching plants will be sited sufficiently away from settlements, agricultural operations, or commercial establishments. Compliance with laws, ordinances, codes, rules, regulations, orders, or declarations -Concrete mixers and batching plants will comply with the requirements of the relevant emission control legislations and -Consent/NOC for all such plants obtained from the State Pollution Control Board will be submitted to the PIU. -The Contractor will not initiate plant/s operation till the required legal clearances are obtained and submitted. In case the concrete is procured from a third party, a valid consent of the plant, along with the latest copy of the Annual report, will be submitted to the PIU before the procurement of any material	Consent to Establish and Operate	Contractor	PMU (AIWTDS+GC) and TSSC
Procurement of Other Construction Vehicles, Equipment and Machinery	Potential for air pollution and noise	**Statutory Compliance:** All Construction equipment[1] and machinery to be used in the project will conform **to** BS IV standards to be adopted by the Ministry of Road Transport and Highways. The discharge standards promulgated under the Environment Protection Act, 1986, will be strictly adhered to. -Noise limits for construction equipment to be procured, such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws, will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Contractor will maintain a record of PUC for all vehicles and machinery used during the contract period.	Certification by Manufacturer of emission and noise levels/ Pollution under Control Certificates, Insurance and Driving License of the driver to be submitted for all vehicles	Contractor	PMU (AIWTDS+GC) and TSSC

[1] *Every agricultural tractor, construction equipment vehicle and combine harvester shall be so manufactured that it complies with the following standards of gaseous pollutants as per rule 115A,after sub-rule (8), of the Central Motor Vehicle Rules, 1989.*

Sourcing of construction material	Unsustainable mining practices	-Contractor will finalise the stone quarry /sand mine / borrow area for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements. The --Contractor will provide a copy of the Environmental Clearance Certificate of the quarry/sand mine and the Consent to Establish and Operate along with the recent compliance report to the PMU before any such quarry is engaged. -In case the contractor decides to use new quarries then the contractor will obtain the environmental clearance and all other permits and licenses and submit the same to the PMU before extracting any material. The contractor will submit a copy of the approval and the rehabilitation plan to the PIU and the Environmental Expert of the PMU Consultant. -Contractor will also work out haul road network and report to the Environmental Expert of the PMC. They will inspect and in turn report to PMU before approval.	Permission for mining/ quarrying of materials from the Mining Department, District Administration and District Level Environment Appraisal Committee	Contractor	PMU (AIWTDS+GC) and TSSC
Identification of water sources for construction	Adverse impact on water resources	If the contractor will source water requirements for construction form groundwater, prior permission from the Ground Water Board is required. A copy of the permission will be submitted to PIU prior to the initiation of construction. A flow meter must be installed, and the records of water used for construction must l be maintained. The usage of groundwater must be recorded. The contractor can use fresh groundwater sources after the required treatment for drinking. Even if water is sourced from third parties, the above provisions must be followed. -If the river water is used, the permission of the Irrigation department must be obtained	Permission from the Ground Water Board for Groundwater usage Permission of the Irrigation /Water Resources Department in case of River water is used.	Contractor	PMU (AIWTDS+GC) and TSSC
Environmental monitoring of baseline conditions of air, noise, water, and soil	To establish baseline environmental conditions and ascertain the impacts during the construction phase	Environmental monitoring to be carried out through recognised[2] Laboratory as per the locations specified in the environmental monitoring plan in **Table 8.4.**Error! Reference source not found.	Submission of test results to PMU	Contractor	PMU (AIWTDS+GC) and TSSC

[2] (National Accreditation Board for Testing and Calibration Laboratories (NABL) Accredited /Ministry of Environment Forest and Climate Change (MoEF&CC) / respective State Pollution Control Board (SPCB's)).

EMP Implementation Training	Lack of awareness of EMP can lead to irresponsible behaviour resulting in an Irreversible impact to the environment, workers, and community.	-Project manager and all key workers will be required to undergo EMP implementation, including spoils management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH&S), core labour laws, applicable environmental laws, etc. Additional modules for Dolphin Protection and Cultural Heritage Management - All new personnel joining the work need to undergo induction training. All personnel joining work after a break of more than 15 days need to undergo refresher.	-Certificate of Completion (Safeguards Compliance Orientation) -Posting of EMP at worksites. -Maintaining Records of training both induction and refresher -Submission of the Training records to the PIU every month	Contractor	PMU (AIWTDS+GC) and TSSC
	Deployment of EHS Officer and OHS Officer	Deploy qualified personnel and management committee. - Contractor must depute qualified EHS personnel in the start of the project to conduct training to all the personnel and effective monitoring of mitigation measures during construction. The name and functions of the responsible EHS persons and their relevant expertise must be notified in the Quarterly Report -If an EHS person resigns/ replaced/replaced or the team has been enlarged, the same must be reported to the Bank within 15 days of the incident	Submission of records of the availability of the EHS personnel onsite in the Monthly Report and Quarterly Report	Contractor	PMU (AIWTDS+GC) and TSSC
Legal compliance	Environmental legal noncompliance may	-Obtain all consents, clearances (CTE/CTO from ASPCB), permits NOCs etc., before start of construction works. -Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (Refer Table 3.1 in this report) -Following consents are required- -Tree cutting-local authority -Storage, handling, and transport of hazardous materials- ASPCB. -Sand mining, quarries, borrow areas- Department of mines and Geology. .-Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs etc. -Include in detailed design drawings and documents all conditions and provisions; if necessary	Copy of the Permit/ Consent to be submitted with QPR to PMU	Contractor	PMU (AIWTDS+GC) and TSSC
Chance finds	Damage / disturbance to artifacts	Construction Contractors to follow these measures in conducting any excavation work.	-Chance Find Protocol	Contractor	PMU (AIWTDS+GC) and TSSC

		-Create awareness among the workers, supervisors and engineers about the chance finds during excavation work. -Stop work immediately to allow further investigation if any finds are suspected. -Inform State Archaeological Department if a find is suspected and taking any action, they require to ensure its removal or protection in situ.	-Awareness training for workers		
Preparation of Method Statement	Occupational Health Safety and Community Health Safety Impacts	Carry out a Hazard Identification and Risk Assessment for all tasks presented in the Method Statement Prepare occupational health and safety plan, including COVID-19 H&S Plan Prepare Community Health Safety Plan to ensure that the community/ pilgrims are segregated from the construction area Prepare a Debris/spoils management plan, Waste Management Plan.	- Occupational Health and Safety Plan (including HIRA) to be integrated with Method Statement - Community Health Safety Plan - Debris/spoils management plan, Waste Management Plan	Contractor	PMU (AIWTDS+GC) and TSSC
	Impact of Aquatic Species and Dolphins	Construction Planning must be carried out so that No-construction /piling (stop the construction activities) in the water part between Mid- March to Mid-June) Construction activities must not be planned on the waterside during the monsoon period. Construction schedule should ensure that no work is planned during the monsoon in the water part.	Construction Scheduling	Contractor	PMU (AIWTDS+GC) and TSSC
Construction Stage					
Clearing and Grubbing for site Preparation (Terminal Site, Base camp, Construction Camp & Labour camp)	Landscape and Aesthetics	Permission of tree(s) removal from non-forest area -Vegetation will be removed from the construction zone before the commencement of civil works. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is avoided or minimized. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of the Consultant. The contractor, under any circumstances, will not cut or damage trees. Trees identified under the project and have received permission of felling from the Forest Dept will only be felled. - Compensatory afforestation must be carried out per the Tree Felling permission provisions.	Verification of number of trees felled; Copy of NOC from forest dept.	Contractor	PMU (AIWTDS+GC) and TSSC

	Loss of topsoil. Loss of natural resources (Earth/soil) in area where the Constrctioncamp is setup	•Top soil (15 cm) would be stripped and kept separately in stockpiles for use in landscaping. • At least 10% of the acquired area for construction purposes must be kept for stockpiling of fertile topsoil •Precautions must be taken while stockpiling. The slope of the stockpile shall not exceed 1:2 (V:H) to retain soil & allow percolation of H_2O and the edges of the pile shall be protected by silt fencing. The piles shall be covered with gunny bags/ tarpaulin. The maximum height of the stockpiles shall be kept less than 2 m •Excavated materials would be preferably used for site filling for land reclamation to construct the terminal	Site verification	Contractor	PMU (AIWTDS+GC) and TSSC
Transporting Construction Materials and Haul Road Management	Impacts on air quality and safety	-Contractor will maintain all hauls roads (existing or built for the project), which are used for transporting construction materials, equipment, and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials or being blown away during the transportation. -Only major roads will be used by the contractor's vehicles or any of his sub-contractor or materials suppliers. --Roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. -Contractor will arrange for regular water sprinkling for dust suppression of all roads and surfaces. -The unloading of materials at construction sites in/close to settlements will be restricted to daytime only. -All stockpiles will be covered/protected to prevent dust generation	Complaints from local community Visual observation in Site reports Monitoring of the air quality in the worksite and material storage area	Contractor	PMU (AIWTDS+GC) and TSSC
	Impacts on Water Quality	- Boats/ Vessels carrying construction material must not be overloaded. - Loading and unloading activities must ensure that spillage does not occur. - loose and friable material transported by boat must be covered	Site Reports	Contractor	PMU (AIWTDS+GC) and TSSC
	Community Safety due to movement of Constractio Vehicles	- Constraction material shall be stored within the construction area to prevent accessibility issue with the community - Schedule transportation of the constraction material so that heavy vehicles do not cause inconvenience to the local population and people on site ;	Site Reports Complaints form Local people on disturbance	Contractor	PMU (AIWTDS+GC) and TSSC

		- Drive vehicles in a considerate manner; - Coordinate with Traffic Police for temporary road diversions, where necessary, and for provision of traffic aids - Notify affected area by public information notices, providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.			
Storage of Construction Material	Potential for waterlogging	-The contractor will ensure that no construction materials like earth, stone, sand, or appendage are disposed of so as not to block the flow of water of any water course and cross drainage channels. -The contactor must not dump any excavated material into the river. -The contractor will take all necessary measures to prevent the blockage of water flow. -The stockpiled material must be prevented from erosion and deposition in the drainage channel from sites where these are stocked for construction.	Complaints of water logging	Contractor	PMU (AIWTDS+GC) and TSSC
	Water Pollution from Storage of Construction Material	Run-off from a material stockpile can also contaminate water. To prevent the contamination of the construction material, the following measures must be adopted; -The runoff from the construction material storage yard must be channelled through peripheral drains -The peripheral drains must be connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity All sedimentation tanks and peripheral drains must be cleaned before the monsoon.	-Site visit Report -Number of sedimentation tanks installed. - Records of surface water quality Monitoring. -No visible Sedimentation to nearby drainages, nallahs or waterbodies due to civil works	Contractor	PMU (AIWTDS+GC) and TSSC
	Water Pollution from Fuel and Lubricants	- The contractor will ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery, and equipment maintenance are in accordance with the provisions stated in (**Annexure 19: Environmental Codes of Practice & Other Plans**) -Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refuelling areas as per the design provided.	-Number of Oil interceptors installed. -Records of surface water quality Monitoring. - No visible degradation to nearby drainages, nallahs or waterbodies due to civil works	Contractor	PMU (AIWTDS+GC) and TSSC

	Pollution of water bodies from domestic activities	**-Wastewater from domestic activities such as bathing and washing at the camp site must be treated.** -The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering streams, water bodies or the irrigation system. -- The liquid waste from the construction camp must be treated and disposed of. -In the absence of construction camp if the contractor takes a rental accommodation must be channelized to the nearest municipality drain. In the absence of a municipality drain, a septic tank and a soak pit system of adequate capacity must be constructed. -Stagnation of water should not be allowed at any place near the campsite as a precaution against vector-borne disease. **Wastewater from the North Guwahati Worksite** -An adequate number of toilets must be provided Bio-toilets of adequate capacity must be provided for the workers based on no of users. The supernatant from the Bio-digestor must be discharged into the soak pits. The Supernatant from the. bio-toilets must be tested at periodic intervals to meet discharge standards **Collection of Food waste and kitchen waste from Construction Camp** -All waste arising from the project is to be stored and disposed of as per the provisions of **Annexure 19- Environment Codes of Practices & other Plans** or as directed by EHS Specialist of the PMU In the case of rented accommodation, arrangements must be made with the Municipal corporation for the disposal of the waste. **Collection and Disposal of Food Waste from the North Guwahati Construction Site** Adequate space must be provided in the Construction Site for the storage of Solid Waste No Solid waste should be discharged into the river Mechanisms of transporting and disposing of the Solid waste to Guwahati must be carried out.	-Adequate number of toilets as per no of labours - Records of surface water quality Monitoring; -No visible degradation to nearby drainages, nallahs or waterbodies due to civil works	Contractor	PMU (AIWTDS+GC) and TSSC

Construction activities in Waterside	Degradation of Water Quality due to piling activities	-The piling work in the river must be undertaken during low-flow periods. -Turbidity traps/curtains/ Geo-Textile synthetic sheet curtains would be placed around piling and construction areas to prevent sediments and construction waste movement.	-Construction methodology for waterside construction -Schedule of construction works to ensure completion of the works before monsoon/ develop a Monsoon Management Plan - Records of Works inspection	Contractor	PMU (AIWTDS+GC) and TSSC
	Impact on aquatic life and dolphins	-Construction Planning must be carried out so that No-construction Period (stop the construction activities in the water part between Mid- March to Mid-June) -The river area in which the piling is planned advisable to carefully determine drop sites before anchor placement to ensure that Dolphin and fish communities that could locally still be present in the area are not unnecessarily damaged -Before piling starts, Dolphin Watch must be carried out in the river for one hour. Piling must commence if dolphins are not spotted. - Before starting piling, allow some time for aquatic fauna to displace from the piling area. -Piling must be stopped for some time if any dolphin/turtle/RET species are sighted in the activity area .-Noise-reducing devices like mufflers ,enclosures baffles must be fitted with the equipment as much as feasible. -Fish exclusion devices must be installed in the water column around the pile driving area to prevent fish access -Geo Textile synthetic sheet curtains &turbidity traps must be placed around piling and construction areas to prevent the movement of sediments and construction waste	Preparation of the Dolphin / Aquatic Manal Management Plan 2. Logs for recording watch and ward for dolphins / turtles during the piling 3. Log for aquatic fauna monitoring	Contractor	PMU (AIWTDS+GC) and TSSC

		-Aquatic ecology monitoring must be carried out before the start of construction and after completion of construction to assess the impact of construction activities on aquatic life. . Effect of piling during the construction period will be managed by the adoption of vibratory piling and the usage of bubble curtains to disperse the fauna and reduce the noise level -If, despite the introduction of preventive measures, fish kills or impact on aquatic life is observed, then the work will stop immediately, and the methods will be reviewed and corrected. -If drilling is carried out Polymer-based mud instead of bentonite to be used as drilling fluid with proper storage of polymer at designated storage areas. Drill cutting and spent drilling mud must not be disposed in the river - All equipment will be adequately maintained to prevent potentially hazardous or toxic products from leaking or spilling. This includes hydraulic fluid, diesel, gasoline and other petroleum products. -The piling activities must be carried out in the shortest possible timeframe.			
	Degradation of water quality due to construction activity	Select a construction methodology that is least disturbing and appropriate for the in-situ soil condition. Schedule construction works to complete the construction work before the onset of the monsoon. Schedule the construction works during the low water level period –ensure that works are completed during the same period before the onset of monsoon. - Inspection and maintenance of disturbed areas where mobilisation and barrier installation occur for sediment control measures. -Washing of vehicles and equipment must not be carried out in rivers or nearby places.	(i) Construction methodology for waterside construction -Schedule of construction works to ensure completion of the works before monsoon/ develop a Monsoon Management Plan -Records of inspection of the sedimentation chamber -Effectiveness of water management measures. -No visible degradation of water quality	Contractor	PMU (AIWTDS+GC) and TSSC

	Water Pollution from Fuel and Lubricants and hazardous waste	- Avoid/minimise storage of fuels, chemicals, and lubricants near the river/water; ensure no spillage - A temporary secured hazardous material handling and waste storage area must be provided at the construction site. As part of a design feature, a permanently secured ('bunded') impermeable surface and dykes capable of carrying 110% volume of materials for accidental spills or leakage must be constructed and maintained. Fuel transfer through decanting is prohibited. The use of a transfer pump with the proper fitting is suggested. -The storage area should be covered. - Dispose of any wastes generated by construction activities as per the guidance presented in **Annexure 19- Environment Codes of Practices & other Plans** and - Conduct surface quality inspection and monitoring according to the EMP. - Contractors will have emergency spill equipment available whenever working near or on the water.	- No of spills reported -Field observation -Water quality monitoring reports	Contractor	PMU (AIWTDS+GC) and TSSC
Construction on the landside	Deterioration of air quality from fugitive sources	**Prevent Dust Generation** -The soil/earth must be transported by covering the haulage vehicles with tarpaulin or any other good quality material. -Dust suppression measures by water sprinkling on worksites and temporary service and access roads. -All construction workers must be provided with pollution masks to mitigate the effect of dust generation on the health of workers. -Construction Material must be transported in covered dump trucks to the project site. This must not be stockpiled at the project site - Clean wheels and undercarriage of haul trucks before leaving the construction site. - Loading and unloading of construction materials must be made at designated locations with provisions of water sprinkling.	- Complaints from sensitive receptors. - Quarterly environmental monitoring report for ambient air, noise, water, and soil	Contractor	PMU (AIWTDS+GC) and TSSC

		-Construction vehicles, machinery & equipment must be regularly serviced and maintained and would have a valid PUC certificate -Don't allow non-project vehicle access in the work area, limit soil disturbance and prevent access by barricading and security personnel. -Traffic detours and diversions must be designed to minimise bottlenecks and ensure smooth traffic. -Air pollution monitoring must be carried out at specified locations as described in the monitoring plan to verify that the contractor follows air pollution norms and that the air quality at the construction site does not exceed the prescribed limits.			
Use of Plant, Equipment Machinery and Vehicle	Emissions from Construction Vehicles, Equipment and Machineries (Generation of Exhaust Gases) lead to the deterioration of air quality	-The contractor will take every precaution to reduce the level of dust from batching Plant/Cement Storage/, construction sites involving earthwork by a sprinkling of water, encapsulation of dust source and by the erection of screens/barriers. -All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. -The contractor will provide necessary certificates to confirm that all Plants, equipment, machinery, and vehicle used in construction conform to relevant dust emission control legislation. -No open burning of bitumen or preparation of hot mix is allowed. -No burning of firewood is allowed in the construction camp. The Contractor must make provisions for LPG cylinders. -Compliance with laws, ordinances, codes, rules, regulations, orders, or declarations -All vehicles, plants and machinery used during construction must conform to the emission standards promulgated under the Environment (Protection) Act, 1986. The contractor will ensure that all vehicles, equipment, and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of PCB. -The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Valid PUC must be maintained throughout the construction period Monitoring results will also be submitted to PMU Consultant and PIU as per the monitoring plan.	- Heavy equipment and machinery with air pollution control devices. - Latest Six-Monthly Compliance Report to ASPCB - Valid Consent to Establish and Consent to Operate. - Certification that vehicles are compliant with Air Act - Quarterly environmental monitoring report for ambient air, noise, water and soil	Contractor	PMU (AIWTDS+GC) and TSSC

		-Contractor will ensure that all vehicles, equipment, and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of CPCB emission standards			
	Noise pollution leads to inconvenience for the people	The Contractor will confirm the following: - All plants and equipment used in construction (including third-party plants and equipment) must conform to the MoEF&CC/CPCB noise standards. - All vehicles and equipment used in construction will be fitted with exhaust silencers. - Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found defective will be replaced. -The activities must be carried out during the daytime. Night-time activities may be carried out in an emergency, but all measures mentioned in the mitigation measures for night work must be strictly adhered to. - Limits for construction equipment used in the project, such as concrete mixers, cranes (moveable), vibrators and saws, must not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. -Maintenance of vehicles, equipment and machinery must be regular and up to the satisfaction of the Environmental Expert of the PMU Consultant to keep noise levels at a minimum. - No noisy construction activities will be permitted around educational institutes/health centres (silence zones) up to 100 m from the sensitive receptors, i.e., schools, health centres and hospitals between 9.00 am to 6.0 pm. -Restriction on Honking at the project site -Traffic management plans prepared during the construction mobilization period must also be implemented during the construction stage. Effective traffic management must be taken care of in sensitive locations, major built-up areas, and along important highway junctions. - Barricading (Temporary noise barrier) around the construction site to minimize the noise level -Monitoring must be carried out at the construction sites as per the monitoring schedule, and results will be submitted to PMC and PIU.	- Complaints from sensitive receptors. - Use of silencers in noise-producing equipment and sound barriers.	Contractor	PMU (AIWTDS+GC) and TSSC

		-The Environmental expert of PMC will be required to inspect regularly to ensure the compliance of EMP.			
	Vibration from the works.	No explosives should be used in construction activities. -Only mechanical equipment must be used to prevent Chances of damage from vibration. -If a mechanical vibrator/ pneumatic hammer is used within 100 m of the archaeological property, advice must be obtained from the State archaeological department for precautions. -The Contractor must employee an archaeologist to monitor the sites during the rock-cutting and piling activities.	-Complaints from sensitive receptors, Archaeology dept. -Site verification -Availability of trained man-power (archaeologist) at site	Contractor	PMU (AIWTDS+GC) and TSSC
	Contamination of Soil	Ensure all equipment, vehicles and other sources of fuels and lubricants will be collected and contained to avoid soil/ groundwater contamination. -Fuel must be stored in proper bounded and covered areas. -All spills and collected petroleum products must be disposed of in accordance with the provisions mentioned in **Annexure 17 Emergency Spill Control Procedure.** -Maintenance and refuelling of vehicles, machinery and other construction equipment must be carried out on an impervious surface so that spillage of fuels and lubricants does not contaminate the ground. -The runoff from the maintenance yard must lead to a peripheral drain and pass through an oil-water separator		Contractor	PMU (AIWTDS+GC) and TSSC
Safety aspects during the execution of works	Community Health Safety risks in Work Zones	The Contractor must ensure that : -The construction zone is hard Barricaded with MS Barricades of a height of 3.0 m. -The construction site must be access controlled, and the workers must be provided valid identification cards to allow entry. -Construction material must be stored in the barricaded area. If temporary storage is required (for 1-2 days) outside the demarcated construction area, the same must be discussed with the community. Hard Barricading with proper signages must be put to prevent the entry of commuters/pilgrims in the areas. The permission of the Environmental Officer is essential. -To prevent the dust from the construction area affecting the sensitive receptor/ commuters' green screens may be used over and above the Hard Barricading at the advice of the Environment Officer of the PMC	-Barricading of the worksites -Traffic management Plan construction works, including number of permanent signages, barricades and flagmen on the worksite -Number of signages placed at the project location. -Regular reporting of the measures in the Quarterly Report	Contractor	PMU (AIWTDS+GC) and TSSC

	Occupational Health Safety: Personal Safety Measures for Labour	The contractor will provide: -Comply with all national, state and local labour laws (refer **Table 8.2: Social Management Plan).** -Develop and implement site-specific occupational health and safety (OHS) plan, which will include measures such as (a) excluding the public from the site; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents -Barricading of all excavation carried out for construction. For deep excavation -shoring and bracing must be provided Movement of equipment and machinery near the deep excavation of soft soil must be prohibited. - Flagmen must accompany all movement of equipment and vehicle inside. -All vehicles and equipment must be fitted with reverse horns, alarms etc. -Protective clothing as may be appropriate to the risk involved in the activities being undertaken by the labour. -Protective clothing must be as per the BIS standards -Earplugs for workers exposed to loud noise, and workers working in concrete mixing operations, piling and other high-noise-generating operations -Adequate safety measures for workers during the handling of materials at the site are taken up. -All tools, tackle, lifting instruments, and cranes must have valid load certification. The tools and tackle must be regularly inspected by the Environment Officer / OHS officer of the PMU. -The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangways, stairwells, excavations, trenches and safe means of entry and egress. -All precautions must be taken for working at heights. -The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract. -Ensure that qualified first aid is always provided. Equipped first-aid stations must be easily accessible throughout the site. - Provide medical insurance coverage for workers.	-Site-specific OHS Plan. -Equipped first-aid stations. -Medical insurance coverage for workers. -Number of accidents. -Supplies of potable drinking water. - Clean eating areas where workers are not exposed to hazardous or noxious substances. - record of H&S orientation trainings - personal protective equipment. - % of moving equipment outfitted with audible back-up alarms; -permanent sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. -Compliance to core labour laws	Contractor	PMU (AIWTDS+GC) and TSSC

		-The Contractor will not employ ad-hoc work procedures, follow best & acceptable work practices -The contractor will document work-related accidents. Provide qualified & easily accessible first-aid facilities all times at all sites. -Secure all installations from unauthorised intrusion and accident risks. -Adequate illumination would be provided at site during evening and night time till the work is being carried out -Rest area for workers would be provided with drinking water and protected from the elements of nature - Barrier structures are of sufficient height to prevent waves or overflows from flooding in the enclosed area. -During working in River, workers must be made aware of risks of water depth, currents, and dangerous areas of water must be properly marked by fixed or floating barricades and signage of danger. Workers must also be made aware of the protection of the biodiversity of the water, and fishing must be strictly prohibited. A boat must be made available at the site to transport labour and materials and be well-maintained for emergencies. Workers must not be allowed to dip or bathe in rivers. A suitable working platform must be provided during construction works in water. -Life-saving equipment and lifeguards must be made available during the period of working in water. -The Contractor will mark 'hard hat' and 'no smoking' and other 'high-risk areas and enforce non-compliance of the use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilisation and will be approved by the Safety Officer of PIU. Please refer **Annexure 22** for Safety Measures during Construction Phase.			
	Injuries/fatalities to the employees	Accident/Incident Reporting for SHE -The PMU must carry out an awareness campaign for the Do's and Do nots in construction sites. -Near misses must be recorded and reported on a regular basis • -Fortnightly meetings must be held with employees to make them aware of unsafe acts and practices.	-Record of near misses - Record of fatalities - No of workers' meetings -Labour Law Compliance Report generated	Contractor	PMU (AIWTDS+GC) and TSSC

			through Labour Law Compliance system		
	Cultural & Heritage Resources	- Adequate signs must be displayed in the access route for the devotees towards this cultural heritage and temples. -Warning signs about the construction activities must be provided to warm commuters/ pilgrims. - Regular supervision by an archaeologist to identify the impact on these archaeological properties from vibration -Make workers aware of chance finds and archaeological heritage • -Make workers aware of controlled vibration when working within 100 m of the site	i. No of training for workers on precautions against vibration ii. Report by the Archaeologist in the Quarterly report.	Contractor	PMU (AIWTDS+GC) and TSSC
Sanitation, Health & Safety	Unhygienic and unsafe living and working condition.	• Hygiene in the camps would be maintained by providing good sanitation and cleaning facilities. • Camp would be well ventilated with adequate provision for illumination, kitchen and safe drinking water. Proper drainage to be maintained around the sites to avoid water logging. • Proper sanitation with toilet and bathing facilities would be provided at the sites and labour camps. Wastewater generated from these facilities would be disposed through septic tanks and soak pit • Preventive medical care to be provided to workers • Segregated solid waste would be disposed of at municipal solid waste disposal location. • LPG will be used for cooking in construction camps • Provision would be made for day crèche for children • First aid facilities, with room, personnel and ambulance would be available at the site. Also, tie-up with local hospitals would be done to handle emergency case, if any. • Rest area would be provided at the site where workers can rest after lunch • Working hours of labourers would not exceed the standard norms as per Factory Act • Wastewater from construction site would not be allowed to be accumulated. Septic tanks/soak pits would be provided for its disposal.	Site Verification	Contractor	PMU (AIWTDS+GC)and TSSC

