



**ASSAM INLAND WATER TRANSPORT
DEVELOPMENT SOCIETY
GOVERNMENT OF ASSAM**

**ENVIRONMENTAL AND SOCIAL
ASSESSMENT STUDIES FOR ASSAM
INLAND WATER TRANSPORT
PROJECT, PHASE-I**

IN-IWT-242294-CS-QCBS

**ESIA REPORT FOR APHALAMUKH
TERMINAL**



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](mailto:environment@wapcos.co.in)

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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
Aol	Area of Influence
ASEB	Assam State Electricity Board
CITES	Convention on International Trade in Endangered species.
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
FGD	Focus Group Discussion
GC	General Consultant
GoA	Government of Assam
Gol	Government of India
GLSR	Ground Level Service Reservoir
HFL	High Flood Level
IMD	India Meteorological Department
IUCN	International Union for Conservation of Nature
IWAI	Inland Waterways Authority of India
LWL	Low Water Level
PIU	Project Implementation Unit
PMU	Project Management Unit
PAPs	Project Affected Persons
PWD	Public Works Department
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
NGO	Non-Government Organizations
NW	National Waterway
SPCB	State Pollution Control Board, Assam
SPL	Sound Pressure Level
TPM	Third Party Monitoring
TSSC	Technical Supervision and Support Consultan

EXECUTIVE SUMMARY

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 No. 2 by the Government of India in 1988.

National waterways are cost efficient and is 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-cultural stability.

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.

2. NEED OF THE PROJECT

The facilities built at most of the IWT 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, there is an urgent need for improvement in passenger ferries and require upgradation of supporting infrastructure.

3. PROJECT FEATURES

The Aphalamukh ghat is located in the Majuli Island. The Island is accessible by ferries from Jorhat and two of the major ghats operated here are Aphalamukh and Kamalabari. Majuli is famous for Vaishnav satras and every year thousands of tourists visit this place especially during the Raas festival which normally falls in the month of October-November. Currently six IWT vessels namely, *M.V Ranigaidinliu*, *Padma*, *S.D Burman* and *MV Rajlakshmi* ply from Neamati to Aphalamukh on daily basis apart from another six boats run by private boat owners.

On an average daily 900-1000 passengers use these ferry services. The existing Ghat lacks basic necessities such as toilets, waiting area, parking and staff seating area. The approach to the ghat is a kaccha road (unmetalled) which makes it vulnerable during rainy season. At present the facilities at this terminal is not sufficient to meet the growing demand of traffic and therefore needs upgradation. However, a bridge over river Brahmaputra is under construction connecting Majuli and Neamti (Jorhat), once construction of the bridge

is completed, it may affect the number of passengers using ferry for commutation in the near future.

River morphological changes between 2010 and 2020 in the vicinity of the proposed terminal site at Aphalamukh shows approximate bank erosion of 100-300 m. As per technical assessment under DPR preparation, terminal site falls under moderate erosion category for which suitable riverbank protection measures are recommended. The proposed terminal site is adjacent to the existing ferry ghat and is downstream of a series of groynes built for anti-erosion under Brahmaputra Board. river bank protection measures are planned under the project to address the scour and slope protection due to river flow, both approach bund and riverbanks shall be protected by Gabion mattress filled with aggregate. This layer will act as slope protection element for drag and lift caused by river flow. Accordingly, ~ 0.5m thick gabion mattress has been proposed for slope protection. These gabion mattresses shall be filled with suitable aggregate material.

HFL of 83.84 m and LWL of 78.21 m has been considered for planning and designing the terminal. As per DPR, movable floating pontoon and linkspan has been planned for Aphalamukh Ghat Terminal. The pontoon shall receive Ro-Pax and catamaran vessels of capacity 100-150 passengers along with two wheelers and four-wheel vehicles.

Following components 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

The Project activities at Aphalamukh shall include construction works in a high bio-diversity area as well as 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 labour influx, health and safety so the project is considered as Category B.

4. STAKEHOLDERS CONSULTATION

The Focus Group Discussions (FGDs) and stakeholder consultations were organized with key stakeholders to get their views and suggestions on proposed terminal locations. The team members were trained enough to ensure that all participants were comfortable and engaged with the discussions, and that their opinions were noted down. Safety and security of passengers, separate entry and exit points, proper displays and announcements ferry, provision of better sanitation facilities, facilities for differently abled & elderly passengers, medical/ first aid facility were the major findings of stakeholder's consultations.

5. BASELINE ENVIRONMENT & SOCIAL STUDY

The information on relevant environmental and social parameters has been collected through primary and secondary sources in order to understand the present environmental and social setting of the proposed project site. The major purpose of describing the environmental and social settings of the study area is:

- To understand the project need and environmental & social characteristics of the area.
- To assess the existing environmental quality, as well as the environmental impacts of the future developments being studied; and
- To identify environmentally significant factors or geographical areas that could preclude any future development.
- Socio-economic and socio-cultural aspects of the proposed site.
- Impacts on land and other assets, likely influx of labour leading to health issues, conflicts with local communities, gender-based violence if any, livelihood impact etc.

The basic parameter on which data has been collected are as follows:

- Physio-chemical aspects (Meteorological Data, Ambient Air Quality, Ambient Noise Quality, Surface Water Quality, Ground Water Quality, Soil Quality);
- Biological aspects (Aquatic Ecology);
- Socio-economic and socio-cultural aspects of the vicinity.

6. ANTICIPATED IMPACTS & MITIGATION MEASURE

It is expected that there will be certain changes in the overall environmental and social matrix of the study area. The baseline data of the existing environment, in the absence of the proposed activity, provides the status of natural environment and with the proposed activity, it further provides a mechanism for prediction of the changes that are likely to occur. In the present study, evaluation of land, water, air, noise, flora, fauna and socio-economic studies were undertaken to understand the baseline environmental status of the area and estimation were made as how this will change with the commencement of the proposed activities. Anticipating the quantum of change, efforts were also made to analyse the degree of alternations and strategies for suitable management to ameliorate the negative impacts of project activities. This exercise has provided a sound basis for formulation of different management plans, which are presented in the ESMP document of the project.

7. ENVIRONMENTAL MONITORING PROGRAM

The overall impact assessment of the proposed project was carried out and monitoring plans have been framed based on the severity of impacts in different areas. During the ESIA study, it has been observed that the Ambient Air Quality and Noise and Water Quality are going to be affected marginally though temporary. The preventive/ curative measures to reduce the ill effects of construction activities on these parameters have been suggested under various plans. A holistic approach has been adapted for monitoring of air, noise and water related factors under different heads with suitable financial provisions for their implementation.

8. RISK ASSESSMENT AND EMERGENCY PREPAREDNESS PLAN

An important element of mitigation is emergency planning, i.e., recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on-site and offsite, that would need to be implemented in the event of an emergency -

- To prevent or minimize damage of property or the environment.
- To render help to the person at site to provide him relief.
- To restore the affected area as soon as possible.
- To review incident to evaluate and strengthen the emergency

9. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

A site-specific Environmental & Social Management Plan (ESMP) has been prepared for avoiding, mitigating, checking the adverse impacts envisaged during ESIA studies on various environmental and social components during construction and operational phases of the project.

Preparation of Environmental and Social Management Plan is required for formulation, implementation and monitoring of Environmental and Social protection measures during construction and operation phases of the project. The Environmental and Social Management plan is a site-specific plan developed to ensure that the project is implemented in an environmentally and social sustainable manner where all contractors and sub-contractors, including consultants if any, understand the potential environmental and social risks arising from the project and take appropriate actions to minimize those risks. ESMP also ensures that the project implementation is carried out in accordance with the planned design and by taking appropriate mitigation actions to reduce adverse environmental and social impacts during project's life cycle.

Environmental budget for Aphalamukh terminal is estimated as Rs. 50.8 lakh, while during operation phase is 56.96 lakh, including contingency charges.

10. IMPLEMENTATION OF ESMP

It is recommended that project authority to establish an Environmental & Social Management Cell (ESMC) at the project site with requisite manpower. The task of the Environmental and

Social Management Cell will be to coordinate various environmental and social activities, to carry out environmental and social monitoring and to evaluate implementation of environmental and social enhancement measures for positive impacts and environmental and social mitigation measures for negative impacts.

The ESMC will closely monitor the environmental and social aspects of the proposed project and identify 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 & Social Management Cell (ESMC) will be to coordinate specific studies to:

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

AIWTDS will engage an independent consulting firm to conduct external and independent monitoring of the ESMP implementation. The main purpose of the external monitoring/ Third Party Monitoring Consultant 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.

It can be concluded that the proposed Assam Inland Water Transport Project is likely to entail certain environmental and social impacts due to the proposed intervention at Aphalamukh. However, these impacts can be ameliorated to a large extent by implementing appropriate mitigation measures with proper monitoring and reporting mechanism, these anticipated impacts shall be largely mitigated both during the construction and operation of the terminal.

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 no. 2 by the Government of India in 1988 (Refer **Figure-1.1**).

Waterways are cost efficient and is 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. There are many places in Assam which are connected to the mainland only through waterways, Majuli, 'the cultural capital' of Assam being one of them. Development of a modern ferry terminal with all basic amenities at Aphalamukh, Majuli is a long demand of the locals. Also, in the river areas (islands) of the river Brahmaputra locally known as 'chaar chapori', the prime mode of transport for the inhabitants are private boats locally known as 'bhutbhootis'. Thus, there is a need to provide safer means of ferries and related infrastructure, facilities to the people by development of wider IWT sector.

A bridge over Brahmaputra River, connecting Majuli and Jorhat is being constructed under Ministry of Road Transport and Highways (MoRTH), GoI. This 2-lane 8.25 km Majuli-Jorhat bridge shall be completed by November, 2025.

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.

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 Aphalamukh ghat is located in the Majuli Island. The Island is accessible by ferries from the city of Jorhat and two of the major ghats operated here are Aphalamukh and Kamalabari. 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. At present the facilities at this terminal is not sufficient to meet the growing demand of traffic and therefore needs upgradation.

1.3 ESIA STUDY

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

Table 1.1: Location of the Terminals

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 Report is prepared for the priority terminals namely Umananda, North Guwahati, Neamati and Aphalamukh. This report is for the ESIA study of Aphalamukh terminal.

1.4 SCREENING AND SCOPING STUDY

Screening and Scoping exercise has been done for Aphalamukh 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.

As a part of environmental and social assessment process, environmental and social safeguards screening exercises have been conducted.

The screening exercise has identified the following potential impacts from the project activities:

1.4.1 Positive Impacts

- Improved facilities and connectivity of Majuli Island with the mainland.
- Improvement in income and living standards due to increase in tourism; potential for development of tourism circuits viz. Guwahati-Kaziranga via Tezpur, Tezpur-Singri-Viswanath, Kaziranga-Neamati-Sibsagar
- Employment generation of this sector will also increase considerably; a number of other indirect and intangible benefits may also flow from the increase in economic activity, including development of tourism and water sports, conservation of biodiversity, and sectoral development with a growth in related services.

1.4.2 Negative Impacts

- Proposed terminal area is prone to erosion and construction activities may further aggravate erosion of the river Bank. Anti-erosion protection works carried out by the Brahmaputra Board has reduced river the bank erosion in this reach. However, bank protection measures need to be taken.
- 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.
- Public health risk by incidence of water borne and other disaster related diseases, and mental fears during construction phase of the project.
- Spillage of construction material into the river.
- Majuli is a high biodiversity region where migratory birds visit during winter season
- 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. Thus, the construction and operational activities may cause threats to this valuable aquatic species.
- Transportation and storage of construction materials may increase the risk of contamination of river water.

- Impact on socio-cultural environment of local community due to labour influx. Construction camp of the Majuli-Jorhat bridge project is located at approximately 3 kms from the proposed terminal location.
- Availability of land at site for setting up of labour camps, however the camps need to be set up considering the high flood level in the area.
- Noise and vibration due to use of machinery and movement of vessels.

The Project activities at Aphalamukh shall include construction works in a high bio-diversity area as well as 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 labour influx, health and safety 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 Dolphin study
- Preparation of Site-Specific Conservation Plan for Dolphins with budgetary provision for construction and operation phases
- 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 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 Aphalamukh Terminal.

2.2 DESCRIPTION OF THE TERMINAL

The Aphalamukh ghat is located in the Majuli Island. Majuli Island is a part of the vast dynamic river system of Brahmaputra basin with a total length of 2706 km and a catchment area of 5,80,000 sq km. The Majuli Island is a fluvial landform (a riverine delta), a unique geographical occurrence and a result of the dynamics of this vast river system. The island itself extends for a length of about 80 km and for about 10-15 km north to south direction with a total area of about 875 Sq km. It is 85 -- 90 m above the mean sea level. It is formed in that stretch of the river where the largest number of tributaries drains out and forms their deltas on the Northern and the Southern banks. It rises from the Brahmaputra basin and in course of time turned into a flat-level alluvial plain. The geomorphology of this region is directly related with its physiographic characteristics. The island is bounded by the river Subanisri and her tributaries Ranganadi, Dikrong, Dubla, Chici and Tuni etc. on the North west, the kherkatia Suli (a spill channel of the river Brahmaputra) in the northeast and the main Brahmaputra River on the South and the South west.¹ (P.Hazarika, B.K Pandey, Y.C. Tripathy)

Another significant feature of this system is the formation of the islets locally called the Chaporis around the Majuli Island. This is resultant of the braiding of the river. 22 Nos Chor- Chapar present in the waters surrounding the island. At present, 18 have been included as stable/permanent islets under Majuli Circle. The banks of the island as well as the North and the South banks of the river Brahmaputra have the wetland a characteristic feature of the hydrology of the system. All of the above the river, its tributaries, the wet lands and the chaporis along with the island of Majuli make it the largest mid river delta system in the world.²

The Island is accessible by ferries from Jorhat and two of the major ghats operated here are Aphalamukh and Kamalabari. Majuli is famous for Vaishnav satras and every year thousands of tourists visit this place especially during the Raas festival in October-November. Tourists also visit the island for bird-watching as Majuli is home to many common, rare and migratory birds that visit the island in the winter. Migratory birds are regular visitors to the chaporis or islets and beels which are accessible from the Kamalabari ghat, which is 20-25 kms from the proposed Aphalamukh Terminal location.

Currently six IWT vessels namely, *M.V Ranigaidinliu*, *Padma*, *S.D Burman* and *MV Rajlakshmi* ply from Neamati to Aphalamukh on daily basis apart from another six boats run by private boat owners.

On an average daily 900-1000 passengers use these ferry services. The existing Ghat lacks basic necessities such as toilets, waiting area, parking and staff seating area. The

¹ Report on biodiversity and bioresources of Majuli island

² River Island Majuli in midstream of Brahmaputra River in Assam,
<https://whc.unesco.org/en/tentativelists/1870/>

approach to the ghat is a kaccha (unmetalled) road which makes it vulnerable during rainy season. At present the facilities at this terminal is not sufficient to meet the growing demand of traffic and therefore needs upgradation. However, a 8.5 km long bridge over river Brahmaputra is under construction connecting Majuli and Neamti (Jorhat), once construction of the bridge is completed, it may affect the number of passengers using ferry for commutation in the near future.

River morphological changes between 2010 and 2020 in the vicinity of the proposed terminal site at Aphalamukh shows approximate bank erosion of 100-300 m. As per technical assessment under DPR preparation, terminal site falls under moderate erosion category for which suitable riverbank protection measures is recommended. The proposed terminal site is adjacent to the existing ferry ghat and is downstream of a series of groynes built for anti-erosion under Brahmaputra Board.

The co-ordinates of Aphalamukh terminal are N - 26° 54' 57.13", E - 94° 17' 57.80", and location map is given in **Figure-2.1**.

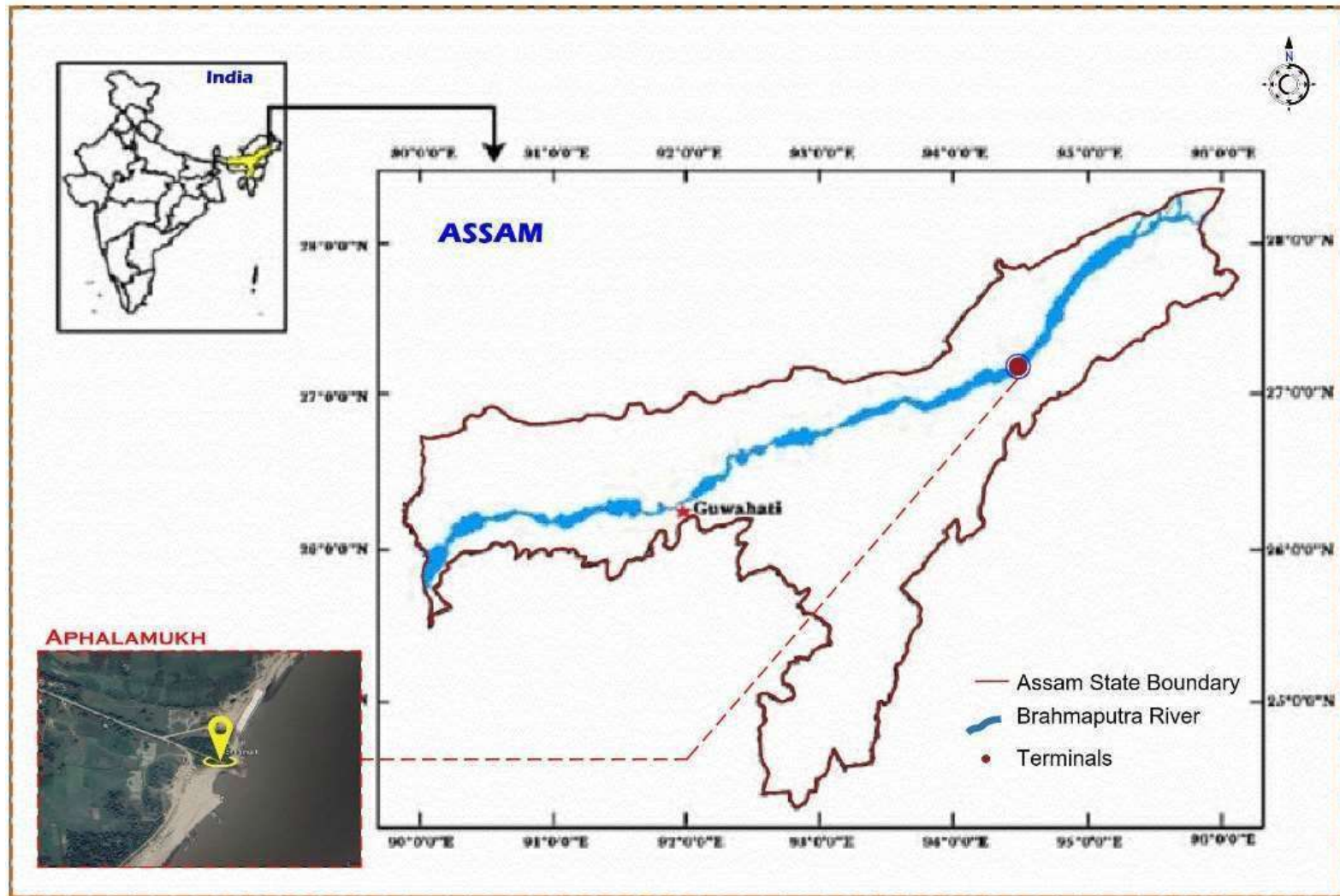


Figure 2.1: Location Map of Aphalamukh Terminal

2.3 EXISTING FACILITY AT Aphalamukh GHAT

The existing facilities at Aphalamukh is as listed below

- The existing riverine infrastructure in the ferry terminal consists of floating pontoon facility for berthing of vessels and boarding and de boarding of passengers and two wheelers.
- At present this terminal also accommodates RO PAX vessels with inbuilt ramps for the transport of two and four-wheeler vehicles.

The existing conditions at Aphalamukh Ghat is shown in **Figure 2.2**.



Figure 2.2: Existing conditions at Aphalamukh Terminal

2.4 PROPOSED UP-GRADATION AT THE TERMINAL

Majuli is a river island in the Brahmaputra River, Assam and in 2016 this is the first island to be declared as separate district of Assam, India. The island is formed by the Brahmaputra River in the south and the Kherkutia Xuti, a branch of the Brahmaputra, joined by the Subansiri River in the north. Majuli island is accessible by ferries from the city of Jorhat and two of the major ghats are Kamalabari and Aphalamukh.

The layout of the proposed Aphalamukh Ghat Terminal is enclosed as **Figure 2.3**. HFL of 83.84 m and LWL of 78.21 m has been considered for planning and designing the terminal. As per DPR, Movable floating pontoon and linkspan has been planned for Aphalamukh Ghat Terminal. The cross-sectional view shown in **Figure 2.4**.

The entire facility has been divided to two categories

- Landside Facility
- Riverine Facility

The landside and riverine infrastructure proposed for the ferry terminal are robust structures and provide floating but permanent boarding/ de-boarding locations for the passengers and vehicles. The design will also ensure a greater sense of safety amongst the passengers, travelling through these vessels. The pontoon shall receive Ro-Pax and catamaran vessels of capacity 100-150 passengers along with two wheelers and four-wheel vehicles.