Table 8.2 - Social Management Plan

Component	Social Attribute and potential impacts	Remedial Measure		Institutional Responsibility	
				Implementation	Supervision
1. Accident, Incident and Safety Risks					
1.1 Health & Safety	Accident and Incident risk from construction activities and safety of workers Impact on Social life.	-Local labour would preferably be employed for construction. -Site would be barricaded and would have security guards. -Register would be maintained for entry to the construction sites. No unauthorized person would be allowed to enter the site. -A board in local language at entrance of site would display name of project, area and hazards associated for public awareness -Rest area for workers would be provided. -Contractors would adopt and maintain safe working practices. SOPs would be prepared and followed for all activities under supervision of site engineer -Complete medical check-up would be done for workers prior to joining and after six months of joining -Emergency telephone nos. of hospitals, ambulance and doctors would be displayed in first aid room. -Working hours of labour should not exceed norms as per state factory law -Maintenance and repair of any local village road used for the project activities should be carried out both before and end of construction by contractor.	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996,	Contractor	PMU (AIWTDS+GC)and TSSC
Labour Influx	-Risk of Gender based violence, STD, HIV/AIDS to local community Increased demand and competition for	-Specifications on employment of local workforce including women should be reflected in the civil works bidding documents and subsequent contracts to ensure that the contractors fulfil these	-Contract Labour Act, 1970; and -Inter-State Migrant Workers Act, 1979	Contractor	PMU (AIWTDS+GC)and TSSC

	local social and health services -Social conflicts between the local community and the construction migrant workers. -Increased illicit behaviour and crime against women, which is a real threat for Assam where gender-based violence is rampant -Increase competition for jobs and have an impact on wage distribution	commitments. Locals including women may be screened further for skills, and adequate orientations can be provided to recruit for the work. AIWTDS can prepare a roster of interested workers and their skills -The project contractor needs to prepare a site-specific Labour Influx Management Plan and/or a Workers' Camp Management Plan. -Security personnel will be deployed at the construction sites, and emergency nos. including contact details of local law enforcement officers, project's helpline no., existing state-run women helpline nos. will be prominently displayed at the site. The contractors will ensure that an Internal Complaints Committee (ICC) for each establishment is set-up to meet their corporate requirement and legal mandate under the Sexual Harassment at the Workplace Act, 2013. -Health problems of the workers should be taken care of by providing basic health-care' facilities through health centres temporarily set up for the construction camp. The health centre should have the requisite staff, free medicines and minimum medical facilities to tackle first-aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses and critical cases. - Awareness camps on HIV/AIDS for both, construction workers and neighbouring villages must be organised at regular intervals by NGOs empanelled with NACO. -It is expected that among the women workers there will be mothers with infants and small children. The provision of a day care crèche as per the Building and Other Construction Workers (regulation of employment and conditions of service) act, 1996 is the contractor's responsibility. The crèche should be provided with trained women to look after the children. -In case work schedule extents up till night, it should be ensured that women workers are exempted night shifts.	Workers Accommodation: Processes and Standards (A guidance note by IFC and EBRD)		

Table 8.3 : Environment Management Plan (Operation Phase)

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
1.0 Climate				
Climate Change	Project is unlikely to cause negative effect on climate. However, project can contribute positively for climate	• Energy efficient measures in the terminal buildings will be implemented • Solar power will be used in potential area	Kyoto Protocol, Forest Conservation Rules & National Forest Policy	DIWT / AIWCL
2.0 Air Quality				
Air Pollution	Emission from machinery, ferry, DG and vehicular movement.	• Only Passenger ferry will be handled in the terminal hence no dust pollution anticipated. • Water sprinkling would be provided in dust generating areas • DG exhaust will be minimised by regular maintenance in AMC • Monitoring of air quality shall be carried out on quarterly basis to check the level of pollutants and effectiveness of EMP • Ferries, deployed, will have efficient fuel combustion system with minimum emission	Environmental Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981	DIWT / AIWCL
3.0 Soil Erosion				
Soil Erosion and management.	• Soil erosion of embankment during heavy rainfall.	• Periodic checking of the slope stabilization measures (stone pitching or otherwise) would be carried to assess the damage if any. Necessary measures for repair shall be followed wherever there are failures	Project requirement	DIWT / AIWCL
4.0 Wastewater Management				
Water pollution	• Surface water pollution. • Siltation and erosion and contamination due to disposal of domestic waste	• Bio digester (4KLD) would be provided to treat the sewage generated. Treated water would be used for horticulture and plantation purpose at the site • Fuel shall be stored in leak proof containers and containers shall be placed on paved surfaces so that no spill occurs • Fuelling of vessels will be leak proof system	Project requirement	DIWT / AIWCL

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
		• Quarterly Monitoring of surface water quality shall be carried out to check the level of pollutants and effectiveness of EMP		
5.0 Noise Control				
Noise Pollution	• Noise generation from operation of vehicle, equipment and machinery. • Impact of underwater noise and risk of ship strikes	• Timely maintenance and servicing of transportation vehicles and the machinery/pumps/vessels to be used during operation phase to reduce the noise generation. • 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 • DG sets shall be provided with acoustic enclosure • Monitoring of Noise levels shall be carried out on quarterly basis to check the level of pollutants and effectiveness of proposed EMP • Impacts of underwater noise and risk of ship strikes can be mitigated by routing ship traffic away from critical dolphin habitats and implementing speed regulations.	Noise Pollution (Regulation and Control) Rules, 2000	DIWT / AIWCL
6.0 Accidental Risk				
Accident and Incident.	Accidents due to Movement of Vessels and other hazards associated with site	• Ensure all their staff are trained in Emergency Response and Rescue in Inland Water and can act as first responders in the case of accidents/crisis situation • Awareness campaigns in sync with the risk communication strategy proposed in the DRM framework • Development of resilient Ghats/Terminals, procurement and maintenance of latest vessels, and safety equipment • Support activities for post-crisis recovery including additional support to vessel accidents victims and community • Adequate illumination should be provided at the site	Project requirement	DIWT / AIWCL
7.0 Flora & Fauna				
Biodiversity loss	Loss of Aquatic Fauna including Dolphins and other macrophytes	• Propeller shall have net system to avoid any accident with dolphins and other aquatic animals. • No wastewater or waste shall be disposed in river from terminal site or from vessel into the water. Penalty shall be imposed on the vessels reported disposing waste/wastewater in the river	Forest Conservation Act 1980, Wild Life Protection Act, 1972	DIWT / AIWCL

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
		• . • Instruction should be given to all vessels and all employee and staff that no dolphin or any other endangered species shall be harmed due to any reason • Instruction shall be given to vessel operator that in case any accident with dolphin occurs that should be reported immediately to terminal authority • Waiting time of vessels shall be reduced at the terminal/lock sites by providing the adequate loading and unloading equipment and vehicles. • Vessels shall be instructed for not using sharp lights and sounds all the time as they may disturb aquatic organisms.		

8.2 ENVIRONMENT MONITORING PLAN

Environmental Monitoring Programme is to ensure that the intended environmental protection goals are achieved and result in desired benefits of the project. The same will be included in tender / bid document. The broad objectives of the environment monitoring program are:

- To monitor impacts on the surrounding environment and the effectiveness of mitigation measures during the construction and operation phase.
- To ensure that the environmental control systems, installed are effective.
- Comply to the provisions of relevant environmental regulations.

Air quality monitoring with respect to PM_{10}, $PM_{2.5}$, NOx, SO_2 and CO at selected locations to assess the impact.

Water quality with reference to DO, BOD, COD, suspended solids, turbidity, alkalinity, oil and grease at selected water bodies to ensure maintenance of BDU criteria.

Noise level at Ghat/commercial zone, Sensitive zones

Aquatic biodiversity and ecological monitoring, including sighting of dolphins near site and record-keeping. The parameters to be monitor, frequency of monitoring, number of samples, locations and responsibility of monitoring is given in **Table 8.4.**

Table 8.4: Summary of Environmental Monitoring Programme: Construction and Operation Phase

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	No. of Samples	Location	Responsibility
1.	**River Water**					
	Physico-chemical parameters	pH, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides.	For three seasons in construction phase; Turbidity, DO and salinity will be monitored once every week at 3 locations: near the Berth, channel and records of monitoring will be maintained during construction phase If DO level goes 4.0 mg/l, then its causes will be investigated, and corrective actions will be taken	Surface Water Upstream- 2 • Downstream-2 • Near Project site- 1 Ground water-2 near the project site	As per AIWTDS directions	Contractor

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	No. of Samples	Location	Responsibility
			For two seasons in operation phase except monsoon			
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	For three seasons in construction phase For two seasons in operation phase except monsoon	Upstream- 2 Downstream- 2 Near Project site- 1	As per AIWTDS directions	Contractor
2.	**Sediments**					
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates, Hg, Pb, Fe, Cu, Zn, Cd	For three seasons in construction phase For two seasons in operation phase except monsoon	Upstream- 2 Downstream- 2 Near Project site- 1	As per AIWTDS directions	Contractor
	Biological parameters	Benthic Meio-fauna, Benthic Macro-fauna	For three seasons in construction phase. For two seasons in operation phase except monsoon	Upstream- 2 Downstream- 2 Near Project site- 1	As per AIWTDS directions	Contractor
3.	**Ambient Air Quality**	$PM_{2.5}$, PM_{10}, SO_2 and NO_2	- For three seasons in construction phase and one season for operation phase. - Twice a week for four consecutive weeks per season.	Upwind- 2 Downwind- 2 Near Project site- 1	As per AIWTDS directions	Contractor

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	No. of Samples	Location	Responsibility
4.	**Noise Quality**	Equivalent Noise Level	During peak construction activities	Construction site- 1 Labour Camp- 2	As per AIWTDS directions	Contractor
5.	**Soil Quality**	N, P, K and Heavy metals	2 samples pre-monsoon season and 2 samples post-monsoon in construction phase and one season during operation phase	Construction site- 1 Labour Camp- 2	As per AIWTDS directions	Contractor
6.	**Dolphin study**	Assessment and presence of Dolphins, survival etc.	Once per year	--	As per AIWTDS directions	AIWTDS

*Note: All the Samples to be collected as per standard norms. Parameters and components may vary as per requirement.

8.3 BUDGET FOR EMP

Tentative Environment budget has been prepared for design, construction and operation phase of the project which includes the cost of environmental structures like septic tank & soak pit, Air Pollution Control System at terminals, monitoring, enhancement measures, training and awareness and technical support for establishment, enhancement measures and environmental guidelines. Environmental budget for North Guwahati Terminal during construction phase is estimated as Rs. 60.46 lakh (including 5% contingency) and for operation phase in approx. 69 lakh (including 5% contingency).

The summary of environmental budget during construction and operation phases are given below. The detailed break-up of costs for construction and operation phase is given at **Table-8.5** and **Table 8.6** respectively**.**

Table 8.5: Summary of Environmental Budget- Construction Stage

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
A.	**Monitoring Measures**			
1	Water Quality Monitoring	Pre -Construction	20000	Contractor
		Construction	120000	Contractor
2	Biological Monitoring	Pre -Construction	125000	Contractor
		Construction	750000	Contractor
3	Sediments: Physico Chemical	Pre -Construction	25000	Contractor
		Construction	150000	Contractor

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
4	Sediments: Biological	Pre -Construction	25000	Contractor
		Construction	150000	Contractor
5	Ambient Air Quality	Pre -Construction	32000	Contractor
		Construction	192000	Contractor
6	Noise Quality	Pre -Construction	10000	Contractor
		Construction	180000	Contractor
7	Soil Quality	Pre -Construction	32000	Contractor
		Demobilisation	32000	Contractor
8	Groundwater	Pre -Construction	8000	Contractor
		Construction	48000	Contractor
		Camp/Kitchen During Construction	192000	Civil works contract
		Decommissioning	8000	
	Subtotal (A)		**20,99,000**	
B.	**Capacity Building**			
1	General environmental awareness; environmental and social sensitivity of the project influence area; Key findings of the EIA; Mitigation measures; EMP; Plans and Protocols Social and cultural values of the area. (1 day)	Training for Selected staff of AIWTDS, supervisor, and contractors, Vessel Operators (at the beginning of Contract)	4,00,000	TSSC
2	Training for Ghat management'	Section officers/ Vessel operators/ Masters/ Khalasi , Ghat officers, Ghat Maintenance workers etc.(At Beginning of Construction)	2,50,000	Contractor
3	Community issues; Awareness of transmissible diseases; social and cultural values.	Construction Crew (once every six months)	2,00,000	Contractor
4	EMP; Waste disposal, Cultural values and social sensitivity.	Once every year or as directed by the PIU	1,00,000	Contractor
5	Road/waterway safety; Defensive driving/sailing; Waste disposal;	Drivers; boat/launch crew, (once every year)	1,00,000	Contractor
6	Camp operation; Waste disposal; Natural resource conservation; Housekeeping.	Camp staff (once every quarter)	2,00,000	Contractor
7	Construction Implementation requirements; handling situations for important flora / fauna especially Dolphin; Physical Cultural resources;	PIU; supervisor Selected crew members and contractors (once every six months)	2,00,000	Contractor

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
8	Health and safety equipment on board and in terminals	Selected crew members and Vessel operators/ Masters/ Khalasi etc.	2,00,000	Contractor
9	Environment Management tracking System	AIWTDS	50,000	Contractor
	Subtotal (B)		**21,50,000**	
C.	**Construction Contractor EMP Implementation**			
5.	Water Sprinkling Measures for Dust Suppression	Construction	-	The cost is integrated as part of the civil work cost
6	Development and Implementation of the Dolphin Management Plan of Contractor	Construction	-	The cost is integrated as part of the civil work cost
7	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0m height at stipulated active site of the same project site, made with angle iron frame of 50x50x5mm and GI sheet of 0.63mm thick including primer painted initially, painting, lettering & border with reflective paint at the time of every shifting, traffic diversion arrangement, safety guard, suitable lightning arrangement during night, complete in all respect till completion of the project as per technical specification and direction of Engineer-In-charge and same shall be possessed by the contractor after completion of the Project	Construction		The cost is integrated as part of the civil work cost
8	Supplying and fixing of cautionary and or informative signs boards including the cost of posts, fixtures, fixing, foundation, fitting and fixing. Sheeting will be made of encapsulated lens type of retro-reflective type and message / borders will be screen printed complete as per screen specification in IRC SP 55: 2001. To be made available	Construction	-	The cost is integrated as part of the civil work cost

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
	at all time at the work sites as required and directed by the engineer			
9	Supplying and fixing of flashing beacon warning lights including the cost of posts, fixtures, fixing, foundation, fitting and fixing, cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc. and as per specification in IRC SP 55: 2001	Construction	-	The cost is integrated as part of the civil work cost
10	Provision and maintenance of Bio toilets with 1 male and 1 female units including cost of material , labour, loading, unloading, lead, lift, transportation, shifting etc. And shall be made available at worksite at the direction of the PIU. The facility shall complete with water arrangement, privacy, lighting arrangement. The WC and /urinals should be made of stainless Steel and the partitions should be made of aluminium framework with FRP panels. The bio-digester tank should be approved by Defence Research & Development Organisation (DRDO)or any other competent agency. The whole toilet shall be mounted on MS framework with skids; Overhead water tank shall be made of HDPE with proper arrangement of ball cock and mosquito proof cover. These should also be provided with two dustbin for wet and dry waste. The bio-digester toilets shall be mounted on skids and shall not require any creation of permanent structure so that they can be shifted from one worksite to another	Construction	-	The cost is integrated as part of the civil work cost
11	Provision of Helmets (IS CODE 2925 : 1984) , Safety Shoes (IS CODE 5852 : 1996), Googles (•IS CODE 5983 : 1980),	Construction	-	The cost is integrated as part of

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
	Reflective Jackets, mitten/ gloves (IS 2573) , safety nose masks to all personnel (including temporary labour) involved in the worksites			the civil work cost
12	Provision of First Aid Kits for worksites	Construction	-	Civil works contract
13	Provision and maintenance of waste collection bins in sets of 2 (blue and green) for collection of municipal solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.	Construction	-	The cost is integrated as part of the civil work cost
14	Environment, Health & Safety Engineer/Supervisor having Bachelors in Env Science / Management/ B. Tech (Env Eng.)	Construction	-	The Manpower Cost is integrated into the cost of the Civil Works
15	Diploma in Central Labour Institute / Regional Labour Institute (Mandatory)	Construction	-	The Manpower Cost is integrated into the cost of the Civil Works
	Subtotal (C)			
D	**PIU/AIWTDS EMP Implementation cost**			
1	EMP Supervision Cost	Construction	2,40,000	PIU Cost
2	Equipment	Construction	1,50,000	PIU Cost
	Sub Total (D)		**3,90,000**	
	Total (A+B+C+D)		**57,59,000**	
E	**Contingency (@5% of (A+B+C+D)**		**2,87,950**	
	Total (A+B+C+D+E)		**60,46,950**	

EMP Implementation Cost to TSSC 400000
EMP Implementation Cost to PIU/ AIWTDS 3,90,000
EMP Implementation Cost to Contractor 40,49000

Table 8.5: Summary of Environmental Budget (Operation Phase)

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
A.	**Monitoring Measures**			
1	Water Quality Monitoring	Operation	2,00,000	AIWCL /DIWTCost
2	Biological Monitoring	Operation	12,50,000	AIWCL /DIWTCost
3	Sediments: Physico Chemical	Operation	2,50,000	AIWCL /DIWTCost
4	Sediments: Biological	Operation	2,50,000	AIWCL /DIWTCost
5	Ambient Air Quality	Operation	1,20,000	AIWCL /DIWTCost
6	Noise Quality	Operation	2,25,000	AIWCL /DIWTCost
8	Groundwater	Operation	-	Civil works contract
	Subtotal (A)		**2295000**	
B.	**Capacity Building**			
1	General environmental awareness; environmental and social sensitivity of the project influence area; Key findings of the EIA; Mitigation measures; EMP; Plans and Protocols Social and cultural values of the area. (1 day)	Training for Selected staff of AIWTDS, supervisor, and contractors, Vessel Operators (once a year for 5 years)	2,50,000	AIWCL/DIWT
2	Training for Ghat management'	Section officers/ Vessel operators/ Masters/ Khalasi, Ghat officers, Ghat Maintenance workers etc. (once a year for five years)	2,50,000	AIWCL/DIWT
3	Community issues; Awareness of transmissible diseases; social and cultural values.	Construction Crew (once every year for five years)	2,50,000	AIWCL/DIWT
	Subtotal (B)		**7,50,000**	
C.	**Operations Stage EMP Implementation**			
5.	Wastewater Management (Biodigester cost in NBC) based on number of people/ hour	Operation	-	Capital Cost covered through the Engineering Design
	Provision of drinking water facilities	Operation	-	The cost is integrated as part of the civil work cost
	Waste Management System	Operation	-	

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0m height at stipulated active site of the same project site, made with angle iron frame of 50x50x5mm and GI sheet of 0.63mm thick including primer painted initially, painting, lettering & border with reflective paint at the time of every shifting, traffic diversion arrangement, safety guard, suitable lightning arrangement during night, complete in all respect till completion of the project as per technical specification and direction of Engineer-In-charge and same shall be possessed by the contractor after completion of the Project	Operation	-	The cost is integrated as part of the O&M Cost
6	Supplying and fixing of cautionary and or informative sign boards including the cost of posts, fixtures, fixing, foundation, fitting and fixing. Sheeting will be made of encapsulated lens type of retro-reflective type and message / borders will be screen printed complete as per screen specification in IRC SP 55: 2001. To be made available at all time at the work sites as required and directed by the engineer	Operation	50,000	AIWCL/DIWT
	Supplying and fixing of flashing beacon warning lights including the cost of posts, fixtures, fixing, foundation, fitting and fixing, cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc. and as per specification in IRC SP 55: 2001	Operation	-	The cost is integrated as part of the civil work cost
	Provision of Helmets (IS CODE 2925 : 1984) , Safety Shoes (IS CODE 5852 : 1996), Googles (•IS CODE 5983 : 1980), Reflective Jackets, mitten/ gloves (IS 2573) , safety nose masks to all personnel (including temporary labour) involved in the worksites	Operation	2,00,000	AIWCL/DIWT
	Provision of First Aid Kits for worksites	Operation	30,000	AIWCL/DIWT
	Provision and maintenance of waste collection bins in sets of 2 (blue and green) for collection of municipal solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.	Operation	-	The cost is integrated as part of the civil work cost

S. No.	Particulars	Stages	Cost (INR)	Costs Covered By
	Terrestrial and Aquatic Fauna including surveillance audit and Dolphin Conservation Management Plan	Operation	10,00,000	The Manpower Cost is integrated into the cost of the Civil Works
	Subtotal (C)		**1280000**	
D	**EMP Implementation cost**			
	EMP Supervision Cost	Construction	9,00,000	AIWCL/DIWT Cost
	Sub Total (D)		**9,00,000**	
	Total (A+B+C+D+E)		**5225000**	
F	**Contingency @ 5% of (A+B+C+D)**		**261250**	
	Total (A+B+C+D+E+F)		**5486258**	

Cost of conducting environment monitoring is calculated based on cost of per sample plus the no. of samples to be tested

EMP Implementation Cost to AIWCL/DIWT Rs.54,86250/-

8.4 BUDGET FOR SMP

The estimated costs for various activities for social management under the subproject is Rs.45 lakh it is given in **Table 8.6.**

Table 8.6: Estimated Cost for SMP

Item of SMP	Duration	Estimated costs (Rs.) lakh
Training for contractor staff on labour laws such as The Bonded Labour System (Abolition) Act, 1976; The Workmen's Compensation Act, 1923; The Contract Labour (Regulation & Abolition) Act, 1970 and Rules; The Child Labour (Prohibition and Regulation) Act, 1986; Public Liability and Insurance Act, 1991 etc. The new labour Act like The Code on Social Security, 2020 and The Code on Wages, 2019, etc	Actual, before and during the project implementation time	15.0
Social safeguards training including training of staff on GRM. GBV training (SEA, SH and HT)	Actual, before and during the project implementation time	15.0

Item of SMP	Duration	Estimated costs (Rs.) lakh
Environmental Health and Safety Officer and Social Development Specialist hired by contractor, for on-site supervision	Actual, during the project implementation	15.0
Total (Rs.)		**45.0**

There are 5 (five) squatters noticed during FGDs at North Guwahati. The tentative provisions for these squatters will be Rs. 9.0 lakh (**Table 8.7**) The Resettlement Action Plan has been prepared and submitted separately.

Table 8.7: Budget for Squatters

S. No.	Parameter	Cost (Rs. Lakh)
1.	Budget for Squatters	9.00

***Note:** Budget for Squatters will be done by AIWTDS

8.5 IMPLEMENTATION OF EMP AND SMP

8.6.1 Constitution of Environmental & Social Management Cell

It is recommended that project authority to establish an Environmental Management Cell (EMC) at the project site with requisite manpower. The task of the Environmental and Social Management Cell will be to coordinate various environmental activities, to carry out environmental monitoring and to evaluate implementation of environmental enhancement measures for positive impacts and environmental mitigation measures for negative impacts.

The Environmental Management Cell (EMC) will report to the appropriate authority having adequate powers for effective implementation of the Environmental Management Plan (EMP) in various phases of project development. The Contractor shall also maintain Environmental Management Cell (EMC) at project level, which consist of Environment, Social & Safety officers and shall assist and report to concerned officers of EMC of AIWTDS at project level.

The EMC will closely monitor the environment aspects of the proposed project and identity problems and accordingly, suggest certain measures to mitigate the same. In addition, it will also all the statutory requirements in the area of environmental protection.

The key task of the Environmental Management Cell will be to coordinate specific studies to:

- Monitor implementation of Environmental Mitigatory measures
- Coordinate activities outlined as a part on Environmental Audit
- Coordinate Environmental Monitoring Programme
- Suggestion of additional measures/studies, if any.

The Environmental Management Cell (EMC) will report to the appropriate authority having adequate powers to implement the required measures. The manpower required for Environmental

Management Cell (EMC) with qualification, experience and role & responsibility is given in **Table-8.8.**

Table 8.8: Environmental & Social Management Cell (ESMC) Detail

Designation in EMC	Number	Qualification	Exposure/ Experience	Roles/Responsibilities
Environmental Expert	1	M. Sc. (Environmental Science/Ecology/ Biodiversity& Wildlife	10 years of working Experience	Overall EMP Compliance and monitoring & supervision Dolphin Conservation Plan implemented by Contractor
Social Development Expert	1	Master in Social Sciences	10 years of working Experience	Overall SMP Compliance and monitoring
Safety Officer	1	M.E./M.Tech / M. Sc. (Environmental Science) and diploma in Safety management	5 years of working Experience	Overall Safety Compliance and monitoring

The ESMC will be part of AIWTDS staff and hence no separate budget is given for ESMC.

8.6.2 Third Party Monitoring

AIWTDS will engage an independent consulting firm to conduct external and independent monitoring of the ESMP implementation. The main purpose of the external monitoring will be to ensure that all the key entities including E&S Construction Supervisor, and contractors are effectively and adequately fulfilling their designated role for ESMP implementation and that all the ESMP requirements are being implemented in a timely and effective manner. Monitoring shall be on-going throughout the project life-cycle and must be implemented to ensure that environmental & social impacts are within the predicted levels and that specified environmental & social performance targets are being achieved. The budget for hiring an independent agency for safeguard compliance, TPM Consultant for the North Guwahati Terminal shall be made from the Project side.

Chapter 9 – SUMMARY AND CONCLUSION

The Assam Inland Water Transport Project (AIWTP) is a unique effort of the Govt. of Assam to transform the system of Water Transport on the rivers of Assam in order to ensure a safe, sustainable and reliable mode for the myriads of users in the state. To modernize IWT in Assam, the World Bank is assisting the GoA through a phase-wise project, which includes up gradation of ferry Infrastructure, Fleet Modernization, institutional capacity development etc.

The facilities built at the existing ferry ghats are not sufficient to meet the growing demand of traffic volume as they lack facilities for berthing, parking, storage areas and other essential facilities such as toilets, drinking water, safety features etc. They usually consist of one pontoon with shore connection for embarking and debarking passenger and cargo. Thus, there is an urgent need for improvement in passenger ferries and require upgradation of supporting infrastructure.

GoA with the implementation of the AIWT Project is committed to modernize the inland water transportation system on the rivers of Assam and improve upon the existing facilities for safe, comfortable and gainful transportation of passengers as well as cargo within the state and thereby provide intra-state, inter-state and international connectivity.

The major benefits of the proposed project are:

- Improve connectivity within the various places of Assam.
- Development of ferry terminal includes beautifications, walkways, recreation, and tourism.
- Infrastructure / property development along the river through Value Capture Financing & Transit Oriented Development for generating revenue.
- Improve monitoring of the river systems, which will reduce to zero waste disposal, mosquito menace, and carbon reduction
- Providing necessary infrastructure for navigation facilities and vessels.

It can be concluded that the proposed Assam Inland Water Transport Project project is likely to entail certain adverse environmental impacts. However, these impacts have been ameliorated to a large extent by implementing appropriate mitigation measures (Chapter-7). Appropriate management measures too have been suggested and delineated as a part of Environmental Management Plan (EMP) (Chapter-10) and for implementing the plans, a budget is proposed in the report.

WAPCOS LIMITED

(A Government of India Undertaking)

76 C, Sector 18, Gurugram - 122015, Haryana, INDIA

Tel. +91 124 2397396, Fax. +91 124 2397392

Email: environment@wapcos.co.in

Annexure – 1A

Land Related Document

GOVT. OF ASSAM

OFFICE OF THE CIRCLE OFFICER ::: NORTH GUWAHATI REV. CIRCLE AMINGAON

No. NGC-2022/ 239 Dated: 07/02/2023

To

The Deputy Commissioner,
Kamrup, Amingaon

Sub:- Regarding availability of land for issue of NOC for construction of passenger ferry terminal at the existing North Guwahati Ferry Ghat of Inland Water Transport, Assam.

Ref:- Govt. Letter No. AIWTDS/57/2018/133; Dated : 18/01/2023.

Sir,

With reference to the subject cited above, I have the honour to inform you that suitable amount of govt. land covered by Govt. Dag No. 585 belonging to village North Guwahati Town of Sila Sindurighopa Mouza is available near the river Brahmaputra (Majgaon) for construction of passenger ferry terminal at the existing North Guwahati Ferry Ghat (Majgaon) of Inland Water Transport, Assam under North Guwahati Revenue Circle.

It may also be mentioned here that there is no zirat for the above mentioned plot of land.

This is for favour of your kind information and necessary action.

Enclosed : Chitha copy.

Yours faithfully,

Circle Officer
North Guwahati Rev. Circle
Amingaon

Circle Officer
North Guwahati Revenue Circle
Kamrup, Amingaon

Memo No. NGC-2022/239-A Dated: 07/02/2023

Copy to:

1. The State Project Director, Assam Inland Water Transport Dev. Society for favour of kind information.

Circle Officer
North Guwahati Rev. Circle
Amingaon

Circle Officer
North Guwahati Revenue Circle
Kamrup, Amingaon

Annexure - 1

Sewage Management & Details of Bio-Digester

1. Sewage Management

1.1 Reference Standards

CPHEEO:2013 - Manual on sewerage and sewage treatment
SP35:1987 - Handbook on water supply and drainage
NBC:2016 - National building code
CPCB/ SPCB/ MoUD guidelines
Guidelines on Bio-Tank for Indian Railways

1.2 Demand Estimation

Only flushing water has been considered for treatment; therefore, estimation has been picked from NBC 2016 norms. The sewage generation has been summarised in Table 1.1 below.

Table 1.1: Sewage Generation estimation

User Type	Average Daily Numbers	Sewage generated Per Day (lpcd)	Total sewage (lpcd)
Passenger	520	5	2600
Staff	23	20	460
Total Sewage (lpcd)		3060	
Total Sewage (kld)		3	
Capacity of treatment setup (KL)		4	

1.3 Treatment

The sewage treatment at the site has been recommended via a bio-digestor tank. Provision for an STP has not been provided due to the limited availability of space, the high capital cost and difficult maintenance. A bio-digester tank is a better alternative to a septic tank as septic tanks are not adequate for elimination of pathogens and foul smell and also require periodical cleaning.

Defence Research & Development Establishment (DRDE) – an R&D organization of DRDO has developed a technology of bacterial inoculums for sewage treatment under diverse geo-climatic conditions. The zero- waste bio-digester technology breaks down human excreta completely into usable water and gas through anaerobic process. It does not have any geographical or temperature limitation and goes away with the need to set up large sewage tanks and regular sludge cleaning. Bio-digestor tanks or Bio tanks are an excellent low-cost alternative.

Table 1.2: Advantages of Bio tank over Septic Tank

SEPTIC TANK	BIO TANK
Requires larger space, bigger volume	Requirement is 40 to 70% less.
Not efficient	Effluent is well treated and safe
Sludge needs periodic evacuation	No such needs
Obnoxious smell	No smell. Generation of odourless and inflammable biogas
Maintenance intensive	Only one time charging of Inoculums
Unhygienic disposal	No such requirement
Water requirement is high	Minimizes water consumption
Cost intensive	Cheaper in long run

A bio-tank of 4 KL occupying 4 sqm (2m X 2m) would be sufficient for the site. The sewage from the terminal building will be conveyed to the bio-tank from the inspection chamber. The effluent from the bio-tank will be connected to a reed bed, with at least 1:250 slope to achieve self-cleaning velocity. From the reed bed, the effluent will be further treated for discharge to river. All sewer pipes will be of HDPE DWC type with a nominal diameter of 150 mm. The outlet parameters of the bio-digester plus reed bed system will be as follows:

Table 1.3: Outlet Parameters of the Bio-digester

DETAILS	RANGE
pH	7.0-7.2
Turbidity (NTU)	2-5
TSS (mg/L)	50-80
TDS (mg/L)	100-300
VS (mg/100ml)	5-12
COD (mg/L)	15-25
BOD (mg/L)	2-4
Coliforms (MPN/ml)	0-12

The sludge from the Bio-digestor tank will need to be removed and transported following all safety protocols. The responsibility of safe collection and transportation of the sludge will be with the municipal body, which deals with the collection and transportation and final disposal of sludge from septic tanks in the locality as well.

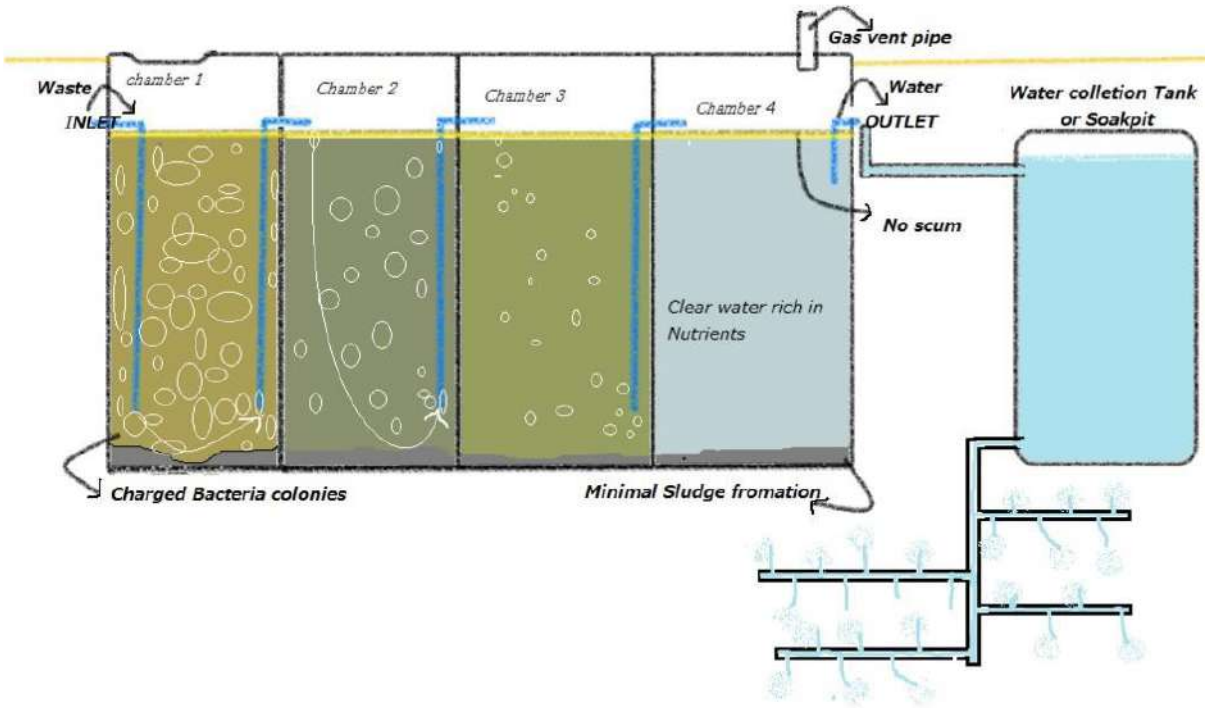


Figure 1.1: Schematic of biobank sourced from DRDO

The grey water from the terminal building gully trap will be connected to the biotin. However, an oil/grit separator will be used to intercept sediment and hydrocarbons before the grey water can be conveyed to the biobank. Soluble pollutants will pass through oil/grit separators.

The oil/grit separator will have two chambers. The greywater will enter the first chamber, which will contain a permanent pool of water and coarse sediment will be trapped by settling. The first chamber will also trap floating trash and debris, such as leaves. The runoff will be drawn from the lower part of the pool with an inverted pipe elbow to trap floating oils and hydrocarbons, which will eventually be discharged from to the second chamber. The second chamber will also contain a permanent pool of water for a second settling opportunity. Hydrocarbons which may have been adsorbed to sediment particles will be settled out in this chamber.

There are several proprietary oil/grit and oil/water separator devices available for the treatment or pre-treatment. Since the performance of oil/grit separators is dependent on the frequent removal of trapped sediments and floating products and should be cleaned out at least twice a year.

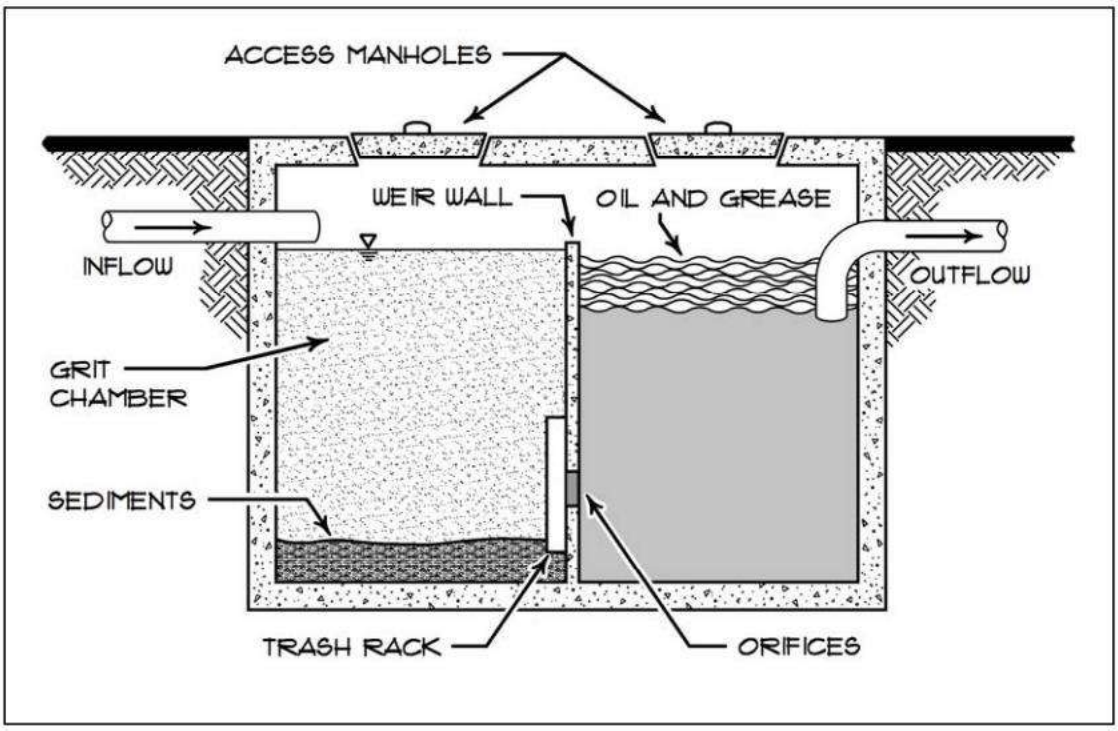


Figure 1.2: Schematic of Oil/Grit Separator

Annexure - 2

NOC from Director of Archaeology

GOVERNMENT OF ASSAM
DIRECTORATE OF ARCHAEOLOGY, ASSAM,
AMBARI, GUWAHATI-01.

NO.ARCH.410/2022-23/ 504 Dated Guwahati, the 24th August, 2022

From : Dr. Deepi Rekha Kouli
Director,
Directorate of Archaeology, Assam,
Ambari, Guwahati-1.

To : Sri Partha Pegu, ACS
Director,
Inland Water Transport and
Addl. State project Director,
AIWTD Society, Ulubari
Guwahati - 7.

Sub. : Regarding 'No Objection' for construction of passenger ferry terminal at Umananda and North Guwahati.

Ref. : Letter No. AIWTDS/57/2019/121, Dated 26/07/2022.

Sir,

With reference to your subject cited above, I have the honour to inform you that the Directorate is pleased to allow the Assam Inland Water Transport Development Society to carry out the proposed work as mentioned in your letter under reference at the sites – near Umananda Temple and near Ashwaklanta Temple, without hampering the integrity and authenticity of the archaeological sites.

This is for the favour of your kind information only.

Yours faithfully,

Director,
Directorate of Archaeology, Assam.
Ambari,Guwahati-781001

Memo NO.ARCH.410/2022-23/ 504 Dated Guwahati, the 24th August, 2022

Copy for information to -

1. The Secretary to the Govt. of Assam, Indigenous and Tribal Faith and Culture Department, Dispur, Guwahati – 6.

Director,
Directorate of Archaeology, Assam,
Ambari,Guwahati-781001.

Annexure – 3

Sample Format of FGD

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Socio-Economic Survey of the families in selected Project Villages

1a.	**Name of the village**		
1b.	Panchayat		
1c.	Development Block		
1d.	Tehsil		
1e.	District		
2a.	Personal Details	House No	
2b.	Name of the family Head		
2c.	Gender	Male	Female
2d.	Religion & Caste		
2e.	Higher caste/OBC/SC/ST		
2f.	Vulnerability status	BPL/ Women headed/SC/ST/ Disabled/other	
2g.	Occupation of the family Head		
3	Family Constellation		

S No.	**Name**	**Status/ Relation**	**Age (yrs.)**	**Education**	**Occupation**	**Monthly Income**

4a.	Family assets							
4b.	Land owned (area in Acres)							
4c.	Type of house	Pucca		Kutcha		Temporary		
4d.	Owner of the house/Tenant							
5a.	Whether a native /migrant to the village							
5b.	Do you have ration card?	Yes/No		BPL card /APL card				
5c.	Do you have Aadhar card?	Yes /No		Card No-				
5d.	Do you have voter's id?	Yes/ No						
6	Will the project impact the family property/assets	Yes /No		Details if impact				
6a	Immovable Properties impacted							
6b	House							
6c	Shop							
6d	Water-mills							
6e	Cattle-shed							
6f	Wells							
6g	Ponds							
6h	Any other							
6 i	Estimated cost of loss (Rs)							
7	Livestock Population	Buffalo	Ox	Goat	Sheep	Horse	Mule	Cow
7a.	Number of possession							
8	Health Status							
8a	Is there any chronic patients in the family	Yes / No						
8b.	Nature of illness							
8c	Treatment facilities (within the village/ distant place?)							
9	Project information							
9a	Are you aware of the project	Yes	No					
9b	How will the project impact you	Positive/negative/neutral						

12	Give reasons for the said impact	
	1.	
	2.	
	3.	

Surveyor's Name and signature:

Signature of the Respondent:

Date of survey:

Part (B) in addition to the above, following information required in case of Land acquisition

1	Loss of Land and other properties	1. Land 2. Residence/House 3. Land+House 4.Shop 5.other (specify)
2	Total Land Owned by Family before land acquisition	
3	Total Land acquired for the project	
4	Total Cost of Land	
4a	Ownership of land	
4b	Any Government land encroached? or in possession(details)	
5	Kinds and quantity of Crops Grown	1. Paddy_____Maize_____ 2. Bajra_____Jowar_____ 3. Fruits_____Vegetables_____ Others (Specify)_____
6	Details any yielding trees lost	
7	Type of House	1. Kutcha house (Mud/Grass Roof) 4. Semi- Pucca (Concrete + Tin sheet) 5. Pucca(RCC)
8	Total Area of the house	
9	Expected cost of construction of such a house	
10	Other non-movable assets in the land	Dug well/ bore well/cattle shed/motor shed/pond/ others
11	Loss of Livelihood due to the project (details)	
11a	Alternate choice to restore livelihood	
12	Any Common Property resources lost?(grazing land/playground/market/ cremation ground etc) Provide details	
12 a	Is there any other impact other than the above? Provide details	

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Village information / community consultations in selected PIA villages

I	**Basic Information**			
a.	Name of the study village			
b.	Name of the Gram Panchayat			
c.	Number of villages in Gram Panchayat			
d.	Number of habitations in the village			
e.	District			
f.	Name of village head			
g.	Sex			
h.	Contact details			
i.	Total Population of the study village			
j.	Male			
k.	Female			
l.	SC Population			
m.	ST Population			
n.	No. of BPL cardholders			
II	**Details of existing Infrastructure facilities in the village**			
	Socio Economic Infrastructure	**No of units**	**Details**	**If 'No' Nearest Place**
a	Anganwadi centres			
b	Primary Schools			
c	Middle Schools			
d	High Schools			
e	Colleges			
f	Professional colleges			
g	Post Office			
h	Police Station			
i	Ration Shops			
j	Banks			
k	Co-operative Societies			
l	PHC/CHC			
m	Private clinic/hospital			
n	Major Government offices			
o	Mobile clinics			
p	Ambulance			
q	Bus service			
r	Markets			
s	Veterinary Hospitals			
t	Cremation grounds			
u	Play grounds/stadium			
v	Drinking water facilities and coverage (%)			
w	Sanitation facilities and c overage			
x	Are there any unique Cultural/tourism centres in the village?			
y	Number of religious centres			
	~~Temples/mosques/churches/ gurudwaras~~/ashrams etc			

III	**Livelihood status of the villagers**		
a	Major livelihoods of the people in the community(list)	1) Agriculture, 2) Horticulture 3) Livestock 4) Fisheries 5) Traditional works 6) Household business **7)** Forest produce collection	
b	Details of traditional craft workers in the village		
c	Major agricultural /Horticultural products of the village?		
d	Where do you market your products?		
e	List out details of factories /industries in the village?		
f	How many private boats and ferry men operate from the village?		
IV	**Project information**		
a	Are you aware of this Inland Water Transport project?	Yes /No	
b	What will be the impact in your village?		
c	What are your suggestions for this project?		
d	Is there any land acquisition in your village proposed, for the purpose of this project?		

Name/Signature of village head **Signature of Data Collector**

Date of consultation:

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Key Informant interview with the Ferry operators

1	Village Name	
2	Jetty Name	
3	River	
4	Date of interview	
5	No of Stakeholders Present (attach attendance sheet)	

S No.	Points Discussed	Outcomes
1.	How many boats currently operates through this jetty	
2.	Time of boats services	
3.	Daily Passengers Number	
4.	Main category of passengers (Workers, Traders, Students etc)	
5.	Highest number of crowd on jetty/time	
6.	Facilities on Boat Jetty	
7.	Major routes / area where people travel from this jetty	
8.	Fares and time required for water transport and road transport	
9.	Alternative Route to travel from one bank to another	
10.	Access Road to the jetty	
11.	Public Demand in terms of • Infrastructure Facilities • Better service • No of services and timing • Capacity development of staff • Safety conditions and precautions • List other ,if any	
12.	General trend in river course changes and its impacts on public transport	
13.	Problems faced by passengers during monsoon season	
14.	Any accidents reported and reasons thereof	
15.	Overall observations	

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Gender issues

Focus Group Discussions/PRA Mapping exercise

1	Name of village	
2	Ghat/landing center	
3	Date of FGD	
4	No of participants(attach attendance sheet)	
5	Time management –How do women of the village spend their time (PRA mapping and list out below)?	
6	Educational background of the women in the group and employment status. Map this analysing the reasons for their educational backwardness and low work participation rate, if any, and list out below?	
7	List out the major issues of the women in the village?	
8	Is there any gender violence reported in the area? Yes/ no	
	a. How many women and girls are victims of such violence?	
	b. What are the root causes of violence against women and girls?	
	c. What interventions were there to help them?	
9	Is there any local NGOs working on Gender Based Violence? Details	
	Name and signature of the PRA team	

Indigenous groups

PRA Mapping exercise/ Focus Group Discussions

1	Name of village	
2	Ghat/landing center	
3	Date of FGD	
4	No of participants(attach attendance sheet)	
5	List of indigenous people in the village	
6	Map the special issues pertinent to indigenous people/groups in the village.	
7	List out the special rights protections (if any) applicable and enjoyed by these groups.	
8	List out the special requirements of indigenous people or inclusion with reference to that village/hamlet.	
9	List out the perception of Indigenous people about the river and the project and their suggestions for inclusion.	

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Format for Focus group discussions

(Village level)

1.	Name of village		
a	Category of Respondents		
b	Number of participants/male/female		
c	Venue of the meet		
2.	List out the Existing facilities and limitations of the Inland water transport programme in the village		
3.	What are the major suggestions for improvement		
4.	Description of the focus group in general		

Hiring of Safeguards Consultant for Environmental and Social Assessment Studies for Assam Inland Water Transport project, Phase-II

Participants List

DATE: **PLACE:**

S. No.	Name of the Participants	Designation / Occupation	Mobile No	Signature

Annexure – 4

Institutional Stakeholders Consultation Meeting Details

ANNXURE-II

Institutional Stakeholders Consultation Meeting

Meeting-1

Consultation Meeting No.	Date	No. of Stakeholders Attended
1	07.05.2022	42
Venue	Conference Hall, Hotel Lily, Guwahati	

Details of The Discussion

Brief Introduction of the discussion:

The meeting was inaugurated By Mr. Ankur Jain (IPS), State Project Director AIWTDS in presence of Sri Partha Pegu (ACS), Director IWT & ASPD, AIWTDS and Sri Rahul Chandra Das, ACS Deputy State Project Director, AIWTDS. Mr. Nabin Sarma (SDE, AIWTDS) was compering the activities.

The meeting started with brief introduction about AIWTDS project, ESIA study and objectives of stakeholder's consultation meeting.

On behalf of project proponent WAPCOS Limited, Consultant for ESIA study led the consultation meeting.

Mr. P D Karkhanis (General Manager, WAPCOS) made a detailed presentation on the works awarded to WAPCOS, activities performed till date by WAPCOS and importance of stakeholder's consultation meeting under this project.

Mr. Rahul Chandra Das, ACS Deputy State Project Director, AIWTDS presented vote of thanks to all stakeholders who has spared time from their busy schedule to attend the meeting and shared their experiences for better outcome of the activities awarded to WAPCOS as well as from the overall project.

Discussion by stakeholders on various points were also discussed during the consultation meeting which are summarized as below:

Name & Designation of Stakeholder	Issue Raised during Interaction	Remark (reply By Project Proponent)
Professor P C Bhattacharya (Retd.)	Management and practice to be followed for situations as: • Fluctuations in water levels of the river Brahmaputra due to climate change. • Safety and carriage capacity of passenger livestock & vehicles in emergency situation. • Provision for EV charging, PA address system and collaboration with ASDM for operation and management of terminals.	• River characteristics and weather conditions will be taken into account while designing the terminals. • Well planned terminals that would cater number of passengers and livestock in emergency would be the priority.
Mr Mridul Buragohain (A.E.E) MoRTH	• Two (02) number bridges are proposed in the vicinity of the project and taken into consideration to avoid any conflicts of interest?	• It was assured that the upcoming bridges and the proposed terminals will not affect each other.
	• River development program under smart city project between Kachari Ghat and DC bunglow having a length of	• AIWTDS assured that the matter will be looked into before finalizing the design.

	15m height 51.5m from road level may come into conflict with the proposed terminal location at Uzan Bazar.	
Dr. Dipendra Singh (Environmental Expert) PWRD	• What will be the length of the stairs from terminal platform to pontoons?	• The length of the stairs will vary as per location.
Mr Mridul K Das (Executive Engineer) Pollution Control Board	• In case of air pollution dust collector, ESP etc. and for water pollution ETP or STP with five stages Physical treatment, Biological treatment, Chemical treatment, Filtration and Sludge management must be included?	• It was clarified that appropriate measures will be taken to control any kind of pollution.
Mr P K Das (Member AIWTDS)	• Consultation meetings, surveys etc. shall be done in coordination and involvement of respective administration and prominent stakeholders.	• Suggestions will be followed.
Dr Abhinandan Saikia (TISS Guwahati)	• Raised the issue of sustainable development and methodology to be used in Dolphin study? • Suggestion for reducing carbon footprint futuristic vessels on alternate fuels like solar, electricity and hybrid should be explored.	• It was clarified that Government of Assam and World Bank policies would be followed for development activities and Zoological Survey of India (ZSI) has been involved for Dolphin study.
Representative from local NGO	• Compensation for land acquisition and livelihood	• Impacts if any occurred will be treated as per project norms.
Mr Nabin Sarma, Social Development Expert, AIWTDS	• Approach about the labour influx and gender based inequality & violence during construction phase?	• The issue would be taken on priority and every possible measures/ policies will be practiced, once the design details gets finalized by DPR consultant.

Meeting-2

The stakeholders consultation for Modular Terminals on Detailed Project Report (DPR) and Environmental and Social Impact assessment Report (ESIA) for the proposed terminals at North Guwahati and Umananda Ghat was organized at the conference hall, AIWTDS on 06.02.2023 under the Chairmanship of Shri Ankur Jain (IPS), State Project Director, AIWTDS and Commodore Shri K.C.Choudhury, Honorary Advisor, AIWTDS and in presence of officials of Royal Haskoning, Design DPR Consultant, WAPCOS Ltd. Safeguard Consultant, Environment and Social safeguard Assessment studies for Modular Terminals, AIWTDS and invitees from line departments, PWD-EAP, ASDMA, APART, APGCL etc.

Consultation Meeting No.	Date	No. of Stakeholders Attended
1	06.02.2023	22
Venue	Conference Hall, AIWTDS, Guwahati	

Details of The Discussion

Brief Introduction of the discussion:

The meeting started with a welcome note by Commodore Sri K.C. Choudhury, Honorary Advisor, Assam Inland Water Transport Development Society welcoming aII the participants in the Stakeholder's meet. He apprised the members that the main purpose of the stakeholder consultation is to identify the views of local communities, relevant institutional and other stakeholders on the project which facilitates identification of any environmental, social components for which mitigation measures may be undertaken to minimize any adverse impacts both during the construction and operation phase of the Project.

An overview of all the components of the project was briefed in details by Commodore K.C. Choudhury, to all the participants. He invited for suggestions from everyone present in the meeting citing the fact that the feedback plays an important part in finalizing the DPR as well as the Environment and Social Impact assessment studies. He highlighted that the upcoming terminals will cater to the requirements of passengers of all age, genders and differently-abled. He also suggested that a small office for quick communication with the jetty be considered so that the office can act as a first point of contact in case of any untoward incidents.

In further continuation to this Mr. P.D. Karkhanis, General Manager, WAPCOS apprised the meeting that, along with the technical aspects of the DPR, the Social & Environmental aspects are also studied. He gave a detailed presentation on the Social and Environmental aspects of the project for the proposed terminals at North Guwahati and Umananda Ghats. He apprised that the current meeting is a part of stakeholders consultation to be held at draft ESIA stage for dissemination of information on project and its key impact and proposed mitigation measures.

Mr. Karkhanis further apprised the participants that the design for both the terminals is environment friendly with no dredging involved. He stated that anticipated impacts of construction as well as operation phase is studied and proper mitigation measures are planned. During the construction phase, labour camps with proper water arrangement facility, sanitation facilities should there, health and safety preventive medical care should be provided. He further emphasized that both the sites being a known habitat for dolphins had been carried out by Zoological Survey of India (ZSI). The findings of the study are now a part of the ESIA.

Discussion by stakeholders on various points were also discussed during the consultation meeting which are summarized as below:

Name & Designation of Stakeholder	Issue Raised during Interaction	Remark (reply By Project Proponent)
Mr. N. Bhattacharjee **Member Umananda Devalaya**	• Need of a “Snaan Ghat” which will allow them to complete a few rituals quite comfortably. • Need of toilets and drinking water facility as well as proper lighting at the ghat and temple premises. • They do have facilities for drinking water and toilets but most of the time they struggle to provide water also incurring huge expenses in	AIWTDS officials stated that the points are noted and taken into consideration in the DPR.

	diesel genset just for pumping water. • Since there is no electricity they are unable to supply water to the toilets or keep the area illuminated. • Requested for a permanent place to store their water pump in the terminal building which is currently left out in the open. • Concrete posts to tie the pontoon at ghat	
Dr Pradip Kumar Sarmah, Advisor, Aswaklanta Devalaya, North Guwahati	• Dr Sarmah, welcomed the project and stated that this is very important project and suggested that the approach road should be considered along with proper illumination of the Ghat. • He further suggested that there should be signage and displays for real time information on ferry timings, cancellation if any, weather etc. • He also suggested that like earlier times, the ghat may be renamed as Aswaklanta Ghat.	
Miss Mandira Buragohain, Project officer, ASDMA	• During the monsoon/ flood period, high flood level marking in DPR before construction should be considered • Ecosystem of river should be thoroughly studied • Provision for Disaster Management Room for storing of emergency rescue equipment • Training of local youths under Aapda Mitra	
Mr. Laksheswar Sarma, President Aswaklanta Devalaya	• Appreciated the Aapda Mitra training for the local youths and suggested to avail such trainings	
Mr. Subhram Goswamai Senior Consultant, PWC (APART Project)	• Provision for transport of agriculture and allied products at reduced freight charges	

Shri Ankur Jain, (IPS) **State Project Director, AIWTDS**	• Water tank to be constructed at the Umananda temple premises so that water can be supplied at terminal through gravity flow	
Commodore K.C.Choudhury, **Honorary advisor, AIWTDS**	• Battery operated vehicle facility especially for senior citizen and disabled to reach pontoon • Provision for Harbour master control room • Incorporation of VVIP room	

Meeting-3

The stakeholders consultation for Modular Terminals on Detailed Project Report (DPR) and Environmental and Social Impact assessment Report (ESIA) at Aphalamukh- IWT Ghat, Majuli for the proposed terminals at Neamti and Aphalamukh Ghat was organized on 08.02.2023 under the Chairmanship of Commodore Shri K.C.Choudhury, Honorary Advisor, AIWTDS and in presence of Sri Kartik Kalita, (ACS) Additional Deputy Commissioner, Majuli District and other officials of Inland Water transport and AIWTDS, Panchayat, Water Resources, Forest Department, APGCL and local villagers.

Consultation Meeting No.	**Date**	**No. of Stakeholders Attended**
1	08.02.2023	43
Venue	IWT Ghat, Aphalamukh, Majuli	
Details of The Discussion		

Brief Introduction of the discussion:

The meeting started with a welcome note by Commodore Sri K.C. Choudhury, Honorary Advisor, Assam Inland Water Transport Development Society welcoming aII the participants in the Stakeholder's meet.

Commodore K.C. Choudhury, Honorary Advisor, AIWTD Society at the very onset, gave an overview of all the Project components that aims to transform the quality of inland water transport services and integrate high quality passenger and vehicle ferry services into Assam's wider transport network. He apprised the participants that modular terminals are being proposed to be developed at Aphalamukh and Neamati Ghats along with the facilities for night navigation. He explained that the meeting is a part of the final stage of discussions with stakeholders for finalizing the design DPR of the terminals and sharing the findings of the environment and social safeguard assessment studies.

This was followed by a power point presentation by Sri Dipankar Das, Project Manager (Technical) of the AIWTD Society on the various issues pertaining to the Technical aspects of the project and how they have been taken care of as per the World Bank guidelines and the various findings of the studies related to Environment and Social Impact Assessment of the project which has been considered in the design of the proposed terminals at Neamati and Aphalamukh.

Mr. Karkhanis further apprised the participants that the design for both the terminals is environment friendly with no dredging involved. He stated that anticipated impacts of construction as well as operation phase is studied and proper mitigation measures are planned. During the construction phase, labour camps with proper water arrangement facility, sanitation facilities should there, health and safety preventive medical care should be provided. He further emphasized that both the sites being a known habitat for dolphins had been carried out by Zoological Survey of India (ZSI). The findings of the study are now a part of the ESIA.

Discussion by stakeholders on various points were also discussed during the consultation meeting which are summarized as below:		
Name & Designation of Stakeholder	**Issue Raised during Interaction**	**Remark (reply By Project Proponent)**
Harendra Borah (Local villager)	He enquired about the job, and possibility of the project initiation.	In response to this, Sri Dipankar Das, Project Manager (Technical), AIWTDS apprised that for the development of terminal works, local contractors will be hired which will in turn engage the local people of those areas.
Jibeswar Hazarika (Local villager)	The Land issue topic was raised by one of the locals who informed that there are instances where the same land belongs to the villagers and then listed as a Govt. Property also.	In this regard, Sri Kartik Kalita, ACS, Addl. Deputy Commissioner, Majuli District informed that there will be proper verification of the land records where a Circle Officer will be sent to check and resolve the issue.
Rita Kalita (Local villager)	One of the female participant requested for job and asked about the employment prospect for women.	In response to this, it was apprised that Self Help Groups will be created for the development of women empowerment.
Sri Kartik Kalita, ACS, Additional. Deputy Commissioner, Majuli District	He raised the concern about the basic amenities that are missing like toilets, waiting area, parking facilities etc and also the communication problem at Aphalamukh Ghat. Proper approach road towards the terminals to be constructed as during floods and rainy season roads become dilapidated making it difficult for users.	In this regard, Sri Dipankar Das, Project Manager (Technical), AIWTD Society apprised that all these facilities will be provided and taken care of during the upcoming terminal port construction works at the Ghats.