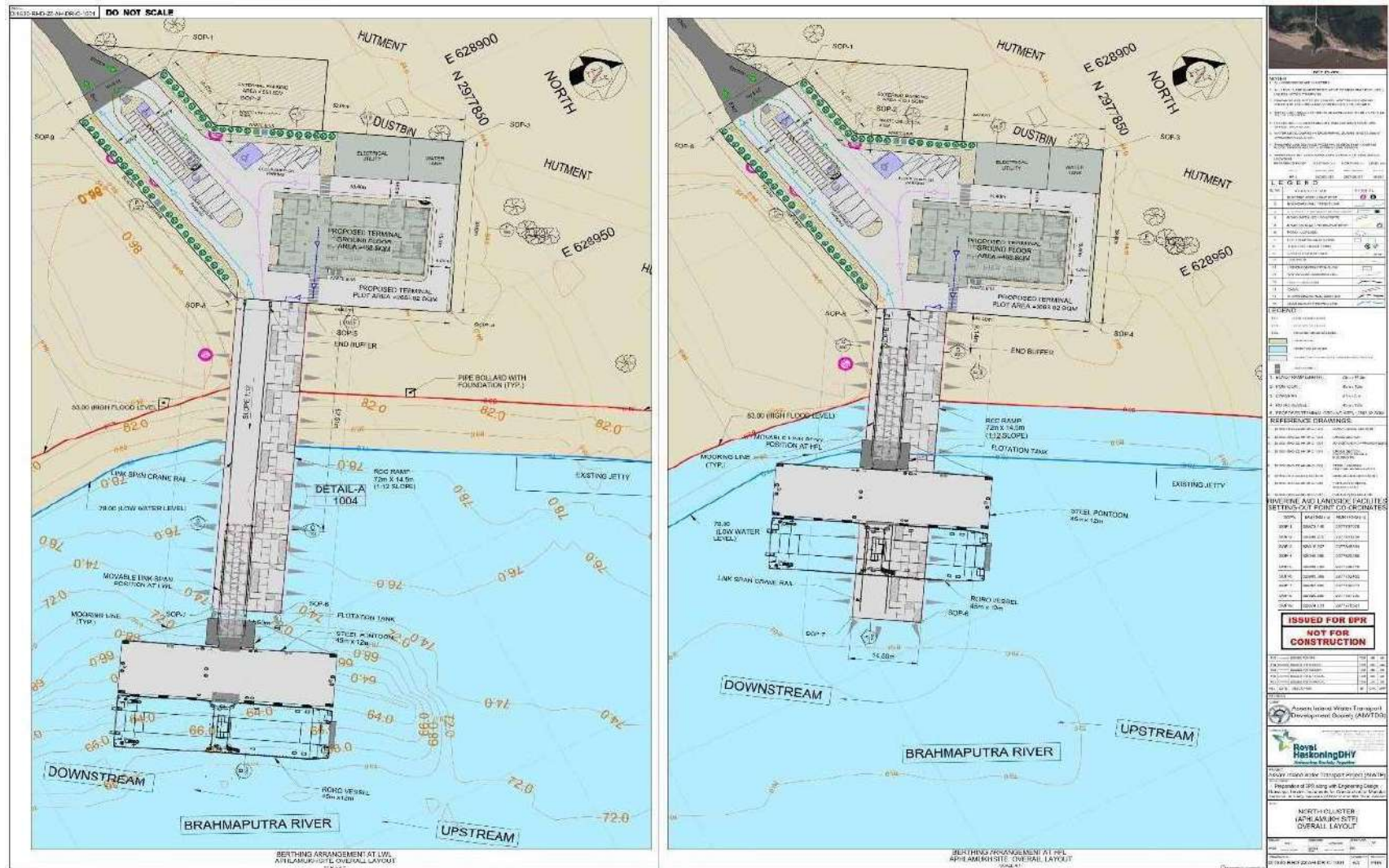
Following components have been planned to fulfil operational needs of the proposed terminal.

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





The summary of land and river components to be developed as a part of the project are given in **Table-2.1**.

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

Components	Nos.	Dimension	Remarks
A. Riverine structures			
I. Type of berthing arrangement	Movable floating pontoon and Linkspan		
II. Floating pontoon	1	45x12 m	Steel pontoon
III. Approach Bund	1	75 m length with 1 in 12 slopes with landing at every 5 m	Lane for cars, bikes and passengers and physically disabled person
IV. Link span	2	27m x 5m	Access/moveable steel structure which connects access the approach bund and the floating pontoon for the safe passage of the passenger and the wheeled vehicles . This shall be of 4.5 m as clear width 2.5 m as clear height
V. Type of slope protection	-	0.5 m thick	Gabion mattress with aggregate as a filling material
VI. Type of bank protection	-	-	Fabric foam mattress solution technology ³
B. Land side facilities			
I. Total land area		2700 Sqm	
II. Building area		470 sqm	
• No. of floors		G+1	

**Source: DPR, 2023*

Other amenities and facilities proposed at Aphalamukh Terminal

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

³ On the trimmed surface of riverbank non-woven Geotextile shall be placed. The geotextile shall be needle punched made of polyester staple fibre. Finally, the fabric form mattress shall place over the geotextile surface. The fabric form mattress shall be filled with suitable filler material like cement mortar which shall be laid on geotextile base for river bank protection.

Source of power supply: In order to meet the total power demand for river terminal, 11kV level 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. Also, provision for emergency diesel generator has been kept which shall run automatically during normal power failure. 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 15 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 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 83.84 m.

Sewage Management - The sewage treatment at the site has been recommended via a bio-digester tank. A bio-tank of 4 KL occupying 6 sqm (2m X 3m) is proposed for the site. Biodigester will be used for sewage treatment for the operation phase. The treated water quality will be of category C (as per CPCB guidelines) which will be used for horticulture purpose. The sewage from the terminal building will be conveyed to the bio-tank from the inspection chamber. The sludge from the Bio digester tank will be removed periodically and transported to designated sites as approved by the municipal commission 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 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. 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

Design and specifications of inland vessels operating in the ghat shall have all the facilities for waste management and disposal as per the provisions specified in the Inland Vessel Rules, 2022. All the inland vessels shall have a holding tank of adequate capacity to store all sewage generated on board,

for subsequent discharge into a shore reception facility. The terminal shall have all the provisions for sewage treatment at the shore. Sewage suction vehicle available with the Majuli district Municipal Corporation shall be engaged by DIWT/AIWCL for collecting the sewage from the vessel. Further, the sewage shall be pumped out and taken from the vessel to the shore-side facility through flexible HDPE pipe.

Firefighting System

Fire system comprises of fire detection, alarm and control system and fire protection system. The fire detection and protection system for the terminal infrastructure (such as pontoon/approach trestle/building/transformer/DG set etc.) are proposed to be designed, manufactured, and tested in accordance with latest applicable Indian Standards (IS) / National Building Code of India (NBC)/ LPA (Loss Prevention Association of India). The static storage for firefighting has been recommended at 100KL as per NBC 2016 Norms. internal hydrants, sprinkler system and fire extinguishers are provided inside the building. At least 04 number of portable dry powder fire extinguishers of 9 litre capacity for all classes of fire to be provided. In addition, 04 numbers Fire buckets (9 lit. Capacity) and 04 numbers Sand boxes (0.5 m x 0.5 m x 0.3 m to be provisioned. 02 numbers of Fire Hose with nozzle to be provisioned with fitting on Main Deck with provision to be connected from shore supply. Pipeline for the internal hydrants and sprinkler system is tapped off from the external hydrant line routed around the building. Design life of the system shall be 20 years. The GLSR will have twin water compartments for firefighting and one potable water compartment. The water will be filled into the firefighting compartments via pumps and the overflow will be connected to the potable water compartment to maintain water circulation. Fire water sprinkler system consisting of Pendent type sprinklers covering certain area of the terminal building such as office areas, security cabin, feeding area, first aid room, restaurant, shops and ticket counters is provided.

Fire extinguishers of ABC type as per IS 14609 are provided at the entry and exit of the building and near restaurant along with exit signages as per IS 9457.

It is proposed to select the fire pump of 2850 l/min. Thus, two pumps, one main pump (common for hydrant and sprinkler) and one common standby pump having capacity of 2850 l/min. In addition to that, one jockey pump of capacity 180 lpm will also be provided. Fire water pump's "inlet / suction pipe size" and "discharge pipe size" is selected as 150mm and 125mm diameter respectively. Main pump shall be AC operated and another pump, as standby shall be diesel engine driven. The water storage twin compartment is internally connected by pipes and isolating valve. Pressure in the fire hydrant pump will be at 4.5 kg/cm² to ensure adequate pressure at all hydrants.

Details of emergency evacuation is further explained in Chapter 7.

Barrier Free Design for Differently-abled

As part of Accessible India Campaign, all designs will be given great emphasis on encouraging the less fortunate members of the society, who, for the reasons of certain physical handicaps are not at par with their counterparts. To create circumstances, environment, and conditions of work, suitable for those who are physically handicapped, certain basic requirements shall have to designed, augmented, or executed in all terminal buildings.

All Barrier free facility designs will be designed in compliance with:

- CPWD Guidelines- Handbook on barrier free and accessibility 2019
- Harmonised Guidelines and Space standards for Barrier Free Environment for Persons with

Disabilities and Elderly Persons, February 2016

- Nation Building Code 2016
- IS 4963-1987 (2020)- Recommendations for Buildings and Facilities for the Physically Handicapped
- Local State and Municipal requirements

The intent is to make buildings and facilities accessible to and usable by all people including those living with disabilities and may include those with inability to walk or difficulty in walking, reliance on walking/ mobility aids, blindness and visual impairments, speech and hearing impairments, limited coordination of motor movements, reaching and manipulation, lack of stamina, difficulty in interpretation and reacting to sensory information and extremities of physical size.

2.5 RIVERBANK PROTECTION

Riverbank at the terminal location is experience moderate erosion as per the technical studies conducted by the Design DPR Consultant. The time history satellite images show shift of riverbank at terminal sites due to bank erosion. Riverbank protection for such location is both technically and economically viable. The riverbank protection activities are being carried out by Brahmaputra Board under a under scheme of Ministry of Development of North Eastern Region (DoNER) for projection of Majuli Island in Assam from flood and erosion of river Brahmaputra. The major components of the scheme include (a) Bank revetment with geo bags filled with earth / sand for a reach length of 27 km in 14 locations (b) RCC porcupine works in 41 locations (c) Construction of a sluice and (d) Construction of a Pilot channel for a length of 3.50 km (Source- <https://pib.gov.in/PressReleaselframePage.aspx?PRID=1514494>). Bank revetment work by placing of Geobags at the upstream and downstream of the terminal location is already been carried by the department. Based on the data collection and desk study by the DPR Consultant, the overall shoreline was found to be stable in the vicinity of the existing terminal where the proposed construction under the Project shall take place. However, river bank protection measures are planned under the project to address the scour and slope protection due to river flow, both approach bund and riverbanks shall be protected by Gabion mattress filled with aggregate. This layer will act as slope protection element for drag and lift caused by river flow. Accordingly, ~ 0.5m thick gabion mattress has been proposed for slope protection. These gabion mattresses shall be filled with suitable aggregate material.

Slope Stability Report by IIT-G along with Gabion Matress design calculation is enclosed as **Annexure- 23**.

2.6 LAND REQUIREMENT AND OWNERSHIP STATUS

The land requirement for the terminal as per DPR is given in **Table 2.2**.

Table 2.2: Land requirement for the four terminals

S. No	Name of Terminal	Land Requirement (sqm)	Ownership
1	Aphalamukh	10,000	Government land

The land related document is enclosed as **Annexure-2**.

2.7 CONSTRUCTION PERIOD

The duration of construction phase is about 12 months for Aphalamukh Terminal.

2.8 COST ESTIMATE

The cost for Aphalamukh terminal is given in **Table-2.3**.

Table 2.3: Cost of the project

S. No	Name of Terminal	Cost (Rs. Cr.)
1	Aphalamukh	25.1

**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	<ul style="list-style-type: none"> • Environmental (Protection) Act, 1986, • Environmental Impact Assessment Notification, 2006 its amendments 	<ul style="list-style-type: none"> • 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.	Applicable GoA notified Majuli as “Majuli Biodiversity Heritage Site”.
4	Notification on Biodiversity Hotspots	The Notification identifies the biodiversity hotspot in the world. Out of the 36 biodiversity hotspots in the world, 4 are in India. These hotspots are: the Himalayas, the	Applicable Under sub-section (1) of section 37 of the Biological diversity Act, 2002 of the Assam Biodiversity Rules, 2010,

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
		Western Ghats, the Indo-Burma region and the Sundaland	the GoA notified Majuli as “Majuli Biodiversity Heritage Site”. Please Refer Notification at Annexure-24
5	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 meet the discharge standards specified in the Rules. The bid documents for civil works contracts shall mention that the contractor would comply with the standards mentioned in these rules.
6	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 machinery and construction activities would comply with the standard specified in the rules. The bid documents for civil works contracts shall mention that the contractor would comply with the standards mentioned in these rules.
7	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

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
			<p>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.</p> <p>Necessary permits to be taken by the contractor for DG set and Batching plant if applicable.</p>
8	Hazardous & Other Wastes Management and Trans boundary Movement) Rules, 2016	Proper handling storage and disposal of hazardous waste.	<p>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</p> <p>During the Operationphase the Vesel Operators will also follow the procedures and comply with the rules</p>
9	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.	<p>Provisions in the bid document be made for disposal of e-waste by contractor.</p> <p>During implementation project proponent will implement the provision of this Act for disposal of e-waste.</p>
10	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.

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
			In operation phase, project proponent will implement the provision of this Act for disposal of Plastic waste.
11	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.
12	Assam Fire Services Rules, 1989	Application for Fire Safety NOC and renewal	The Contractor needs to apply for fire safety NOC during construction of terminal. Similarly, fire NOC during operation of terminal fore NOC need to be taken by AIWCL/DIWT.
13	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
14	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.
15	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 workers are also required to ensure that they do not carry out "unsafe act" or "unsafe practices" which

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
			jeopardise the safety of himself or other workers. The Bid document will carry specific clauses on the planning and implementation of Occupational Health and Safety during implementation.
16	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.
17	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.
18	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
19	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.
20	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	The provisions of this act are bearing on AIWTDS/ contractor etc. For providing the information

S. No.	National/ State Legislation	Description on provisions related to the Project	Relevance to the Project
		authorities, to promote transparency and accountability in the working of every public authority. 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.	to the public on their demand.
21	RFCTLARR ACT,2013	<p>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.</p> <p>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.</p> <p>Independent SIA (Social Impact Assessment) study needs to be conducted</p>	Not Applicable, as the project land is government land.
22	Assam LAAR Rules 2015	<p>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.</p> <p>Similar provisions for SIA (Social Impact Assessment) study also exist in this act.</p>	Not Applicable as the project land is government land
23	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.

• **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)*

• **Legislation Framed for Vessels Playing in Inland Waterways**

There are certain legislations framed for vessels playing in Inland Waterways by IWA and Ministry of Ports, Shipping and Waterways, Govt 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

Name	Key Requirements	Applicability
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 World Bank's Operational Policy 4.01, 4.04 and 4.12 is applicable to the project and accordingly Environment Management Framework, Social Management Framework (SMF), RPF & Gender Development Framework, Environmental Codes of Practice has been prepared and approved by the Bank and disclosed. The gap analysis is included in the SMF, RPF and Gender Development Framework. The ESIA and ESMP has been prepared on the basis of this framework.

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 Aphalamukh shall include construction works in a high bio-diversity area as well as 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 labour influx, health and safety so the project is considered as Category B.

Chapter 4 - STAKEHOLDERS CONSULTATION 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 engaging Stakeholder for the
Category-1- Ferry Operators			
Ferry operators (Government & Private Operators) Association	Livelihood & Service Delivery	Better quality of Service	FGDs
Category -2- Project Impacted Groups			
Squatters/ encroachers on the affected land	Loss of assets/livelihood	Project impacted/ displaced person	SIA
Vulnerable categories Gender Groups Indigenous People	Better access	Vulnerable beneficiary	SIA
Category -3- Community leaders/ Village level officers			
Gaon Panchayat Leaders	Facilitation Support	Opinion leaders	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	Official communication

2Stakeholder	Rationale	Relevance to the project	Strategy engaging Stakeholder for the
		valued as per PWD rates	
Forest Department	Wherever forest land impacted	Land transfer	Official communication
Water Resource Department	Convergent functions	Supportive intervention	Consultations
State Disaster management authority	Convergent functions	Supportive intervention	Consultations
Fisheries Department	To understand whether fishing activities are undertaken near proposed terminal location	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
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.

- **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.

- **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.

- **Focus Group Discussions (FGDs) at Priority Terminals**

Focus Group Discussions (FGDs) with different groups of people were conducted in the month of May'2022 (20.05.2022) to ascertain views of the participants on the proposed project. The Concerns raised in the Focus Group Discussions (FGDs) are presented below:

Table 4.2: Focus Group Discussions (FGDs) Details

Focused Group	Concerns Raised	Response & mitigation Measures
Regular Commuters	<ul style="list-style-type: none"> • Passengers demanded an immediate need for a toilet at ghat especially for the women, children and aged ones. • Offline ticket should also be available apart from online • Students expressed the need for discounted monthly passes • Overcrowding in private ferries may leads to mishaps • Frequent technical and safety check-up of private ferries • Separate corridor for elderly and physically challenged • Signboards and announcement • Electronic Display systems at terminals • Provision of EV chargers for vehicles at terminal 	<ul style="list-style-type: none"> • New structure to have wider approach road and corridor, Construction of new and proper washrooms and drinking water facility are also proposed • Special design to cater the elderly and physically challenged people • Digital display system proposed at terminal sites

Focused Group	Concerns Raised	Response & mitigation Measures
Occasional Commuters (Tourist of all age groups including youth, women, aged persons and children)	<ul style="list-style-type: none"> • Proper signboards displaying the route of the ferry Audio/ visual announcement 	<ul style="list-style-type: none"> • Digital display system proposed at terminal sites
Shopkeepers	<ul style="list-style-type: none"> • Upgradation of proposed terminal facilities will lead to better business and economic activities 	<ul style="list-style-type: none"> • Facilities will also be upgraded
Ferry Operators	<ul style="list-style-type: none"> • Regular 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. • Deployment of additional security personnel at the ghats, to control and check unruly behaviour/ without ticket passengers • Mandatory to wear safety jackets to all before boarding • Creche facilities • Record keeping of commuters before boarding and de-boarding of ferries 	<ul style="list-style-type: none"> • 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:

- **Vessel Operators**

Inland Water Transport Officials (Date: on 21st 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 21st 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
- Deployment of additional security personnel on the boat to look after the passenger's safety and security.

Private ferry Operators

Consultation meeting with Private Operators on 21st May 2022

The vessels operated by private ferry operators often works on odd hours due to frequent changes of ramp position from one place to another especially during arrival and departure of boats. In the year 2021 the operation of private boats was suspended due to a major accident in Neamati ghat on 8th September 2021. The boat collision occurred due to striking of one boat on another boat already parked at berthing.

Concern Raised

- The proposed project will be beneficial as it will attract more tourists.
- Space for ticket counters
- Ticket rates for Government ferries are very low hence they are losing the commuters. Subsidies are requested to keep the ticket rates at par with Government rates.
- Mandatory to wear safety jackets to all before boarding
- Lack of operating space and basic facilities
- Operators spoke about the need of a search and rescue team.
- The private boat operators expressed a need for a siren in the pontoon to alert the passengers about arrival and departure of boats from berths.
- They expressed the need of keeping the records of passengers before boarding and de-boarding, besides need to provide proper covered seating arrangements for the personnel deputed for this work.

4.5.1 Relevant Department Officials on 22nd 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 22nd 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
- Riverbank protection done by Brahmaputra Board with Geobags.

4.5.2 Vendors on 22nd 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. During FGDs it was noticed that the access/approach road to terminal sites few vendors who are earning their livelihood through temporary shops would be affected. However, as per joint survey conducted by Revenue Department and AIWTDS on 9th June 2023, the proposed project is free from encroachment.

4.5.3 Institutional Stakeholders Consultation on 7th May 2022

Stakeholders' consultations were 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** and photographs of FGDs and site condition are given in **Annexure- 5**.

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.

4.5.4 Terminal Location Aphalamukh (Majuli) on February 8, 2023

A stakeholder's consultation to present DPR and draft ESIA study for Neamati and Aphalamukh was organized by AIWTDS at Aphalamukh (Majuli) terminal location on 08.02.2023 under the Chairmanship of Honorary Advisor, AIWTDS and in presence of Additional Deputy Commissioner, Majuli District and other officials of Inland Water transport and AIWTDS, Panchayat, Water Resources, Forest Department, APGCL and local villagers

4.5.5 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
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 jet locations is essential	Provision of signage of appropriate visibility and provision for public address systems to announce the

		operating status of the terminal, ferry timings and safety 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
7	Toilets	Provision of clean, gender segregated, well-lit wheelchair accessible toilets.
8	Safety and carriage capacity	Safety and carriage capacity of passenger livestock & vehicles in emergency situation.
9	EV charging and PA system	Provision for EV charging, PA address system and collaboration with ASDM for operation and management of terminals.

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 10km 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 Aphalamukh 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 November 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 - 5th August to 31st August' 2022
 - Noise - 12th August'2022
- Ecological Aspects
 - Terrestrial Ecology - 11th March'2022
 - Aquatic Ecology - 31st August' 2022
- Socio-economic Aspects
 - Social Aspects - 20-25th May 2022

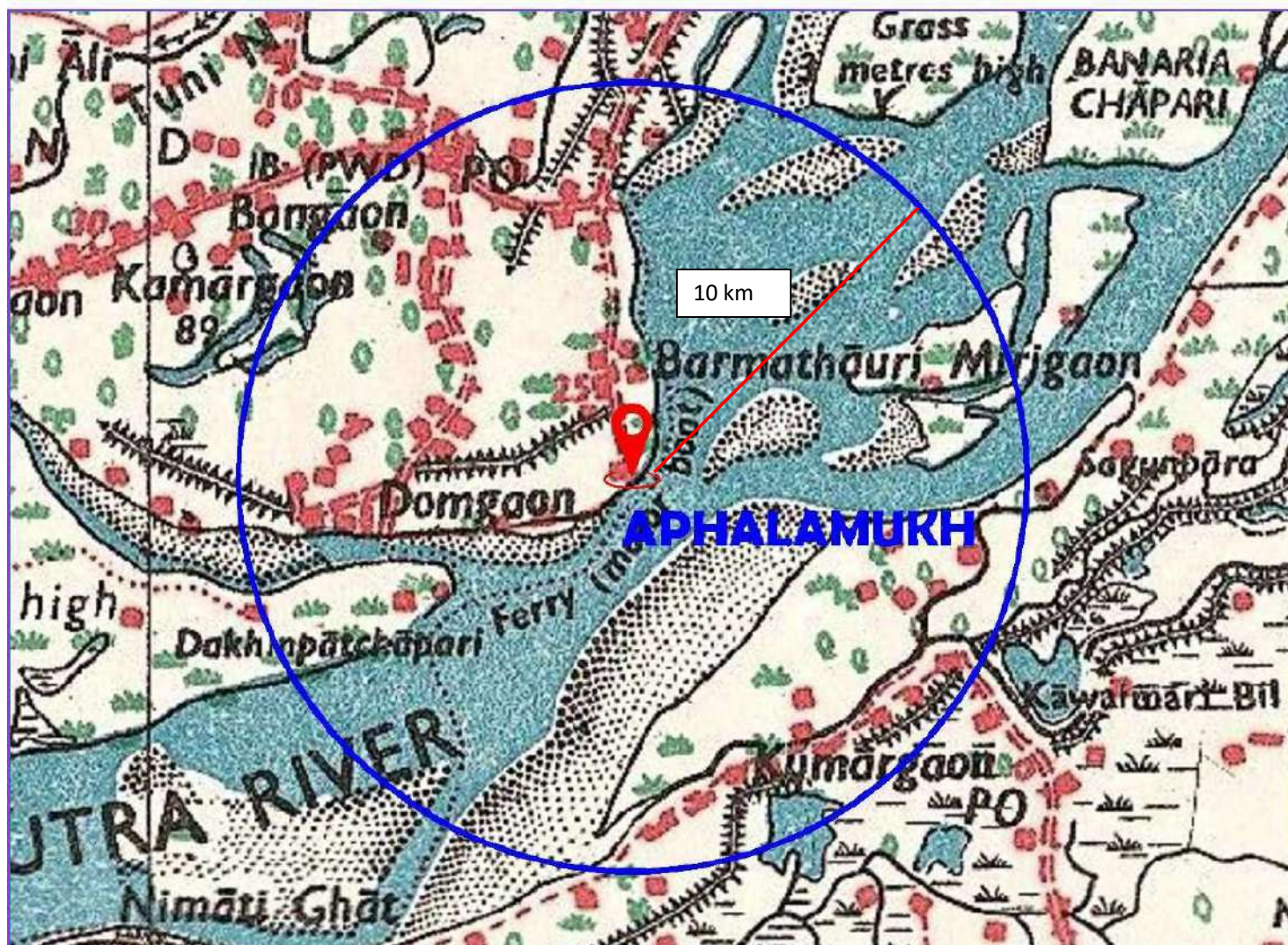


Figure 5.1: Study area map of Aphalamukh terminal

5.3 PHYSICO-CHEMICAL ASPECTS

- Meteorology**

The project area is within sub-tropical humid climatic zone. It is characterised by hot and wet summer and dry and cool winter. The annual rainfall is reported as 2609 mm. The mean monthly temperature ranged from 18.8°C to 28.1°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**

The study area is a part of Majuli district. The recent alluvial soils of recent rivers are light grey to dark grey in colour and are confined to the flood plain area adjacent to the Brahmaputra River and its tributaries. Aphalamukh project site falls into north 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
Soil Unit 3	Medium dense to very dense SAND	10 - 11.2
Soil Unit 1	Firm to stiff silty CLAY	11.2 - 12.5
Soil Unit 3	Medium dense to very dense SAND	12.5 - 50.13

**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	Loose silty SAND	0 - 10
Soil Unit 3	Medium dense to very dense SAND	10 - 80.14

**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 changing land use pattern of Majuli island from 1975 to 2000 is given below in Table 5.3.

Table 5.3: Land use Pattern of Majuli Island

Year	1975		2000		Change Between 1975-2000 (in %)
Land Use Class	Land in Ha	Land in %	Land in Ha	Land in %	
Forest	12749.8	18.37	9587.15	13.82	24.81
Wetland	1533.96	2.21	1382.94	1.99	9.85
Water Body	1400.76	2.02	15959.8	8.59	325.47
Agriculture	12405.20	17.88	15703.80	22.63	26.59
Grassland	11061.70	15.94	895.424	1.29	91.91
Sand	10076.40	14.52	13222.10	19.05	31.22
Fallow Land	13119.10	18.91	14999.7	21.62	14.33
Built-up Area	7044.48	10.15	7640.486	11.01	8.46
Total	6939.40	100.00	69391.40	1000.00	

*Source <https://www.researchgate.net/publication/319635810>

By comparing the areas of various classes above, it is evident that forest, agriculture, and grasslands have declined, and the rest, chief among them water—have increased. This has strained both the ecology and economy of the island. Overall, the 325 percent increase in water and nearly 31 percent increase in sands have come at the cost of 119 villages (107 cadastral, and 12 noncadastral) that have been lost either partially or wholly.

In Majuli island there are number of Beels (lake-like wetland with static water), out of which 9 are registered beels spread in 379Ha of land and many unregistered beels spread in 640Ha of land (Source- <https://majuli.assam.gov.in/departments/fishery>). Typically, beels are formed by inundation of low-lying lands during flooding, where some water gets trapped even after flood waters recede back from the flood plains. Beels may also be caused by filling up of low-lying areas during rains, especially during the monsoon season. Beels are one of the prime reasons for making Majuli biodiversity hotspot. Beels are more close to the existing Kamalabari ghat. Nearest Beel from the existing Aphalamukh Ghat is Ga-khajua beel which is 2.7 km from the proposed terminal location.

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 Aphalamukh terminal are given in **Table-5.4** and **Figure-5.2**.

Table 5.4: Land use Pattern of Aphalamukh Terminal

S. No	Category	Area (m ²)	Percentage (%)
1.	Waterbodies	427230.37	54.37%
2.	vegetation	29098.06	3.70%
3.	Open Land	33445.67	4.26%
4.	Built Area	48994.29	6.23%
5.	Crop Area	247031.03	31.44%

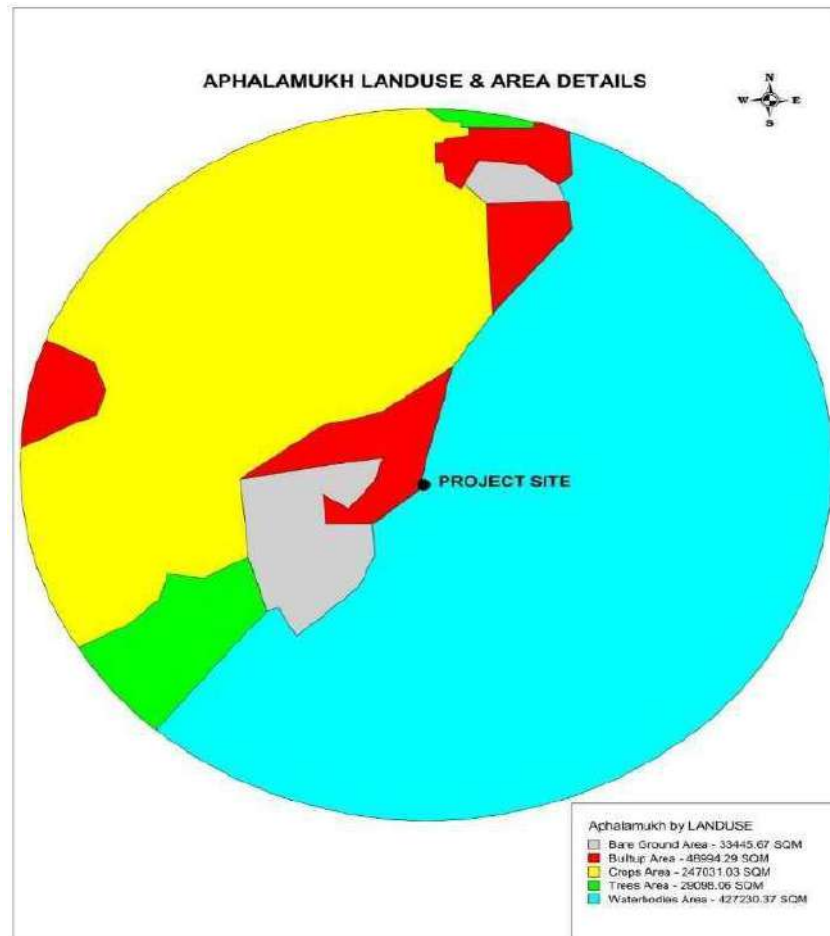


Figure 5.2: Land use pattern of Aphalamukh Ghat

• 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 Aphalamukh Terminal are listed in **Table-5.5**. The sampling location map is enclosed as **Figures-5.3**.

Table 5.5: Details of Soil Sampling Locations

Sampling Code	Location	Coordinates
SAG1	Aphalamukh (100 m u/s of terminal)	26°54'57.30"N 94°17'54.90"E
SAG2	Aphalamukh (150 m d/s of terminal)	26°54'49.97"N 94°17'51.03"E

The analysis of soil sampling was conducted as per IS 2720 and results are given in **Table 5.6**. Laboratory monitoring reports for soil testing are enclosed as Annexure 6. The pH was in the range of 7.80 to 8.24 which indicates that neutral range having slight alkalinity. The EC values are ranging between 493 to 501 $\mu\text{S}/\text{cm}$. The soil type of the area is sandy clay loam.

Table 5.6: Results of soil sampling analysis of study area for Aphalamukh terminal

S. No	Parameters	SAG1	SAG2
1.	pH (1:5 suspension)	8.24	7.80
2.	Electrical Conductivity @ 25°C (1:1 suspension)	501	493
3.	Calcium (As Ca)	2007	1993
4.	Magnesium (As Mg)	372	406
5.	Sodium (as Na)	241	178
6.	Available Potassium (as K)	309	385
7.	Salinity @ 25°C (1:1 suspension)	281	268
8.	Organic Matter	0.91	1.15
9.	Sodium Absorption Ratio	0.49	0.49
10.	Nitrogen	0.11	0.099
11.	Available Phosphorus (As P_2O_5)	155	169
12.	Bulk Density	1.25	1.21
13.	Organic Carbon	0.53	0.67
14.	Particle Size Distribution		
	a. Sand	61.4	58.4
	b. Clay	22.6	20.3
	c. Silt	16.0	21.3
15.	Exchangeable Sodium Percentage	4.78	4.85



Figure 5.3: Soil sampling Location map of Aphalamukh Terminal

- **Water Quality**

The proposed terminal is located on the bank of river Brahmaputra. The dense networks of the numerous wetlands, marshes, swamps and streams of the Brahmaputra and its tributaries drain the entire Sub-Division. Moreover, Tuni, the only river of Majuli and other Channels such as Marituni, Sukansuti, Kharjan, Kaniajan, Bojkajan, Dighalijan, etc. also contribute in the drainage system of the island.

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 physico-chemical parameters. Details of sampling locations are listed in **Table-5.7**. The sampling location map is enclosed as **Figures-5.4**.

Table 5.7: Details of Water Sampling Locations

Sampling Code	Location	Co-ordinates
WAG1	Aphalamukh (375 m d/s of terminal)	26°54'44.70"N 94°17'47.76"E
WAG2	Aphalamukh (450 m d/s of terminal)	26°55'5.79"N 94°18'2.24"E
WAG3	Aphalamukh (near terminal site)	26°54'53.90"N 94°17'55.87"E

The analysis of water samples was conducted as per IS:3025 and results of the analysis are given in **Table-5.8**. Laboratory monitoring reports for water quality are enclosed as **Annexure-7**. The results of water quality monitoring have been compared with Class C standard of River water quality standards (**Annexure- 8**).

The Electrical Conductivity (EC) in water samples ranged from 226 to 238 μ S/cm and total hardness ranged from 62.0 to 70.0 mg/l. Dissolved oxygen values ranges from 6.3 to 6.5 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 Aphalamukh Terminal

Table 5.8: Water quality in the study area for Aphalamukh Terminal

S. No	Parameters	Unit	Permissible Limit (As per IS:2296)	WAG1	WAG2	WAG3
1.	pH	6.5-8.5	6.97	6.90	6.94
2.	Colour	Hazen	300	<5.0	<5.0	<5.0
3.	Electricity Conductivity	µs/cm	--	226	228	238
4.	Turbidity	NTU	--	<1.0	<1.0	<1.0
5.	Total Hardness (As CaCO ₃)	mg/l	--	62.0	64.0	70.0
6.	Fluoride (as F)	mg/l	1.5	<0.10	<0.10	<0.10
7.	Dissolve Oxygen	mg/l	4	6.5	6.4	6.3
8.	Chloride (as Cl)	mg/l	600	76.0	78.0	79.0
9.	Calcium (as Ca)	mg/l	--	12.5	13.0	16.0
10.	BOD (3 days at 27°C)	mg/l	3	<2.0	<2.0	<2.0
11.	Nitrate (as NO ₃)	mg/l	50	5.0	5.5	6.0
12.	Total Dissolved Solid	mg/l	1500	148	150	158
13.	Sulphate (As SO ₄)	mg/l	400	9.0	10.0	11.5
14.	Magnesium as Mg)	mg/l	--	7.5	7.7	7.3
15.	Phosphate (as P)	mg/l	--	<0.05	<0.05	<0.05
16.	Sodium (as Na)	mg/l	--	3.5	4.0	4.5
17.	Potassium (as K)	mg/l	--	<1.0	<1.0	<1.0
18.	COD (as O ₂)	mg/l	--	4.0	6.0	8.0
19.	Residual Sodium Carbonate	mg/l	--	Nil	Nil	Nil
20.	Total Chromium (as Cr)	mg/l	0.05	<0.05	<0.05	<0.05
21.	Iron (as Fe)	mg/l	0.5	0.12	0.13	0.14
22.	Manganese (As Mn)	mg/l	--	<0.10	<0.10	<0.10
23.	Copper (As Cu)	mg/l	1.5	<0.05	<0.05	<0.05
24.	Zinc (as Zn)	mg/l	15	0.08	0.11	0.16
25.	Arsenic (as As)	mg/l	0.2	<0.01	<0.01	<0.01
26.	Cadmium (as Cd)	mg/l	0.1	<0.01	<0.01	<0.01
27.	Cyanide (As CN)	mg/l	0.05	<0.01	<0.01	<0.01
28.	Lead (As Pb)	mg/l	0.1	<0.01	<0.01	<0.01
29.	Selenium (as Se)	mg/l	0.05	<0.01	<0.01	<0.01
30.	Mercury (Hg)	mg/l	--	<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 the proposed 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-5.9**.

Table 5.9: Ambient Air Quality Monitoring Stations

Sampling Code	Location	Coordinates
AAQ-A1	Aphalamukh	26°55'5.05"N 94°17'19.91"E
AAQ-A2	Aphalamukh	26°55'21.97"N 94°17'33.14"E
AAQ-A3	Aphalamukh	26°54'57.24"N 94°17'43.02"E

Ambient Air Quality monitoring results are given in **Tables- 5.10 to 5.13**. Laboratory monitoring reports for air quality are enclosed as **Annexure- 9**.



Figure 5.5: Air sampling Location map of Aphalamukh Terminal

Table 5.10: Ambient air quality monitoring at Aphalamukh Terminal (AAQ-N1)

S.N.	Date	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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	05.08.2022	56.1	35.1	6.4	17.8	0.46	22.8	11.4	<0.01	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	60.3	33.5	6.9	20.3	0.54	21.9	10.9	<0.01	<5.0	<1.0	<4.2	<0.5
3	12.08.2022	50.7	29.8	<6.0	16.4	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	52.1	27.4	<6.0	16.9	0.40	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	63.7	31.9	7.2	22.5	0.74	23.5	11.7	0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	59.2	34.8	7.0	19.6	0.66	20.7	10.3	<0.01	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	55.0	26.2	<6.0	16.4	0.46	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	63.5	35.3	<6.0	16.9	0.72	<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 Aphalamukh Terminal (AAQ-N2)

S.N.	Date	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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	05.08.2022	51.3	32.1	6.5	19.6	0.44	22.5	11.3	<0.01	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	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	12.08.2022	46.1	27.1	<6.0	15.8	0.42	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	51.9	27.3	6.2	17.4	0.48	21.3	10.6	<0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	55.0	27.5	6.8	20.8	0.46	23.9	12.0	<0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	53.1	31.2	<6.0	16.7	0.54	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	47.8	22.8	<6.0	15.6	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	45.6	25.3	<6.0	15.3	0.30	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5

*Source: Primary survey

Table 5.12: Ambient air quality monitoring at Aphalamukh terminal (AAQ-N3)

S.N	Date	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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	05.08.2022	73.1	45.7	7.5	23.1	0.76	25.1	12.5	0.02	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	68.9	38.3	6.9	20.3	0.64	22.3	11.2	0.01	<5.0	<1.0	<4.2	<0.5
3	12.08.2022	74.6	43.9	7.7	24.7	0.82	26.4	13.2	0.02	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	68.3	35.9	<6.0	18.1	0.66	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	66.1	33.1	<6.0	16.9	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	75.3	44.3	7.9	22.3	0.54	24.1	12.0	0.02	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	67.2	32.0	<6.0	18.7	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	71.4	39.7	7.3	15.9	0.56	22.7	11.3	0.01	<5.0	<1.0	<4.2	<0.5

**Source: Primary survey*

Table 5.13: Summary of ambient air quality monitoring for Aphalamukh Terminal
(Unit: $\mu\text{g}/\text{m}^3$)

Station	Minimum	Maximum	Average	98 percentile
Particulate Matter less than 10 micron (PM_{10})				
AAQ-A1	50.7	63.7	57.6	63.7
AAQ-A2	45.6	55.0	49.9	54.7
AAQ-A3	66.1	75.3	70.6	75.2
Particulate Matter less than 2.5 micron ($\text{PM}_{2.5}$)				
AAQ-A1	26.2	35.3	31.7	35.2
AAQ-A2	22.8	32.1	27.5	31.9
AAQ-A3	32.0	45.7	39.1	45.5
Sulphur dioxide (SO_2)				
AAQ-A1	6.4	7.2	6.9	7.2
AAQ-A2	6.2	6.8	6.5	6.8
AAQ-A3	6.9	7.9	7.5	7.9
Nitrogen dioxide (NO_2)				
AAQ-A1	16.4	22.5	18.4	22.2
AAQ-A2	15.1	20.8	17.0	20.6
AAQ-A3	15.9	24.7	20.0	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	0.7	0.8
Ozone (O_3)				
AAQ-A1	20.7	23.5	22.2	23.5
AAQ-A2	21.3	23.9	22.6	23.8
AAQ-A3	22.3	26.4	24.1	26.3
NH_3				
AAQ-A1	10.3	11.7	11.1	11.7
AAQ-A2	10.6	12.0	11.3	12.0
AAQ-A3	11.2	13.2	12.0	13.1
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

Station	Minimum	Maximum	Average	98 percentile
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
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 5.13** that average concentration of PM₁₀ at various monitoring stations ranged from 49.9 to 70.6 µg/m³. The highest PM₁₀ value was recorded as 75.3 µg/m³. The PM₁₀ values monitored during the field survey were well below the permissible limit of 100 µg/m³ for industrial, residential, rural and other areas.

The average concentration of PM_{2.5} at various monitoring stations monitored ranged from 27.5 to 39.1 µg/m³. The highest PM_{2.5} value was recorded as 45.7 µg/m³. The PM_{2.5} values monitored during the field survey were well below permissible limit of 60 µg/m³ for industrial, residential, rural and other areas.

The average concentration of SO₂ at various stations monitored ranged from 6.75 to 7.5 µg/m³. The highest SO₂ value was recorded as 7.9 µg/m³. The average concentration of SO₂ at various stations in the study area was well below the prescribed limits of 80 µg/m³ specified for industrial, residential, rural and other areas.

The average NO₂ concentration at various sampling stations ranged from 17.0 to 20.0 µg/m³. The average concentration of NO₂ at various stations in the study area was observed to be well below the prescribed limit of 80 µg/m³ specified for industrial, residential, rural and other areas.

The average concentration of Ozone (O₃), Ammonia (NH₃), Lead, Nickel, Arsenic, Benzene, Benzo(a) pyrene are well below the prescribed limits specified for industrial, residential, rural and other areas.

Baseline ambient air quality is found to be within the standard.