Invitation Letter for Stakeholder Meeting (07.05.2022) Guwahati

অসম আভ্যন্তৰীণ জল পৰিবহন উন্নয়ন সমিতি
(অসম চৰকাৰৰ পৰিবহন বিভাগৰ অধীনস্থ স্বতন্ত্ৰ সংস্থা)
Assam Inland Water Transport Development Society
(An Autonomous Body under the Transport Department, Government of Assam)
3rd floor, Directorate of Inland Water Transport, Ulubari, Guwahati – 7::email: dir.iwtds-as@gov.in::Tel:+91361-2462677

No: AIWTDS/266/2021/195 Dated:

To,

The Chief Engineer
PWD –EAP, Assam
Guwahati

Subject: Stakeholder Meeting for proposed Construction of Modular Terminals, Slipways and CTC under AIWT Project, Transport Department, GoA

Sir/Madam

With reference to the subject cited above, I wish to inform you that Assam Inland Water Transport Development Society, an apex autonomous body under Transport Department, Govt. of Assam has initiated AIWT Project with financial assistance from the World Bank for transforming the quality of inland water transport services and integrate high quality passenger and vehicle ferry services into Assam's wider transport network.

M/S WAPCOS Ltd. an accredited public sector enterprise under the aegis of the Union Ministry of Jal Shakti, has been engaged as consultant for conducting Environment and Social Impact Assessment (ESIA) and CIA study for the aforesaid interventions of the Project. The Consultant has already conducted field visits to all the proposed locations and have submitted their inception report where they have suggested a stakeholders meet for better understanding and co-ordination. In this regard, AIWTD Society in association with M/S WAPCOS Ltd is organising the Stakeholder meeting for the better understanding of the environmental impacts due to the proposed interventions as well as other projects in the vicinity of AIWT project locations viz. Construction of Ferry Terminal & Riverine Infrastructure at Guwahati Gateway Ghat (GGG), South Guwahati and Modular Terminals at North Guwahati, Umananda, Uzan Bazar, Kurua, Goalpara, Bahari (Barpeta) Guijan (Tinsukia), Disangmukh (Sivsagar), Ghagor (Lakhimpur), Matmora (Lakhimpur), Kacharighat (Dhubri), Aphalamukh (Majuli) and Neamati (Jorhat), two Slipways at Dikhowmukh (Sivsagar) and Dhubri along with seting up of Crew Training Centre (CTC) near the Pandu Port.

Accordingly, you are requested to attend the meeting as per the schedule. Please find enclosed the draft Agenda, Questionnaire for your reference and needful action.

Venue of the Meeting: Hotel Lily, Khanapara
Time: 10:30 AM onwards
Enclosed: Note on Assam IWT Project

Thank you

Yours faithfully

Sri. Ankur Jain, IPS
State Project Director
AIWTD Society

Meeting Schedule

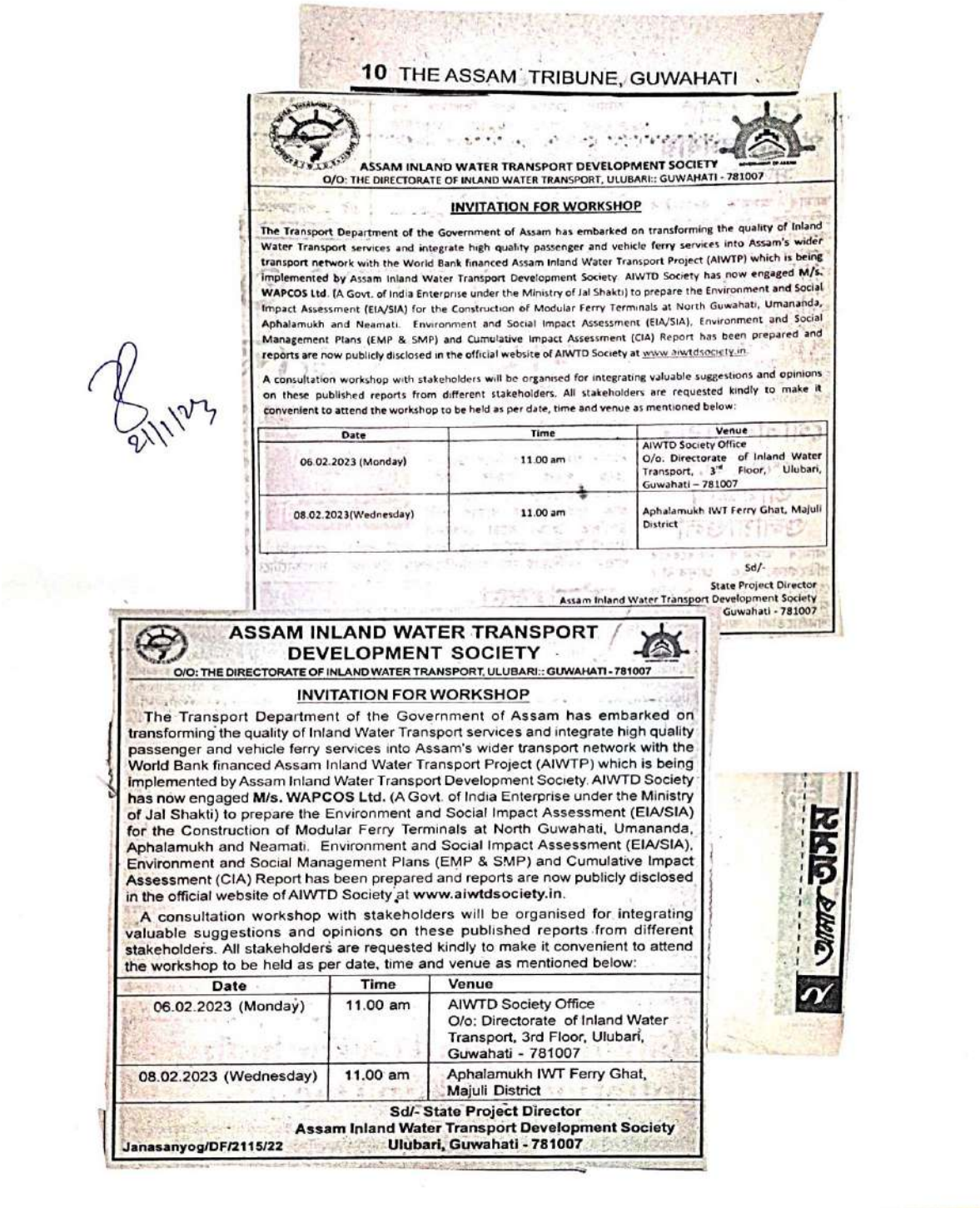
STAKEHOLDER CONSULTATION OF
ASSAM INLAND WATER TRANSPORT PROJECT ON
ENVIRONMENTAL AND SOCIAL SAFEGUARDS STUDIES AND CUMILIATIVE IMPACT ASSESSMENT (CIA) STUDIES

SATURDAY, MAY 07, 2022

HOTEL LILY
G S ROAD, KHANAPARA, GUWAHATI, ASSAM 781022

10.30 – 11.00 am	Registration	
11.00 am	Inaugural Address	Sri. Ankur Jain, IPS State Project Director, Assam Inland Water Transport Development Society (AIWTDS)
11.15 am	Welcome Note Background to the Assam Inland Waterways Transport Project and Workshop Objective	Sri. Partha Pegu, ACS Director, IWT & ASPD, AIWTDS
11.30 -12.00 noon	Participants Introduction	
12:00 - 12:30 pm	Overview of the Environment and Social and CIA Study Objectives, Methodology and Results	WAPCOS Ltd.
12.30 - 1.00 pm	DPR Presentation on smaller terminals	Royal Haskoning DHV Consulting Pvt. Ltd
1.00 – 1.30 pm	Question and Answers/ Queries/ Group Discussion	WAPCOS/ Royal Haskoning
2.00 pm	Vote of thanks	Sri. Rahul Ch. Das, ACS Dy. State Project Director, AIWTD Society
2.15 pm	**Lunch**	

Advertisement of Stakeholder Consultation (06.02.2023 & 08.02.2023)



10 THE ASSAM TRIBUNE, GUWAHATI

ASSAM INLAND WATER TRANSPORT DEVELOPMENT SOCIETY
O/O: THE DIRECTORATE OF INLAND WATER TRANSPORT, ULUBARI:: GUWAHATI - 781007

INVITATION FOR WORKSHOP

The Transport Department of the Government of Assam has embarked on transforming the quality of Inland Water Transport services and integrate high quality passenger and vehicle ferry services into Assam's wider transport network with the World Bank financed Assam Inland Water Transport Project (AIWTP) which is being implemented by Assam Inland Water Transport Development Society. AIWTD Society has now engaged M/s. WAPCOS Ltd. (A Govt. of India Enterprise under the Ministry of Jal Shakti) to prepare the Environment and Social Impact Assessment (EIA/SIA) for the Construction of Modular Ferry Terminals at North Guwahati, Umananda, Aphalamukh and Neamati. Environment and Social Impact Assessment (EIA/SIA), Environment and Social Management Plans (EMP & SMP) and Cumulative Impact Assessment (CIA) Report has been prepared and reports are now publicly disclosed in the official website of AIWTD Society at www.aiwtdsociety.in.

A consultation workshop with stakeholders will be organised for integrating valuable suggestions and opinions on these published reports from different stakeholders. All stakeholders are requested kindly to make it convenient to attend the workshop to be held as per date, time and venue as mentioned below:

Date	Time	Venue
06.02.2023 (Monday)	11.00 am	AIWTD Society Office O/o. Directorate of Inland Water Transport, 3rd Floor, Ulubari, Guwahati – 781007
08.02.2023(Wednesday)	11.00 am	Aphalamukh IWT Ferry Ghat, Majuli District

Sd/-
State Project Director
Assam Inland Water Transport Development Society
Guwahati - 781007

ASSAM INLAND WATER TRANSPORT DEVELOPMENT SOCIETY
O/O: THE DIRECTORATE OF INLAND WATER TRANSPORT, ULUBARI:: GUWAHATI - 781007

INVITATION FOR WORKSHOP

The Transport Department of the Government of Assam has embarked on transforming the quality of Inland Water Transport services and integrate high quality passenger and vehicle ferry services into Assam's wider transport network with the World Bank financed Assam Inland Water Transport Project (AIWTP) which is being implemented by Assam Inland Water Transport Development Society. AIWTD Society has now engaged **M/s. WAPCOS Ltd.** (A Govt. of India Enterprise under the Ministry of Jal Shakti) to prepare the Environment and Social Impact Assessment (EIA/SIA) for the Construction of Modular Ferry Terminals at North Guwahati, Umananda, Aphalamukh and Neamati. Environment and Social Impact Assessment (EIA/SIA), Environment and Social Management Plans (EMP & SMP) and Cumulative Impact Assessment (CIA) Report has been prepared and reports are now publicly disclosed in the official website of AIWTD Society at **www.aiwtdsociety.in**.

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Sd/- State Project Director
Assam Inland Water Transport Development Society
Ulubari, Guwahati - 781007

Janasanyog/DF/2115/22

Meeting Schedule

STAKEHOLDER CONSULTATION OF ASSAM INLAND WATER TRANSPORT PROJECT ON ENVIRONMENTAL AND SOCIAL SAFEGUARDS STUDIES AND CUMILIATIVE IMPACT ASSESSMENT (CIA) STUDIES AND DETAIL PROJECT REPORT (DPR) FOR MODULER TERMINALS

MONDAY, FEBRUARY 06, 2023

CONFERENCE HALL, AIWTD SOCIETY, ULUBARI, GUWAHATI, ASSAM 781007

10.30 – 11.00 am	Registration	
11.00 am	Inaugural Address	Comm. K C Choudhury, Hon. Advisor, Assam Inland Water Transport Development Society (AIWTDS)
11.10 am	Welcome Note Background to the Assam Inland Waterways Transport Project and Workshop Objective	Sri. Partha Pegu, ACS Director, IWT & ASPD, AIWTDS
11.15 -11.30 am	Participant Introductions	
11:30 - 11:45 am	DPR Presentation on smaller terminals	Royal Haskoning DHV Consulting Pvt. Ltd
11.45 - 12.00 noon	Overview of the Environment and Social and CIA Study Objectives, Methodology and Results	WAPCOS Ltd.
12.00 – 12.15 pm	Question and Answers/ Queries/ Group Discussion	WAPCOS/ Royal Haskoning
12.30 pm	Vote of thanks	AIWTD Society
12.45 pm	Lunch	

Annexure - 5

Photographs of Stakeholders Consultation

Photographs of Stakeholders Consultation

North Guwahati and Umananda (06.02.2023)

Institutional Stakeholders Consultation at Guwahati (07.05.2022)

PHOTOGRAPHS FGDs AND SITE CONDITIONS

UMANANDA

Interaction with vendor selling drinking water

Approach road to Umananda ferry terminal from Uzan Bazar side

Interaction with commuters and devotees

Existing pontoon at Umananda terminal

Interaction with IWT ferry and operational staff

Stall owner

Stall owner

Woman stall owner

Interaction with temple committee members

Existing entrance at Umananda Ghat

Annexure - 6

Environmental Monitoring Report- Soil

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Analysis	SS-260422-41	26-04-2022

Issued To: M/s Wapcos Limited (A Government of India Undertaking- Ministry of Jal Shakti)
76- C, Institutional Area, Sector- 18, Gurugram- 122015 (Haryana) India

SAMPLING & ANALYSIS DATA

Sample Received On : 30.03.2022
Project Name : Assam Inland water Transport Project, Phase II
Sample Description : Soil Sample collected from SNG1
Sample Quantity : 2.0 Kg
Analysis Duration : 30.03.2022 to 25.04.2022

TEST RESULTS

S. No.	PARAMETERTS		TEST METHOD	RESULT	UNIT
1.	pH (1:5 suspension)		IS:2720(Part-26)	7.81	-
2.	Electrical Conductivity @25^{0}C (1:1suspension.)		IS:2720(Part-21)	469	µS/cm
3.	Calcium (as Ca)		STP/SOIL	1578	mg/kg
4.	Magnesium (as Mg)		STP/SOIL	365	mg/kg
5.	Sodium (as Na)		STP/SOIL	139	mg/kg
6.	Available Potassium (as K)		STP/SOIL	271	mg/kg
7.	Salinity @25^{0}C (1:1suspension.)		STP/SOIL	245	µS/cm
8.	Organic Matter		STP/SOIL	0.74	% by mass
9.	Sodium Absorption Ratio		STP/SOIL	1.01	-
10.	Nitrogen		STP/SOIL	0.12	% by mass
11.	Available Phosphorus (as P_2O_5)		STP/SOIL	86	mg/kg
12.	Bulk Density		STP/SOIL	1.21	gm /cc
13.	Organic Carbon		STP/SOIL	0.43	% by mass
14.	Particle Size Distribution	a. Sand	STP/SOIL	59.4	% by mass
		b. Clay	STP/SOIL	22.1	% by mass
		c. Silt	STP/SOIL	18.5	% by mass
15.	Exchangeable Sodium Percentage		STP/SOIL	4.75	% by mass

Notes: -

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

Checked by

Authorized Signatory

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Analysis	SS-260422-42	26-04-2022

Issued To: M/s Wapcos Limited (A Government of India Undertaking- Ministry of Jal Shakti)
76- C, Institutional Area, Sector- 18, Gurugram- 122015 (Haryana) India

SAMPLING & ANALYSIS DATA

Sample Received On : 30.03.2022
Project Name : Assam Inland water Transport Project, Phase II
Sample Description : Soil Sample collected from SNG2
Sample Quantity : 2.0 Kg
Analysis Duration : 30.03.2022 to 25.04.2022

TEST RESULTS

S. No.	PARAMETERTS		TEST METHOD	RESULT	UNIT
1.	pH (1:5 suspension)		IS:2720(Part-26)	7.54	-
2.	Electrical Conductivity @25^{O}C (1:1suspension.)		IS:2720(Part-21)	423	µS/cm
3.	Calcium (as Ca)		STP/SOIL	1376	mg/kg
4.	Magnesium (as Mg)		STP/SOIL	325	mg/kg
5.	Sodium (as Na)		STP/SOIL	153	mg/kg
6.	Available Potassium (as K)		STP/SOIL	283	mg/kg
7.	Salinity @25^{O}C (1:1suspension.)		STP/SOIL	228	µS/cm
8.	Organic Matter		STP/SOIL	1.05	% by mass
9.	Sodium Absorption Ratio		STP/SOIL	1.03	-
10.	Nitrogen		STP/SOIL	0.11	% by mass
11.	Available Phosphorus (as P_2O_5)		STP/SOIL	115	mg/kg
12.	Bulk Density		STP/SOIL	1.18	gm /cc
13.	Organic Carbon		STP/SOIL	0.61	% by mass
14.	Particle Size Distribution	a. Sand	STP/SOIL	61.5	% by mass
		b. Clay	STP/SOIL	19.7	% by mass
		c. Silt	STP/SOIL	18.8	% by mass
15.	Exchangeable Sodium Percentage		STP/SOIL	3.69	% by mass

Notes: -

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

Checked by

Authorized Signatory

Annexure - 7

Environmental Monitoring Report- Water

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-03	26/04/2022

Issued To: M/s Wapcos Limited (A Government of India Undertaking- Ministry of Jal Shakti)
76- C, Institutional Area, Sector- 18, Gurugram- 122015 (Haryana) India.

SAMPLING & ANALYSIS DATA

Sample Received On	:	30/03/2022
Sample Drawn By	:	NTL
Project Name	:	Assam Inland Water Transport Project, Phase-II
Sample Description	:	Water Sample
Sampling Location	:	Water Sample (WNG1)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	7.68	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Electrical Conductivity	IS-3025(P-14)	258	µS/cm
4.	Turbidity	IS-3025(P-10)	<1.0	NTU
5.	Total Hardness (as CaCO3)	IS:3025(Part-21)	58.0	mg/l
6.	Fluoride (as F)	APHA 22nd edit	0.28	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.7	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	26.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	13.0	mg/l
10.	BOD (3 days at 27^{0}C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO_3)	IS: 3025 (P- 34)	1.5	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	168	mg/l
13.	Sulphate (as SO_4)	IS: 3025 (P- 24)	2.8	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	6.2	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	1.6	mg/l
17.	Potassium (as K)	IS-3025(P-45)	<1.0	mg/l
18.	COD (as O_2)	IS-3025 (P-38)	6.0	mg/l
19.	Residual Sodium Carbonate	APHA 22nd edit 2012	Nil	mg/l
20.	Total Chromium (as Cr)	IS-3025(P-52)	<0.05	mg/l
21.	Iron (as Fe)	IS: 3025(P-53)	0.11	mg/l
22.	Manganese (as Mn)	IS 3025 (P-59)	<0.10	mg/l
23.	Copper (as Cu)	IS: 3025 (P-42)	<0.05	mg/l
24.	Zinc (as Zn)	IS: 3025 (P- 49)	0.09	mg/l

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TEST CERTIFICATE

25.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
26.	Cadmium (as Cd)	IS-3025(P-41)	<0.01	mg/l
27.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
28.	Lead (as Pb)	IS-3025(P-47)	<0.01	mg/l
29.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
30.	Mercury (Hg)	IS-3025(P-48)	<0.001	mg/l

MICROBIOLOGICAL REQUIREMENT

S. No.	Parameter	Test Method	Results
1.	Total Coliform *MPN/100ML)*	IS-1622	Absent
2.	*Faecal Coliform (MPN/100ML)*	IS-1622	Absent

Notes: -

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
5. The test samples will be disposed off after two weeks from the date of issue of test report, unless until specified by the customer.

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-04	26/04/2022

Issued To: M/s Wapcos Limited (A Government of India Undertaking- Ministry of Jal Shakti)
76- C, Institutional Area, Sector- 18, Gurugram- 122015 (Haryana) India.

SAMPLING & ANALYSIS DATA

Sample Received On	:	30/03/2022
Sample Drawn By	:	NTL
Project Name	:	Assam Inland Water Transport Project, Phase-II
Sample Description	:	Water Sample
Sampling Location	:	Water Sample (WNG2)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	7.80	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Electrical Conductivity	IS-3025(P-14)	228	µS/cm
4.	Turbidity	IS-3025(P-10)	<1.0	NTU
5.	Total Hardness (as CaCO3)	IS:3025(Part-21)	49.0	mg/l
6.	Fluoride (as F)	APHA 22nd edit	0.19	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.6	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	26.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	15.0	mg/l
10.	BOD (3 days at 27^{0}C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO_3)	IS: 3025 (P- 34)	1.2	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	148	mg/l
13.	Sulphate (as SO_4)	IS: 3025 (P- 24)	3.5	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	2.8	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	2.0	mg/l
17.	Potassium (as K)	IS-3025(P-45)	<1.0	mg/l
18.	COD (as O_2)	IS-3025 (P-38)	4.0	mg/l
19.	Residual Sodium Carbonate	APHA 22nd edit 2012	Nil	mg/l
20.	Total Chromium (as Cr)	IS-3025(P-52)	<0.05	mg/l
21.	Iron (as Fe)	IS: 3025(P-53)	0.12	mg/l
22.	Manganese (as Mn)	IS 3025 (P-59)	<0.10	mg/l
23.	Copper (as Cu)	IS: 3025 (P-42)	<0.05	mg/l
24.	Zinc (as Zn)	IS: 3025 (P- 49)	0.13	mg/l

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TEST CERTIFICATE

25.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
26.	Cadmium (as Cd)	IS-3025(P-41)	<0.01	mg/l
27.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
28.	Lead (as Pb)	IS-3025(P-47)	<0.01	mg/l
29.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
30.	Mercury (Hg)	IS-3025(P-48)	<0.001	mg/l

MICROBIOLOGICAL REQUIREMENT

S. No.	Parameter	Test Method	Results
1.	Total Coliform *MPN/100ML)*	IS-1622	Absent
2.	*Faecal Coliform (MPN/100ML)*	IS-1622	Absent

Notes: -

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
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Checked by

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-05	26/04/2022

Issued To: M/s Wapcos Limited (A Government of India Undertaking- Ministry of Jal Shakti)
76- C, Institutional Area, Sector- 18, Gurugram- 122015 (Haryana) India.

SAMPLING & ANALYSIS DATA

Sample Received On	:	30/03/2022
Sample Drawn By	:	NTL
Project Name	:	Assam Inland Water Transport Project, Phase-II
Sample Description	:	Water Sample
Sampling Location	:	Water Sample (WNG3)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	7.64	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Electrical Conductivity	IS-3025(P-14)	218	µS/cm
4.	Turbidity	IS-3025(P-10)	<1.0	NTU
5.	Total Hardness (as CaCO3)	IS:3025(Part-21)	60.0	mg/l
6.	Fluoride (as F)	APHA 22nd edit	0.22	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.4	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	32.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	17.0	mg/l
10.	BOD (3 days at 27^0C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO_3)	IS: 3025 (P- 34)	2.6	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	142	mg/l
13.	Sulphate (as SO_4)	IS: 3025 (P- 24)	4.0	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	4.3	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	2.5	mg/l
17.	Potassium (as K)	IS-3025(P-45)	<1.0	mg/l
18.	COD (as O_2)	IS-3025 (P-38)	6.5	mg/l
19.	Residual Sodium Carbonate	APHA 22nd edit 2012	Nil	mg/l
20.	Total Chromium (as Cr)	IS-3025(P-52)	<0.05	mg/l
21.	Iron (as Fe)	IS: 3025(P-53)	0.14	mg/l
22.	Manganese (as Mn)	IS 3025 (P-59)	<0.10	mg/l
23.	Copper (as Cu)	IS: 3025 (P-42)	<0.05	mg/l
24.	Zinc (as Zn)	IS: 3025 (P- 49)	0.17	mg/l

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TEST CERTIFICATE

25.	Arsenic (as As)	IS-3025(P-37)	<0.01	mg/l
26.	Cadmium (as Cd)	IS-3025(P-41)	<0.01	mg/l
27.	Cyanide (as CN)	IS-3025(P-27)	<0.01	mg/l
28.	Lead (as Pb)	IS-3025(P-47)	<0.01	mg/l
29.	Selenium (as Se)	IS: 3025 (P- 56)	<0.01	mg/l
30.	Mercury (Hg)	IS-3025(P-48)	<0.001	mg/l

MICROBIOLOGICAL REQUIREMENT

S. No.	Parameter	Test Method	Results
1.	Total Coliform *MPN/100ML)*	IS-1622	Absent
2.	*Faecal Coliform (MPN/100ML)*	IS-1622	Absent

Notes: -

1. The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
2. Responsibility of the Laboratory is limited to the invoiced amount only.
3. This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
4. This test report will not be used for any publicity/legal purpose.
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Checked by

Authorized Signatory

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Annexure - 8

Drinking Water Quality Standard

Drinking water quality standards

Characteristics	***Acceptable**	****Cause for Rejection**
Turbidity (units on JTU scale)	2.5	10
Colour (Units on platinum cobalt scale)	5.0	25
Taste and Odour	Unobjectionable	Unobjectionable
PH	7.0 to 8.5	<6.5 or >9.2
Total Dissolved Solids (mg/l)	500	1500
Total hardness (mg/l) (as $CaCO_3$)	200	600
Chlorides as CD (mg/l)	200	1000
Sulphates (as SO_4)	200	400
Fluorides (as F) (mg/l)	1.0	1.5
Nitrates (as NO_3) (mg/l)	45	45
Calcium (as Ca) (mg/l)	75	200
Magnesium (as Mg) (mg/l) If there are 250 mg/l of sulphates, Mg content can be increased to a maximum of 125 mg/l with the reduction of sulphates at the rate of 1 unit per every 2.5 units of sulphates	30	150
Iron (as Fe) (mg/l)	0.1	1.0
Manganese (as Mn) (mg/l)	0.05	0.5
Copper (as Cu) (mg/l)	0.05	1.5
Zinc (as Zn) (mg/l)	5.0	15.0
Phenolic compounds (as phenol) (mg/l)	0.001	0.002
Anionic detergents (as MBAS) (mg/l)	0.2	1.0
Mineral Oil (mg/l)	0.01	0.3
Toxic materials		
Arsenic (as As) (mg/l)	0.05	0.05
Cadmium (as Cd) (mg/l)	0.01	0.01
Chromium (as hexaalent Cr) (mg/l)	0.05	0.05
Cyanides (as CN) (mg/l)	0.05	0.05
Lead (as Pb) (mg/l)	0.1	0.1
Selenium (as Se) (mg/l)	0.01	0.01
Mercury (total as Hg) (mg/l)	0.001	0.001
Polynuclear aromatic hydrocarbons (PAH)	0.2 μg/l	0.2 μg/l

Notes:-

*1.The figures indicated under the column `Acceptable' are the limits upto which water is generally acceptable to the consumers

**2. Figures in excess of those mentioned under `Acceptable render the water not acceptable, but still may be tolerated in the absence of alternative and better source but upto the limits indicated under column "Cause for Rejection" above which are supply will have to be rejected.

Annexure - 9

Ambient Air Quality Monitoring Report

TEST REPORT

Name & Address of the Customer:
WAPCOS LIMITED
76-C, Institutional Area, Sector-18,
Gurgaon : 122015 (Haryana) Haryana 122015

Report No. : MSK/GHY/2022-23/1543
Report Date : 15.01.2023
Sample Description : Ambient Air
Sampling Location : (AAQ-5) North Guwahati
Sample No. : MSKGL/ED/2022-23/09/00446-00451,01454-01455

Ref. No. & Date : W.O. No. : WAP/Envt./IWT Assam/2022/398 dt:30.03.2022, Date : 09/01/2022

ANALYSIS RESULT

SL.N0.	Date of Monitoring	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	Ni (ng/m^3)	As (ng/m^3)	Benzene ($\mu g/m^3$)	Benzo(a) pyrene (ng/m^3)
1	02.08.2022	55.7	34.8	6.4	18.1	0.46	22.7	11.3	<0.01	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	60.3	33.5	6.9	19.6	0.54	21.3	10.6	<0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	48.1	28.3	<6.0	15.7	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	52.4	27.6	<6.0	16.3	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	63.1	31.6	7.2	21.5	0.74	24.1	12.0	0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	59.2	34.8	6.4	18.4	0.62	20.5	10.3	<0.01	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	54.3	25.9	<6.0	15.6	0.44	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	64.1	35.6	<6.0	16.3	0.48	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
Limit as per CPCB notification, New Delhi, 18th Nov, 2009. for Ambient air quality		100	60	80	80	2	180	400	1	20	6	5	1
Sampling and Analysis done according to		IS: 5182 (Part-23) -2006 (Reaff. 2012)	USEPA CFR-40, Part-50, Appendix-L	IS: 5182 (Part-2) -2001	IS: 5182 (Part- 6) -2006	IS 5182 : (Part10) : 1999	Air Sampling, 3rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3rd Edn. By James P. Lodge (Method-401)	USEPA IO-3.4	USEPA IO-3.4	USEPA IO-3.4	IS 5182 : (Part11) : 2006	IS 5182 : (Part 12) :2004 Rffm:2009

Limit as per CPCB notification, New Delhi, 18th Nov, 2009. For Ambient air quality

Report Prepared By :

For Mitra S.K. Pvt. Ltd.