• **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 daytime equivalent noise levels estimated for terminals are given in **Table 5.14**. The daytime and night time equivalent noise level at various sampling stations is given in **Table 5.15**. 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 45.75 to 46.14 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. Baseline ambient noise level is found to be within the standards.



Figure 5.6: Noise sampling Location map of Aphalamukh Terminal

Table 5.14: Hourly equivalent noise levels - Aphalamukh Terminal (Unit: dB(A))

Location	N-A1	N-A2	N-A3
6-7 AM	42	42	41
7-8 AM	43	44	43
8-9 AM	43	44	44
9-10 AM	44	45	44
10-11 AM	45	45	46
11-12 Noon	46	46	46
12 noon - 1 PM	46	47	47
1-2 PM	47	47	46
2-3 PM	48	48	47
3-4 PM	49	48	48
4-5 PM	48	49	49
5-6 PM	46	46	47
6-7 PM	45	45	47
7-8 PM	44	45	46
8-9 PM	43	43	45

**Source: Primary survey*

Table 5.15: Day and night-time equivalent noise levels – Aphalamukh Terminal

S. No.	Location	Co-ordinates	Zone	L _{eq} day (dB(A))	L _{eq} night (dB(A))	Permissible Limit
1.	N-A1	26°55'5.05"N 94°17'19.91"E	Residential	45.75	55	1.
2.	N-A2	26°55'21.97"N 94°17'33.14"E	Residential	46.01	55	2.
3.	N-A3	26°54'57.24"N 94°17'43.02"E	Commercial	46.14	65	3.

5.4 TERRESTRIAL ECOLOGICAL ASPECTS

The Government of Assam notified Majuli as “Majuli Biodiversity Heritage Site” vide notification dated 29th March, 2017. Majuli with its fertile floodplains and highly productive wetlands forms rich habitat for a variety of birds including rare migratory and uncommon birds and faunal species.

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, proposed AIWTP Terminal locations. The objective of the ecological survey was 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

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- 5.16**.

Table 5.16: Number and size of quadrats laid at different sites at Aphalamukh Terminal

Site	Vegetation components	Number of quadrats laid	Size of quadrat
Aphalamukh Terminal (Aphalamukh and adjoining areas)	Tree	25	10m x 10m
	Shrub	25	5m x 5m
	Herb	25	1m x 1m

During the survey, each individual within the quadrat was identified up to the species level, and the number of individuals of each species in each quadrat was counted. The GBH of all trees having girth of more than 16 cm (equivalent to 5 cm DBH) was measured. Based on the quadrat data, frequency, density and cover (basal area) for each species were calculated.

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.

Results

Floristic composition

During the floristic survey, a total of 104 plant species were recorded from Aphalamukh site. Of these, Herbs (31), Tree (31), Shrubs (24), Climbers (3), Bamboo (2) and Grass (16) species recorded, shown in **Figure-5.7**.

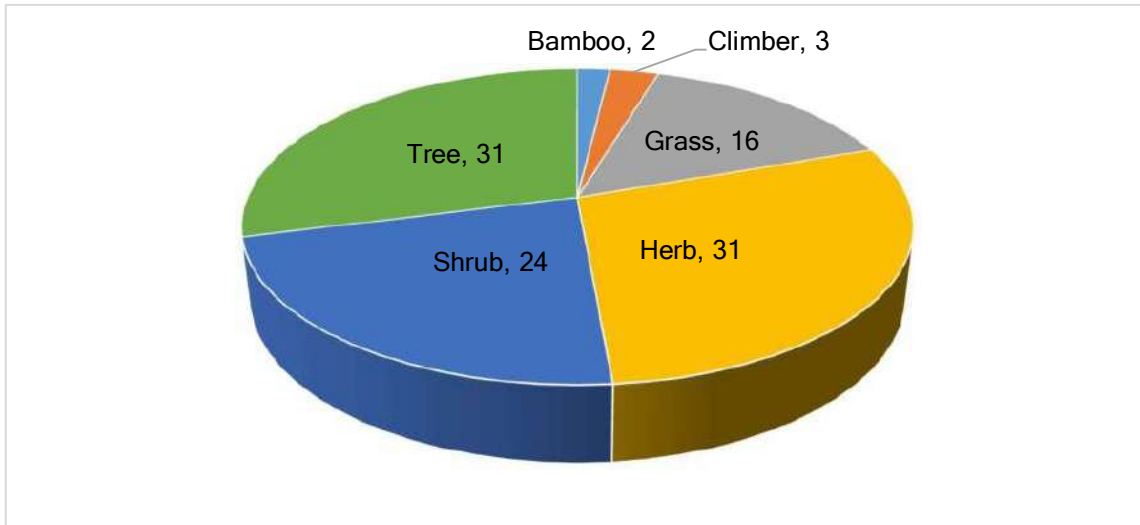


Figure 5.7: Graphical analysis of total number of tree, shrub, herb, bamboo, grass, and climber were recorded from Aphalamukh site

Plant List

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

Total of 107, plant species were recorded, dicot (85) and monocotyledon (22), belonging to 49 families were recorded in the Aphalamukh site (**Figure-5.8**). The most dominant families recorded in the site were- Poaceae (14), followed by Asteraceae (9), Fabaceae (7), Cyperaceae, Malvacea, Moraceae, Myrtaceae & Verbenaceae (4).

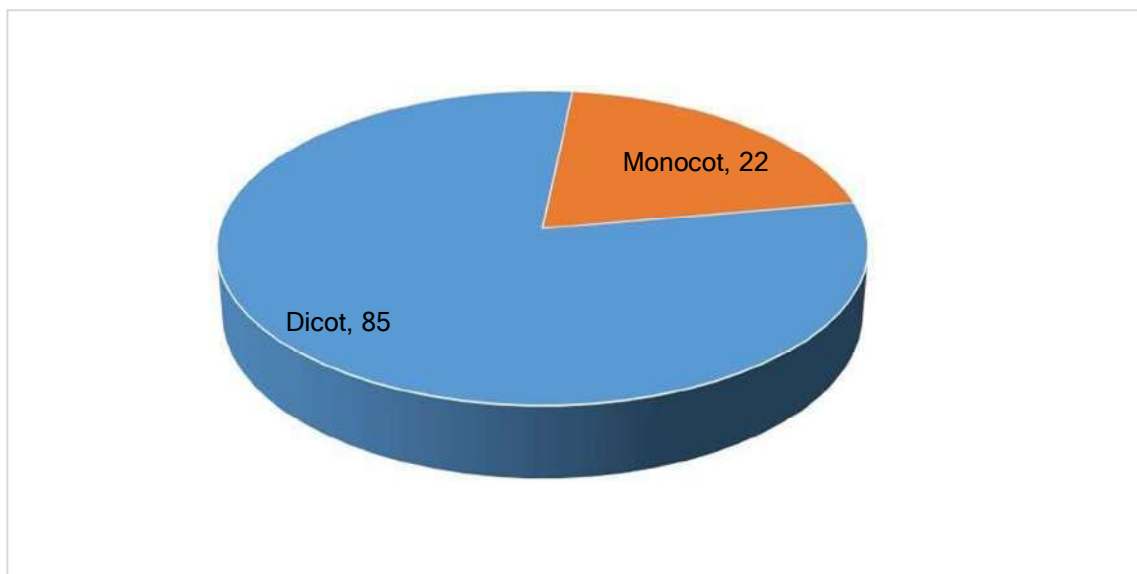


Figure 5.8: Graphical analysis number of Dicot and Monocot species was recorded from Aphlamukh site.

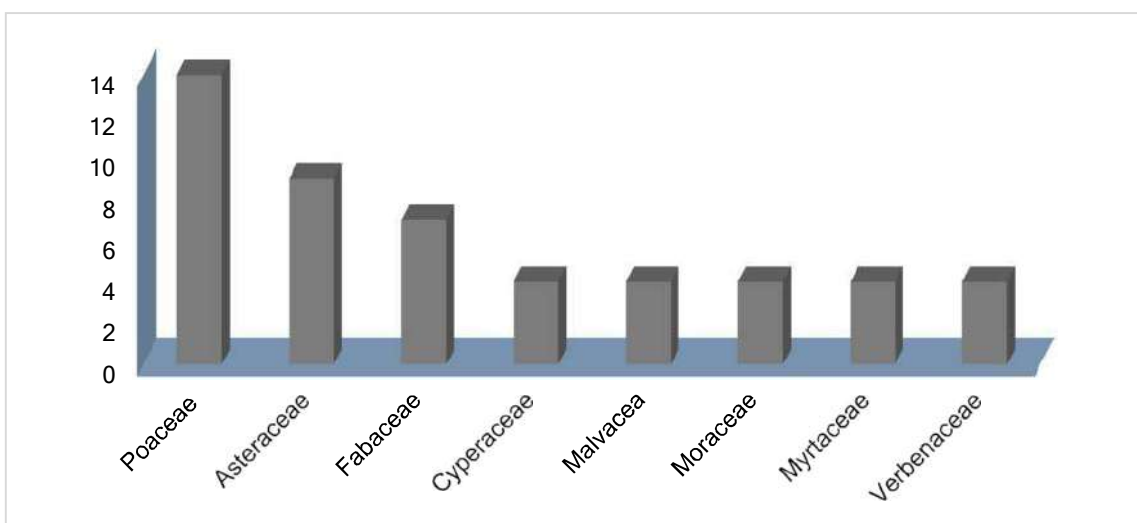


Figure 5.9: Graphical analysis of dominant family recorded from Aphlamukh site

Economically important plant species

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

Table 5.17: Economically important plant species recorded from Aphlamukh site

Botanical name	Local name	Purpose of Use
<i>Acacia nilotica</i> (L.) Delile	Babool	Fuel wood
<i>Albizia saman</i> (Jacq.) Merr.	Rain tree	Fuel wood/Construction
<i>Alstonia scholaris</i> (L.) R. Br.	Devil's tree	Ornamental
<i>Areca Catechu</i> L.	Tamul	Fruit edible
<i>Artocarpus heterophyllus</i> Lam.	Kothal	Fruit edible
<i>Bambusa arundinacea</i> (Retz.) Willd.	Bara bans	Construction
<i>Bambusa tulda</i> Roxb.	Jati	Construction
<i>Bombax ceiba</i> L.	Semal	Ornamental
<i>Callistemon lanceolatus</i> (Sm.) Sweet	Bottlebrush	Ornamental
<i>Carica papaya</i> L.	Papaya	Fruit edible
<i>Cocos nucifera</i> L.	Coconut	Fruit edible
<i>Corymbia citriodora</i> (Hook.) K.D.Hill & L.A.S.Johnson	Safada	Construction/fuel wood
<i>Cyperus rotundus</i> L.	Coco-grass	Fodder
<i>Dalbergia sissoo</i> DC.	Sheesam	Timber/fuel wood
<i>Delonix regia</i> (Hook.) Raf.	Gulmohar	Timber/fuel wood
<i>Dendrocalamus strictus</i> (Roxb.) Nees	Bijuli	Construction
<i>Digitaria ciliaris</i> (Retz.) Koeler	Crabgrass	Fodder
<i>Ficus religiosa</i> L.	Peepal	Religious
<i>Fimbristylis dichotoma</i> (L.) Vahl	Fringe-rush	Fodder
<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	Kher/Sauri	Fodder
<i>Ipomoea carnea</i> Jacq.	Besharam	Fuel wood
<i>Mangifera indica</i> L.	Aam	Fruit edible/fuel wood
<i>Moringa oleifera</i> Lam.	Sahjan	Fruit edible
<i>Musa × paradisiaca</i> L.	Kala	Fruit edible
<i>Phyllanthus emblica</i> L.	Amla	Fruit edible
<i>Pongamia pinnata</i> (L.) Pierre	Karanja	Ornamental
<i>Psidium guajava</i> L.	Amrud	Fruit edible
<i>Saraca asoca</i> (Roxb.) Willd.	Ashok	Ornamental
<i>Shorea robusta</i> Gaertn.	Sal	Timber

***Source:** Primary 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- 5.18**.

Table 5.18: Medicinal Plant species recorded from Aphlamukh site

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

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

Agricultural and Horticulture Crops

Agriculture is the chief occupation in the Aphalamukh site. 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*), and Bamboo species grown in the Aphalamukh site.

Migratory birds

Majuli is a hotspot for flora and fauna, harbouring many rare and endangered avifauna species including migratory birds that arrive in the winter season. It is one of the three identified areas in Assam which is a part of the Central Asian Flyway. Centre has recently launched National Action Plan for Conservation of Migratory birds along the Central Asian Flyway. Tourists from different parts of the country and abroad visit the prominent bird watching sites of Majuli with the help of country boats from the IWT Kamalabari ghat. Migratory birds are regular visitors to the chaporis or islets and beels which are near Kamalabari ghat, 20-25 kms from the proposed Aphalamukh Terminal location.

Majuli is famous for its Waterfowl, both resident and migrant. The Lesser Whistling Duck (*Dendrocygna javanica*) along with Northern Pintail (*Anas acuta*), Northern Shoveller (*Anas clypeata*), Gadwall (*Anas strepera*), Garganey (*Anas querquedula*). The Falcated Teal (*Anas falcata*) with other ducks such as the Brahminy Duck (*Tadorna ferruginea*) is common in winter, along with the Bar-headed (*Anser indicus*) and the Greylag geese (*Anas anser*). Swamp Francolin (*Francolinus gularis*) is also found in the grassland.

Quantitative Analysis of Aphlamukh site

Riparian Habitat of Brahmaputra at Aphalamukh

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 function, 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 Aphalamukh terminal are given in following table 5.19.

Table 5.19: Riparian plant species in the project area of Aphalamukh terminal

Scientific name	Family
<i>Ageratum conyzoides</i>	Asteraceae
<i>Arundo donax</i>	Poaceae
<i>Convolvulus arvensis</i>	Convolvulaceae
<i>Cynodon dactylon</i>	Poaceae
<i>Cyperus brevifolius</i>	Cyperaceae
<i>Eclipta prostrate</i>	Asteraceae
<i>Ipomoea aquatica</i>	Convolvulaceae
<i>Ipomoea carnea</i>	Convolvulaceae
<i>Marsilea minuta</i>	Marseliaceae
<i>Parthenium hysterophorus</i>	Asteraceae
<i>Persicaria maculosa</i>	Polygonaceae
<i>Phragmites karka</i>	Graminae
<i>Ranunculus sceleratus</i>	Ranunculaceae
<i>Rumex maritimus</i>	Polygonaceae
<i>Saccharum spontaneum</i>	Poaceae
<i>Salvinia natans</i>	Salviniaceae
<i>Senecio viscosus</i>	Asteraceae
<i>Solanum surattense</i>	Solanaceae
<i>Stellaria media</i>	Caryophyllaceae
<i>Tamarix canariensis</i>	Tamaricaceae
<i>Typha domingensis</i>	Typhaceae
<i>Xanthium strumarium</i>	Asteraceae

Tree

A total of 15 tree species (≥ 5 cm dbh or ≥ 16 cm GBH) were recorded from Aphalamukh site, during the field study. The density of tree species recorded was 220 individuals (ha^{-1}). In terms of density, *Bombax ceiba* were the dominant tree (22 individual's ha^{-1}) followed by *Azadirachta indica*, *Hibiscus elatus*, *indica* and *Shorea robusta* (18 individual's ha^{-1}). The total basal area of tree recorded were $23.08 \text{ m}^2 \text{ ha}^{-1}$ from site-9. In terms of basal area *Bombax ceiba* has maximum basal area as compared to other tree. In terms of importance value index (IVI), *Bombax ceiba* was the dominant tree (IVI= 34.51) followed by *Tectona grandis* (IVI= 24.13) in **Table-5.20**.

Table 5.20: Frequency, density, basal area, abundance, IVI and volume

Botanical Name	Frequency (%)	Density (Individual ha ⁻¹)	Basal Area (m ² ha ⁻¹)	IVI	Volume (m ³)	Abundance
<i>Azadirachta indica</i> A.Juss.	28	18	7.74	23.56	0.62	1.29
<i>Bombax ceiba</i> L.	32	22	17.38	34.51	1.91	1.38
<i>Cassia fistula</i> L.	16	10	4.9	13.72	0.34	1.25
<i>Aegle marmelos</i> (L.) Corrêa	8	6	1.92	6.88	0.10	1.50
<i>Hibiscus elatus</i> Sw.	24	18	10.62	24.60	0.85	1.50
<i>Mangifera indica</i> L.	20	16	12.64	24.04	1.14	1.60
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	16	14	12.46	21.68	1.25	1.75
<i>Phytolacca dioica</i> L.	12	10	4.1	11.77	0.29	1.67
<i>Psidium guajava</i> L.	20	14	4.9	16.84	0.29	1.40
<i>Artocarpus heterophyllus</i> Lam.	20	16	12.48	23.91	0.87	1.60
<i>Artocarpus chama</i> Buch.- Ham.	16	12	5.04	14.74	0.30	1.50
<i>Shorea robusta</i> Gaertn.	20	18	10.44	23.16	0.84	1.80
<i>Syzygium fruticosum</i> DC.	24	14	4.48	17.80	0.27	1.17
<i>Tamarindus indica</i> L.	20	14	7.14	18.66	0.50	1.40
<i>Tectona grandis</i> L.f.	32	18	6.84	24.13	0.41	1.13
Total	308	220	123.08	300.00	9.97	21.92

*Source: Primary field survey

Shrub

A total of 21 shrub species were recorded from Aphalamukh site, during the field study. The density of shrub species recorded was 548 individuals (ha⁻¹). In terms of density, *Tamarix canariensis* were the dominant shrub species (56 individual's ha⁻¹) followed by *Lantana camara* (44 individual's ha⁻¹). In terms of importance value index (IVI), *Tamarix canariensis* was the dominant shrub species (IVI= 19.60) followed by *Lantana camara* (IVI= 13.65) in **Table-5.21**.

Table 5.21: Frequency, density IVI and abundance

Botanical name	Frequency (%)	Density (Individual ha ⁻¹)	IVI	Abundance
<i>Bambusa arundinacea</i> (Retz.) Willd.	8	8	3.71	1
<i>Dioscorea bulbifera</i> L.	8	12	4.44	1.5
<i>Parthenium hysterophorus</i> L.	28	28	12.97	1.00

Botanical name	Frequency (%)	Density (Individual ha ⁻¹)	IVI	Abundance
<i>Houttuynia cordata</i> Thunb.	16	20	8.14	1.25
<i>Ipomoea indica</i> (Burm.) Merr.	12	20	7.02	1.67
<i>Boerhaavia diffusa</i> L.	20	28	10.73	1.4
<i>Bougainvillea spectabilis</i> Willd.	20	32	11.46	1.6
<i>Tamarix canariensis</i> Willd.	36	52	19.60	1.44
<i>Calotropis gigantea</i> (L.) Dryand.	12	16	6.29	1.33
<i>Cannabis sativa</i> L.	12	20	7.02	1.67
<i>Carica papaya</i> L.	20	28	10.73	1.40
<i>Cascabela thevetia</i> (L.) Lippold	16	28	9.60	1.75
<i>Clerodendrum glandulosum</i> Lindl.	12	20	7.02	1.67
<i>Datura metel</i> L.	24	36	13.31	1.5
<i>Hibiscus rosa-sinensis</i> L.	16	20	8.14	1.25
<i>Ipomoea carnea</i> Jacq.	12	28	8.48	2.33
<i>Isodon ternifolius</i> (D.Don) Kudô	20	36	12.19	1.8
<i>Jasminum nervosum</i> Lour.	16	28	9.60	1.75
<i>Lantana camara</i> L.	20	44	13.65	2.2
<i>Plumeria rubra</i> L.	8	8	3.71	1
<i>Ricinus communis</i> L.	20	36	12.19	1.8
Total	356	548	200.00	32.31

*Source: Primary field survey

Herb

A total of 37 herb species were recorded from Aphalamukh site, during the field study. The density of herb species recorded was 88000 individuals (ha⁻¹). In terms of density, *Rumex patientia* were the dominant herb species (5600 individual's ha⁻¹) followed by *Cynodon dactylon* (4400 individual's ha⁻¹). In terms of importance value index (IVI), *Rumex patientia* was the dominant herb species (IVI= 11.69) followed by *Cynodon dactylon* (IVI= 9.14) in **Table-5.22**.

Table 5.22: Frequency, density IVI and abundance

Botanical name	Frequency (%)	Density (Individual ha ⁻¹)	IVI	Abundance
<i>Achyranthes aspera</i> L.	16	2800	5.55	1.75
<i>Argemone mexicana</i> L.	20	2000	5.23	1
<i>Cymbopogon martini</i> (Roxb.) W.Watson	16	2000	4.64	1.25
<i>Cynodon dactylon</i> (L.) Pers.	28	4400	9.14	1.57

Botanical name	Frequency (%)	Density (Individual ha ⁻¹)	IVI	Abundance
<i>Cyperus cyperoides</i> (L.) Kuntze	20	2800	6.14	1.4
<i>Digitaria sanguinalis</i> (L.) Scop.	12	1600	3.59	1.33
<i>Eragrostis amabilis</i> (L.) Wight & Arn.	20	2800	6.14	1.4
<i>Fimbristylis dichotoma</i> (L.) Vahl	16	2000	4.64	1.25
<i>Panicum paludosum</i> Roxb.	12	1600	3.59	1.33
<i>Poa annua</i> L.	20	2800	6.14	1.4
<i>Saccharum bengalense</i> Retz.	12	1600	3.59	1.33
<i>Setaria verticillata</i> (L.) P.Beauv.	12	1200	3.14	1
<i>Athyrium drepanopterum</i> (Kunze) A. Braun ex Milde	24	2400	6.28	1
<i>Senecio viscosus</i> L.	20	2800	6.14	1.4
<i>Allantodia aspera</i> (Blume) Ching	16	2000	4.64	1.25
<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	20	2800	6.14	1.4
<i>Amaranthus spinosus</i> L.	20	3200	6.59	1.6
<i>Cyanthillium cinereum</i> (L.) H.Rob.	16	1600	4.19	1
<i>Desmodium triflorum</i> (L.) DC.	20	2400	5.69	1.2
<i>Diplazium esculentum</i> (Retz.) Sw.	12	1600	3.59	1.33
<i>Eclipta prostrata</i> (L.) L.	16	2000	4.64	1.25
<i>Euphorbia hirta</i> L.	20	2800	6.14	1.4
<i>Glinus lotoides</i> L.	12	1600	3.59	1.33
<i>Lasia spinosa</i> (L.) Thwaites	28	2800	7.32	1
<i>Leucas aspera</i> (Willd.) Link	20	2400	5.69	1.2
<i>Melilotus indicus</i> (L.) All.	12	1200	3.14	1
<i>Mikania micrantha</i> Kunth	20	2800	6.14	1.4
<i>Mimosa pudica</i> L.	16	1600	4.19	1
<i>Angiopteris evecta</i> (G. Forst.) Hoffm	16	2000	4.64	1.25
<i>Oxalis corniculata</i> L.	8	1200	2.55	1.5
<i>Plantago major</i> L.	20	2400	5.69	1.2
<i>Portulaca oleracea</i> L.	16	2400	5.09	1.5
<i>Ranunculus sceleratus</i> L.	24	2800	6.73	1.17

Botanical name	Frequency (%)	Density (Individual ha ⁻¹)	IVI	Abundance
<i>Adiantum proliferum</i> Roxb.	20	2800	6.14	1.4
<i>Rumex patientia</i> L.	36	5600	11.69	1.56
<i>Stellaria media</i> (L.) Vill.	20	2800	6.14	1.4
<i>Tridax procumbens</i> (L.) L.	20	2400	5.69	1.2
Total	676	88000	200.00	47.96

*Source: Primary field survey

5.4.1 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 Wiener 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 Wiener index (H) more than 2 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 5.23**.

Shannon index of general diversity (H) index for tree, shrub and herb of Aphalamukh Terminal is given in **Table-5.23**.

Table 5.23: Shannon-Wiener Diversity Index

Project Sampling Site	Shannon-Wiener Diversity Index (H)		
	Tree	Shrub	Herb
Aphalamukh terminal	2.67	2.955	3.551

Value of Shannon Wiener index (H) as seen from the **Table- 5.23** 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. 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- 5.24**.

Table 5.24: Dominance Diversity Index

Project Sampling Site	Dominance Diversity Index		
	Tree	Shrub	Herb
Aphalamukh terminal	0.0714	0.05589	0.03045

Gibson's Evenness Diversity Index for species richness and evenness is shown in **Table 5.25**.

Table 5.25: Buzas and Gibson's Evenness Diversity Index

Project Sampling Site	Gibson's Evenness Diversity Index		
	Tree	Shrub	Herb
Aphalamukh terminal	0.9625	0.914	0.9439

At present the design or plans do not indicate the requirement for felling any of the tress present in the island. The photographs of common plant species observed during the study are enclosed as **Annexure- 14**.

Terrestrial Fauna

Faunal Diversity in and around Aphalmukh 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 faunae documented which is listed in **Table-5.26**.

Table 5.26: List of mammals (Fauna)

Zoological name	Local name	Family	IUCN / IWPA, 1972Status
<i>Platanista gangetica</i>	Xihu/Dolphin	Platanistidae	EN
<i>Sus scrofa</i>	Wild boar	Suidae	Least Concern / Schedule III
<i>Canis aureus</i>	Jackal	Canidae	Least Concern / Schedule II
<i>Herpestes edwardsii</i>	Nevala	Herpestidae	Least Concern / Schedule IV
<i>Macaca mulatta</i>	Rhesus macaque	Cercopithecidae	Least Concern / Schedule II
<i>Lutra lutra</i>	Common otter	Mustelidae	Near Threatened / Schedule II
<i>Lepus nigricollis</i>	Indian hare	Leporidae	Least Concern/Schedule IV
<i>Mus rattus</i>	Indian rat	Muridae	Schedule V
<i>Bandicota bengalensis</i>	Field rat	Muridae	Least Concern / Schedule V
<i>Vulpes bengalensis</i>	Fox	Canidae	Least Concern / Schedule II

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

Avifauna

More than 186 species of birds, including the endangered storks and innumerable migratory birds visit Majuli during winter⁴. Prominent bird - watching sites of Majuli includes Sakuli Beel, Vereki Beel, Dowkpara, Borbilla, Dubori tali, Rambolia. Other important sites for birdwatching -are Kakarikata, Dherapora beel, Katimora beel, Doria Dubi, Bata MarL beel, Borphutuka beel, Kharkhari beel, Bhogpur beel, Kochari Boka, Goroimari and Baghemari beel, Sawla-gatanga, Sorai Chong, Fakelani, Howlee, Nalani, Goroimari and orghuli. The migratory birds generally assemble in these wetlands/beels from the early part of every winter and thus they have become regular visitors of Majuli which in turn has made the island a centre of beauty and attraction for the people coming from different parts of the world.

These locations are near to the Kamalabari Ghat and are not within the 10 km radius of the proposed terminal location. However, many common birds listed below visit the site for foraging on the small fishes and aquatic biota. Sometimes migratory waterfowl like Lesser Whistling Duck (*Dendrocygna javanica*) along with Northern Pintail (*Anas acuta*) and other wild ducks are seen by locals near the river close to site. During the site visits, it was informed by the locals that these birds sometimes visit the areas near the river for preying on the small fishes.

Avifauna as observed is given in **Table- 5.27**.

⁴ A Report on Biodiversity and Bioresources of Majuli Island

Table 5.27: List of Avi-fauna

Zoological name	Local / Common name	IUCN / IWPA, 1972 Status
<i>Acridotheres ginginianus</i>	Myna	Least Concern / Schedule IV
<i>Coracias benghalensis</i>	Indian roller	Least Concern / Schedule IV
<i>Merops orientalis</i>	Little green bee-eater	Least Concern / Schedule IV
<i>Charadrius dubius</i>	Little ringed plover	Least Concern / Schedule IV
<i>Fulica atra</i>	Common root	Least Concern / Schedule IV
<i>Rallus aquaticus</i>	Water rail	Least Concern / Schedule IV
<i>Lophura leucomelanos</i>	Kalij pheasant	Least Concern / Schedule IV
<i>Aythya fuligula</i>	Tufted duck	Least Concern / Schedule IV
<i>Anas crecca</i>	Common teal	Least Concern / Schedule IV
<i>Egretta garzetta</i>	Little egret	Least Concern / Schedule IV
<i>Ardeola grayii</i>	Indian pond heron	Least Concern / Schedule IV
<i>Ardea cinerea</i>	Grey heron	Least Concern / Schedule IV
<i>Passer domesticus</i>	Indian house sparrow	Least Concern / Schedule IV
<i>Coturnix coturnix</i>	Common or grey quail	Least Concern / Schedule IV
<i>Ceryle rudis</i>	Pied kingfisher	Least Concern / Schedule IV
<i>Psittacula krameri</i>	Rose ringed parakeet	Least Concern / Schedule IV
<i>Grus grus</i>	Common crane	Least Concern / Schedule IV
<i>Eudynamys scolopaceus</i>	Koel	Least Concern / Schedule IV
<i>Nettapus coromandelianus</i>	Cotton pigmy goose	Least Concern / Schedule IV
<i>Corvus splendens</i>	House crow	Least Concern / Schedule IV
<i>Dicrurus macrocercus</i>	Black drongo	Least Concern / Schedule IV
<i>Anthus rufulus</i>	Paddyfield pipit	Least Concern / Schedule IV

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

Butterfly

The floral biodiversity itself indicates the species of butterflies that can be predicated in that area. During the survey total of 10 species of butterflies belonging to 3 families were recorded and listed in **Table-5.28**.

Table 5.28: List of butterflies

Zoological name	Common name	Family	IUCN / IWPA, 1972 Status
<i>Eurema hecabe</i>	Grass Yellow	Pieridae	Schedule IV
<i>Papilio polytes</i>	Common Mormon	Papilionidae	Schedule IV
<i>Appias albina</i>	Common Albatross	Pieridae	Schedule IV
<i>Junonia hierta</i>	Yellow pansy	Nymphalidae	Least Concern / Schedule IV
<i>Neptis hylas</i>	Common Sailer	Nymphalidae	Schedule IV
<i>Danaus chrysippus</i>	plain tiger	Nymphalidae	Least Concern / Schedule IV
<i>Papilio paris</i>	Paris Peacock	Papilionidae	Schedule IV

Zoological name	Common name	Family	IUCN / IWPA, 1972 Status
<i>Graphium xenocles</i>	Great Zebra	Papilionidae	Schedule IV
<i>Junonia lemonias</i>	Lemon pansy	Nymphalidae	Schedule IV
<i>Athyma perius</i>	Common Sergeant	Nymphalidae	Schedule IV

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

Herpetofauna

P.Hazarika, B.K Pandey, Y.C Tripathy (2010) in their report, 'A Report on Biodiversity and Bioresources of Majuli Island', has mentioned the presence of endangered Gharials (*Gavialis gangeticus*) and Mugger Crocodile (*Crocodilus pelsutris*) in the Tuni river which is 21 kms from the existing Aphalamukh ghat.

A complete checklist of Herpetofauna is listed in **Table-5.29**.

Table 5.29: List of herpetofauna recorded from the site.

Zoological name	Local / Common name	IUCN / IWPA, 1972 Status
<i>Hoplobatrachus tigerinus</i>	Indian bull frog	Least Concern
<i>Fejervarya limnocharis</i>	Common pond frog	Least Concern
<i>Clinotarsus alticola</i>	Assam hills frog	Least Concern
<i>Hylarana garoensis</i>	Water frog	Least Concern
<i>Ptyas mucosa</i>	Common rat snake	Least Concern / Schedule II
<i>Bungarus fasciatus</i>	Banded krait	Least Concern / Schedule IV
<i>Hemidactylus frenatus</i>	House gecko	Least Concern
<i>Calotes versicolor</i>	Indian garden lizard	Least Concern
<i>Urosaurus ornatus</i>	Tree lizard	Least Concern / Schedule II

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

Protected and Eco-sensitive areas

The list of eco-sensitive protected areas and its distance from the proposed Aphlamukh terminal is depicted in **Table 5.30**.

Table 5.30: Protected and Eco-sensitive areas

Terminals	Protected and Eco sensitive area	Aerial Distance within 10 kms from Proposed Project Site
Aphalamukh site	Hatishal Eco Park	7.0
	Dolphin sighting area	6.0

5.5 AQUATIC ECOLOGY

• 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.

• 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. Another important study, 'River Dolphin Conservation and Management: Best Practices Around the World by WWF was referred for preparing the mitigation measures for dolphin management plan. The aforesaid documents present the mitigation measures for the entire river basin, however for the present ESIA, mitigation measures which are relevant to the Project during construction and operation phase of the proposed terminal at Aphalamukh has been considered.

• 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 slipway. The Zoological Survey of India (ZSI) had carried the survey for aquatic ecology and Ganges River Dolphin (*Platanista gangetica gangetica*) on 5th September 2022.

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

There was frequent sighting of Dolphins near the Ghat. There are good population of Gangetic Dolphins observed at Aphalmukh Ghat during the survey, several Dolphins were sighted in the deeper part of the river near the Ghat as per the survey conducted by ZSI.

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 project proponent/authority during the construction and operation phase of the project.

As a part of the EIA study, a survey was 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 was recorded in the study. Based on this study, the dolphin conservation plan was prepared which is being implemented during the construction of Guwahati Gateway Ghat (GGG) Terminal under the Project. This plan was also referred for preparing the dolphin conservation plan for the next set of interventions under the Project.

- **Methodology, Preservation, and Identification of Planktons**

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.

For collecting 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- 10 μ), 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 were 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*, *Zygnema* sp., *Anabaena* sp. *Oscillatoria* sp. *Achnanthes* sp. *Cymbella* sp. etc.

Zooplanktons

Zooplankton community comprised of Cladocera, Copepoda, Euglenophyceae, Protozoa and Rotifera. The most dominant 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- 5.31**

Table 5.31: List of the ichthyofauna

Zological name	Family	Local name	IUCN Status
<i>Rita rita</i>	Bagridae	Catfish	LC
<i>Labeo boga</i>	Cyprinidae	Bhangone	LC
<i>Cabdio morar</i>	Cyprinidae	Boriola	LC
<i>Chanda nama</i>	Ambassidae	Chanda	LC
<i>Barilius bendelisis</i>	Cyprinidae	Korang	LC
<i>Amblypharyngodon mola</i>	Cyprinidae	Moa	LC
<i>Pethia ticto</i>	Cyprinidae	Puthi	LC
<i>Puntius chola</i>	Cyprinidae	Puthi	LC
<i>Monopterusuchia</i>	Synbranchidae	Rice eel	LC
<i>Labeo gonius</i>	Cyprinidae	Romanized	LC
<i>Mystus tengara</i>	Bagridae	Tingara	LC
<i>Mystus cavasius</i>	Bagridae	Xingarah	LC

5.6 SOCIO-ECONOMIC ASPECTS

As per the joint survey conducted by Revenue Department and AIWTDS, the proposed project site is free from encroachment. However, in the radius of 500 meters from the proposed terminal site vendors, tourist, and commuters etc. have been noticed in day times only.

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 no blasting would be carried out for the development of the proposed terminal at Aphalmukh. Therefore, any changes would require an updating of the ESIA.

6.2 ASSESMENT OF IMPACTS

6.2.1 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 assumed to be only 18 months. The following activities may cause environmental impacts during construction of the proposed project:

- Site preparation
- Rock Cutting, levelling and backfilling
- Hauling of Construction materials
- Erection of concrete and steel structures
- Operation of the Heavy Equipment
- Painting and finishing
- Clean up operations.
- Landscaping

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 levelling	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
	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
	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

- **Pre-construction activities**

Pre-construction activities include the Clearing, stripping and levelling the sites, earth filling, excavation for foundations and construction activities would result in generation of debris and construction wastes. Since, the proposed development is taking place near existing jetties, the existing roads would be utilised for gaining access for construction. After award of the work, construction activities shall be planned very carefully. Construction material & equipment shall be

stored on site as it is an encroachment free 20 acres & 14 lesa land. Labour camp shall be identified and established post award of the work after consultation with stakeholders and as per applicable standard and guideline for the establishment of labour camp.

- **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 the passengers especially elderly and people with 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 any reclamation and riverbank protection must be carefully assessed so that the hazards due to Bank failure do not affect the stability of the structure.
- The design of the ramps, staircase etc should conform to the Harmonized Guidelines & Standards for Universal Accessibility in India – CPWD, 2021.
- During the work the entire area would be hard barricades.
- Green screens would be provided to prevent dust during the chiselling operations.
- The Bio-toilets should be installed at all sites 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 Construction activities are incorporated in the design and the construction 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 ferry terminal. The total land requirement for Aphalamukh terminal has been estimated as 10,000 m². The land required for upgradation is in possession of IWT belongs to government.

Mitigation measures: No mitigation measures are required as the sufficient government land is available.

Impacts due to pre-construction activities

Pre-construction activities include the Clearing, stripping and levelling the sites, earth filling, excavation for foundations and construction activities would result in generation of debris and construction wastes. Since, the proposed development is taking place near existing jetties, the existing roads would be utilised for gaining access for construction.

Impacts due to Sourcing of material

The proposed jetties are proposed on the bank of rivers and envisages the construction of passenger jetty berth. The proposed sites need to be levelled for construction of jetty and backup facilities. The construction material shall be sourced from nearby approved existing quarries and markets.

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.

The source and quantity of construction material is given in **Table 6.2**.

Table 6.2: Source and Quantity of Construction Material

S. No.	Name of Jetties	Quantity (m ³)	Source and distance from Site
1	Aphalamukh	50000	Gogamukh- 95 km

(Source: DPR)

Mitigation measures:

- The material extracted due to site preparation shall be used to the maximum possible on the proposed sites for levelling and reclamation.
- 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 PIU for verification and obtain approval from the PIU before procuring any material
- Submit to PIU 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

Impacts due to construction activities

The major components envisaged as a part of the proposed project includes construction of floating Jetties with various utility facilities like rest rooms, cloak room, terminal building, shops,

restaurants, Bio-digesters, fire-fighting facilities etc. The construction material required for the project is proposed to be brought from nearest market and, which is about 65 km from the project site.

For working in the water at low water levels, coffer dams would need to be developed. The construction of the coffer dam would have an impact on the water quality and noise environment. These have been discussed in the relevant sections. It will also have an impact on the health and safety of workers which is discussed in the health and safety section.

Mitigation measures: There is no major vegetation on the land to be acquired for the proposed sites and no major wildlife has been reported in the area. The following measures shall be implemented:

- A dedicated area shall be identified and demarcated for the temporary storage of debris. No debris from the excavation should be stored outside the designated area. All construction material shall be obtained from the licensed quarries. Before procuring any material, the contractor should submit the Environment Clearance Certificate and CTO to the Client. Construction debris waste generated from the construction activities should be stored in a designated area. Municipal Solid Waste from the construction zone should be stored in two bin systems and transported to municipality for disposal.
- No exclusive quarries are proposed for these projects.
- During transportation of the material, adequate measures shall be implemented to avoid damages to the air and noise environment.
- Awareness programmes shall be undertaken to sensitize workers so as to avoid the loss of vegetation and disturbance to the faunal species in the area.
- On completion of construction activities, surplus materials, debris, discarded boxes, containers, drums etc; will be removed from the site and disposed in designated disposal site.
- Select a construction methodology that is least disturbing and appropriate for the in-situ soil condition.
- The reclamation work in the river must be undertaken during the low flow period -Schedule construction works to complete the construction work before the onset of the monsoon
- No material shall be stored inside the river bed or outside the construction area. All loose construction material which are liable to be washed away should be removed.
- Consider all the safety and noise mitigation measures for coffer dams as discussed in the respective sections.
- Measures adopted to prevent water pollution from coffer Dam and the safety of the personnel working have been addressed under Water Environment and Occupational Health and safety discussed later in the document.

Impact due to disposal of solid waste

During construction phase, domestic solid wastes generated will contain mainly vegetable matter followed by paper, cardboard, packaging materials, wood boards, polythene, etc. The total solid waste that may be generated is estimated to be of the order of 20 kg/day for Aphalmukh terminal @ 200 gm per person per day.

Mitigation measures: The solid waste management shall be based on the principle of reduce, reuse and recycle. Adequate facilities for collection and conveyance of municipal wastes generated at each post shall be developed. Garbage bins will be kept for collection of solid waste at appropriate locations at each construction site. Solid waste will be disposed-off at designated landfill sites to be identified in consultation with local administration.

- **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 6.3**.

Table 6.3: Average noise levels generated by the operation of various construction equipment

Equipment	Noise level (dB(A))
Batching Plant	90
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 6.4**.

Table 6.4: 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 6.4**, that at a distance of 1 km from the construction site, the increase in noise levels will be only 1 dB(A). The nearest residential areas are at a distance of 0.5 km from the site. Hence, no adverse impacts are anticipated on ambient noise levels during construction phase of the proposed project.

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 6.5**. Workers operating in the high noise areas shall be provided with ear plugs.

Table 6.5: 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	1/2
115	1/4
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

- **Impact on Ecology**

The terminal location is near the existing ferry ghat of Aphalamukh. No ecologically sensitive areas present near to proposed terminal. However, the entire river island is considered as biodiversity hotspot due to presence of dolphins in the river stretch of Brahmaputra near the ghat and also visited by migratory birds during the winter. No tree cutting is also envisaged for the proposed project.

U.S. National Science Foundation studied the impact of light and noise on birds behaviour. The biologists found that light pollution causes birds to begin nesting up to a month earlier than normal in open environments such as grasslands and wetlands, and 18 days earlier in forested environments. The consequence could be a mismatch in timing -- hungry chicks may hatch before their food is available. When considering noise pollution, results showed that birds living in forested environments tend to be more sensitive to noise than birds in open environments. Noise pollution delayed nesting for birds whose songs are at a lower frequency and thus more difficult to hear through low-frequency human noise.

Impacts on Migratory Birds

Major habitat areas of migratory birds in the island are near the various beels as discussed above. Similarly, the foraging sites are 21 km from the present project location. All such habitats are far from the existing and operational IWT ghat at Aphalamukh where the upgradation and construction

of the terminal shall take place. Thus, the Majuli wetlands which is famous for the migratory birds as detailed above and will not be directly impacted by this project.