Authorized Signatory

- *The results relate only to the item(s) tested.*
- *This Test Report shall not be reproduced except in full, without the permission of Mitra S.K. Private Limited.*

TEST REPORT

Name & Address of the Customer:
WAPCOS LIMITED
76-C, Institutional Area, Sector-18,
Gurgaon : 122015 (Haryana) Haryana 122015

Report No. : MSK/GHY/2022-23/1544
Report Date : 15.01.2023
Sample Description : Ambient Air
Sampling Location : (AAQ-5) North Guwahati
Sample No. : MSKGL/ED/2022-23/09/01456-01463

Ref. No. & Date : W.O. No. : WAP/Envt./IWT Assam/2022/398 dt:30.03.2022, Date : 09/01/2022

ANALYSIS RESULT

SL.N0.	Date of Monitoring	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	Ni (ng/m^3)	As (ng/m^3)	Benzene ($\mu g/m^3$)	Benzo(a) pyrene (ng/m^3)
1	02.08.2022	53.1	33.2	6.4	19.6	0.44	21.7	10.8	<0.01	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	48.7	27.1	<6.0	15.1	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	46.3	27.2	<6.0	15.7	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	51.7	27.2	6.2	17.6	0.48	20.3	10.2	<0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	53.8	26.9	6.8	20.3	0.46	23.1	11.5	<0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	52.5	30.9	<6.0	16.8	0.54	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	46.8	22.3	<6.0	15.7	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	44.7	24.8	<6.0	14.3	0.34	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
Limit as per CPCB notification, New Delhi, 18th Nov, 2009. for Ambient air quality		100	60	80	80	2	180	400	1	20	6	5	1
Sampling and Analysis done according to		IS: 5182 (Part-23) -2006 (Reaff. 2012)	USEPA CFR-40, Part-50, Appendix-L	IS: 5182 (Part-2) -2001	IS: 5182 (Part- 6) -2006	IS 5182 : (Part10) : 1999	Air Sampling, 3rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3rd Edn. By James P. Lodge (Method-401)	USEPA IO-3.4	USEPA IO-3.4	USEPA IO-3.4	IS 5182 : (Part11) : 2006	IS 5182 : (Part 12) :2004 Rffm:2009

Limit as per CPCB notification, New Delhi, 18th Nov, 2009. For Ambient air quality

Report Prepared By :

For Mitra S.K. Pvt. Ltd.

Authorized Signatory

- *The results relate only to the item(s) tested*
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TEST REPORT

Name & Address of the Customer:
WAPCOS LIMITED
76-C, Institutional Area, Sector-18,
Gurgaon : 122015 (Haryana) Haryana 122015

Report No MSK/GHY/2022-23/1545
Report Date : 15.01.2023
Sample Description : Ambient Air
Sampling Location : (AAQ-5) North Guwahati
Sample No. : MSKGL/ED/2022-23/09/01464-01471

Ref. No. & Date : W.O. No. : WAP/Envt./IWT Assam/2022/398 dt:30.03.2022, Date : 09/01/2022

ANALYSIS RESULT

SL.NO.	Date of Monitoring	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	CO (mg/m^3)	O_3 ($\mu g/m^3$)	NH_3 ($\mu g/m^3$)	Pb ($\mu g/m^3$)	Ni (ng/m^3)	As (ng/m^3)	Benzene ($\mu g/m^3$)	Benzo(a) pyrene (ng/m^3)
1	02.08.2022	73.1	45.7	7.4	23.1	0.76	24.3	12.1	0.02	<5.0	<1.0	<4.2	<0.5
2	05.08.2022	68.7	38.2	6.9	19.6	0.64	21.8	10.9	0.01	<5.0	<1.0	<4.2	<0.5
3	09.08.2022	74.8	44.0	7.7	24.7	0.78	25.7	12.8	0.02	<5.0	<1.0	<4.2	<0.5
4	12.08.2022	67.5	35.5	<6.0	16.8	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
5	17.08.2022	65.3	32.7	<6.0	15.9	0.66	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
6	21.08.2022	74.1	43.6	7.4	21.3	0.54	23.5	11.8	0.02	<5.0	<1.0	<4.2	<0.5
7	25.08.2022	67.8	32.3	6.2	18.1	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
8	29.08.2022	72.5	40.3	<6.0	15.2	0.52	22.7	11.3	0.01	<5.0	<1.0	<4.2	<0.5
Limit as per CPCB notification, New Delhi, 18th Nov, 2009. for Ambient air quality		100	60	80	80	2	180	400	1	20	6	5	1
Sampling and Analysis done according to		IS: 5182 (Part-23) -2006 (Reaff. 2012)	USEPA CFR-40, Part-50, Appendix-L	IS: 5182 (Part-2) -2001	IS: 5182 (Part- 6) -2006	IS 5182 : (Part10) : 1999	Air Sampling, 3rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3rd Edn. By James P. Lodge (Method-401)	USEPA IO-3.4	USEPA IO-3.4	USEPA IO-3.4	IS 5182 : (Part11) : 2006	IS 5182 : (Part 12) :2004 Rffm:2009

Limit as per CPCB notification, New Delhi, 18th Nov, 2009. For Ambient air quality

Report Prepared By :

For Mitra S.K. Pvt. Ltd.

Authorised Signatory

- *The results relate only to the item(s) tested*
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Annexure - 10

National Ambient Air Quality Monitoring Standards

National Ambient Air Quality Monitoring Standards

Parameter	**Industrial, Residential, Rural & other areas**	**Ecologically Sensitive Area Central Government**
Particulate Matter PM 2.5 (µg/m3)	60	60
Particulate Matter PM 10 (µg/m3)	100	100
Sulphur Dioxide (as SO2) (µg/m3)	80	80
Oxides of Nitrogen (as NO2) (µg/m3)	80	80
Carbon Monoxide (as CO), (mg/m3)	02	02
Ozone (as O3) (µg/m3)	100	100
Lead (as Pb) (µg/m3)	1.0	1.0
Ammonia (as NH3) (µg/m3)	400	400
Benzene (as C6H6) (µg/m3)	05	05
Benzo (O) Pyrene (as BaP) (ng/m3)	01	01
Arsenic (as As) (ng/m3)	06	06
Nickel (as Ni) (ng/m3)	20	20

Annexure - 11

Noise Quality Report

Date: 05.08.2022

Hourly equivalent noise levels – North Guwahati terminal (Unit:dB(A))

Location	N-NG1	N-NG2	N-NG3
6-7 AM	44	43	44
7-8 AM	47	46	45
8-9 AM	47	47	47
9-10 AM	46	45	48
10-11 AM	48	47	49
11-12 Noon	48	48	48
12 noon – 1 PM	47	46	48
1-2 PM	48	47	48
2-3 PM	49	48	49
3-4 PM	49	48	49
4-5 PM	50	49	48
5-6 PM	49	48	48
6-7 PM	48	48	47
7-8 PM	47	47	47
8-9 PM	45	46	45

Annexure - 12

Ambient Noise Standards

Ambient Noise Standards

Area Code	Category of Area	Limits in dB(A)Leq	
		Day time	Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note : 1. Day time 6 A.M. and 9 P.M.

2. Night time is 9 P.M. and 6 A.M.

3. Silence zone is defined as areas upto 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by competent authority. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.

4. Environment (Protection) Third Amendment Rules, 2000 Gazette notification, Government of India, date 14.2.2000.

Annexure - 13

Plant species of Umananda site

Table: Plant species recorded from North Guawahti site

Botanical name	Local name	Family	Habit at	IUCN Status	Division
Acacia nilotica (L.) Delile	Babool	Fabaceae	Tree	LC	Dicot
Achyranthes aspera L.	Chaff-flower	Amaranthaceae	Herb	-	Dicot
Adiantum proliferum Roxb.	Maidenhair fern	Pteridaceae	Herb	-	Dico
Aegle marmelos (L.) Corrêa	Bael	Rutaceae	Tree	-	Dicot
Ageratum houstonianum Mill.	Blueweed	Asteraceae	Herb	-	Dicot
Albizia procera (Roxb.) Benth.	Safed siris	Mimosaceae	Tree	LC	Dicot
Albizia saman (Jacq.) Merr.	Rain tree	Mimosaceae	Tree	-	Dicot
Aloe vera (L.) Burm.f.	Aloe	Asphodelaceae	Shrub	-	Monocot
Alpinia nigra (Gaertn.) Burtt	Tora	Zingiberaceae	Shrub	LC	Dicot
Alstonia scholaris (L.) R. Br.	Devil's tree	Apocynaceae.	Tree	LC	Dicot
Alternanthera sessilis (L.) R.Br. ex DC.	Sessile joyweed-	Amaranthaceae	Herb	LC	Dicot
Amaranthus spinosus L.	Pigweed	Amaranthaceae	Herb	-	Dicot
Argemone mexicana L.	Satyanashi	Papaveraceae	Herb	-	Dicot
Araucaria heterophylla (Salisb.) Franco	Christmas tree	Araucariaceae	Tree	VU	Gymnosperm
Areca Catechu L.	Tamul	Arecaceae	Shrub	-	Monocot
Artocarpus heterophyllus Lam.	Kothal	Moraceae	Tree	-	Dicot
Azadirachta indica A.Juss.	Neem	Meliaceae	Tree	LC	Dicot
Bambusa arundinacea (Retz.) Willd.	Bara bans	Poaceae	Bamboo	-	Monocot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
Bambusa pallida Munro	Bijuli	Poaceae	Bamboo	-	Monocot
Bauhinia variegata L.	Kanchan	Fabaceae	Tree	LC	Dicot
Biophytum reinwardtii (Zucc.) Klotzsch	-	Oxalidaceae	Herb	-	Dicot
Boehmeria macrophylla Hornem.	-	Urticaceae	Shrub	-	Dicot
Boerhaavia diffusa L.	Punarnava	Nyctaginaceae	Shrub	-	Dicot
Bombax ceiba L.	Semal	Malvacea	Tree	LC	Dicot
Callistemon lanceolatus (Sm.) Sweet	Bottlebrush	Myrtaceae	Tree	-	Dicot
Calotropis gigantea (L.) Dryand.	Madar	Apocynaceae	Shrub	-	Monocot
Carica papaya L.	Papaya	Caricaceae	Shrub	DD	Dicot
Cascabela thevetia (L.) Lippold	Pila kaner	Apocynaceae	Shrub	LC	Dicot
Catharanthus roseus (L.) G.Don	Sadabahar	Apocynaceae	Herb	-	Dicot
Citrus limon (L.) Osbeck	Lemon	Rutaceae	Shrub	LC	Dicot
Citrus medica L.	Joratenga	Rutaceae	Shrub	LC	Dicot
Clerodendrum glandulosum Lindl.	Nephaphu	Verbenaceae	Shrub	-	Dicot
Cocos nucifera L.	Coconut	Arecaceae	Tree	-	Dicot
Colocasia esculenta (L.) Schott	Kachu	Araceae	Herb	LC	Dicot
Commelina benghalensis L.	wandering jew	Commelinaceae	Herb	LC	Monocot
Convolvulus arvensis L.	Bindweed	Convolvulaceae	Herb	-	Dicot
Corymbia citriodora (Hook.) K.D.Hill & L.A.S.Johnson	Safada	Myrtaceae	Tree	LC	Dicot
Cyanthillium cinereum (L.) H.Rob.	Sahadevi	Asteraceae	Herb	-	Dicot
Cymbopogon martini	Rosha grass	Poaceae	Grass	-	Monocot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
(Roxb.) W.Watson					
Cyperus cyperoides (L.) Kuntze	Flat Sedge	Cyperaceae	Grass	LC	Monocot
Cynodon dactylon (L.) Pers.	Dub	Poaceae	Grass	-	Monocot
Cyperus rotundus L.	Coco-grass	Cyperaceae	Grass	LC	Monocot
Dalbergia sissoo DC.	Sheesam	Fabaceae	Tree	LC	Dicot
Datura metel L.	Dhatura	Solanaceae	Shrub	-	Dicot
Delonix regia (Hook.) Raf.	Gulmohar	Fabaceae	Tree	LC	Dicot
Dendrocalamus hamiltonii Nees & Arn. ex Munro	Tama bamboo	Poaceae	Bamboo	-	Monocot
Dendrocalamus strictus (Roxb.) Nees	Bijuli	Poaceae	Bamboo	-	Monocot
Desmodium triflorum (L.) DC.	-	Fabaceae	Herb	LC	Dicot
Digitaria ciliaris (Retz.) Koeler	Crabgrass	Poaceae	Grass	-	Monocot
Digitaria sanguinalis (L.) Scop.	Crab grass	Poaceae	Grass	LC	Monocot
Dioscorea bulbifera L.	Air yam	Dioscoreaceae	Climber	-	Dicot
Diplazium esculentum (Retz.) Sw.	Dhekiasak	Athyriaceae	Herb	LC	Dicot
Echinochloa colona (L.) Link	Jungle ricegrass	Poaceae	Grass	LC	Monocot
Eclipta alba (L.) Hassk.	Kehraj	Asteraceae	Herb	LC	Dicot
Eclipta prostrata (L.) L.	Bhringraj	Asteraceae	Herb	LC	Dicot
Eleusine indica (L.) Gaertn.	Crowfoot grass	Poaceae	Grass	LC	Monocot
Euphorbia hirta L.	Asthma Weed	Euphorbiaceae	Herb	-	Dicot
Ficus benghalensis L.	Badh	Moraceae	Tree	-	Dicot
Ficus racemosa L.	Moudimoru	Moraceae	Tree	LC	Dicot
Ficus religiosa L.	Peepal	Moraceae	Tree	-	Dicot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
Glinus lotoides L.	Damascisa	Molluginaceae	Herb	LC	Dicot
Glycosmis pentaphylla (Retz.) DC.	Sauldhua	Rutaceae	Shrub	LC	Dicot
Gomphrena globosa L.	Globe amaranth	Amaranthaceae	Herb	-	Dicot
Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.	Kher/Sauri	Poaceae	Grass	-	Monocot
Hibiscus rosa-sinensis L.	Hibiscus	Malvaceae	Shrub	-	Dicot
Ipomoea carnea Jacq.	Besharam	Convolvulaceae	Shrub	-	Dicot
Isodon ternifolius (D.Don) Kudô	-	Lamiaceae	Shrub	-	Dicot
Ipomoea indica (Burm.) Merr.	Blue morning glory	Convolvulaceae	Climber	DD	Dicot
Jasminum nervosum Lour.	Wild Kund	Oleaceae	Shrub	-	Dicot
Lantana camara L.	Lantana	Verbenaceae	Shrub	-	Dicot
Lasia spinosa (L.) Thwaites	Sengmora	Araceae	Herb	LC	Dicot
Leucas aspera (Willd.) Link	Thumbai	Lamiaceae	Herb	-	Dicot
Mangifera indica L.	Aam	Anacardiaceae	Tree	DD	Dicot
Marsdenia tinctoria R. Br.	-	Asclepiadaceae	Climber	-	Dicot
Melia azedarach L.	Chinaberry tree	Meliaceae	Tree	LC	Dicot
Melilotus indicus (L.) All.	Sweetclover	Papilionaceae	Herb	-	Dicot
Mikania micrantha Kunth	-	Asteraceae	Herb	-	Dicot
Mimosa pudica L.	Lazvanti	Mimosaceae	Herb	LC	Dicot
Moringa oleifera Lam.	Sahjan	Moringaceae	Tree	LC	Dicot
Musa × paradisiaca L.	Kala	Musaceae	Shrub	-	Dicot
Neolamarckia cadamba (Roxb.) Bosser	Kadam	Rubiaceae	Tree	-	Dicot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
Ocimum sanctum L.	Tulsi	Lamiaceae	Shrub	-	Dicot
Oldenlandia diffusa (Willd.) Roxb.	Bonjaluk	Rubiaceae	Herb	LC	Dicot
Oplismenus compositus (L.) P.Beauv.	-	Poaceae	Grass	LC	Monocot
Oxalis corniculata L.	Sorutengacha	Oxalidaceae	Herb	-	Dicot
Panicum paludosum Roxb.	-	Poaceae	Grass	-	Monocot
Parthenium hysterophorus L.	Gajar ghas	Asteraceae	Shrub	-	Dicot
Paspalum dilatatum Poir.	Dallis grass	Poaceae	Grass	-	Monocot
Perilla frutescens (L.) Britton	Beefsteak	Lamiaceae	Herb	LC	Dicot
Persicaria barbata (L.) H.Hara	Field sedge	Polygonaceae	Grass	LC	Monocot
Phoenix acaulis Roxb.	Khejur	Arecaceae	Tree	-	Dicot
Phoenix sylvestris (L.) Roxb	Wild date palm	Arecaceae	Tree	-	Monocot
Phyllanthus emblica L.	Amla	Euphorbiaceae	Tree	LC	Dicot
Plantago major L.	Buckhorn	Plantaginaceae	Herb	LC	Dicot
Plumeria rubra L.	Kemboja	Apocynaceae	Shrub	LC	Dicot
Poa annua L.	-	Poaceae	Grass	LC	Monocot
Polygonum hydropiper L.	Marsh pepper	Polygonaceae	Herb	LC	Dicot
Polygonum microcephalum D. Don	Modhusuleng	Polygonaceae	Herb	-	Dicot
Portulaca oleracea L.	Malbhugkhutora	Portulacaceae	Herb	LC	Dicot
Pongamia pinnata (L.) Pierre	Karanja	Fabaceae	Tree	LC	Dicot
Psidium guajava L.	Amrud	Myrtaceae	Tree	LC	Dicot
Ranunculus sceleratus L.	Buttercup	Ranunculaceae	Herb	LC	Dicot
Ricinus communis L.	Arandi	Euphorbiaceae	Shrub	LC	Dicot
Rumex patientia L.	Patience	Polygonaceae	Herb	-	Dicot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
Saccharum bengalense Retz.	Munj	Poaceae	Grass	-	Monocot
Saccharum spontaneum L.	Wild sugarcane	Poaceae	Grass	LC	Monocot
Saraca asoca (Roxb.) Willd.	Ashok	Fabaceae	Tree	VU	Dicot
Sesamum indicum L.	Benne	Pedaliaceae	Herb	-	Dicot
Senecio viscosus L.	Sticky ragwort	Asteraceae	Herb	-	Dicot
Setaria verticillata (L.) P.Beauv.	Bristly foxtail	Poaceae	Grass	-	Monocot
Shorea robusta Gaertn.	Sal	Depterocarpaceae	Tree	LC	Dicot
Sida acuta Burm.f.	Teaweed	Malvaceae	Herb	-	Dicot
Smilax zeylanica L.	Tikonibaruah	Smilacaceae	Climber	-	Dicot
Solanum virginianum L.	Kantakari	Solanaceae	Shrub	-	Dicot
Solidago gigantea Aiton	Giant goldenrod	Asteraceae	Herb	-	Dicot
Stellaria media (L.) Vill.	Morolia	Caryophyllacee	Herb	-	Dicot
Stenotaphrum secundatum (Walter) Kuntze	Buffalo turf	Poaceae	Grass	LC	Dicot
Stephania glabra (Roxb.) Miers	-	Menispermacea e	Climber	-	Dicot
Syzygium cumini (L.) Skeels	Borjamu	Myrtaceae	Tree	LC	Dicot
Tamarindus indica L.	Imli	Fabaceae	Tree	LC	Dicot
Tectona grandis L.f.	Teak	Verbencaeae	Tree	-	Dicot
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Arjun	Combretaceae	Tree	-	Dicot
Thespesia lampas (Cav.) Dalzell	Ban kapasi	Malvaceae	Shrub	-	Dicot
Trichilia dregeana Sond.	Mahogany	Meliaceae	Tree	LC	Dicot
Tridax procumbens (L.)	Coatbuttons	Asteraceae	Herb	-	Dicot

Botanical name	Local name	Family	Habit at	IUCN Status	Division
L.					
Vallaris solanacea (Roth) Kuntze	Bread flower	Apocynaceae	Climber	-	Dicot
Vitex negundo L.	Posotia	Verbenaceae	Shrub	LC	Dicot
Ziziphus jujuba Mill.	Bogori	Rhamnaceae	Tree	LC	Dicot

Note- LC= Least Concern, VU= Vulnerable, DD= Data Deficient and - = Not listed

Annexure - 14

Photographs of common plant species observed during the study

PHOTOGRAPHS OF COMMON PLANT SPECIES OBSERVED DURING FLORISTIC SURVEY (NORTH GUWAHATI TERMINAL)

Tamarindus indica

Delonix regia

Saraca asoca

Panicum paludosum

Eclipta prostrate

Datura metel

Hibiscus rosa-sinensis

Euphorbia hirta

Rumex patientia

Ricinus communis

Parthenium hysterophorus

Lantana camara

Musa paradisiaca

Digitaria ciliaris

Annexure - 15

AIWTDS MoU with State Commission for Women to address GBV issues

असम ASSAM

MEMORANDUM OF UNDERSTANDING

L 620999

This Memorandum of Understanding (the "MOU")dated 17th August 2022, by and between, **Assam Inland Water Transport Development Society [AIWTDS]** with a registered address at 3rd Floor Directorate of Inland water transport, Ulubari, Guwahati-781007 and **Assam State Commission for Women [ASCW]** with a registered address at Beltola, Maidamgaon, Guwahati – 781028. (Together hereinafter the "Parties" or separately the "Party").

BACKGROUND

A. The Parties wish to enter into a joint agreement as outlined in this MOU; and

B. The Parties wish to record their understandings and responsibilities in relation to the proposed agreement;

1. **Purpose of the agreement**. This MOU sets out the basic terms upon which the Parties would use their respective skills, knowledge, and assets for mutual benefit for achieving the following:

Statement of Purpose. Strengthen grievance redressal mechanism (GRM) to fast-track Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) complaints reported on vessels and terminals operated by the AIWTDS.

Brief Description of Expectations. It is expected that ASCW will provide support to AIWTDS in (a) registration and resolution of SEA/SH complaints reported on vessels and terminals, and construction sites operated by AIWTDS, (b) organizing gender sensitization and capacity building trainings for AIWTDS staff, crew and operators on prevention and response to SEA/SH, and (c) in creating public awareness on GRM for SEA/SH.

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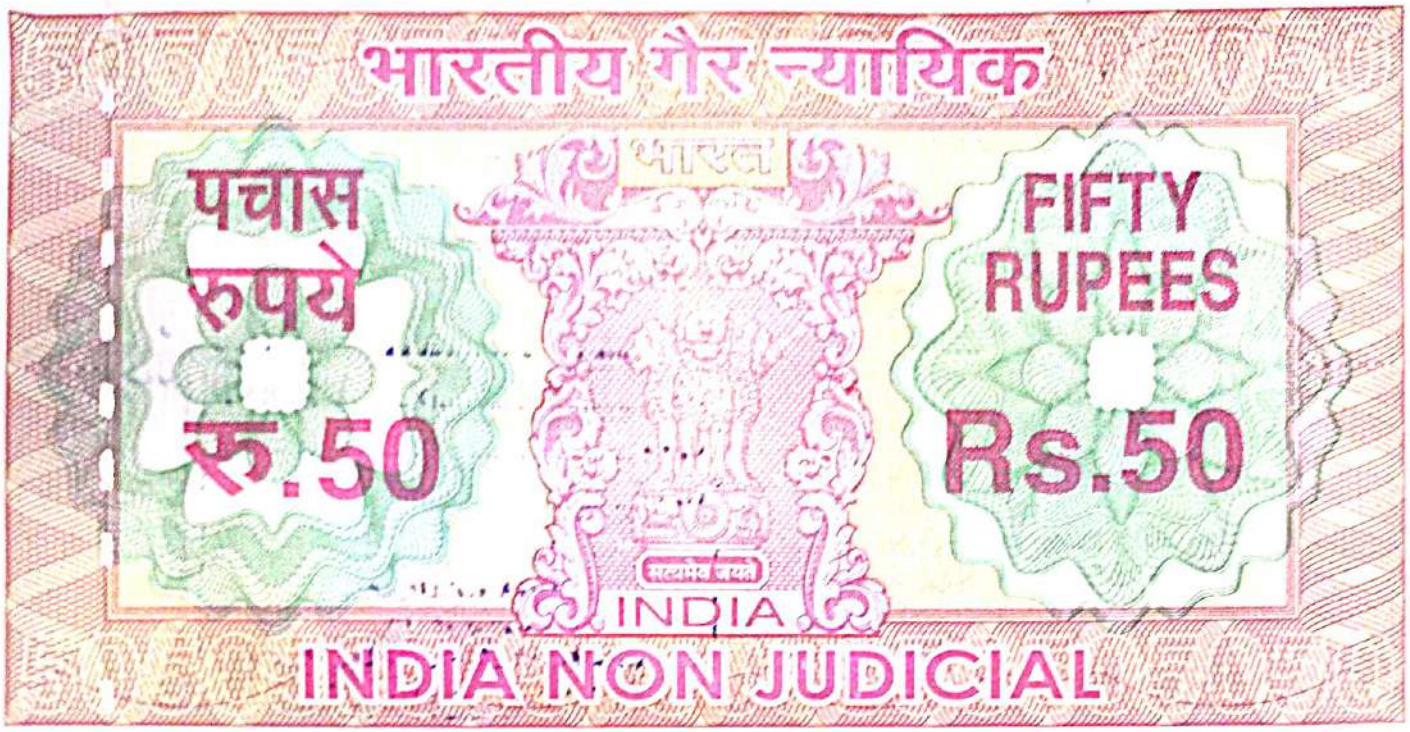

असम ASSAM L 620994

Justification for the Agreement. The AIWTDS does not have the requisite expertise and sufficient capacity to handle complaints related to SEA/SH. The ASCW has the necessary infrastructure and mandate to address emergency response to women affected by violence, has agreed to provide support to the AIWTDS in handling complaints related to SEA/SH incidents reported on vessels and terminals operated by AIWTDS.

2. **Mutual Understandings.** It is mutually agreed upon and understood by and among the Parties that:

a. The Parties agree to work together and co-operate in good faith and to fully participate in achieving the objective of this MOU;
b. None of the services, financing or resources set out in clauses 4 or 5 shall be deemed to be a commitment of funds; and
c. Neither Party shall have any liability to the other Party in respect to any of the provisions of this MOU.

3. **Term and Termination.** The understandings and agreements outlined in this MOU shall subsist until such time as the Assam Inland Water Transport Project is completed or the AIWTDS develops the requisite expertise and sufficient capacity to handle complaints related to SEA/SH or until **31.12.2024** whichever is the earlier. The term may be extended only by agreement of both Parties in writing.

4. **Services provided by the Parties.** The Parties agree to work together in good faith in order to ensure the realization of the MOU and each party will endeavor to provide the following services in meeting the objective:

a. **Services to be provided by AIWTDS**
   i. Refer complaints of SEA/SH reported on vessels and terminals, construction sites to the ASCW

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ii. Maintain database of SEA/SH complaints received/referred and follow-up on status of case load with ASCW

iii. Disseminate and display the Helpline no. 18008897417 on the vessels and terminals operated by AIWTDS. Further the complaints can be registered online on the AIWTDS official website (www.aiwtdsociety.in) under the CONTACT US > GRIEVANCE tab.

iv. Disseminate and display the Helpline no. 18008897417 at the construction sites for terminals and slipways.

v. Ensure that the contractor provides a copy of the Contractor's Code of Conduct (given in the Contract documents) to each of its personnel and obtain that person's a signature/fingerprint acknowledging receipt of the same.

vi. Ensure that the Code of Conduct is visibly displayed in multiple locations on the construction site and any other place where the works will be carried out.

vii. Provide the following logistical support in organizing gender sensitization and capacity building training of AIWTDS staff, crew and operators on prevention and response to SEA/SH.
    1. Develop a work plan and allocate budget for organizing gender sensitization and capacity building training in consultation with ASCW
    2. Organize gender sensitization and capacity building training as per the work plan
    3. Provide any other logistical support required such as venue, invitations, equipment, registration, catering, copies of training material, certificates, honorarium, etc.

viii. Carry out the following tasks for public awareness on grievance redressal mechanism for SEA/SH in vessels and terminals.
    1. Develop the media strategy and share with the ASCW for feedback
    2. Provide resources needed for activities listed in the media strategy.
    3. Seek support of ASCW in reviewing materials/contents developed for public awareness as per the media strategy.
    4. Implement the activities listed in the media strategy.

b. Services to be provided by ASCW

i. Register complaints of SEA/SH reported on vessels and terminals operated by AIWTDS, following the due process of law.

ii. Register complaints of SEA/SH reported during the construction of terminals and slipways under the AIWTDS, following the due process of law.

iii. To the extent possible, resolve the SEA/SH complaints within seven days from the date of filing the complaint.

iv. Adhere to procedures for handling complaints and meet confidentiality requirements for dealing with SEA/SH complaints as per guidelines of ASCW.