However, since the island is frequented by migratory water fowl like Brahminy Duck (*Tadorna ferruginea*), along with the Bar-headed (*Anser indicus*) and the Greylag geese (*Anas anser*). Swamp Francolin (*Francolinus gularis*) in winter. During consultation, it was reported that some of them at times use the mud flat and shallow water near the terminal location approximately 500 m for foraging. Construction activities might have some temporary impacts due to obstruction of water areas, sound from construction equipment etc. Some of the mitigation measures to be undertaken by the Contractor during proposed construction of the terminal is listed below:

- No vegetation clearance should be carried outside the designated area.
- Construction waste should not be placed outside designated areas.
- Municipal solid waste and food waste should be either composted or handed over to the municipality or disposal.
- Wastes from the labour camps should be disposed as per the prescribed methods suggested in the EMP.
- No vegetation removal should occur during migratory bird nesting season if there are any sites identified by the forest dept within the proposed construction site.
- All avoidance, mitigation and monitoring plans proposed to address impacts on migratory birds should be updated during the detailed design stage by conducting detailed studies for identification of nesting trees, migratory route etc. with representatives from the forest departments, local biodiversity experts and with intervention from the AIWTDS/DIWT
- No tree felling is envisaged in the DPR for the terminal location. However, if the contractor decides to setup a Camp outside the construction site, in such case he needs to identify active bird nests. Felling of trees for contractor camp is not advisable, however, if it needs to be felled, the PMU needs to be notified in advance and necessary permission from the Forest Department obtained. Also, the Contractor need to coordinate with the Forest Department and local biodiversity experts to confirm that no active nests are present then only they can start the process of felling.
- Regular maintenance and servicing and usage of noise mufflers at site can significantly reduce noise levels. Isolation of exhaust system and by keeping engine room doors shut can reduce noise further.
- No hunting/trapping of wild life, migratory birds by workers shall be permitted while working or residing on-site. The Contractor should provide training to his staff with support from the PMU.
- Enforce speed limits in the construction areas. Updated PuCs of all construction vehicles at site.

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. Piling activities are not envisaged for the proposed construction at Aphalamukh. So no impact is envisaged from the piling.

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)
- Dolphin Watch must be carried out in the river for one hour before any construction activity starts in water.
- Noise-reducing devices like mufflers, enclosures baffles must be fitted with the equipment as much as feasible.
- Usage of bubble curtains to disperse the fauna and reduce the noise level
- Geo Textile synthetic sheet curtains & turbidity traps must be placed around 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 stop 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.

Impact on Fisheries

As per the baseline data collected during the site visits a total of 23 species belonging to 20 genera, 17 families and 10 orders have been recorded in and around the project locations of Brahmaputra River during the study period. The fish fauna of the river is more diverse though a representative of species could only be collected during the single visit to each location. Most of the fish species reported in the near to project sites are of Least Concern.

As there are no significant fishing zones reported in the vicinity of the proposed jetties, and considering the low fish catch at study area known to involve in fishing activity no significant impact are 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. The downstream impacts on fisheries are not envisaged.

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

• Impact on Surface Water Quality

Impacts due to effluents from labour camps

During construction phase, about 40-45 workers are likely to be engaged in the project. The details of labour and water requirements are given in **Table-6.3**.

Table-6.3: Details of labours involved and water requirement in construction phase

Name of terminals	Peak labour strength	Water Requirement (KLD)
Aphalamukh	40-45	2

The labour involved in construction phase would come from the nearby villages. However, technical manpower is likely to be deployed from outside and will stay near the site during construction phase. It is assumed that about 25% of the total peak labour population will come from outside and a smaller number of labour camps needs to be constructed.

The total water requirement during construction phase for Aphlamukh terminal has been estimated as 2 KLD.

The sewage generated is normally taken as 80% of the total water requirement. Thus, the sewage generated would be of the order of 1.6 KLD. The disposal of sewage without treatment could lead to significant problems related to water pollution and public health. The disposal of sewage without treatment can cause problems of odour and water pollution.

Normally untreated sewage would find its way to natural drainage system which ultimately confluences into the lake. It is proposed to treat the sewage from labour camps before disposal.

Mitigation measures: Proper infrastructure for storage and if required treatment e.g. disinfection or other units, shall be provided to ensure potable water supply to the labour population.

During construction phase, total about 1.6 KLD of sewage is expected to be generated at all the proposed sites. Modular Toilets to be provided for each construction site for the labours. The sewage from the community toilets can be treated in a biodigester. The treated effluent can be used for meeting irrigation requirements of areas being afforested under greenbelt development.

The construction machinery shall be staged in the construction yard. The wash water from the construction machinery has to be treated before discharge. Runoff from the construction yard would have sediments, oil & grease this has to be treated before discharge

Effluent from other sources

Substantial quantities of water would be used in the construction activities. With regard to water quality, waste water from construction activities and runoff from construction site would mostly contain suspended impurities. Adequate care should be taken so that excess suspended solids in the wastewater are removed before discharge into water body.

Mitigation measures: The effluent is proposed to be treated by collecting waste water and runoff from construction sites and treating the same in settling tanks. The settling tanks shall be so designed that it has a detention time of 1.5 to 2 hours. No flocculants are proposed to be used for this purpose.

Effluent from workshops, oil storage, etc.

The effluent from workshops, oil storage, etc. will contain oil and grease and needs to be treated prior to disposal.

Mitigation measures: The effluent shall be treated in oil skimmer and the decanted effluent shall be disposed. The collected oily component shall be stored in cans, etc. and disposed through authorized vendors of the Pollution Control Board.

- **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.

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 leveling 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 PM₁₀ 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, top soil removal, vehicular movement over roads, etc.

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

- Dust generation during leveling 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 NO_x, 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 6.6**. 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
Batching plant	40	1	40
Dumpers	20	2	40
Loaders and unloaders	25	1	25
Excavators	25	1	25
Water tanker	8	2	16
Total			236

The major pollutant likely to be emitted due to construction of diesel in various construction equipment shall be SO₂. The short-term increase in SO₂ 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 SO₂ (□g/m³)

Wind Speed (m/s)	Distance (km)			
	0.1	0.2	0.3	0.4
0.2	0.47 x10 ⁻³⁴	2.3 x10 ⁻¹¹	1.15 x10 ⁻⁶	9.4 x10 ⁻⁵
0.85	2.8 x10 ⁻⁸	5.3 x10 ⁻⁴	4.4 x10 ⁻⁴	4.2 x10 ⁻⁵
1.53	7.4 x10 ⁻⁵	1.75 x10 ⁻⁴	4.2 x10 ⁻⁵	2.2 x10 ⁻⁴
2.78	1.09 x10 ⁻⁴	1.23 x10 ⁻⁴	2.6 x10 ⁻⁵	8.1 x10 ⁻⁶
4.30	9.4 x10 ⁻⁵	1.23 x10 ⁻⁴	2.6 x10 ⁻⁵	8.1 x10 ⁻⁶
5.98	7.1 x10 ⁻⁵	6.4 x10 ⁻⁵	1.28 x10 ⁻⁵	5.8 x10 ⁻⁵
7.00	6.8 x10 ⁻⁵	5.5 x10 ⁻⁵	1.09 x10 ⁻⁵	5.0 x10 ⁻⁶

It is evident from **Table 6.7** that the maximum short-term increase in SO₂ is observed as 0.00053 □g/m³, 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:

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

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 the 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 on the island, better job opportunities, entertainment facilities etc. Overall enhancement in socio-economic status.

Negative Impacts

The proposed terminal is to be developed in Government land and hence land acquisition is not an issue as per DPR. However, the terminal needs to be shifted especially during rainy seasons hence, other lands need to be explored for some period.

- As per joint survey conducted by District Revenue Department and AIWTDS, proposed project site is free from encroachment.
- Difficulties in riverine based livelihoods such as agriculture and inland fishing may occur at the time of construction works.
- Inward migration due to increased connectivity from various parts of the state and country can lead to an increase in antisocial activities, unless adequate precautionary measures are taken.
- During construction phase approximately 40-45 manpower (including skilled, semi-skilled and un-skilled) would be required. 35-45% of the workers shall be engaged from outside Labour influx shall be a temporary and minor; the impact shall be mitigated appropriately.
- 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 be strengthened in these areas, by strengthening the Health Surveillance systems.
- The status of women varies across the places which needs a close analysis and consultation to make further analysis and interpretations.
- The Child Labour (Prohibition and Regulation) Act, 1986 and its amendment in 2016 prohibits the employment/ engagement of children and adolescent in such a sector/industry which are hazardous to the lives and health. Proposed project comes under the "Building and construction industry" that prohibits engagement of child and adolescent. The M&E tool – ICT based system shall be developed to track the age of labour on real time basis for which a medical check-up would be carried out and a certificate shall be issued and uploaded on the M&E system. The provision of the Act shall be followed strictly and monitored by the TSSC/TPM/PIU/PMU during construction phase.

Labour Influx

The influx of workers can lead to adverse impacts like increased demand and competition with existing social and health 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. However, regular community awareness can help in avoiding any form of social and environmental impacts or disturbances on the local communities which comprise of Indigenous groups, especially the residential area located near the labour camp

Mitigation Measures

- Unskilled and Semi-skilled job opportunity shall be provided to the local people based on their skill and education. If required, skill development training shall be given to the workers,
- The contractor shall take care of all the arrangements for the accommodation of the workers hired from outside and establish labour camp as per applicable standard and guideline,
- Drinking water facilities shall be provided to all workforce engaged,
- Local staff engaged at proposed site during operation phase will be stationed in the nearby vicinity. Apart from this Quarters facility will be provided to the staff who are migrants or who are not resident of Majuli. Staff Quarters must include drinking water, sanitation, septic tank, proper hygiene, etc.,

- Labour camp and staff quarters must have proper basic facilities like drinking water, sanitation, hygiene, solid waste disposal, garbage collection and drainage etc.
- Labour Management Plan shall be developed and followed for the engagement and management of labour,
- Migrant workers shall be advised to respect local customs in order to facilitate good relationship with co-workers and avoid any sort of conflict,
- Implement policies to promote equal opportunities, eliminate gender-based discrimination, ensure fair wages and benefits, and prevent sexual harassment. Provide training on gender sensitivity and work-life balance,
- Onsite and offsite emergency plan should be made to take appropriate action during emergency. Mock drill at onsite for the emergency situation should be conducted. Proper training should be provided to the workforce engaged at the site.

Gender Based Violence and Harassment

Construction, particularly of major infrastructure projects, can be a high-risk environment for GBV, SEA-SH affecting community members, workers and service users. GBV and SEA-SH 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. As per the baseline survey conducted by AIWTDS, one (1) no. case against Eve Teasing was registered in the project area.⁵

Mitigation Measures

- Code of Conduct shall be signed by the workers.
- The Woman workers shall be made aware with several helpline numbers like 'Assam Women Helpline No. 181 and the National Commission for Women helpline no. 011-26942369, State Women Helpline No. +91-9345215029, +91-361-2521242, or email ssp-cid@assampolice.gov.in,
- Integration of GBV into existing strategy, Grievance Redressal Mechanism (GRM), safety talks, tool box meeting and regular trainings for the workers,
- Identification of GBV focal points through community consultations, and training for the capacity building of focal point,
- The focal point for GBV would explaining GBV, SEA and SH in the context of the project, including identified GBV risks and hotspots. Awareness about the key mitigation strategies and GRM mechanisms for GBV incidents and response. It shall conduct continuous dialogue and feedback from the community for GBV prevention and mitigation
- Identification of Hotspots for GBV within the project including construction sites and labour camps alongside the local communities, schools, vocational training centres, vicinity of Tavern shops, migrant labourers' residing in rented accommodations within the villages,

⁵ Baseline Survey Report V4, Assam Inland Water Transport Project, April 2023, Page No. 59

- Both men and women labours shall be made aware about the applicable rules and regulations,
- Formation of a committee comprising of representatives from but not limited to local NGOs/ CBOs, police, academia, law and enforcement agency, etc. with at least 70% women members. The committee shall meet every quarter in order to address the issues and challenges faced by the labours/ local community.
- 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

As per joint survey conducted by District Revenue Department and AIWTDS, Proposed project site is free from encroachment. Hence, Livelihood Restoration Plan is not required.

6.2.4 Impacts During Project Operation Phase

• Impact on Land Environment

Impacts on Land Use Pattern of the Area

The proposed jetties are proposed near the existing jetty used for the water transport in Assam. The land required for these projects falls within periphery of the river and belongs to the government. The projects will not interfere with natural drainage in the area. The operation of the proposed jetty 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 jetty. This will lead to conversion of barren land into commercial use near to the jetties.

Impacts due to Generation of Solid Waste at jetty

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. List of authorised recyclers under SPCB, Assam is provided at **Annexure 18**.

- **Impact on Water Environment**

- **Impacts due to Generation of Wastewater**

For major jetties, an average of 225-275 persons per day are expected in each jetty depending on their capacity. Thus, the total daily demand is 15 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 for the terminal is given in **Table 6.8**.

Table 6.8: Water Requirement in operation phase

Name of terminals	Number of passengers expected	Water Requirement (KLD)	Bio-digester capacity (KLD)
Aphalmukh	200-300	38	12

Mitigation Measures: Suitable wastewater treatment measures will be provided for the treatment of domestic sewerage from the jetty premises. Bio-digestors shall be provided at Aphalmukh 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 the 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 the aquatic environment would be disposal of wastewater from boats etc. Environmental implications during routine operations at the jetty could be due to release of waste generated from the boats including garbage, solid waste as well as sewage, washing of boats etc. Stringent measures will be applied to the disposal of waste from boats. Thus, movement of boats have insignificant impacts.

Mitigation Measures

Procedures to dispose- off waste in a safe and ecologically friendly environment should be included in the waste management manuals in order to 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 of at the facilities provided at the 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 fauna 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 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 offshore drilling 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 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.

Conservation plan

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.

Impact on Air Environment

During the 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 Boat movement in the project area.

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, the 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 terminals at Aphalamukh.

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 CONSIDERATIONS

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 and National Disaster Management Guidelines on Boat Safety issued by National Disaster Management Authority, Government of India, September 2017.

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.

The risk assessment for the Aphalamukh 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 bio-digester.
- The facility would be designed as per the hydro-geomorphology of the region as well as with bank erosion protection.
- Aphalmukh has been considered as category-2 under soil erosion. This implies moderate erosion potential as per the DPR. The riverbank at the terminal site locations experiencing moderate erosion is grouped under this category. The time history satellite images show moderate shift of riverbank at terminal sites due to bank erosion. For these terminal sites, riverbank protection is both technically and economically viable. Due to the moderated stability in the riverbank, either a flexible or fixed terminal operation facility will be considered as a suitable solution.
- In terms of traffic categorisation, Aphalamukh has been considered under Category A-Ro Pax vehicles with four and two wheelers with foot passengers.
 - Under this category, the ferry terminals shall be planned with consideration of safe and efficient movement of the four and two-wheeler vehicles and foot passengers on the Ro -Pax 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 to prevent erosion. Plantation of suitable plant species in the river bank which includes *Tamarix dioica* (Jhaubon), *Vetiveria zizanioides* (Birinabon), *Ipomoea biloba* (Morning Glory) etc need to be taken to check 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.

7.3 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 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 easily accessible location of Aphalmukh a minimum mobilization period of 1.5months has been allowed for the site set-up

- Construction of riverine facilities

The other activity 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 months 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.

The riverine activities will be most affected due to the on-set of monsoons, June to September.

- **Landside development**

The construction of the approach bund and shore protection works will mainly depend upon the planning and timely procurement of rock. This work will be affected during the monsoon; however, some progress has been assumed considering a few dry spells.

A total of 12 months has been allotted for the construction of the landside facilities at Aphalamukh.

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 shall be provided which will act 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.

Fabric form Mattress solution methodology

Initially riverbank steep slopes trimmed to achieve ideal slope where the placing of the riverbank erosion protection component becomes easy, and which gets good stability. On the trimmed surface of riverbank non-woven Geotextile shall need to be placed. The geotextile shall be needle punched made up of polyester staple fibre. Finally, the fabric form mattress shall place over the geotextile surface. The fabric form mattress shall be filled with suitable filler material, in this case cement mortar considered as filler material shall be laid on geotextile base. The minimum ultimate strength of the fabric form mattress filled with cement mortar should be 75 kN/m.

Linkspan Parallel to Sloping Bund

The terminal would be a combination of floating pontoons (two Nos), guide piles, linkspan and sloping access bund. The main advantage of this option is the linkspan can be supported with intermediates supports to counter the heavy super imposed loads of the vehicle

Key activities

Key items of work include floating pontoons as the berthing facility, mooring and anchoring of the pontoons, linkspan, approach slope bund, associated landside infrastructure, miscellaneous works, general and other items.

d) 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 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.
- Hazards due to ramp structures
For Aphalamukh 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. The side slopes of approach ramp are placed at 1V:2H by placing granular fill. However, to address the scour and slope protection due to river flow, approach ramp slopes on all over three sides shall be protected by Gabion mattress filled with aggregate. This layer will act as slope protection element for drag and lift caused by river flow. On preliminary basis it is understood that ~ 0.5m thick gabion mattress shall be

sufficient for slope protection. These gabion mattresses shall be filled with suitable aggregate material.

7.3.2 Natural or Climate induced

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 a 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 the 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 the establishment of temporary structures.
- Based on the topographic survey information, ground surface along the proposed jetty location varies between +64m in the river to +88m at the landside.

7.4 Emergency Evacuation

7.4.1 Emergency Planning

- Emergency response plan specifically tailored for the terminal, including evacuation procedures, assembly points, and communication protocols will be developed by Terminal operations team.
- Clear roles and responsibilities for employees and emergency response teams will be established with involvement of vessel crew, IWT-Quick Response Plan (QRT)s
- Regular drills and exercises to test the effectiveness of emergency plans will be conducted to enhance the preparedness of staff.
- Local fire departments and emergency services will be well collaborated to ensure coordination and support during an incident including fire emergency.
- **Evacuation and Escape Routes**
- Terminals are designed with designated clearly marked emergency/fire exit routes as per NBC norms.
- The locations of all emergency routes are easily accessible. These exits will be always kept unobstructed and clearly indicated with signage.

- All emergency routes will be well lit with emergency lighting system. Periodical maintenance and testing of emergency lighting systems will be conducted.
- Well planned access routes equipped with ramps, refuge areas, etc for individuals with disabilities have been provided as per NBC and CPWD norms, including designated evacuation assistance points.
- All these exits will be clearly marked in comprehensive evacuation plan. Such plans, evacuation routes signages will be placed at all strategic locations clearly visible to all occupants.
- Plans with designated assembly points for passengers and staff, as well as clear instructions on how to evacuate the terminal safely will be shown in plans as well as will be announced during emergencies. Such plans will be pasted at all strategic locations.
- Detailed procedures to follow in the event of an emergency will be well established and such training will be given to all terminal staff.
- This plan should include designated assembly points for passengers and staff, as well as clear instructions on how to evacuate the terminal safely.

Communication and Notification Systems

- Terminal shall be equipped with integrated public address system to broadcast emergency instructions and updates to occupants. Passengers will be provided with information regarding fire safety measures and emergency procedures. This will be done through public announcements, signage, brochures, or briefings at the beginning of the cruise service.
- Multiple channels for communication, such as Audible Alarms (Sounders), hooters, Manual call points and visual alerts, have been planned to ensure warning will be noticed by everyone in the terminal.

7.4.2 Training and Education

- Regular fire safety training sessions for employees, focusing on prevention, response procedures, and the proper use of firefighting equipment will be conducted. This includes knowledge of evacuation routes, the use of fire extinguishers, and effective communication during emergencies.
- Periodical awareness among employees and visitors about potential fire hazards and the importance of adhering to safety protocols will be conducted.

Training on first aid and basic life-saving techniques to selected staff members will be provided.

- Regular mock drills and exercises to be conducted to test the effectiveness of emergency plans in line with the Emergency Search & Rescue plan of IWT with

relevant stakeholders like Assam State Disaster Management Authority (ASDMA), National Disaster Response Force (NDRF), State Disaster Response Force (SDRF) etc.



Fig 7.1- Typical signage map showing emergency exits and other amenities inside the building
(Source June, DPR)

7.5 RISK ASSESSMENT

• 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.

The area could also experience heavy footfall in specific festival seasons. This could enhance the pressure on infrastructure and security. There could be a scenario wherein the footfalls could lead to crowd issues such as stampede or conflicts or skirmish.

Table 7.1: Simplified Risk Matrix

Probability Days of operation	Severity			
	Minor (1)	Major (2)	Critical (3)	Catastrophic (4)
Frequent to 1/100 (1)	Very minor to minor faults			
	Collision with terminal at low speed	Major fault at the terminal- suspension of operation		
	Collision with terminal at high speed	Fuel Leakage scenario at terminal		
1/100 to 1/10,000 (2)		High speed Collision with fuel leakage		
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 construction and operation phase has been enclosed as **Annexure- 20**.

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 Aphalamukh terminal. The list provides reference implementing organisation and responsible entity.

8.2 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 Aphalamukh Terminal for both construction and operational phase is given in **Table 8.1 to Table 8.3**.

Table 8.1: Environment Management Plan (Construction Phase)

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
Design					
Development of the Final Design ⁶	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 During the design phase	TSSC & PMU (AIWTDS+ GC)
	Design of the Riverbank Protection	The design of any reclamation and riverbank protection must be carefully assessed so that the hazards due to Bank failure do not affect the stability of the structure.	Assessment of Design for Resilience	Contractor During the design phase	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-Digester Assessment of space for the setting up bio-toilets, Adequate space for storage of Municipal Solid waste	Contractor During the design phase	TSSC & PMU (AIWTDS+ GC)

⁶ Contractor shall develop the terminal based on the design & BOQ provided by PMU. EMP for design phase hence not applicable.