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v. Document the level of support given to an SEA/SH survivor, including referral to other service providers and share the following aggregate data on case load with AIWTDS on a quarterly basis:
   - Number of SEA/SH cases received/referred by the AIWTDS, disaggregated by age and by sex;
   - Number of cases open, and the average time they have been open; and
   - Number of cases closed, and the average time they were open

vi. Provide the following support to AIWTDS against a work order issued by AIWTDS in organizing a gender sensitization and capacity building training of AIWTDS staff, crew and operators on prevention and response to SEA/SH. However no budget allocation or funds will be provided to ASCW. Expenditure related to trainings etc will be borne by AIWTDS.
   1. Provide resource persons for the trainings
   2. Develop training modules
   3. Provide training materials for the participants

vii. Provide the following support to the AIWTDS in creating public awareness on grievance redressal mechanism for SEA/SH in vessels and terminals
   1. Provide inputs to the media strategy developed by AIWTDS
   2. Provide feedback on any materials/contents developed for public awareness.

5. **Resources Provided.** The Parties will attempt to secure all required financing and resources required for the tasks and will endeavor to provide the following financing, resources, intellectual property and labor:

a. Financing and Resources to be provided by AIWTDS
   i. Signage's on vessels and terminals operated by AIWTDS
   ii. Financial and logistical support in organizing the gender sensitization and capacity building training on prevention and response to SEA/SH
   iii. Financial and logistical support in developing and implementing the media strategy and materials/contents for public awareness.

b. Resources to be provided by ASCW
   i. Resource Persons for training on prevention and response to SEA/SH.
   ii. Training Material for training on prevention and response to SEA/SH.
   iii. Experts for reviewing the media strategy and materials/contents for public awareness.

Contd.....

Assam State Commission For Women ★ Bellola, Guwahati-28 ★ Date

Official Use

6. **Dispute Resolution.** The Parties will attempt in good faith to resolve any dispute arising out of or in relation to this MOU through negotiations to settle the relevant dispute. If the dispute cannot be settled amicably within 45 day from the date on which either Party has served written notice on the other of the dispute. The following Grievance procedure may be used.

I) Stakeholder can raise a complaint

- On the website of AIWTP :www.aiwtdsociety.in Or
- Through e-mail dir.iwtds-as@gov.in Or
- In writing to: GRO - Third Floor, Directorate of Inland Water Transport Assam, Ulubari, Guwahati – 07
- Through BSNL Landline no: 036124462677/ Toll free no: 18008897417

II) Confirmation of Receipt (within 2 business days)

- Notify receipt of complaint.
- Notify Project Team and other relevant staff of AIWTP
- Forward the complaint to the Officer concerned and preparation of the report.

III) Evaluation (within 10 business days of receipt)

- Assess complaint based on criteria set forth in procedures by the GRM Cell.
- Decide whether to process complaint
- Request the complainant for additional information if needed.
- Notify Complainant the status of complaint

IV) Formulation of proposal (within 30 days)

- Analyze issues raised with Project Team
- Project Team formulates proposal to address concerns
- Proposed action plan and timeline for addressing the complaint.
- Complainant agrees on final proposal
- Complainant rejects - complaint closed

V) Implementation of agreed action plan and resolution

- Project Team reports on progress of implementation of agreed actions
- Resolution - Complaint is closed when actions are satisfactorily implemented

6. **Notice.** All notices or communications required in this MOU shall be given in writing and must be delivered to the address(es) set forth above (or at such other address as the other Party may direct in writing): (a) in person, (b) by facsimile, (c) by registered mail, or (d) by a commercial courier that provides a signature of receipt. A signed receipt for the communication shall constitute proof of delivery, but if the sender can prove that delivery was made as provided for above, then it will constitute delivery despite the absence of a signed receipt.

Dr. Parikshit Gogoi
Dr. Parikshit Gogoi

Assam I.W.T Development Society GHY-7 Ulubari

Assam State Commission For Women Beltola, Guwahati-28 Date

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7. **Entire Agreement.** The provisions herein contained constitute the entire agreement between the parties hereto and supersede all previous communication, representations, expectations, understandings and agreements whether verbal or written between the parties or their respective representatives with respect to the subject matter of this MOU and shall not be modified or amended except by written agreement signed by the parties.

8. **Governing Law.** The provisions of this MOU shall be governed by and interpreted in accordance with laws of India.

9. **Assignment.** Neither party may assign or transfer the responsibilities or agreement made herein without the prior written consent of the non-assigning party, which approval shall not be unreasonably withheld.

10. **Severability.** Should any part of this MOU be declared or held invalid for any reason, that invalidity shall not affect the validity of the remainder which shall continue in force and effect and be construed as if this MOU had been executed without the invalid portion and it is hereby declared the intention of the parties hereto that this MOU would have been executed without reference to any portion which may, for any reason, be hereafter declared or held invalid.

This MOU shall be effective as of the date first written above.

SIGNATURE

Director
Inland Water Transport, Assam &
Addl State Project Director
Assam Inland Water Transport
Development Society

ADDL. STATE PROJECT DIRECTOR
Assam Inland Water Transport Development Society
(AIWTDS)

SIGNATURE

Member Secretary
Assam State Commission for Women

MEMBER SECRETARY
Assam State Commission for Women
Reltola Guwahati-28

Annexure - 16

The Cultural Heritage Management Plan

CULTURAL HERITAGE MANAGEMENT PLAN

1. INTRODUCTION

Cultural heritage resources play an important role, not only as historical information, but also as an economic and social asset for local communities as well as for national development. The Cultural Heritage Management Plan (CHMP) sets out measures designed to protect cultural heritage throughout the project life-cycle.

Umananda is a famous pilgrim place and archaeological site in Guwahati. The site is significant with the presence of stone sculptures and carvings belonging to the early medieval period. Thus, construction activities may cause risk of damage or theft.

2. OBJECTIVE

The objective of the Cultural Heritage Management Plan (CHMP) is to prevent any inadvertent loss of cultural heritage during project pre-construction, construction and operation phases. The development of a CHMP is to be made an integral part of the Environmental Impact Assessment process. Typically, the plan includes measures for avoiding or mitigating any adverse impacts on cultural heritage, provisions for the management of chance finds, any necessary measures for strengthening institutional capacity, a monitoring system to track the progress of these activities, and takes into account the country's overall policy framework, national legislation and institutional capabilities regarding cultural heritage. The main objectives of the CHMP are:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To address cultural heritage as an integral aspect of sustainable development.
- To promote meaningful consultation with stakeholders regarding cultural heritage.
- To promote the equitable sharing of benefits from the use of cultural heritage.

3. SCOPE OF THE CHMP

The CHMP will be implemented during all phases of the Project including project construction and operation phases. The term 'cultural heritage' encompasses tangible and intangible heritage, which may be recognized and valued at a local, regional, national or internationa level, as follows:

- Tangible cultural heritage, which includes movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Tangible cultural heritage may be located in urban or rural settings, and may be above or below land or under the water;
- Intangible cultural heritage, which includes practices, representations, expressions, knowledge, skills as well as the instruments, objects, artifacts and cultural spaces associated therewith that communities and groups recognize as part.

The Environmental and Social Standards (ESS-8) is applicable for the Umananda terminal as

the project impact area have cultural heritage sites. The Project will avoid supporting any sub-projects in the historic sites or its buffer. Though the initially identified components do not have an impact on heritage sites or its assets, there may be potentially minor impact on tangible and intangible forms of cultural heritage resources in potential project sites outside historic part or its buffer.

4. APPLICABLE STANDARDS

4.1 National Laws and Regulations

The applicable national policies are presented in Table-1.

Table-1: Applicable Policies for CHMP

S No.	Policy/ Act	Description
1	Ancient Monuments and Archaeological Sites and Remains Act 1958.	• An Act to provide for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects.
2	Ancient Monuments and Archaeological Sites and Remains (Amendments and Validation) Act, 2010	• The act declares certain monuments/ sites as being of "national importance". Stipulates conservation of cultural and historical remains found in India. • 100m radius is a "prohibited" area – no construction or reconstruction. Repairs allowed. • A 200m radius is a "regulated" area (structures can be constructed by archaeological officers with due sanctions from a competent authority). Protection, maintenance, and conservation managed by the Archaeological Survey of India (ASI).
3	Indian Treasure Trove Act, 1878	• Promulgated to protect and preserve treasures found accidentally but had archaeological and historical value.
4	Antiquities and Art Treasure Act,1972	• Effective control over moveable cultural property consisting of antiquities and art.
5	ESS 8: Cultural Heritage	• To protect cultural heritage from the adverse impacts of project activities and support its preservation • To address cultural heritage as an integral aspect of sustainable development • To promote meaningful consultation with stakeholders regarding cultural heritage

4.2 International Standards

The applicable guidelines of World Bank for CHMP has been presented in the Table-2 below:

Table - 2: Applicable World Bank Guidelines of for CHMP

S. No.	E&S Standard	Description
1	ESS 8: Cultural Heritage	• To protect cultural heritage from the adverse impacts of project activities and support its preservation.

S. No.	E&S Standard	Description
		• To address cultural heritage as an integral aspect of sustainable development. • To promote meaningful consultation with stakeholders regarding cultural heritage. • To promote the equitable sharing of benefits from the use of cultural heritage.

5. POTENTIAL IMPACT TO CULTURAL HERITAGE

The indicative project activities, impacts and mitigation measures for inclusion in CHMP are given in Table-3.

Table-3: Possible Impacts and Mitigation Measures

Stage	Activity	Impact	Mitigation Measures
Pre-Construction Phase	Site Clearance	Physical and cultural impacts of cleared material strewn around heritage features	Follow proper stacking of cleared material in areas away from heritage features and ensure site housekeeping
		Chance find of heritage feature during works and damage	Training/ instructions to workers on chance finds Discussion with informants and Site examination with user group/ communities before initiating construction activities Chance find procedures to be followed Barricading the area, watch, and vigil till authorities are notified and take charge Photo documentation if allowed and directed by authorities
		Dust pollution due to the removal of cleared material from the	Dust suppression measures
	Transport and stacking of materials and Tools	Stacking of tools and material around heritage features	Follow proper covered/ safe stacking in areas away from heritage features, and ensure signage (with reflectors)
Construction and Operation Phase	Construction Activities	Public Nuisance	consultation with the priest/vendors/temple committee to ensure that they have a good understanding of Project activities and potential impacts on the temple (including the potential for the Project to disrupt ceremonies and activities), and the grievance mechanism.
	Noise and Vibration	Land slides	The Project shall plan to avoid use of large equipment and machinery which may cause noise and vibration disturbance

Stage	Activity	Impact	Mitigation Measures
			to the island.
	Excavation or material sourcing, shifting & use of assets	Chance Find of historic/ culturally important property (idols, structures, potteries, stone tools, fossils etc.	Discussion with informants and site examination with user group/ communities before initiating construction activities Chance find procedures to be followed Barricading the area, watch and vigil till authorities are notified and take charge Photo documentation if allowed and directed by authorities
		Structural and non-structural disturbances to physical or cultural heritage features, aesthetics or users/ occupiers due to construction activities	Plan to minimize disturbances, months, time and schedule (minimize vibration, festival period, tourist visiting hours) in consultation with communities, service provider and authorities. Repairs and other supports. Arrange protection in place, or scheduled visitations, or community-sanctioned movement of sacred items if required Preserve the physical and visual context of individual or groups of historic structures by considering the appropriateness and effect of project infrastructure proposed for location within the range of sight Guard against theft and illegal trafficking of movable cultural heritage items affected by the project and will notify relevant authorities of any such activity
		Erosion and slippage affecting downstream heritage features	Proper site planning to avoid erosion, slippage Protective measures like fencing, barricading of downstream heritage features
	Transportation/ loading/ unloading of material and waste	Negative aesthetic impact due to mismanagement of material and waste in the vicinity of heritage feature	Proper stacking& storage of material Waste management plan
		Dis-coloration of Monuments due to air emissions deposition of dust on the monument	Emission control measures Dust suppression and control measures
		Accidents affecting heritage features during construction or operations	Emergency preparedness and response plan

6. ROLES AND RESPONSIBILITIES UNDER CHMP

The identified risk, mitigations to be adopted, institutional responsibilities for Umananda heritage site management is outlined in Table-4.

Table-4: Roles and Responsibility of CHMP

S No.	Anticipated Risks and Impacts	Avoidance/ Mitigation/ Management Measures	Responsibility
1	Accidental Structural Damage	Prepare emergency preparedness and response plan considering potential accident scenarios.	Construction Contractor/ PIU
2	Aesthetically and functionally negative Impact	• Proper stacking of material • Proper storage of C & D at the worksite • Waste management plan to be followed • Inform communities/ users of possible disturbances and support them in minimizing these	Construction Contractor/ PIU

7. MONITORING AND REPORTING

During construction, the contractor shall be responsible for implementing the CHMP activities in compliance with the CHMP. The Plan shall be monitored by TSSC on regular basis and TPM on quarterly basis. Monitoring results, including any non-conformances and associated corrective actions, will be reported to PMU and World Bank.

Annexure – 17

Emergency Oil Spill Control Procedure

EMERGENCY OIL SPILL CONTROL PROCEDURE

Oil tankers are only one source of oil spills. According to the United States Coast Guard, 35.7% of the volume of oil spilled in the United States from 1991 to 2004 came from tank vessels (ships/barges), 27.6% from facilities and other non-vessels, 19.9% from non-tank vessels, and 9.3% from pipelines; 7.4% from mystery spills. On the other hand, only 5% of the actual spills came from oil tankers, while 51.8% came from other kinds of vessels. The following effects can occur due to oil spills.

More persistent and viscous oils (i.e. heavy fuels) cause more impact to birds, mammals and shorelines than do lighter oils.

Spills of light oils (e.g., diesel) and crude oil cause higher impacts in the water column (on fish, shellfish and plankton) than equal volume spills of heavy fuels or gasoline, because heavy fuels are not easily entrained into the water column (requiring high turbulence to do so), and gasoline is much more volatile and so results in lower water column toxicity than the light fuels and crude oils.

Impacts vary considerably and primarily by the sensitivity of the environment oiled and the density of vulnerable organisms in those locations oiled.

Impacts vary by season of the year because densities of vulnerable organisms vary from season to season. Seasonal patterns of organisms vary considerably, such that overall impact risk varies less as a composite for all resources combined than for individual organism groups. Spillage Assessment criteria is given in **Table-1.**

Table-1 Spillage Assessment

Appearance	Film thickness (mm)	Quantity Spread (L/ha)
Barely visible	0.0000380	0.37
Silvery sheen	0.0000760	0.73
First trace of colour	0.0001500	1.50
Bright bands of colour	0.0003000	2.90
Colours begin to dull	0.0010000	9.70
Colours are much darker	0.0020000	19.50

**Source: International Safety Guide for Oil Tankers & Terminals (ISGOTT)*

Oil Spill Clean Up measures

By observing the thickness of the film of oil and its appearance on the surface of the water, it is possible to estimate the quantity of oil spilled. If the surface area of the spill is also known, the total volume of the oil can be calculated.

Cleanup and recovery from an oil spill is difficult and depends upon many factors, including the type of oil spilled, the temperature of the water (affecting evaporation and biodegradation), and the types of shorelines and beaches involved.

Methods for cleaning up include:

- Use of microorganisms or biological agents to break down or remove oil; such as the bacteria Alcanivorax.
- Oleophilic, hydrophobic chemical, containing no bacteria, which chemically and physically bonds to both soluble and insoluble hydrocarbons. The bioremediation accelerator acts as a herding agent in water and on the surface, floating molecules to the surface of the water, including soluble such as phenols and BTEX, forming gel-like agglomerations. Undetectable levels of hydrocarbons can be obtained in produced water and manageable water columns. By over spraying sheen with bioremediation accelerator, sheen is eliminated within minutes. Controlled burning can effectively reduce the amount of oil in water, if done properly. But it can only be done in low wind and can cause air pollution.
- A dispersant is either a non-surface active polymer or a surface-active substance added to a suspension, usually a colloid, to improve the separation of particles and to prevent settling or clumping. They may rapidly disperse large amounts of certain oil types from the water surface by transferring it into the water column. They will cause the oil slick to break up and form water-soluble micelles that are rapidly diluted. The oil is then effectively spread throughout a larger volume of water than the surface from where the oil was dispersed. They can also delay the formation of persistent oil-in-water emulsions. However, laboratory experiments showed that dispersants increased toxic hydrocarbon levels in fish by a factor of up to 100 and may kill fish eggs. Dispersed oil droplets infiltrate into deeper water and can lethally contaminate coral. Research indicates that some dispersants are toxic to corals.
- Dredging for oils dispersed with detergents and other oils denser than water.
- Skimming requires calm waters at all times during the process.
- Solidifying solidifiers are composed of dry hydrophobic polymers that both adsorb and absorb. They clean up oil spills by changing the physical state of spilled oil from liquid to a semi-solid or a rubber-like material that floats on water. Solidifiers are insoluble in water, therefore the removal of the solidified oil is easy and the oil will not leach out. Solidifiers have been proven to be relatively non-toxic to aquatic and wild life and have been proven to suppress harmful vapours commonly associated with hydrocarbons such as Benzene, Xylene, Methyl Ethyl, Acetone and Naphtha.

- Vacuum and centrifuge oil can be sucked up along with the water, and then a centrifuge can be used to separate the oil from the water - allowing a tanker to be filled with near pure oil. Usually, the water is returned to the river, making the process more efficient, but allowing small amounts of oil to go back as well. This issue has hampered the use of centrifuges due to a United States regulation limiting the amount of oil in water returned to the river.

Equipment used includes:

- Booms: large floating barriers that round up oil and lift the oil off the water
- Skimmers: skim the oil
- Sorbents: large absorbents that absorb oil
- Chemical and biological agents: helps to break down the oil
- Vacuums: remove oil from beaches and water surface

Annexure - 18

List of authorized recyclers under SPCB

Pollution Control Board:: Assam
Bamunimaidam; Guwahati-21
(Department of Environment & Forests :: Government of Assam)
Phone: 0361-2652774 & 2550258; Fax: 0361-2550259
Website: www.pcbassam.org

A. List of Authorized Recyclers in Assam of Used oil and waste oil (Schedule-IV, Sl-20)

Sl. No.	Name of the Recycling Industries	Validity of Authorization	Contact details
1	M/s Modern Lube Industries, A.K Azad Road, Kamrup(M)	31.10.2022	Phone : 94351-17458 Email: modernlube@yahoo.in
2	M/s Progressive Industries, Rani Industrial Area, Kamrup (Rural)	15.02.2026	Phone : 9435-044441 Email: suniltaparia123@rediffmail.com
3	M/s G.S Lubes, Madalpur, Changsari, Kamrup (Rural)	09.07.2026	Phone : 8638873771 Email: gslubes11@gmail.com

B. List of Authorized Recyclers of Used Lead Acid Battery (Schedule-IV, Sl-17)

Sl. No.	Name of Industries	Validity of Authorization	Contact details
1	Kamakhya Power Solution, 15th mile, Byrnihat, Kamrup(M)	31.03.2026	Phone: 9706025684
2	Shree Sai Vamika Industries, North Guwahati,Kamrup (Rural)	31.03.2026	Phone:8811024400 Email:saivamika@gmail.com
3	RESS Iron and Steel LTD,IGC Matia, Goalpara	31.03.2024	Phone : 9957511434, 9988661432

(Shantanu Kr. Dutta)
Member Secretary

Annexure - 19

Environmental Codes of Practice & Other Plans

Environmental Codes of Practice (ECoPs) & other Plans to be followed by the Contractor

The environmental codes of practice (ECoPs) are generic, non-site-specific guidelines. The ECoPs consist of environmental management guidelines and practices to be followed by the contractors for management of all environmental issues. The contractor will be required to follow them by preparing site-specific management plans. The ECoPs are listed below and detailed in table below-

- ECoP 1: Waste Management
- ECoP 2: Fuels and Hazardous Substances Management
- ECoP 3: Water Resources Management
- ECoP 4: Drainage Management
- ECoP 5: Soil Quality Management
- ECoP 6: Erosion and Sediment Control
- ECoP 7: Top Soil Management
- ECoP 8: Topography and Landscaping
- ECoP 9: Air Quality Management
- ECoP 10: Noise and Vibration Management
- ECoP 11: Protection of Flora
- ECoP 12: Protection of Fauna
- ECoP 13: Protection of Fisheries
- ECoP 14: Road Transport and Road Traffic Management
- ECoP 15: River Transport management
- ECoP 16: Construction Camp Management
- ECoP 17: Cultural and Religious Issues
- ECoP 18: Workers Health and Safety

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
ECoP 1: Waste Management		
General Waste	Soil and water pollution from the improper management of wastes and excess materials from the construction sites.	The Contractor shall • Develop waste management plan for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to Construction Contractor for approval. • Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, so as to cause less environmental impact. • Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. • Segregate and reuse or recycle all the wastes, wherever practical. • Prohibit burning of solid waste

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Collect and transport non-hazardous wastes to all the approved disposal sites. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route • Train and instruct all personnel in waste management practices and procedures as a component of the environmental induction process. • Provide refuse containers at each worksite. • Request suppliers to minimize packaging where practicable. • Place a high emphasis on good housekeeping practices. • Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.
Hazardous Waste	Health hazards and environmental impacts due to improper waste management practices	The Contractor shall • Collect chemical wastes in 200 liter drums (or similar sealed container), appropriately labeled for safe transport to an approved chemical waste depot. • Store, transport and handle all chemicals avoiding potential environmental pollution. • Store all hazardous wastes appropriately in bunded areas away from water courses. • Make available Material Safety Data Sheets (MSDS) for hazardous materials on-site during construction. • Collect hydrocarbon wastes, including lube oils, for safe transport off-site for reuse, recycling, treatment or disposal at approved locations. • Construct concrete or other impermeable flooring to prevent seepage in case of spills
ECoP 2: Fuels and Hazardous Goods Management		
Fuels and hazardous goods.	Materials used in construction have a potential to be a source of contamination. Improper storage and handling of fuels, lubricants, chemicals and hazardous goods/materials on-site, and potential spills from these goods may harm the environment or health of construction workers	The Contractor shall • Prepare spill control procedures and submit the plan for Construction Contractor approval. • Train the relevant construction personnel in handling of fuels and spill control procedures. • Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses. • Refueling shall occur only within bunded areas. • Make available MSDS for chemicals and dangerous goods on-site. • Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by DoE. • Provide absorbent and containment material (e.g., absorbent matting) where hazardous material are used and stored and personnel trained in the correct use. • Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. • Store hazardous materials above flood plain level. • Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. • Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. • Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution. • Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. • Return the gas cylinders to the supplier. However, if they are not empty prior to their return, they must be labeled with the name of the material they contained or contain, information on the supplier, cylinder serial number, pressure, their last hydrostatic test date, and any additional identification marking that may be considered necessary.
ECoP 3: Water Resources Management		
Hazardous Material and Waste	Water pollution from the storage, handling and disposal of hazardous materials and general construction waste, and accidental spillage	The Contractor shall • Follow the management guidelines proposed in ECoPs 1 and 2. • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Discharge from construction sites	During construction both surface and groundwater quality may be deteriorated due to construction activities in the river, sewerages from construction sites and work camps. The construction works will modify groundcover and topography changing the surface water drainage patterns of the area including infiltration and storage of storm water. These changes in hydrological regime lead to increased rate of runoff, increase in sediment and contaminant loading, increased flooding, groundwater contamination, and effect habitat of fish and other aquatic biology.	The Contractor shall • Install temporary drainage works (channels and bunds) in areas required for sediment and erosion control and around storage areas for construction materials • Install temporary sediment basins, where appropriate, to capture sediment-laden run-off from site • Divert runoff from undisturbed areas around the construction site • Stockpile materials away from drainage lines • Prevent all solid and liquid wastes entering waterways by collecting solid waste, oils, chemicals, bitumen spray waste and wastewaters from brick, concrete and asphalt cutting where possible and transport to an approved waste disposal site or recycling depot • Wash out ready-mix concrete agitators and concrete handling equipment at washing facilities off site or into approved bunded areas on site. Ensure that tires of construction vehicles are cleaned in the washing bay at the entrance of the construction site) to remove the mud from the wheels. This shall be done in every exit of each construction vehicle to ensure the local roads are kept clean
Soil Erosion and siltation	Soil erosion and dust from the material stockpiles will increase the sediment and contaminant loading of surface water bodies.	The Contractor shall • Stabilize the cleared areas not used for construction activities with vegetation or appropriate surface water treatments as soon as practicable following earthwork to minimize erosion • Ensure that roads used by construction vehicles are swept regularly to remove sediment. • Water the material stockpiles, access roads and bare soils on an as required basis to minimize dust. Increase the watering frequency during periods of high risk (e.g. high winds)
Construction activities in water bodies	Construction works in the water bodies will increase sediment and contaminant loading, and effect habitat of fish and other aquatic biology	The Contractor Shall • Dewater sites by pumping water to a sediment basin prior to release off site – do not pump directly off site • Monitor the water quality in the runoff from the site or areas affected by dredge plumes, and improve work practices as necessary • Protect water bodies from sediment loads by silt screen or bubble curtains or other barriers • Minimize the generation of sediment, oil and grease, excess nutrients, organic matter, litter, debris and any form of waste (particularly petroleum and chemical wastes). These substances must not enter waterways, storm water systems or underground water tables. • Use environment friendly and nontoxic slurry during construction of piles to discharge into the river.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Reduce infiltration of contaminated drainage through storm water management design • Do not discharge cement and water curing used for cement concrete directly into water courses and drainage inlets
Drinking water	Groundwater at shallow depths is contaminated with arsenic and hence not suitable for drinking purposes. Depletion and pollution of groundwater resources	The Contractor Shall • Pumping of groundwater shall be from deep aquifers of more than 300 m to supply arsenic free water. Safe and sustainable discharges are to be ascertained prior to selection of pumps. • Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross contamination • All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned • Install monitoring wells both upstream and downstream areas near construction yards and construction camps to regularly monitor the water quality and water levels. • Protect groundwater supplies of adjacent lands
ECoP 4: Drainage Management		
Excavation and earth works, and construction yards	Lack of proper drainage for rainwater/liquid waste or wastewater owing to the construction activities harms environment in terms of water and soil contamination, and mosquito growth	The Contractor shall • Prepare a program for prevent/avoid standing waters, which Construction Contractor will verify in advance and confirm during implementation • Provide alternative drainage for rainwater if the construction works/earth-fillings cut the established drainage line • Establish local drainage line with appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing established drainage lines already there • Rehabilitate road drainage structures immediately if damaged by contractors' road transports. • Build new drainage lines as appropriate and required for wastewater from construction yards connecting to the available nearby recipient water bodies. Ensure wastewater quality conforms to the relevant standards provided by DoE, before it being discharged into the recipient water bodies. • Ensure the internal roads/hard surfaces in the construction yards/construction camps that generate has storm water drainage to accommodate high runoff during downpour and that there is no stagnant water in the area at the end of the downpour. • Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. • Provide appropriate silt collector and silt screen at the inlet and manholes and periodically clean the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		drainage system to avoid drainage congestion • Protect natural slopes of drainage channels to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problem. • Reduce infiltration of contaminated drainage through storm water management design
Ponding of water	Health hazards due to mosquito breeding	• Do not allow ponding of water especially near the waste storage areas and construction camps • Discard all the storage containers that are capable of storing of water, after use or store them in inverted position
ECoP 5: Soil Quality Management		
Filling of Sites with dredge spoils	Soil contamination will occur from drainage of dredged spoils	The Contractor shall • Ensure that dredged sand used for land filling shall be free of pollutants. Prior to filling, sand quality shall be tested to confirm whether soil is pollution free. Sediments shall be properly compacted. Top layer shall be the 0.5 m thick clay on the surface and boundary slopes along with grass. Side Slope of Filled Land of 1:2 shall be constructed by suitable soils with proper compaction as per design. Slope surface shall be covered by top soils/ cladding materials (0.5m thick) and grass turfing with suitable grass. • Leaching from the sediments shall be contained to seep into the subsoil or shall be discharged into settling lagoons before final disposal. • No sediment laden water in the adjacent lands near the construction sites, and/or wastewater of suspended materials excessive of 200mg/l from dredge spoil storage/use area in the adjacent agricultural lands
Storage of hazardous and toxic chemicals	Spillage of hazardous and toxic chemicals will contaminate the soils	The Contractor shall • Strictly manage the wastes management plans proposed in ECoP1 and storage of materials in ECoP2 • Construct appropriate spill contaminant facilities for all fuel storage areas • Establish and maintain a hazardous materials register detailing the location and quantities of hazardous substances including the storage, use of disposals • Train personnel and implement safe work practices for minimizing the risk of spillage • Identify the cause of contamination, if it is reported, and contain the area of contamination. The impact may be contained by isolating the source or implementing controls around the affected site • Remediate the contaminated land using the most appropriate available method to achieve required

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		commercial/industrial guideline validation results.
Construction material stock piles	Erosion from construction material stockpiles may contaminate the soils	The Contractor shall • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds
ECoP 6: Erosion and Sediment Control		
Clearing of construction sites	Cleared areas and slopes are susceptible for erosion of top soils, that affects the growth of vegetation which causes ecological imbalance	• Reinstate and protect covered areas as soon as possible • Mulch to protect batter slopes before planting • Cover unused area of disturbed or exposed surfaces immediately with mulch/grass turfings/tree plantations
Construction activities and material stockpiles	The impact of soil erosion are (i) Increased run off and sedimentation causing a greater flood hazard to the downstream, (ii) destruction of aquatic environment in nearby lakes, streams, and reservoirs caused by erosion and/or deposition of sediment damaging the spawning grounds of fish, and (iii) destruction of vegetation by burying or gullying.	The Contractor shall • Locate stockpiles away from drainage lines • Protect the toe of all stockpiles, where erosion is likely to occur, with silt fences, straw bales or bunds • Remove debris from drainage paths and sediment control structures • Cover the loose sediments and water them if required • Divert natural runoff around construction areas prior to any site disturbance • Install protective measures on site prior to construction, for example, sediment traps • Control drainage through a site in protected channels or slope drains • Install 'cut off drains' on large cut/fill batter slopes to control water runoff speed and hence erosion • Observe the performance of drainage structures and erosion controls during rain and modify as required.
ECoP 7: Top Soil Management		
Land clearing and earth works	Earthworks will impact the fertile top soils that are enriched with nutrients required for plant growth agricultural development.	The Contractor shall • Strip the top soil to a depth of 15 cm and store in stock piles of height not exceeding 2m. • Remove unwanted materials from top soil like grass, roots of trees and similar others. • The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil. • Locate topsoil stockpiles in areas outside drainage lines and protect from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites • Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bunding of the

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		soil layers, water penetration and re vegetation
Transport	Vehicular movement outside ROW or temporary access roads will affect the soil fertility of the agricultural lands	• Limit equipment and vehicular movements to within the approved construction zone • Construct temporary access tracks to cross concentrated water flow lines at right angles • Plan construction access to make use, if possible, of the final road alignment • Use vehicle-cleaning devices, for example, ramps or wash down areas
ECoP 8: Topography and Landscaping		
Land clearing and earth works	Flood plains of the existing Project area will be affected by the construction of various project activities. Construction activities especially earthworks will change topography and disturb the natural rainwater/flood water drainage as well as will change the local landscape.	The Contractor shall • Ensure the topography of the final surface of all raised lands (construction yards, approach roads, access roads, bridge end facilities, etc.) are conducive to enhance natural draining of rainwater/flood water; • Keep the final or finished surface of all the raised lands free from any kind of depression that insists water logging • Undertake mitigation measures for erosion control/prevention by grass-turfing and tree plantation, where there is a possibility of rain-cut that will change the shape of topography. • Cover immediately the uncovered open surface that has no use of construction activities with grass-cover and tree plantation to prevent soil erosion and bring improved landscaping
ECoP 9: Borrow Areas Management		
Development and operation of borrow areas	Borrow areas will have impacts on local topography, landscaping and natural drainage	The Contractor shall • Use only approved quarry and borrow sites • Identify new borrow and quarry areas in consultation with Project Director, if required. • Reuse excavated or disposed material available in the project to the maximum extent possible. • Store top soil for reinstatement and landscaping. • Develop surface water collection and drainage systems, anti-erosion measures (berms, re vegetation etc.) and retaining walls and gabions where required. Implement mitigation measures in ECoP 3: Water Resources Management, ECoP 6: Erosion and Sediment Control • The use of explosive should be used in as much minimum quantity as possible to reduce noise, vibration and dust. • Control dust and air quality deterioration by application of watering and implementing mitigation measures proposed in ECoP 10: Air Quality Management. • Noise and vibration control by ECoP 11: Noise and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		Vibration Management
ECoP 10: Air Quality Management		
Construction vehicular traffic	Air quality can be adversely affected by vehicle exhaust emissions and combustion of fuels.	The Contractor shall • Fit vehicles with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition. • Operate the vehicles in a fuel efficient manner • Cover haul vehicles carrying dusty materials moving outside the construction site • Impose speed limits on all vehicle movement at the worksite to reduce dust emissions • Control the movement of construction traffic • Water construction materials prior to loading and transport • Service all vehicles regularly to minimize emissions • Limit the idling time of vehicles not more than 2 minutes
Construction machinery	Air quality can be adversely affected by emissions from machinery and combustion of fuels.	The Contractor shall • Fit machinery with appropriate exhaust systems and emission control devices. Maintain these devices in good working condition in accordance with the specifications defined by their manufacturers to maximize combustion efficiency and minimize the contaminant emissions. Proof or maintenance register shall be required by the equipment suppliers and contractors/subcontractors • Focus special attention on containing the emissions from generators • Machinery causing excess pollution (e.g. visible smoke) will be banned from construction sites • Service all equipment regularly to minimize emissions • Provide filtering systems, duct collectors or humidification or other techniques (as applicable) to the concrete batching and mixing plant to control the particle emissions in all its stages, including unloading, collection aggregate handling, cement dumping, circulation of trucks and machinery inside the installations

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities	Dust generation from construction sites, material stockpiles and access roads is a nuisance in the environment and can be a health hazard	• Water the material stockpiles, access roads and bare soils on an as required basis to minimize the potential for environmental nuisance due to dust. Increase the watering frequency during periods of high risk (e.g. high winds). Stored materials such as gravel and sand shall be covered and confined to avoid their being wind-drifted • Minimize the extent and period of exposure of the bare surfaces • Reschedule earthwork activities or vegetation clearing activities, where practical, if necessary to avoid during periods of high wind and if visible dust is blowing off-site • Restore disturbed areas as soon as practicable by vegetation/grass-turfing • Store the cement in silos and minimize the emissions from silos by equipping them with filters. • Establish adequate locations for storage, mixing and loading of construction materials, in a way that dust dispersion is prevented because of such operations • Crushing of rocky and aggregate materials shall be wet-crushed, or performed with particle emission control systems
ECoP 11: Noise and Vibration Management		
Construction vehicular traffic	Noise quality will be deteriorated due to vehicular traffic	The Contractor shall • Maintain all vehicles in order to keep it in good working order in accordance with manufactures maintenance procedures • Make sure all drivers will comply with the traffic codes concerning maximum speed limit, driving hours, etc. • Organize the loading and unloading of trucks, and handling operations for the purpose of minimizing construction noise on the work site
Construction machinery	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment.	The Contractor shall • Appropriately site all noise generating activities to avoid noise pollution to local residents • Use the quietest available plant and equipment • Modify equipment to reduce noise (for example, noise control kits, lining of truck trays or pipelines) • Maintain all equipment in order to keep it in good working order in accordance with manufactures maintenance procedures. Equipment suppliers and contractors shall present proof of maintenance register of their equipment. • Install acoustic enclosures around generators to reduce noise levels. • Fit high efficiency mufflers to appropriate construction equipment • Avoid the unnecessary use of alarms, horns and

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		sirens
Construction activity	Noise and vibration may have an impact on people, property, fauna, livestock and the natural environment	The Contractor shall • Notify adjacent landholders prior any typical noise events outside of daylight hours • Educate the operators of construction equipment on potential noise problems and the techniques to minimize noise emissions • Employ best available work practices on-site to minimize occupational noise levels • Install temporary noise control barriers where appropriate • Notify affected people if major noisy activities will be undertaken, e.g. pile driving • Plan activities on site and deliveries to and from site to minimize impact • Monitor and analyze noise and vibration results and adjust construction practices as required. • Avoid undertaking the noisiest activities, where possible, when working at night near the residential areas
ECoP 12: Protection of Flora		
Vegetation clearance	Local flora are important to provide shelters for the birds, offer fruits and/or timber/fire wood, protect soil erosion and overall keep the environment very friendly to human-living. As such damage to flora has wide range of adverse environmental impacts.	The Contractor shall • Reduce disturbance to surrounding vegetation • Use appropriate type and minimum size of machine to avoid disturbance to adjacent vegetation. • Get approval from supervision consultant for clearance of vegetation. • Make selective and careful pruning of trees where possible to reduce need of tree removal. • Control noxious weeds by disposing of at designated dump site or burn on site. • Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the • construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. • Do not burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. • Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. • Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Minimize the length of time the ground is exposed or excavation left open by clearing and re-vegetate the area at the earliest practically possible. • Ensure excavation works occur progressively and re-vegetation done at the earliest • Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction • Supply appropriate fuel in the work caps to prevent fuel wood collection
ECoP 13: Protection of Fauna		
Construction activities	The location of construction activities can result in the loss of wild life habitat and habitat quality,.	The Contractor shall • Limit the construction works within the designated sites allocated to the contractor • check the site for animals trapped in, or in danger from site works and use a qualified person to relocate the animal
	Impact on migratory birds, its habitat and its active nests	The Contractor shall • Not be permitted to destruct active nests or eggs of migratory birds • Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and located active nests • Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds.
Vegetation clearance	Clearance of vegetation may impact shelter, feeding and/or breeding and/or physical destruction and severing of habitat areas	The Contractor shall • Restrict the tree removal to the minimum required. • Retain tree hollows on site, or relocate hollows, where appropriate • Leave dead trees where possible as habitat for fauna • Fell the hollow bearing trees in a manner which reduces the potential for fauna mortality. Felled trees will be inspected after felling for fauna and if identified and readily accessible will be removed and relocated or rendered assistance if injured. After felling, hollow bearing trees will remain unmoved overnight to allow animals to move of their own volition
Construction camps	Illegal poaching	• Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	The Contractor shall • Ensure the riverine transports, vessels and ships are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from vessels and ships and in

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		this regard, make an emergency oil spill containment plan to be supported with enough equipment, materials and human resources • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECoP 3 : Water Resources Management and EC4: Drainage Management
	Filling of ponds for site preparation will impact the fishes.	The Contractor shall • Inspect any area of a water body containing fish that is temporarily isolated for the presence of fish, and all fish shall be captured and released unharmed in adjacent fish habitat • Install and maintain fish screens etc. on any water intake with drawing water from any water body that contain fish
ECoP 14: Protection of Fisheries		
Construction activities in River	The main potential impacts to fisheries are hydrocarbon spills and leaks from riverine transport and disposal of wastes into the river	The Contractor shall • Ensure the riverine transports, vessels and ships are well maintained and do not have oil leakage to contaminate river water. • Contain oil immediately on river in case of accidental spillage from vessels and ships and in this regard, make an emergency oil spill containment plan to be supported with enough equipment, materials and human resources • Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river
Construction activities on the land	The main potential impacts to aquatic flora and fauna River are increased suspended solids from earthworks erosion, sanitary discharge from work camps, and hydrocarbon spills	The Contractor shall • follow mitigation measures proposed in ECoP 3 : Water Resources Management and EC4: Drainage Management
	Filling of ponds for site preparation will impact the fishes.	The Contractor shall • Inspect any area of a water body containing fish that is temporarily isolated for the presence of fish, and all fish shall be captured and released unharmed in adjacent fish habitat

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Install and maintain fish screens etc. on any water intake with drawing water from any water body that contain fish
ECoP 15: Road Transport and Road Traffic Management		
Construction vehicular traffic	Accidents and spillage of fuels and chemicals	The Contractor shall • Prepare and submit a traffic management plan to the Construction Contractor for his approval at least 30 days before commencing work on any project component involved in traffic diversion and management. • Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, and road signs. • Provide signs at strategic locations of the roads complying with the schedules of signs contained in the IWT Traffic Regulations. • Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the following information in Assam: • Duration of construction period • Period of proposed detour / alternative route • Suggested detour route map • Name and contact address/telephone number of the concerned personnel • Name and contact address / telephone number of the Contractor • Inconvenience is sincerely regretted. • Restrict truck deliveries, where practicable, to day time working hours. • Restrict the transport of oversize loads. • Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions. • Enforce on-site speed limit
ECoP 16: River Transport management		

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction activities in River	The presence of construction and dredging barges, pipe lines and other construction activities in the river can cause hindrance and risks to the river traffic.	The Contractor shall • Not obstruct other normal riverine transport while doing riverine transport and works • Identify the channel to be followed clearly using navigation aids such as buoys, beacons, and lighting • Provide proper buoyage, navigation lights and markings for bridge and dredging works to guide the other normal riverine transport • Keep regular and close contacts with Assam Inland Water Transport Authority (AIWTDS) regarding their needs during construction of the project • Plan the river transport and transportation of large loads in coordination with AIWTDS to avoid traffic congestions. • Provide signage for river traffic conforming to the AIWTDS requirements • Position the dredge and pipeline in such a way that no disruption to the channel traffic will occur
	Accidents	The Contractor shall • Prepare an emergency plan for dealing with accidents causing accidental sinking of the vessels and ships • Ensure sufficient equipment and staffs available to execute the emergency plans • Provide appropriate lighting to barges and construction vessels
ECoP 17: Construction Camp Management		
Siting and Location of construction camps	Campsites for construction workers are the important locations that have significant impacts such as health and safety hazards on	The Contractor shall • Locate the construction camps at areas which are acceptable from environmental, cultural or social point of view. • Consider the location of construction camps away from communities in order to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities. • Submit to the Construction Contractor for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps. • Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities so as to maintain effective surveillance over public health, social and security matters.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
Construction Camp Facilities	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health hazards.	Contractor shall provide the following facilities in the campsites • Adequate housing for all workers • Safe and reliable water supply. Water supply from deep tube wells of 300 m depth that meets the national standards • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons • Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities Both sides of roads are to be provided with shallow v drains to drain off storm water to a silt retention pond which shall be sized to provide a minimum of 20 minutes retention of storm water flow from the whole site. Channel all discharge from the silt retention pond to natural drainage via a grassed swale at least 20 meters in length with suitable longitudinal gradient. • Paved internal roads. Ensure with grass/vegetation coverage to be made of the use of top soil that there is no dust generation from the loose/exposed sandy surface. Pave the internal roads of at least haring-bond bricks to suppress dusts and to work against possible muddy surface during monsoon. • Provide child crèches for women working construction site. The crèche shall have facilities for dormitory, kitchen, indoor and outdoor play area. Schools shall be attached to these crèches so that children are not deprived of education whose mothers are construction workers • Provide in-house community/common entertainment facilities. dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible
Disposal of waste	Management of wastes is crucial to minimize impacts on the environment	The Contractor shall • Ensure proper collection and disposal of solid wastes within the construction camps • Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at household level. • Store inorganic wastes in a safe place within the household and clear organic wastes on daily basis to waste collector. Establish waste collection, transportation and disposal systems with the manpower and equipment/vehicles needed. • Dispose organic wastes in a designated safe place on daily basis. At the end of the day cover the organic wastes with a thin layer of sand so that flies,

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		mosquitoes, dogs, cats, rats, are not attracted. One may dig a large hole to put organic wastes in it; take care to protect groundwater from contamination by leachate formed due to decomposition of wastes. Cover the bed of the pit with impervious layer of materials (clayey or thin concrete) to protect groundwater from contamination. • Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odor likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children to enter and play with. • Do not establish site specific landfill sites. All solid waste will be collected and removed from the work camps and disposed in approval waste disposal sites
Fuel supplies for cooking purposes	Illegal sourcing of fuel wood by construction workers will impact the natural flora and fauna	The Contractor shall • Provide fuel to the construction camps for their domestic purpose, in order to discourage them to use fuel wood or other biomass. • Made available alternative fuels like natural gas or kerosene on ration to the workforce to prevent them using biomass for cooking. • Conduct awareness campaigns to educate workers on preserving the protecting the biodiversity and wildlife of the project area, and relevant government regulations and punishments on wildlife protection
Health and Hygiene	There will be a potential for diseases to be transmitted including malaria, exacerbated by inadequate health and safety practices. There will be an increased risk of work crews spreading sexually transmitted infections and HIV/AIDS	The Contractor shall • Provide adequate health care facilities within construction sites. • Provide first aid facility round the clock. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse. • Provide ambulance facility for the laborers during emergency to be transported to nearest hospitals. • Initial health screening of the laborers coming from outside areas • Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work Provide HIV awareness programming, including STI (sexually transmitted infections) and HIV information, education and communication for all workers on regular basis • Complement educational interventions with easy access to condoms at campsites as well as voluntary counseling and testing • Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellant sprays during monsoon.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Carryout short training sessions on best hygiene practices to be mandatorily participated by all workers. Place display boards at strategic locations within the camps containing messages on best hygienic practices
Safety	In adequate safety facilities to the construction camps may create security problems and fire hazards	The Contractor shall • Provide appropriate security personnel (police / home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area. • Maintain register to keep a track on a head count of persons present in the camp at any given time. • Encourage use of flameproof material for the construction of labor housing / site office. Also, ensure that these houses/rooms are of sound construction and capable of withstanding wind storms/cyclones. • Provide appropriate type of firefighting equipment suitable for the construction camps • Display emergency contact numbers clearly and prominently at strategic places in camps. • Communicate the roles and responsibilities of laborers in case of emergency in the monthly meetings with contractors
Site Restoration	Restoration of the construction camps to original condition requires demolition of construction camps.	• The Contractor shall • Dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates at the completion of the construction work. • Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed • Give prior notice to the laborers before demolishing their camps/units • Maintain the noise levels within the national standards during demolition activities • Different contractors shall be hired to demolish different structures to promote recycling or reuse of demolished material. • Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site. • Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so. • Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner. • Not make false promises to the laborers for future employment in O&M of the project.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
ECoP 18: Cultural and Religious Issues		
Construction activities near religious and cultural sites	Disturbance from construction works to the cultural and religious sites, and contractors lack of knowledge on cultural issues cause social disturbances	The Contractor shall • Communicate to the public through community consultation and newspaper announcements regarding the scope and schedule of construction, as well as certain construction activities causing disruptions or access restriction. • Do not block access to cultural and religious sites, wherever possible • Restrict all construction activities within the foot prints of the construction sites. • Stop construction works that produce noise (particularly during prayer time) shall there be any mosque/religious/educational institutions close to the construction sites and users make objections. • Take special care and use appropriate equipment when working next to a cultural/religious institution. • Stop work immediately and notify the site manager if, during construction, an archaeological or burial site is discovered. It is an offence to recommence work in the vicinity of the site until approval to continue is given by the Construction Contractor /PMU. Provide separate prayer facilities to the construction workers • Show appropriate behavior with all construction workers especially women and elderly people • Allow the workers to participate in praying during construction time • Resolve cultural issues in consultation with local leaders and supervision consultants • Establish a mechanism that allows local people to raise grievances arising from the construction process. • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works so as to maintain effective surveillance over public health, social and security matters
ECoP 19: Worker Health and Safety		
Best practices	Construction works may pose health and safety risks to the construction workers and site visitors leading to severe injuries and deaths. The population in the proximity of the construction site and the construction workers will be exposed to a number of (i) biophysical health risk factors, (e.g. noise, dust, chemicals, construction	The Contractor shall • implement suitable safety standards for all workers and site visitors which shall not be less than those laid down on the international standards (e.g. National / International Labor for 'Safety and Health in Construction; World Bank Group's 'Environmental Health and Safety Guidelines') and contractor's own national standards or statutory regulations, in addition to complying with the national standards of the Government of Assam and Government of India • Provide the workers with a safe and healthy work environment, taking into account inherent risks in its particular construction activity and specific classes of

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
	material, solid waste, waste water, vector transmitted diseases etc), (ii) risk factors resulting from human behavior (e.g. STD, HIV etc) and (iii) road accidents from construction traffic.	hazards in the work areas, • Provide personal protection equipment (PPE) for workers, such as safety boots, helmets, masks, gloves, protective clothing, goggles, full-face eye shields, and ear protection. Maintain the PPE properly by cleaning dirty ones and replacing them with the damaged ones. • Safety procedures include provision of information, training and protective clothing to workers involved in hazardous operations and proper performance of their job • Appoint an environment, health and safety manager to look after the health and safety of the workers • Inform the local authorities responsible for health, religious and security duly informed before commencement of civil works and establishment of construction camps so as to maintain effective surveillance over public health, social and security Matters
	Child and pregnant labor	The Contractor shall • not hire children of less than 14 years of age and pregnant women or women who delivered a child within 8 preceding weeks, in accordance with the Bangladesh Labor Code, 2006
Accidents	Lack of first aid facilities and health care facilities in the immediate vicinity will aggravate the health conditions of the victims	• Provide health care facilities and first aid facilities are readily available. Appropriately equipped first-aid stations shall be easily accessible throughout the place of work Document and report occupational accidents, diseases, and incidents. • Prevent accidents, injury, and disease arising from, associated with, or occurring in the course of work by minimizing, so far as reasonably practicable, the causes of hazards. In a manner consistent with good international industry practice. • Identify potential hazards to workers, particularly those that may be life-threatening and provide necessary preventive and protective measures. • Provide awareness to the construction drivers to strictly follow the driving rules • Provide adequate lighting in the construction area and along the roads
Construction Camps	Lack of proper infrastructure facilities, such as housing, water supply and sanitation facilities will increase pressure on the local services and generate substandard living standards and health	The Contractor shall provide the following facilities in the campsites to improve health and hygienicconditions as mentioned in ECoP 17 Construction Camp Management • Arrangement for trainings • Adequate ventilation facilities • Safe and reliable water supply. Water supply from deep tube wells that meets the national standards • Hygienic sanitary facilities and sewerage system. The toilets and domestic waste water will be collected through a common sewerage.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		• Treatment facilities for sewerage of toilet and domestic wastes • Storm water drainage facilities. • Recreational and social facilities • Safe storage facilities for petroleum and other chemicals in accordance with ECoP 2 • Solid waste collection and disposal system in accordance with ECoP1. • Paved internal roads. • Security fence at least 2 m height. • Sick bay and first aid facilities
Water and sanitation facilities at the construction sites	Lack of Water sanitation facilities at construction sites cause inconvenience to the construction workers and affect their personal hygiene.	The contractor shall provide portable toilets at the construction sites, if about 25 people are working the whole day for a month. Location of portable facilities shall be at least 6 m away from storm drain system and surface waters. These portable toilets shall be cleaned once a day and all the sewerage shall be pumped from the collection tank once a day and shall be brought to the common septic tank for further treatment. Contractor shall provide bottled drinking water facilities to the construction workers at all the construction sites.
Other ECoPs	Potential risks on health and hygiene of construction workers and general public	The Contractor shall follow the following ECoPs to reduce health risks to the construction workers and nearby community • ECoP 2: Fuels and Hazardous Goods Management • ECoP 4: Drainage Management • ECoP 10: Air Quality Management • ECoP 11: Noise and Vibration Management • ECoP15: Road Transport and Road Traffic Management • ECoP 16: River Transport management
Trainings	Lack of awareness and basic knowledge in health care among the construction workforce, make them susceptible to potential diseases.	The Contractor shall • Train all construction workers in basic sanitation and health care issues (e.g., how to avoid malaria and transmission of sexually transmitted infections (STI) HIV/AIDS. • Train all construction workers in general health and safety matters, and on the specific hazards of their work Training shall consist of basic hazard awareness, site specific hazards, safe work practices, and emergency procedures for fire, evacuation, and natural disaster, as appropriate. • Commence the malaria, HIV / AIDS and STI education campaign before the start of the construction phase and complement it with by a strong condom marketing, increased access to condoms in the area as well as to voluntary counseling and testing. • Implement malaria, HIV/AIDS and STI education campaign targeting all workers hired, international and national, female and male, skilled, semi- and unskilled occupations, at the time of recruitment and thereafter pursued throughout the construction

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		phase on ongoing and regular basis. This shall be complemented by easy access to condoms at the workplace as well as to voluntary counseling and testing.

Construction Debris Management Plan

1. 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.

2. Excavated Soil

Site is undulating and thus will require cut & fill for levelling. Finished level of the soil will be 37m. Top excavated soil of 15 cm shall be stripped and shall be stored separately under coveredsheds. This soil shall be used for green belt plantation.Lower layers of excavated soil shall be re-used within the site for filling purpose, constructionofapproach & internal roads & railway link. If any extra soil is remained, then that should bedisposed of to the approved debris disposal site

3. 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 besegregated into recyclable and non-recyclable waste. Recyclable waste shall be stored in thecovered area and shall be sold to authorized vendors regularly. Non-recyclable waste shall bedisposed at approved debris site in covered vehicles.

4. Municipal Waste

Municipal waste will be generated from labour camp. Dustbins for recyclable and no recyclable waste shall be provided in labour camp area. Recyclable waste shall be sold toauthorized 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 onenvironment. Concept of reduce, re-use and recycle shall be followed at site. The rejectedwaste should be disposed in a secured manner. Thus a site should be identified for disposal ofthe rejected waste.

4.1Selection 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 belocated away from water body and disposal site should be lined properly to preventinfiltration 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 siteselected.Environment Engineer of PMU and Executive Engineer of Contract Management Unit must approve the Plan before commencement of work.

Contaminated sediment (a permanent disposal site is required) disposal aspects;

- No sensitive areas
- Government owned land (encumbrance free)
- Private land (non-agricultural)
- Details of the safeguard measures of the contaminated sediment disposal is included in the Environment Management Plan (EMP)

4.2 Principles for lease agreement

The Project Management Unit of the AIWTDS will arrange land for disposal of the dredged materials following GOA law i.e. Acquisition. The land will be requisitioned through the concerned district collectors of the project districts. The PMU will pay the required amount to DC office asper law as required for renting/leasing for the particular land for the sand deposition. DC officewill annually assess the rent for the land and claim fund from the PMU to disburse to thelessees.

A lease agreement would be signed between the PMU and the land owners according to the broad principles as under-

1. DC will identify the actual owners of the proposed land taking into account of the recordof rights to the property

2. Rent would be paid through the DC office on yearly basis at the beginning of the year

3. Land will be used for project purposes only (sand deposition)

4. Land will be restored to original condition and returned to the land owners after agreed lease period.The lease agreement will be based on requisition of land

4.2 Precautions to be adopted during Disposal of Debris / WasteMaterial

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 onlywith 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 affectedarea 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 withinand 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 winddirection 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 atthe debris disposal siteMaterial should be disposed through covered vehicles onlyNo contaminated/hazardous/e-waste shall be disposed at the debris disposal site

4.3 Record Keeping

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

4.4 Guidelines for Rehabilitation of Disposal Sites

The dumpsites filled only up to the ground level could be rehabilitated as per guidelines belowand 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

4.5 Penalties

Stringent action & penalties should be imposed off on contractor for dumping of materials in

locations other than the pre-identified locations. Grievance Readressal mechanism should be inplace for taking note and action on such complaints.

Along with the Construction and Labour Camp management Plan ECoPs shall be followed by the Contractor.

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 ofthe construction and labour camp for keeping the health & Safety of workers and impacts of setting upsuch camps on the local community in consideration while developing and establishing such camp. Thisplan is prepared in reference to the Workers accommodation: processes and standards (A guidance noteby IFC and EBRD). The plan aims to promote “safe and healthy working conditions, and to protect andpromote 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 500mshall 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 barricadingClean Water FacilityClean kitchen area with provision of clean fuel like LPGClean Living Facilities for WorkersSanitation FacilitiesWaste Management FacilitiesRest area for workers atconstruction siteAdequate Illumination & ventilationSafe access road is required at camps Health Care FacilitiesCrèche Facility & Play SchoolFire-fighting FacilityEmergency 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 workersshould 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 onlyand 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 animalsinto the site. Entry gate should be provided at the site and labour camp which should beguarded by security guard. All workers should be issued ID cards and entry of outsiders shall bemaintained in the register at the gate. Board should be displayed at the site and the labourcamp, the name of project, capacity of project, authority carrying our projects, restriction of entrywithout authorization, no smoking zone and associated risks. Plant operation shall be restrictedto 6:00 Am to 10:00 PM

3.3 Clean Water Facility

Potable water shall be provided for construction labour for drinking & cooking purpose. Cleanwater shall be provided for bathing, cleaning and washing purpose. Water quality testing fordrinking water provided for workers shall be carried out on monthly basis. Water dispensersshould be cleaned on monthly basis. Adequate water per person should be provided at site fordrinking, cooking, bathing, 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 andany 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 wasteshould be daily cleaned and disposed off. Water storage facility at kitchen should be coveredand cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathingarea.

Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparationtables are also equipped with a smooth durable washable surface. Lastly, in order to enableeasy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixturesare not built into the floor, and all cupboards and other fixtures and all walls and ceilings have asmooth 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 eachworkers and each bed should be at least 1 m apart from another. Double deck bedding shouldbe avoided, in case provided, adequate fire-fighting facility should be provided. Bed linen shouldbe washed regularly and should be applied with repellent and disinfectants so as to manage thediseases caused due to pests. Facilities for storage of personal belongings for workers shouldbe 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 systemshould be ensured in construction camps.

3.6 Sanitation Facilities

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided shouldhave running water availability all the time. Bathing, washing & cleaning areas shall be providedat the site for construction labour. Washing and bathing places shall be kept in clean anddrained condition. Adequate nos. of bathing & toilet facility should be provided at site and shouldnot exceed 1 unit per 15 person. Toilets and bathing facility should be closed to the camps

Workers shall be hired especially for cleaning of the toilets and bathing area. Septic tanks andsoak pits shall be provided at site for disposal of the sewage generated.The toilets should becleaned on daily basis. These tanks should be evacuated through authorized vendors if

filledand at the time of closure. Pest management should be carried out at the camps if the area isinfected by any pests. Adequate lighting should be ensured in camp area especially duringnight 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 andnon-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 inEMP. 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 than3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space providedshall 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 shall be displayed in first-aid room, site office & labour camps. List of contact nos. of emergencypersonnel, hospitals, fire brigade and other emergency contact should be displayed at campsite, 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. Workersshall have access to adequate preventive measures such as contraception (condoms inparticular) and mosquito nets.