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
	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 During the design Phase	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/ AIWTDS 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	Copy of the Permit of the Forest Department, Government of Assam	Contractor If required during the pre-construction phase	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 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	Approved copy of the C-EMP	Contractor Once before the start of construction activities	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		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 Once before functioning/operation of plant & machinery	PMU (AIWTDS+ GC) and TSSC
Procurement of Other Construction Vehicles, Equipment and Machinery	Potential for air pollution and noise	Statutory Compliance:- All Construction	Certification by Manufacturer of emission and noise levels/	Contractor Once before deployment of all vehicles	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>equipment⁷ 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.</p> <p>-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.</p> <p>The Contractor will maintain a record of PUC for all vehicles and machinery used during the contract period.</p>	Pollution under Control Certificates, Insurance and Driving License of the driver to be submitted for all vehicles	used throughout the contract period	
Sourcing of construction material	Unsustainable mining practices	<p>-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</p>	Permission for mining/ quarrying of materials from the Mining Department, District Administration and District Level	Contractor Once if quarrying is required for sourcing of construction materials	PMU (AIWTDS+ GC)and TSSC

⁷ 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.

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		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.	Environment Appraisal Committee		
Identification of water sources for construction	Adverse impact on water resources	If the contractor will source water requirements for construction from 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 be maintained. The usage of groundwater must be recorded.	Permission from the Ground Water Board for Groundwater usage	Contractor -Once before the start of construction activities	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		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 of the Irrigation /Water Resources Department in case of River water is used.		
Environmental monitoring of air, noise, water, and soil	Considering environmental conditions mentioned in ESIA report as baseline and ascertain the impacts during the construction phase	Environmental monitoring to be carried out through recognised ⁸ Laboratory as per the locations, parameters and frequency specified in the environmental monitoring plan in Table 8.4 .	Submission of test results to PMU	Contractor - Frequency of monitoring as per Table-8.4	PMU (AIWTDS+ GC)and TSSC
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. - All new personnel joining the work need to undergo induction training. All personnel	-Certificate of Completion (Safeguards Compliance Orientation) -Posting of EMP at worksites. -Maintaining Records of training both induction and refresher	Contractor - Once before initiating construction activities	PMU (AIWTDS+ GC)and TSSC

⁸ (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)).

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		joining work after a break of more than 15 days need to undergo refresher.	-Submission of the Training records to the PIU every month		
	Deployment of EHS Officer and OHS Officer	<p>Deploy qualified personnel and management committee.</p> <p>- 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.</p> <p>The name and functions of the responsible EHS persons and their relevant expertise must be notified in the Quarterly Report</p> <p>-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</p>	Submission of records of the availability of the EHS personnel onsite in the Monthly Report and Quarterly Report	Contractor - EHS personnel to be engaged by the Contractor for the entire period of construction	PMU (AIWTDS+ GC)and TSSC
Legal compliance	Environmental legal noncompliance may	<p>-Obtain all consents, clearances (CTE/CTO from ASPCB), permits NOCs etc., before start of construction works.</p> <p>-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)</p> <p>-Following consents are required-</p> <p>-Tree cutting-local authority</p> <p>-Storage, handling, and transport of hazardous materials-ASPCB.</p>	Copy of the Permit/ Consent to be submitted with QPR to PMU	Contractor - During the course of activity as required	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		-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			
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/ 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 - once for the construction phase	PMU (AIWTDS+ GC)and TSSC
	Impact of Aquatic Species and Dolphins	Construction Planning must be carried out so that No-construction (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 Scheduling	Contractor - once for the construction phase	PMU (AIWTDS+ GC)and TSSC
Construction Stage					

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
Clearing and grubbing for site Preparation (Terminal Site, Base camp, Construction Camp & Labour camp)	Landscape and Aesthetics	<p>Permission of tree(s) removal from non-forest area</p> <p>-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.</p> <p>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.</p> <p>- Compensatory afforestation must be carried out per the Tree Felling permission provisions.</p> <p>The contractor shall take care of all the arrangements for the accommodation of the workers, hired from outside and establish labour camp as per applicable standard and guideline. Please refer ECoP 17 Construction Camp Management,</p>	Verification of number of trees felled; Copy of NOC from forest dept.	Contractor -once for the construction phase if required	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
	Loss of topsoil. Loss of natural resources (Earth/soil) in area where the Construction camp is setup	<ul style="list-style-type: none"> • 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 H₂O 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 - once for the construction phase if required	PMU (AIWTDS+ GC) and TSSC
Transporting Construction Materials and Haul Road Management	Impacts on air quality and safety	<ul style="list-style-type: none"> - Contractor will maintain all hauls roads (existing or built for the project), which are used for transporting construction materials, equipment, and machineries as precised. 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- 	Complaints from local community Visual observation in Site reports Monitoring of the air quality in the worksite and material storage area	Contractor - Daily Basis	PMU (AIWTDS+ GC) and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>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.</p> <p>-Contractor will arrange for regular water sprinkling for dust suppression of all roads and surfaces.</p> <p>-The unloading of materials at construction sites in/close to settlements will be restricted to daytime only.</p> <p>-All stockpiles will be covered/protected to prevent dust generation</p>			
	Impacts on Water Quality	<p>- Boats/ Vessels carrying construction material must not be overloaded.</p> <p>- Loading and unloading activities must ensure that spillage does not occur.</p> <p>- loose and friable material transported by boat must be covered</p>	Site Reports	Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC
Storage of Construction Material	Potential for waterlogging	<p>-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.</p> <p>-The contractor must not dump any excavated material into the river.</p> <p>-The contractor will take all necessary measures to prevent the blockage of water flow.</p>	Complaints of water logging	Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		-The stockpiled material must be prevented from erosion and deposition in the drainage channel from sites where these are stocked for construction.			
	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 -Daily Basis	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	-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 -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		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.			
	Pollution of water bodies from domestic activities	<p>-Wastewater from domestic activities such as bathing and washing at the camp site must be treated.</p> <p>-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.</p> <p>-Stagnation of water should not be allowed at any place near the campsite as a precaution against vector-borne disease. Wastewater from the Aphalamukh Worksite</p> <p>An adequate number of toilets must be provided</p> <p>Bio-toilets of adequate capacity must be provided for the workers based on no of users.</p>	<p>-Adequate number of toilets as per no of labours</p> <p>- Records of surface water quality Monitoring;</p> <p>-No visible degradation to nearby drainages, nallahs or waterbodies due to civil works</p>	Contractor - As and when required	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>The supernatant from the Bio-digester must be discharged into the soak pits. The Supernatant from the. bio-toilets must be tested at periodic intervals to meet discharge standards</p> <p>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.</p> <p>Collection and Disposal of Food Waste from the Aphalamukh 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</p>			
	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)	Preparation of the Dolphin / Aquatic Manal Management Plan	Contractor - During the course activity required	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>-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</p> <p>-Before piling starts, Dolphin Watch must be carried out in the river for one hour. Piling must commence if dolphins are not spotted.</p> <p>- Before starting piling, allow some time for aquatic fauna to displace from the piling area.</p> <p>-Piling must be stopped for some time if any dolphin/turtle/RET species are sighted in the activity area</p> <p>.-Noise-reducing devices like mufflers ,enclosures baffles must be fitted with the equipment as much as feasible.</p> <p>-Fish exclusion devices must be installed in the water column around the pile driving area to prevent fish access</p> <p>-Geo Textile synthetic sheet curtains &turbidity traps must be placed around</p>	<p>2. Logs for recording watch and ward for dolphins / turtles during the piling</p> <p>3. Log for aquatic fauna monitoring</p>		

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>construction areas to prevent the movement of sediments and construction waste</p> <p>-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.</p> <p>-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.</p> <p>-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</p> <p>- 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.</p>			

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		-The piling activities must be carried out in the shortest possible timeframe.			
	Degradation of Water Quality due to land reclamation	<p>-Select a construction methodology that is least disturbing and appropriate for the in-situ soil condition.</p> <p>- The reclamation work in the river must be undertaken during the low flow period - Schedule construction works to complete the construction work before the onset of the monsoon.</p> <p>-Turbidity traps/curtains/ Geo-Textile synthetic sheet curtains would be placed around the piling and construction area to prevent the movement of sediments and construction waste.</p>	<p>-Regular monitoring of site</p> <p>- Water quality tests</p>	Contractor - During the course of activity as required	PMU (AIWTDS+ GC)and TSSC
	Degradation of water quality due to construction activity	<p>Select a construction methodology that is least disturbing and appropriate for the in-situ soil condition.</p> <p>Schedule construction works to complete the construction work before the onset of the monsoon.</p> <p>Schedule the construction works during the low water level period -ensure that works are completed during the same period before the onset of monsoon.</p> <p>- Inspection and maintenance of disturbed areas where mobilisation and barrier</p>	<p>(i) Construction methodology for waterside construction</p> <p>-Schedule of construction works to ensure completion of the works before monsoon/ develop a Monsoon Management Plan</p> <p>-Records of inspection of the sedimentation chamber</p>	Contractor - During the course of activity as required	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		installation occur for sediment control measures. -Washing of vehicles and equipment must not be carried out in rivers or nearby places.	-Effectiveness of water management measures. -No visible degradation of water quality		
	Water Pollution from Fuel and Lubricants and hazardous waste	<ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> - No of spills reported -Field observation -Water quality monitoring reports 	Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
Construction on the landside	Deterioration of air quality from fugitive sources	Prevent Dust Generation <ul style="list-style-type: none"> -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. -Construction vehicles, machinery & equipment must be regularly serviced and 	<ul style="list-style-type: none"> - Complaints from sensitive receptors. - Quarterly environmental monitoring report for ambient air, noise, water, and soil 	Contractor - Daily basis during the construction activities - Conducting quarterly environmental monitoring	PMU (AIWTDS+ GC) and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>maintained and would have a valid PUC certificate</p> <p>-Don't allow non-project vehicle access in the work area, limit soil disturbance and prevent access by barricading and security personnel.</p> <p>-Traffic detours and diversions must be designed to minimise bottlenecks and ensure smooth traffic.</p> <p>-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.</p>			
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	<p>-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.</p> <p>-All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement.</p>	<p>- Heavy equipment and machinery with air pollution control devices.</p> <p>- Latest Six-Monthly Compliance Report to ASPCB</p> <p>- Valid Consent to Establish and Consent to Operate.</p>	<p>Contractor</p> <p>- Daily basis during the construction activities</p> <p>-Conducting quarterly environmental monitoring</p>	<p>PMU (AIWTDS+ GC)and TSSC</p>

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> -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 	<ul style="list-style-type: none"> - Certification that vehicles are compliant with Air Act - Quarterly environmental monitoring report for ambient air, noise, water and soil 		

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		Monitoring results will also be submitted to PMU Consultant and PIU as per the monitoring plan. -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.	- Complaints from sensitive receptors. - Use of silencers in noise-producing equipment and sound barriers.	Contractor - Daily basis during the construction activities - Conducting quarterly environmental monitoring	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> - 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 			

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> -Monitoring must be carried out at the construction sites as per the monitoring schedule, and results will be submitted to PMC and PMU. -The Environmental expert of PMC will be required to inspect regularly to ensure the compliance of EMP. 			
	Vibration from the works.	<ul style="list-style-type: none"> 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 employ an archaeologist to monitor the sites during the rock-cutting and piling activities. 	<ul style="list-style-type: none"> -Complaints from sensitive receptors, Archaeology dept. -Site verification -Availability of trained man-power (archaeologist) at site 	Contractor - During the course of activity required	PMU (AIWTDS+ GC)and TSSC
	Contamination of Soil	<ul style="list-style-type: none"> 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 		Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>provisions mentioned in Annexure 17- Oil & Waste Storage</p> <ul style="list-style-type: none"> -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 			
Safety aspects during the execution of works	Community Health Safety risks in Work Zones	<p>The Contractor must ensure that :</p> <ul style="list-style-type: none"> -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 in the areas. The permission of the Environmental Officer is essential. -To prevent the dust from the construction area affecting the sensitive receptor/ 	<ul style="list-style-type: none"> -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 -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		commuters' green screens may be used over and above the Hard Barricading at the advice of the Environment Officer of the PMC			
	Occupational Health Safety: Personal Safety Measures for Labour	<p>The contractor will provide:</p> <ul style="list-style-type: none"> -Comply with all national, state and local labour laws (refer Table 7.1A: 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. 	<ul style="list-style-type: none"> -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 	<p>Contractor</p> <ul style="list-style-type: none"> - OHS plan shall be prepared once and implementation as per the approved plan on a daily basis 	<p>PMU (AIWTDS+ GC)and TSSC</p>

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> -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) 	<ul style="list-style-type: none"> equipment, and areas for storage and disposal. -Compliance to core labour laws 		

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>Convention No. 62 as far as those are applicable to this contract.</p> <ul style="list-style-type: none"> -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. -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 			

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>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.</p> <p>-Life-saving equipment and lifeguards must be made available during the period of working in water.</p> <p>-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.</p>			
	Injuries/fatalities to the employees	<p>Accident/Incident Reporting for SHE</p> <p>-The PIU must carry out an awareness campaign for the Do's and Do not's in construction sites.</p> <p>-Near misses must be recorded and reported on a regular basis</p>	<p>-Record of near misses</p> <p>- Record of fatalities</p> <p>- No of workers' meetings</p> <p>-Labour Law Compliance Report generated</p>	Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> -Fortnightly meetings must be held with employees to make them aware of unsafe acts and practices. 	through Labour Law Compliance system		
Sanitation, Health & Safety	Unhygienic and unsafe living and working condition.	<ul style="list-style-type: none"> • Labour camps must be set up above the HFL as the site is prone to floods • 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 Verification	Contractor -Daily Basis	PMU (AIWTDS+ GC)and TSSC

Component	Environmental Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementati on & Frequency	Supervisio n
		<p>site. Also, tie-up with local hospitals would be done to handle emergency case, if any.</p> <ul style="list-style-type: none"> • 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. 			

Table 8.2: Social Management Plan

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
1.1 Health & Safety of Workers	Accident and Incident risk from construction activities and safety of workers	-Local labour would preferably be employed for construction.	-Regular health check-up of the workers once a week.	Contractor Minor health issues are addressed on a	PMU (AIWTDS+GC)and TSSC

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
	Impact on Social life of commuters, passengers and tourists.	<ul style="list-style-type: none"> -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. 	<ul style="list-style-type: none"> -Training on communicable diseases. 	daily basis if and when required.	

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> -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. 			
Labour Influx	<ul style="list-style-type: none"> -STD, HIV/AIDS to local community Increased demand and competition for 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 	<ul style="list-style-type: none"> -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 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. 	<ul style="list-style-type: none"> - Awareness training for applicable regulatory regulations. 	<p>Contractor</p> <ul style="list-style-type: none"> - site-specific Labour Influx Management Plan and/or a Workers' Camp Management Plan shall be prepared and submitted to PMU once during the construction period - Implementation of approved site-specific Labour Influx Management Plan and/or a Workers' Camp Management Plan on a daily 	<p>PMU (AIWTDS+GC) and TSSC</p>

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>-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.</p> <p>-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</p>			

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<p>with nearest higher order hospital to refer patients of major illnesses and critical cases.</p> <p>- Awareness camps on HIV/AIDS for both, construction workers and neighbouring villages must be organised at regular intervals by NGOs empanelled with NACO.</p> <p>-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.</p> <p>-In case work schedule extents up till night, it should be ensured that women workers are exempted night shifts.</p>			

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
Gender Based Violence	There might be a possibility of gender-based violence arising from the inflow of migrant workers/ labours.	<ul style="list-style-type: none"> - Code of Conduct shall be signed by the workers. - Integration of GBV into existing strategy, Grievance Redressal Mechanism, safety talks, tool box meeting and regular trainings for the workers. - Identification of GBV focal points through community consultations. - Trainings shall be arranged for the workers on Occupational Health and Safety. - Identification of Hot Spots for GBV within the project including construction sites and labour camps alongside local communities, schools, vocational training centers, liquor shops, migrant laborers' residing in rented accommodations within the villages. 	<ul style="list-style-type: none"> -Regular Training shall be conducted. -IEC material should be displayed at site -Awareness Campaign 	Contractor -Once in a month	PMU (AIWTDS+GC)and TSSC

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		<ul style="list-style-type: none"> - Both men and women labours shall be made aware about the applicable rules and regulations. - Formation of a committee comprising of representatives from local NGOs/ CBOs, police, academia, advocate, etc. with at least 70% women members. The committee shall meet every quarter in order to address the problems faced by the labours/ locals. <p>Consultation with women's groups should also be held during construction and operation phases to listen to their issues and concerns regarding labour, health and safety etc. as well as to solicit their ideas on various community initiatives.</p>			
Community Health and Safety	With the inflow of migrant workers and their interaction with the local population, health issues	<ul style="list-style-type: none"> - Regular medical camps can be conducted amongst the labours and the local population to make them aware about 	<ul style="list-style-type: none"> - Regular health check-up of the workers 	<p>Contractor</p> <ul style="list-style-type: none"> - community consultation once in a month 	PMU (AIWTDS+GC) and TSSC

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
	<p>among the local community might emerge.</p> <p>Health problems like STIs, HIV/AIDS, Hepatitis B&C, Tobacco chewing, Tuberculosis etc. might spread in the area because of this floating population</p>	<p>HIV/AIDS and associated factors.</p> <ul style="list-style-type: none"> - Awareness on health issues like HIV/AIDS, Tuberculosis, Hepatitis B & C, Sexually Transmitted Infections, Dengue, Chikungunya, Malaria, Tobacco control, etc., shall be conducted periodically. - District AIDS and Prevention Control Unit (DAPCU), District level Agency for the implementation of National Health Mission and Employee's State Insurance Corporation (ESIs) Hospital shall be liasoned for the same. - Community based meetings, consultations in camp, distribution of leaf lets, IEC tools (outreach programmes, campaigns, awareness through newspapers, TV's, etc.), posters, banners. 	Training on communicable diseases		

Component	Social Attribute and potential impacts	Remedial Measure	Monitoring Indicators	Institutional Responsibility	
				Implementation & Frequency	Supervision
		Use of mobile phones shall be banned during driving and construction activities.			

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	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Only Passenger ferry will be handled in the terminal hence no dust pollution anticipated. • Water sprinkling would be provided in dust generating areas 	Environmental Protection Act, 1986; The Air (Prevention and Control of	DIWT / AIWCL

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
		<ul style="list-style-type: none"> 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 	Pollution) Act, 1981	
3.0 Soil Erosion				
Soil Erosion and management.	<ul style="list-style-type: none"> Soil erosion of embankment during heavy rainfall. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Surface water pollution. Siltation and erosion and contamination due to disposal of domestic waste 	<ul style="list-style-type: none"> Bio digester (12KLD) 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 Quarterly Monitoring of surface water quality shall be carried out to check the level of pollutants and effectiveness of EMP 	Project requirement	DIWT / AIWCL
5.0 Noise Control				
Noise Pollution	<ul style="list-style-type: none"> Noise generation from operation of 	<ul style="list-style-type: none"> Timely maintenance and servicing of transportation vehicles and the machinery/pumps/vessels to be used during operation phase to reduce the noise generation. 	Noise Pollution (Regulation and Control) Rules, 2000	DIWT / AIWCL

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
	vehicle, equipment and machinery. • Impact of underwater noise and risk of ship strikes	<ul style="list-style-type: none"> 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. 		
6.0 Accidental Risk				
Accident and Incident.	Accidents due to Movement of Vessels and other hazards associated with site	<ul style="list-style-type: none"> 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 	Project requirement	DIWT / AIWCL

Component	Environmental Attribute and potential impacts	Remedial Measures	Relevant laws/ Contracts	Institutional Responsibility Implementation & Supervision
		<ul style="list-style-type: none"> Adequate illumination should be provided at the site 		
7.0 Flora & Fauna				
Biodiversity loss	Loss of Aquatic Fauna including Dolphins and other macrophytes	<ul style="list-style-type: none"> 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. 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. 	Forest Conservation Act 1980, Wild Life Protection Act, 1972	DIWT / AIWCL

8.3 GRIEVANCE REDRESSAL MECHANISM

AIWTDS has a department website (<https://www.aiwtdsociety.in>) wherein complaints can be lodged or emailed (dir.iwtds-as@gov.in). Further, a dedicated Helpline no. for grievance redressal has been setup at the PMU, AIWTDS office, Guwahati (18008894717) where project related complaints can be registered at any time during project Pre-construction, Construction and Operation Phases. The AIWTDS will outsource the Helpline to a call centre for backend support services needed for its operation.