3.12Crèche Facility & Play School

Crèche facility and play school should be constructed at the site temporarily so as children ofconstruction 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 enteractive work areas.

3.13 Fire-Fighting facilities

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

3.14 Emergency AssemblyArea

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 teamleader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in anycondition 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 AIWTDS. Site should be wellilluminated to maintain minimum illumination level of 200 lux. Personnel working shall obtainpermit to work from the team leader prior carrying out any work in night time and the record ofsuch working shall be maintained in register. Any accidents, if occurs at site during night timeworking shall be immediately reported and recorded. Penalty shall be imposed on the contractorfor the accident. Analysis shall be carried out to find the reason for such accidents for futurelearning.

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 bemaintained.

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 to 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 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. Securityguards should allow only authorized personnel to the campsite. Guards should be availableduring both morning and night time. Guard should allow entry of workers to the site only beseeing the ID cards. Guard should report if any unusual or unfair practise happening at site andnearby area. Guards should be trained to handle emergency situations like fire fighting andshould 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

Along with the Construction and Labour Camp management Plan ECoPs shall be followed by the Contractor.

Annexure - 20

Risk Assessment & Disaster Management Plan

North Guwahati Terminal

The risk assessment for the North Guwahati terminal has been designed considering the following assumptions.

- The passenger ferry terminal would cater to a multi modal vehicle type system.
- The passenger ferry terminal would consist of structures as per the relevant IS or acceptable international codes pertaining to the construction of such structures.
- The passenger ferry terminal would consist of several structures for passenger amenities including general office, waiting block, ticketing and sales office, public conveniences and medical or first aid facilities. The terminal would also house a firefighting section or provisions thereof.
- The facility would have provisions for sewerage and STPs.
- The facility would be designed as per the hydro-geomorphology of the region as well as with bank erosion protection.
- North Guwahati has been considered as category-3 under soil erosion. This implies stable conditions as per the DPR. The riverbank at the terminal site locations experiencing stable conditions is grouped under this category. The time history satellite images show moderate shift of riverbank at terminal sites due to water level. For these terminal sites, riverbank protection is both technically and economically viable. Due to the stability in the riverbank, fixed terminal operation facility will be considered as a suitable solution.
- In terms of traffic categorisation, North Guwahati has been considered under Category B- Catamaran vehicles with two wheelers with foot passengers.
    - Under this category, the ferry terminals shall be planned with consideration of safe and efficient movement of the two-wheeler vehicles and foot passengers on the catamaran vessels. The berthing facility will have all the basic infrastructure that is needed for mooring the vessel and roll on and roll of vehicles. The access ramp shall be planned in straight line for the easy movement of the four wheelers. In such situation where there is a constraint for planning the straight access ramp, curved access shall be planned with safe turning radius provisions.

- The passenger ferry terminal would provide necessary safety services to the passengers including public announcements and briefing as and when necessary.
- Safety boundaries as per the demarcation of HTL and LTL in the ferry is essential for ensuring overall safety of the passengers and vessels operating at the Passenger Ferry facility. Water level variation between high and low flows is in the range of 8-10m
- Bank protection measures would be implemented for locations prone to erosion
- The passenger ferry service would also house a suitable weather station for alerts and warnings as and when required.
- The site would not have any storage of hazardous chemicals over and above the prescribed lower limit as specified in Column 3 of the MSIHC Rules 1989 amended 2004 for flammable and toxic chemicals.
- The site is protected by providing adequate security round the clock.
- The passenger terminal is based on flexible and mobile options for riverine infrastructure.

DISASTER MANAGEMENT PLAN

Terminal

Prevention Plan

- Timely weather predictions displayed on website, advisory through RIS, notices displayed at terminals, jetties, VHF broadcast and through sailing notices
- All the terminals and jetties designed as per the hazard profile and accounting change in profile due to climate change impact
- Storage area is distant from other buildings with provision of secondary containment
- Periodic Mock drills
- Procurement of safety equipment 6. Evacuation route is marked at terminals

Response Plan

- Assess immediate surroundings for dangers
- Direct Staff to safe exit and to assembly points at terminals
- Operating equipment should be shut down

If required vessels should cast off from berth and proceed to safe waters, away from the immediate crisis or anchored in a safe zone

- A proper approach, check in and exit gate and parking area at the Ro-Ro terminal for cargo lorries/trucks and other vehicles is maintained and is in a safe and operational condition.
- A proper ramp for safe loading and discharging of cargo trucks and other vehicles is available.
- A concourse or hall for waiting passengers and a separate access gangway for passengers where feasible to embark and disembark from the vessel shall be maintained in good condition
- A separate entry and exit for passengers to safely enter and exit the Ro-Ro terminal/Jetty. Proper segregation is maintained between vehicles and people. Where feasible Passengers shall disembark vessel first on arrival.
- Proper securing arrangements to tie the Ro-Ro vessel safely is available.
- Systems in place for stoppage of Ro-Ro operations in adverse weather conditions.
- There is proper and safe connectivity to the loading point/port/terminal by Road.
- To ensure, the capacity of the terminal to handle trucks with turning radius, size restrictions etc is adequate
- The size of Ro-Ro vessels which can be handled safely at the terminal taking into account the dimensions of the loading terminal, depth of water available alongside, securing arrangements etc.
- To ensure, all permissions as required as per National, state and local regulations are available and in order
- Vehicles are properly stowed/parked and secured on the Ro-Ro / Ro-Pax vessel for the intended passage.
- The terminal is provided with adequate safety equipment like lifebuoys, life jackets, fire extinguishers etc
- Vehicles being loaded are in proper condition and not leaking Oil or giving out fumes or carrying uncovered dusty cargo or undeclared hazardous goods or faulty refrigerated cargo etc
- To ensure, properly trained staff is available at the terminal and working hours of all staff at the terminal is regulated
- To ensure, properly Security arrangements for regulating vehicles and passengers movement is available at the terminal

- To ensure, adequate lighting is available for safe operations.
- To ensure, noise level is maintained to the minimum during operations.
- To ensure, Ro-Ro/Ro-Pax Vessels decks are in proper condition and not slippery, oiled etc.
- To ensure, the correct size of vehicles/trucks are stowed/parked in the proper places
- The master of the vessel to ensure that the loading of the vessel is done in accordance with the approved trim and stability booklet of the vessel. No over loading of the vessel is done and no carriage of oversize vessel above the design limit of deck strength of the vessel /design limit is done. The loading pattern adopted may ensure no undue trim and absolute minimum list of the vessel.
- To ensure, proper traffic control at load and discharge operations with regard to directions, speed, weather, blind spots, reversing, parking etc. are observed.
- Master of the vessel to ensure that the vessel approaches the jetty in slow and guided manner so as to avoid any damage to the jetty or any fittings of the jetty.
- The master of the vessel to ensure that the ramp operating systems and safety devices, if any, are in proper working condition.
- Sufficient vertical clearance for the vehicles carried onboard Ro-Ro/ Ro-Pax vessels to be ensured.
- Ensure availability of sufficient numbers of adequate strength mooring lines both onboard the vessels and terminal.
- To ensure that before the vessel sails from the terminal, all the Navigational Aids and equipment's onboard like AIS, Echo sounder, GPS, wind indicator, Radar, Compass, etc as required by rules and regulations are operational and in proper working condition

Functional Failure Prevention Plan

- SOP for all the operational activities
- Checklist for inspection of structures, buildings, material handling equipment and vessel's seaworthiness
- Use of anti-corrosion paint, inspect structures periodically, report any cracks developed

- All the DPR's should consider appropriate loads according to the design use and possible loads caused by wind or vibrations(earthquake)
- Regular fitness check and maintenance

Response Plan

- Stop operations of that area
- Attend to if some personal injuries with help of medical officer
- Provide first aid
- Activate secondary structure/ equipment
- If there is damage to cargo/container, unload it with the help of cranes and forklifts
- Remove the debris/ equipment parts
- Inspect the site and submit report 8. Assess liabilities if any

For Passenger Vessels

The Ministry of Ports, Shipping and Waterways on June 07, 2022, has issued the Inland Vessels (Life Saving Appliances) Rules, 2022.

The selected and relevant provisions of the rules are listed below:

Compliance by existing inland vessels. –

- All existing inland vessels shall comply with the requirements existing prior to coming into force of these rules:
- Provided that the existing inland vessels that undergo major conversion or modification shall comply with the requirements specified under these rules, as may be considered necessary by the Designated Authority:
- Provided further that in the case of change of propulsion system or main engines, the new rules shall apply to that equipment and systems only:
- Provided also that existing vessels shall comply with the requirements of provision of life jackets, life buoys and life-raft or buoyant apparatus specified in rule 7 and the safety equipment plan specified in Rule 16 within one year from the date of coming into force of these rules.
- The owner and master of any new inland vessel, shall ensure that the vessel is constructed, maintained, and operated in accordance with the requirements of these rules and that the vessel is suitable for its intended service.
- In vessels carrying not more than 50 passengers in which the passengers have access to only one passenger compartment or space, a portable loud hailer

may be carried in lieu of the a public address system as required under sub-rule (1).

- Entertainment systems shall be turned off automatically when the public address system is used and option for manual shut off shall be available on vessels with loud hailers.
- The system shall be used to inform the passengers of the action they shall take in the event of an emergency which may lead to the vessel being abandoned and such information, shall be given either prior to or immediately on leaving the berth. The items specified in sub rule (7) shall be part of the information provided.
- In the case of vessels which operate regular ferry service of short duration where compliance would result in very frequent broadcasting of the safety message, other arrangements shall be considered by the Designated authority and such arrangements may include drawing attention to the relevant safety notices and the like.
- A public address system shall be powered from the main source of electrical power and from an alternative source of electrical power situated in a location remote from the main source and the battery back-up or spare batteries shall be carried for loudhailers.

Terminal Security Rules, to be observed by all visitors passengers:

- No unauthorized passengers or personnel permitted.
- All passengers must meet facility ID requirements.
- No weapons allowed on Terminals property under any circumstances.
- Restricted and with permission only photography is permitted on terminal, duly approved by Terminals Management, local operating authority, IWWA, and/or other authorised security agency. Failure to adhere to this policy will result in the immediate suspension of privilege to enter the facility.
- No smoking.
- Public urination strictly prohibited. Failure to adhere will result in permanent revocation of privilege to access facility.
- Required PPE strictly enforced
- Passengers are required to adhere to warning and alarms including any call for evacuation

- Seatbelt required while operating vehicle

Annexure - 21

Dolphin Conservation Plan

Dolphin Conservation Plan

1. Introduction

The Gangetic dolphin is found in Ganges-Brahmaputra-Meghna and Karnaphuli River systems of India, Nepal and Bangladesh (Anderson 1878, Kasuya & Haque 1972, Jones 1982, Mohan 1989, Reeves & Brownell 1989, Shrestha 1989 and Reeves et al. 1993). In the nineteenth century, the dolphins were plentiful in the entire distributional range (Sinha & Sharma 2003), however, the range and abundance of this species has sharply declined in the last 100 years (Reeves & Leatherwood 1995) and the IUCN correspondingly revised its threatened status from Vulnerable (Klinowska 1991) to Endangered (IUCN 1996). It is estimated that currently there are less than 2000 individuals of this subspecies globally.

In comparison to the Ganges River system, little research on dolphins has been undertaken in the Brahmaputra River system of Assam in India. Choudhury (1997) mentioned the distribution of the species in both the Brahmaputra and Barak River systems of Assam. Mohan et. al. (1997) investigated the population of dolphins in the Brahmaputra and confirmed the existence of the species in Brahmaputra mainstream, Kulsi and Subansiri River. Mohan et. al. (1998) also documented one residential dolphin population in the Kulsi River, near Guwahati. Biswas & Baruah (2000) investigated the habitat ecology of the Gangetic dolphin in the Brahmaputra river stretch within Eastern Assam and Bairagi (1999) reported the impact of the oil bait fishery on the dolphins of Brahmaputra River. Wakid (2005) assessed the population status and distribution pattern of dolphin population in the entire Brahmaputra river system and conducted detailed ecological investigations on the dolphins in Eastern Assam. In Assam till three decades ago, the Gangetic dolphin was one of the most commonly sighted aquatic mega-fauna in the Brahmaputra River system. However, due to increasing anthropogenic pressures, the overall population of the species has been declining and they have been extirpated from most of the major tributaries of the Brahmaputra and are now restricted to pockets in the Brahmaputra mainstream.

Gangetic dolphins feed on small fishes like *Mystus sps*., *Barbus sps*., *Channa sp*., *Puntius sp*., *Xenentodon cancila* etc. Prey availability and water depth in the area were found to be limiting factors for the occurrence of species. They prefer deep water areas and pools, with at least 4 m depth. Habitat selection by dolphins is a complex and dynamic function of food requirement, mate availability, avoidance from predators and competitors, and ability to move between habitat patches. The distribution, abundance, and diversity of prey species are one of the most important factors that influence the dolphins' choice of habitat. Habitat fragmentation due to the construction of dams and barrages at upper reaches of the river Brahmaputra has also led to loss of connectivity and thereby decrease in their abundance and population structure. They are also highly vulnerable to poaching and accidental killing.

A comprehensive dolphin survey by Wakid (2005) confirmed the existence of Ganges River dolphins in only three rivers in Assam – a. the Brahmaputra mainstream, b. Kulsi River, and c. the Subansiri River. As a part of this report , 'Protection of endangered

Ganges River dolphins in the Brahmaputra River, Assam, India' by Abdul Wakid, an extensive survey was conducted in the entire 1044 km of dolphin inhabited sections of the Brahmaputra River from the Assam-Arunachal Pradesh border to India-Bangladesh border. The best estimate of 264 dolphins in the entire Brahmaputra River system was recorded, with 80.3% occurring in the Brahmaputra mainstream, 11% in the Kulsi River and 8.7% in the Subansiri River. Dolphin encounter rate in the Brahmaputra was 0.24 dolphin/km, in the Kulsi was 0.40 dolphin/km and in the Subansiri it was 0.24 dolphin/km. Based on high abundance, potential for protection and possibilities for dolphin eco-tourism, eight river sections were identified as potential protected areas and community-based conservation areas. These includes 5 in the Brahmaputra River, 2 in the Kulsi and 1 protected area in the Subansari river.

As a part of the EIA study, a survey was earlier conducted in the Brahmaputra and Barak River to understand the effect of the project activities on the Gangetic dolphin population. The study mainly aimed at assessment of risks associated with the navigational activities and development of riverine infrastructure under the AIWT Project on the aquatic biodiversity and Gangetic dolphins, identification of breeding grounds and populated sites, good habitat for dolphins and preventive measures for avoiding and reducing any harmful impact on river dolphins and based on the study prepare a conservation plan for mitigating the anticipated impacts. The dolphin survey was carried out in the entire stretch of River Brahmaputra and Barak to understand the impact of project activities on the Gangetic dolphin population. The Dolphin Census was carried out for dry season from 26th March to 29th - March 2019 for dry season and for the monsoon season from 2nd August to 6th August- 2019. A total of 36 dolphins were sighted in the dry season and 57 during monsoon period.

For the next set of AIWTD interventions i.e. construction of modular terminals at North Guwahati, Umananda, Neamati and Aphalamukh, M/S WAPCOS was appointed by the Project for conducting the safeguard assessments. As a part of this assignment, WAPCOS has assigned the Zoological Survey of India (ZSI) for conducting Aquatic Biodiversity study with especial emphasis on dolphins in the Brahmaputra river which is a part of the ESIA report and the suggested mitigation measures are part of the site specific ESMPs for the 4 modular terminals. Besides 'An in-depth study on global best practices for effective and conservation of the Ganges River dolphin (Platanista gangetica) commissioned by the World Bank and WWF is also reviewed the mitigation measures to be undertaken during the time of construction and operation of the proposed construction of modular terminals under the Project.

2. Mitigation Measures

Based on the available literature and recommendations made under the different studies conducted under the Project, the following mitigation measures are now proposed for both construction and operation phases of the modular terminals to be constructed under the Project.

2.1 **Mitigation Measures during Construction Phase**

- Relevant information (e.g. encounter with vulnerable species during engineering work) shall be shared with the State Environment and Forest Department and concerned local/ regional biodiversity experts. The Project team shall liaise with relevant departments for formation of emergency rescue team comprising representatives of the forest, environment, bio-diversity experts, IWT representative for dealing with any emergency e.g. accidental trap of dolphins at site, injury etc.
- Emergency Contact numbers of the expert committee shall be displayed at site.
- Anti-poaching measures during the construction phase should be strengthened to check for any violation of existing regulations. Awareness campaign to be made among the workers to aware them on the endangered and other important species.
- Construction vehicles must be operated at safe speed to avoid collision with wildlife. Training should be provided for the vehicle operators and warning signs should be installed at site.
- Change of geology and topography should be kept minimum.
- Avoid constructing labour camps and construction yards near the river banks.
- To minimize any negative impacts, noisy operations should be avoided during breeding season of the dolphins (March-June)
- River flow should not be blocked at all times for free movement of dolphins.
- Measures such as the creation and monitoring of an exclusion zone of a 500m radius for at least 30 minutes before the start of construction activities shall be followed. If dolphins are observed in the exclusion zone, construction works should be delayed until they have left the area. If dolphins enter the exclusion zone after construction has commenced, construction works should cease until they have left.
- All activities that increase soil erosion or contribute to nutrients and pollutants to water need be minimized both onsite and off-site by using measures such as silt curtain.
- Construction activities should be carried out in close supervision of the dolphin ecologist appointed by the Contractor.
- Construction works should be avoided or kept minimum in vicinity of the dolphins favorable microhabitats (downstream of shallow areas/sandbars, tributary junctions)
- Dolphins are likely to prefer water depth range between 4.1 to 6 m. Therefore, movement of sediment and influx of soil/silt etc. should be avoided to keep the favorable depth range.
- In case rare birds of prey are observed near the construction area, the construction work will be avoided during their breeding season.
- Before construction of piers the construction site must be checked for the presence of threatened turtles, migratory birds, and other threatened species and their nests. If the turtles and/or their nest are found inside or near the construction area the animals and/or the eggs must be physically moved to safer habitat areas under the guidance of the local wildlife experts.
- All boats or ferries transporting construction material and workers will have propeller guards installed to prevent injury and death of dolphins, turtles and other aquatic fauna.

- One of the threats to bird and turtle habitat is conversion of the river edges from natural soft embankments into hard concrete embankments. Therefore, the natural bank slope needs to be preserved and location of the piers should avoid such areas. No construction camp, borrow areas or disposal sites will be established within 100m of the shorelines at the highest water level period.
- All avoidance, mitigation and enhancement measures and monitoring plans proposed to address impacts on flora, fauna and the threatened species should be updated during the detailed design stage by conducting detailed studies such as identification of the migrating routes of dolphins and birds, exact locations of turtle nesting grounds, etc. and confirmation of the same from local biodiversity experts, institutions working in this area.

2.2 Mitigation Measures during Operation Phase

- For conservation of dolphin instruction should be given to all vessels' operators and all employee and staff that dolphins or any other endangered species should not be harmed due to any reason.
- Instruction should be given to vessel operators for maintaining a safe distance and speed if dolphins are spotted, in case of accidental injury to dolphins it should be reported immediately to terminal authority for informing the emergency rescue team.
- Vessel operators should be instructed for not using sharp lights and sounds as they may disturb the aquatic fauna.
- Provision for propeller guards should be provided for all the vessels to minimize the propeller inflicted injuries and scars.
- Regulation of vessel speed in Dolphin habited area.
- Sub-surface aquatic disposal is required, minimum one meter below the water surface. Careful mapping of sensitive areas directly affected by the dredge;
- Preventative maintenance of equipment to mitigate negative environmental impacts such as leakages and spillages
- The mess size of the iron wire to be used to fix the boulders below the steps at Ghats close to the water line or river edge should be four inches instead of eight inches.
- Any plantation if required, species identification should be done carefully with local people, experts natural amphibious/aquatic grasses of riparian zone of the river grow which should not be disturbed.
- There should be minimum or no noise under the water during implementation of the project.
- If any mechanized boat is used during implementation of the project, the same may have provision for propeller guards.

3. Gangetic Dolphin and Underwater Noise Impacts Management Plan during Construction and Operation Period

3.1 Underwater Noise Monitoring:

Underwater noise monitoring shall be carried out by using hydrophones at the critical locations where the dolphins have been spotted. A hydrophone is used to identify underwater noise levels by using piezoelectric transducer that generated electricity when subjected to pressure changes in a denser medium than air such as water. This shall aid in understanding the baseline noise levels at the critical locations to carry out noise modelling in the future scenario. The major sources of underwater noise shall include the existing vessels during construction phase along with construction equipment such as dredger and motorized pumps. During the construction phase the underwater noise contributors shall include new vessels and dredgers used to maintain the least available depth.

3.1.1 Measures for Avoidance and Mitigation of Noise Impacts on Aquatic Ecology

- Vessel speed should be restricted to 2.7 knots in VSDS. Hooting should also be prohibited in sanctuary areas (if any)
- Vessel should be fitted with the dolphin reflectors.
- Usage of non-toxic and non-Tributyltin (TBT) containing anti-fouling paints for painting vessel.
- Provision of propeller guards with vessel to minimize injury to the aquatic fauna
- Barge/vessel movement will be restricted to the designate route only to minimize noise disturbance of Aquatic life.
- If any aquatic mammal spotted, then the measures should be taken to push it away through sirens/signals and creating noise signals.
- If any accident of aquatic mammal occurs, then that should be reported to AIWTDS/IWT for rescue action through emergency rescue team comprising wildlife and forest department officials.
- All vessels should follow proper disposal mechanism for managing their liquid and solid wastes. No vessel should discharge the liquid and solid waste in the river. All waste should be discharged at vessel repair facility only. AIWTDS should develop the stringent norms to be followed by vessel operators and should develop the system of penalizing based on polluters pay principle in case the standards are not met or violated.
- Material having potential to generate the dust like sand stone aggregates should be transported under covered conditions to minimize dust generation and its settlement on river surface.
- Provision of oil water interceptors with the bilge tank to separate oil prior discharge of bilge water into river.
- The proposed oil spill control and management plan **(Annexure 17**) should be effectively communicated for any emergency situations.
- Crew of the vessel carrying especially oil should be competent and experienced so as they can prevent the accidents to happen as much as possible.
- Regular maintenance of vessels engine and propellers.

- River training works should be carried out at the bank locations which are prone to erosion to minimize sedimentation & impact on water quality & aquatic organisms
- Adequate depth to be maintained to prevent grounding under low flow conditions. Information on available depths should be conveyed to the navigators through online systems by AIWTDS. River Information System being developed by AIWTDS will serve this purpose.
- Maintaining flood plains & riparian corridors wherever possible and limit potential damage to the navigation channel.
- Restricting the project activities in breeding and spawning ground of the fisheries which are majorly the bends in the meandering river.
- A possible solution to the impact caused by the project during the construction and operation phase of the project is to provide dolphin deterrent devices (ADD) on the terminals and vessels. A deterrent device is a mechanical audio signal generating instrument which can generate ultrasonic signals to keep the dolphins away from the activity area. ADD is a device with a low intensity (source level: < 150 dB re 1 µPa at 1 m) and emits signal in the middle to high frequencies (2.5 – 10 kHz) with higher harmonic frequencies (up to 160 – 180 kHz).
- Modern design vessels having low draught say 2 m instead of 2.5 m for equal payload should be procured by IWAI for transportation. Modern vessel- better technology vessels or with retrofits with quieting techniques to reduce further the noise generation (specifically cavitation's noise).
- Regular patrol and inspections should be carried out to monitor the activities in waterway. Also, regular monitoring of environmental attributes as proposed in environment planning plan of this should be carried out for the waterway to keep track of the condition of the environmental attributes.
- The navigation channel should maintain a minimum distance of 100m horizontally and 500m either side along the river at the confluence point of major tributaries with river Brahmaputra.

4. Enhancement Measures:

Support for promoting fish productivity through setting up or supporting existing fish nurseries. Also providing training and awareness support through reputed institutes or experts like Central Inland Fishery Research Institute (CIFRI) for better fishing techniques. Provision of supporting studies for conservation and safety of dolphins should be made during the course of the Project for documenting the best practices as well as updating the conservation/management plan.

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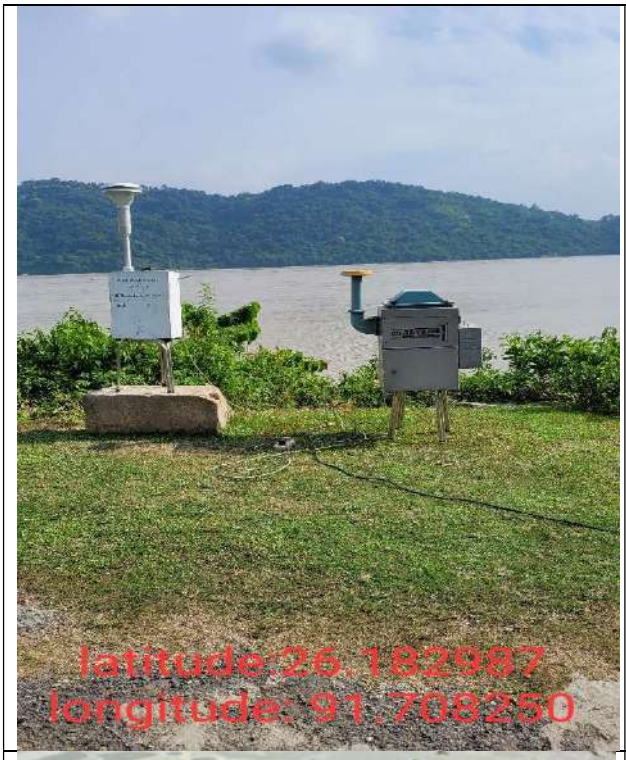
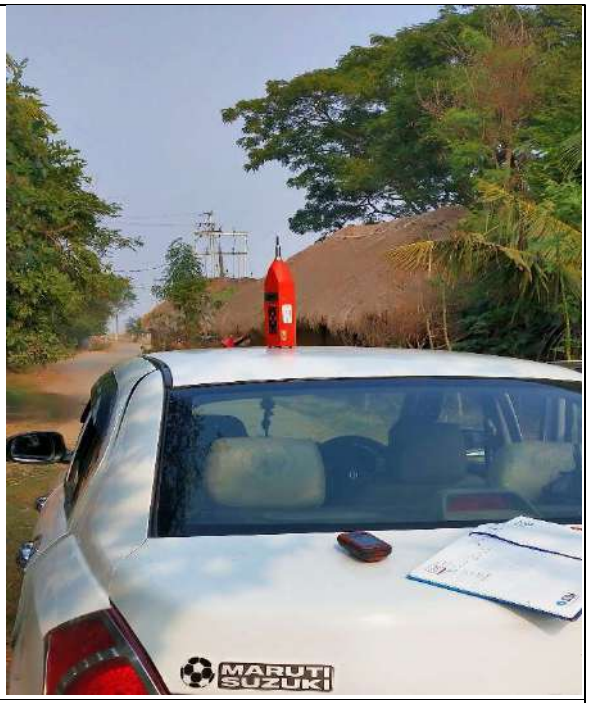
Annexure – 22

Environmental Monitoring Photographs

Environmental Monitoring Photographs: North Guwahati




MARUTI
SUZUKI

Annexure - 23

SAFETY PRACTICES DURING CONSTRUCTION PHASE

SAFETY PRACTICES DURING CONSTRUCTION PHASE

The Contractor is required to comply with all the precautions as far as possible for safety of the workers. The contractor will supply all necessary safety appliances such as masks, ear plugs, etc., to the workers and staff. The contractor shall comply with all regulation regarding, working platforms, excavations, trenches and safe means of entry and egress.

In order to guarantee construction safety, efficient lighting and safety signs shall be installed on temporary roads during construction and adequate traffic regulations shall be adopted and implemented for temporary roads. The key safety practices are given as below:

- Provide personal protective equipment to the labours.
- Ensure the labours are trained to work on the specific project.
- For untrained labour – training should be provided before permission to work on the site.
- The contractor shall provide, if required, erect and maintain necessary (temporary) living accommodation and ancillary facilities during the progress of work for labour to standards and scales approved by the Engineer- In charge.
- Contractor shall follow all relevant provisions of the Factories Act, 1948 and the Building & other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction & maintenance of labour camp.
- Construction camps shall not be proposed within 1000m or sufficiently away from nearest habitation to avoid conflicts and stress over the infrastructure facilities, with the local community. The location, layout and basic facility provision of each labour camp shall be submitted to Engineer prior to their construction.
- Safety and sanitation facility should be provided in the labour camp. Uncontaminated water shall be supplied to the construction workers at labour camps.
- The contractor shall arrange for a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone, Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital
- Always maintain a fully equipped first aid box in the construction camp.

Some of the safety sign boards to be displayed at construction site are as follows:

The code of practices to be adopted during the construction period are already given in the ESMP. The same code of practice is included as **Annexure- 19.** The contractor shall be responsible for implementing the management measures suggested for construction phase.

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