Procedure for Grievance Response

The steps to be taken by the AIWTDS for receiving and handling grievances pertaining to the Project are outlined below and graphically presented in **Figure** below:

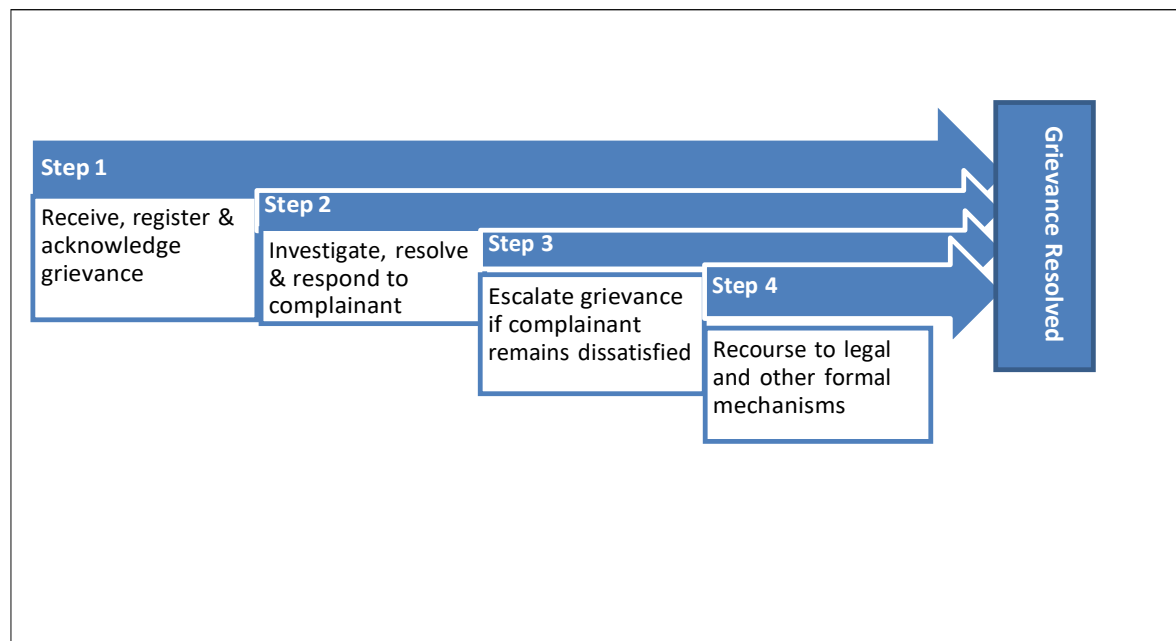


Figure 8.1: Procedure for Grievance Response

STEP 1: Receive, register, and acknowledge the Grievances

A grievance can be submitted to the AIWTDS through the following channels:

1. During regular meetings held between communities and project stakeholders (field level and PIU staff, contractors, supervision consultants, etc.);
2. Through communication directly with management - for example a letter addressed to site management, or other operational offices, or SPD/ASPD/DSPD AIWTD Society Ulubari, Guwahati-7;
3. Directly by e-mail to the official mail address, or online at website which is disclosed in the official website of AIWTDS (<https://www.aiwtdsociety.in>);

4. Placing a query in the community suggestion boxes in the local offices of the project;
5. Directly on toll free number displayed at ghats; and
6. Through twitter, Facebook and other social media accounts.

Upon receipt of complaints, unique identification number will be issued to each grievance for easy tracking- once it is logged into the online grievance register.

In cases of complaints received through **Channels 1 to 4**, the Project personnel (field and PIU level staff) will log the complaint in the online grievance register and inform the Helpline call center/operators within 3 working days. The helpline operators on behalf of the Project personnel will acknowledge the receipt of the complaint through a phone call or text message to the complainant. The acknowledgment will include the unique identification number so the complainant can use this as a reference to track the status of the complaint. If the grievance is not well understood or if additional information is required, the Project personnel or the Helpline operator will contact the complainant during this step for further clarification.

If the complaint is received through **Channels 5 and 6**, the Helpline call center/operator will log the complaint in the online grievance register and acknowledge its receipt immediately. The complaint will then be transferred to the Project personnel for investigation and resolution.

STEP 2: Develop resolution and respond to Complainant

Upon investigation, the Project personnel (field and PIU level staff) will propose a resolution as soon as possible, and in consultation with the complainant and others concerned. The Project personnel, through the Helpline operator will continually update the complainant on the progress of the investigation and the timeline for conclusion. The resolution is communicated to the complainant through the proper channel. The Helpline operator will ask the complainant for a written acceptance of the resolution, and close the grievance if he/she is satisfied with the resolution. The Project personnel will aim to complete investigation within 15 working days of the grievance first being logged.

STEP 3: Scale up the grievance if the complainant remains dissatisfied

If the complainant rejects the proposed resolution, the Helpline operator will refer the case to the GRO (PMU) within 30 days of its decision. The GRO will facilitate to reach an agreeable resolution and will produce a resolution within 15 working days. If the resolution is accepted by the complainant, it will be implemented, and the grievance will be closed once the implementation is completed.

STEP 4: Recourse to legal and other formal recourse

If the complainant rejects the proposed resolution, the complainant is free to approach the court of law/any other formal mechanisms in place at the local/state level.

Record Keeping

All queries and grievances are to be logged into the online grievance register. This includes details of the queries/ grievance, the complainant, and the steps taken to resolve the grievance. Any accompanying documentation e.g. written statements, photographic evidence, or investigation reports are to be filed along with the grievance log both in hard and soft copies.



Helpline Call Center/ Operator: The Helpline no. will be operated by the Call Center, which will be responsible for documentation and acknowledgement of complaints, and communication with complainants till their complaints are satisfactorily closed. The Helpline operators will also send alerts/reminders to the project personnel for investigation and resolution, so that grievances are resolved within the stipulated timeframe. The Call Center will be operational from 8.00 am till 10.00 pm in two shifts daily.

8.4 Project officials/personnel: Field level staff, supervision consultants, and contractors will be responsible for investigating and resolving grievances in a timely manner. They will also record direct complaints on the online grievance registration portal and follow-up with the Helpline operators to update them on the status of the complaint.

8.5 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 PM₁₀, PM_{2.5}, NO_x, SO₂ 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

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.	Construction Phase: For three seasons in construction phase; Turbidity, DO and salinity will be monitored once every week at 3 locations: near the Berth, channel and	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
			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			
			Operation Phase-For two seasons in operation phase except monsoon			
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplankton's, Zooplanktons	Construction Phase-For three seasons in construction phase	Upstream- 2 Downstream- 2 Near Project site- 1	As per AIWTDS directions	Contractor
			Operation Phase-For two seasons in operation phase except monsoon			
2.	Sediments					
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates, Hg, Pb, Fe, Cu, Zn, Cd	Construction Phase-For three seasons in construction phase	Upstream- 2 Downstream- 2 Near Project site- 1	As per AIWTDS directions	Contractor
			Operation Phase For two seasons in operation			

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	No. of Samples	Location	Responsibility
			phase except monsoon			
	Biological parameters	Benthic Micro-fauna, Benthic Macro-fauna	Construction Phase-For three seasons in construction phase. Operation Phase-For two seasons 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	Construction Phase- For three seasons Operation Phase one season - Twice a week for four consecutive weeks per season.	Upwind- 2 Downwind- 2 Near Project site- 1	As per AIWTDS directions	Contractor
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	Construction Phase-2 samples pre-monsoon season and 2 samples post-monsoon Operation Phase-one season during operation phase	Construction site- 1 Labour Camp- 2	As per AIWTDS directions	Contractor
6.	Dolphin study	Assessment and presence of Dolphins,	Once per year	--	As per AIWTDS	AIWTDS

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	No. of Samples	Location	Responsibility
		survival etc.			directions	

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

8.6 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 Aphalamukh terminal is estimated as Rs. 50.8 lakh, while during operation phase is 56.96 lakh, including contingency charges. The summary of environmental budget is given below. The detailed break-up of costs is given in **Table- 8.5 and 8.6.**

Table 8.5: Summary of Environmental Budget- Construction Stage

S.No	Particulars	Stages	Cost	Costs Covered By
			(INR)	
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
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	Contractor
		Decommissioning	8000	Contractor
	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
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	5,00,000	Contractor
	Subtotal (B)		21,50,000	
C.	Construction Contractor EMP Implemenation			
5.	Water Sprinkling Measures for Dust Supression	Construction		The cost is integrated as part of the civil work cost
6	Development and Implementation of the Dolphim 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 2.0 mtr 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 initialy, painting, lettering & border with reflective paint at the time of every shifing, 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 informationary signboards 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	Construction		The cost is integrated as part of the civil work cost
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), Goggles (IS CODE 5983 : 1980), Reflective Jackets, mitten/ gloves (IS 2573), safety nose masks to all personnel (including temporary labour) involved in the worksites	Construction		The cost is integrated as part of 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 are integrated as part of the civil work cost
14	Environment, Health & Safety Engineer/Supervisor having Bachelors in Env Science / Management/ B.Tech (Env Engg.)	Construction	0	The Manpower Cost is integrated into the cost of the Civil Works
15	Diploma in Central Labour Institute / Regional Labour Institute (Mandatory)	Construction	0	The Manpower Cost is integrated into the cost of the Civil Works
	River bank protection through plantation (Erosion management)		200000	Contractor
	Sub total (C)		2,00,000	
D	PIU EMP Implementation cost			
1	EMP Supervision Cost	Construction	2,40,000	PIU Cost
2	Equipments	Construction	1,50,000	PIU Cost
	Sub Total (D)		3,90,000	
	Total (A+B+C+D)		48,39,000	
E	Contingency (@5% of (A+B+C+D))		2,41,950	
	Total (A+B+C+D+E)		50,80,950	

****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 TSSC	4,00,000
EMP Implementation Cost to PIU/AIWTDS	3,90,000
EMP Implementation Cost to Contractor	40,49,000

Table 8.6: Summary of Environmental Budget (Operation Phase)

	Particulars	Stages	Cost	
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S.No			(INR)	Costs Covered By
A.	Monitoring Measures			
1	Water Quality Monitoring	Operation	2,00,000	AIWCL/ DIWT
2	Biological Monitoring	Operation	12,50,000	AIWCL/ DIWT
3	Sediments: Physico Chemical	Operation	2,50,000	AIWCL/ DIWT
4	Sediments: Biological	Operation	2,50,000	AIWCL/ DIWT
5	Ambient Air Quality	Operation	1,20,000	AIWCL/ DIWT
6	Noise Quality	Operation	2,25,000	AIWCL/ DIWT
8	Groundwater	Operation		Civil works contract
	Subtotal (A)		22,95,000	
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 (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 are integrated as part of the civil work cost
	Waste Management System	Operation		
	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0 mtr 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 are 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. Sheetings 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	Operation	50,000	AIWCL/ DIWT

	time at the work sites as required and directed by the engineer			
	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 are 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 are integrated as part of the civil work cost
	Terrestrial and Aquatic Fauna including surveillance audit and Dolphin Conservation Management Plan	Operation	10,00,000	AIWCL/ DIWT
	River bank protection through plantation (Erosion management)		2,00,000	AIWCL/ DIWT
	Sub total (C)		14,80,000	
D	PIU EMP Implementation cost			
	EMP Supervision Cost	Operation	9,00,000	AIWCL/ DIWT
	Sub Total (D)		9,00,000	
	Total (A+B+C+D+E)		54,25,000	
F	Contingency @ 5% of (A+B+C+D)		2,71,250	
	Total (A+B+C+D+E+F)		56,96,250	

****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. 56,96,250

8.7 BUDGET FOR SMP

The estimated costs for various activities for social management under the subproject is Rs.45 lakh it is given in **Table-8.7**.

Table 8.7: Estimated Cost for SMP

Item of SMP	Duration	Estimated costs (Rs.) lakh
<p>Training for contractor staff on labour laws such as:</p> <p>Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996;</p> <p>The Bonded Labour System (Abolition) Act, 1976;</p> <p>The Workmen's Compensation Act, 1923;</p> <p>The Contract Labour (Regulation & Abolition) Act, 1970 and Rules;</p> <p>The Child Labour (Prohibition and Regulation) Act, 1986;</p> <p>The Indian Factories Act, 1948 and State Rules;</p> <p>Public Liability and Insurance Act, 1991 etc.</p> <p>The new labour Act like The Code on Social Security, 2020 and The Code on Wages, 2019, etc.</p>	Actual, before and during the project implementation time	15.0
<p>Social safeguards training including training of staff on GRM, contractor's code of conduct, SEA/SH,</p> <p>GBV training (SEA, SH)</p>	Actual, before and during the project implementation time	15.0
Environmental and Health and Safety Officer and Social Development	Actual during the project	15.0

Item of SMP	Duration	Estimated costs (Rs.) lakh
Specialist hired by contractor, for on-site supervision	implementation	
Total (Rs.)		45.0

8.8 IMPLEMENTATION OF EMP & SMP

11 Constitution of Environmental & Social Management Cell

It is recommended that project authority to establish an Environmental & Social Management Cell (ESMC) 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 & Social Management Cell (ESMC) 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 & Social Management Cell (ESMC) at project level, which consist of Environment, Social & Safety officers and shall assist and report to concerned officers of ESMC of AIWTDS at project level.

The ESMC will closely monitor the environmental aspects of the proposed project and identify 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 & Social Management Cell (ESMC) 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 & Social Management Cell (ESMC) will report to the appropriate authority having adequate powers to implement the required measures. The manpower required for Environmental & Social Management Cell (ESMC) with qualification, experience and role & responsibility is given in **Table- 8.9**.

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

Designation in EMC	Number	Qualification	Exposure/ Experience	Roles/Responsibilities
Environmental Expert	1	M.E./ M.Tech / M. Sc. (Environmental	10 years of working Experience	Overall EMP Compliance and monitoring
Social Development Expert	1	Masters 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	5 years of working Experience	Overall Compliance and Safety monitoring

12 Third Party Monitoring

AIWTDS will engage an independent consulting firm to conduct external and independent monitoring of the EMP 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 EMP & SMP implementation and that all the ESMP requirements are being implemented in a timely and effective manner. TPM shall carry out a periodic quarterly review of environmental and social safeguard activities being implemented in the project and provide specific recommendations to mitigate the issues identified during the review period as per the approved ESMP of contractor. 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 Aphalamukh Terminal shall be made from the Project side.

Chapter 9 - SUMMARY AND CONCLUSION

INTRODUCTION

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. 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. Currently, the facilities and infrastructure built at these terminals are not sufficient to meet the growing demand of traffic volume as they lack facilities for safety, 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 which is being planned through the Assam Inland Water Transport Project (AIWTP).

The Majuli Island is accessible by ferries from Jorhat and two of the major ghats operated here are Aphalamukh and Kamalabari. On an average about 1000 passengers travel to and from from Neamati to Kamalabari and Neamati to Aphalamukh Terminal. During the peak tourist and festival season, more than 5000-6000 passengers use these ferry services to reach Majuli. The existing terminal caters to both passengers, two wheelers and four-wheeler vehicles. However, the existing conditions of the terminal needs to be upgraded owing to the importance of the terminal for the locals, tourists and at the same time making it safe for passengers with adequate amenities. The pontoon shall receive Ro-Pax and catamaran vessels of capacity 100-150 passengers along with two wheelers. 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 Project activities at Aphalamukh shall include construction works in a high bio-diversity area as well as 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 labour influx, health and safety so the project is considered as Category B.

. The anticipated impacts are both positive and negative but will be significant.

ESIA studies were conducted for the site and stakeholders meeting were conducted at different stages of the ESIA study. Baseline conditions of the site were assessed and information on relevant environmental parameters were collected through primary and secondary sources in order to understand the present environmental setting of the proposed project site. Anticipating the quantum of change, efforts were also made to analyse the degree of alternations and strategies for suitable management to ameliorate the negative impacts project activities. This

exercise has provided a sound basis for formulation of different management plans, which are presented in the ESMP document of the project. ESIA study of the proposed project was carried out and monitoring plans have been framed based on the severity of impacts in different areas. The preventive/ curative measures to reduce the ill effects of construction activities on these parameters have been suggested under various plans. A holistic approach has been adapted for monitoring of air, noise and water related factors under different heads with suitable financial provisions for their implementation. An important element of mitigation is emergency planning, i.e., recognizing that accidents are possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on-site and offsite, that would need to be implemented in the event of an emergency both during construction and operation phase of the terminal.

A site-specific Environmental & Social Management Plan (ESMP) has been prepared for avoiding, mitigating, checking the adverse impacts envisaged during ESIA studies on various environmental components during construction and operational phase of the project with a budget for implementing the ESMP is kept. Majuli island being one of the Biodiversity Heritage sites, implementation of the ESMP by the Contractor with strict adherence shall be important.

TSSC for the Project along with GC shall provide requisite support to AIWTDS and Contractor for implementing the ESMP. 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 needs to be implemented to ensure that environmental & social impacts are within the predicted levels and that specified environmental & social performance targets are being achieved.

It can be concluded that the proposed Assam Inland Water Transport Project project is likely to entail certain environmental impacts due to the proposed intervention at Aphalamukh. However, these impacts can be ameliorated to a large extent by implementing appropriate mitigation measures with proper monitoring and reporting mechanism, these anticipated impacts shall be largely mitigated both during the construction and operation of the terminal.

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-digester 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-digester 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-digester 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.

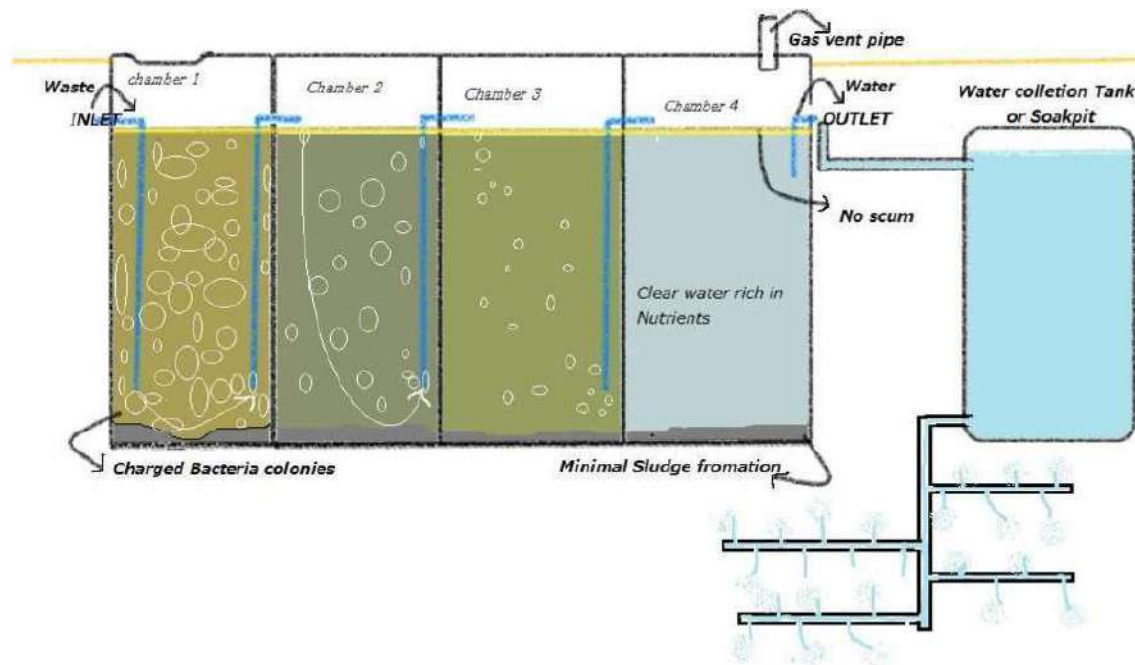


Figure 1.1: Schematic of biobank sourced from DRDO

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.

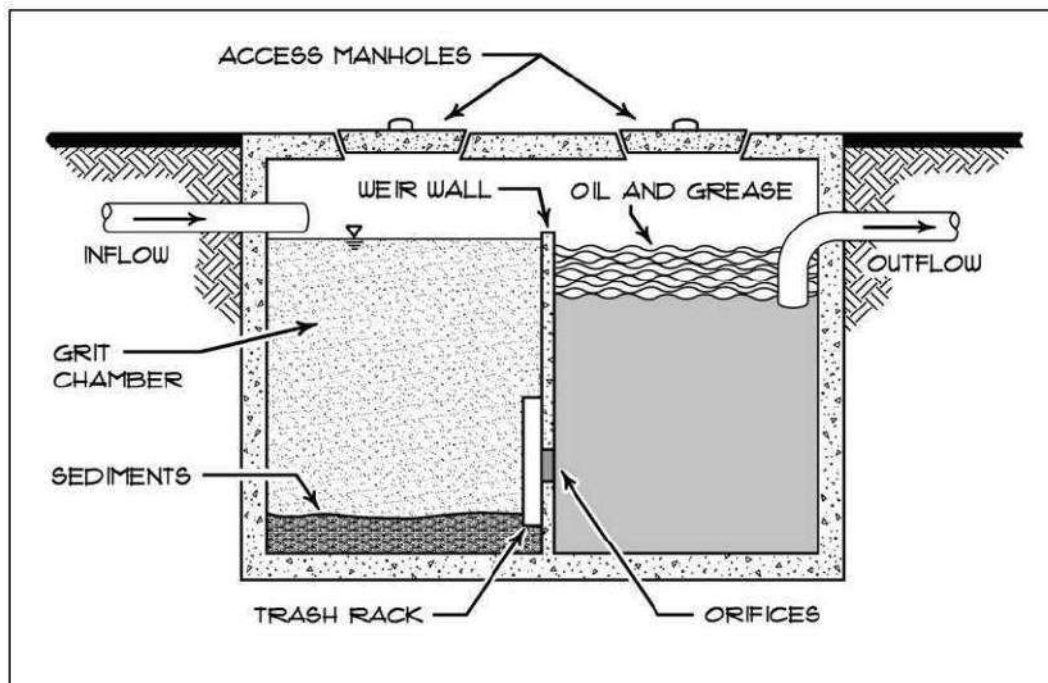


Figure 1.2: Schematic of Oil/Grit Separator

Annexure - 2
Land Related Document



GOVERNMENT OF ASSAM
OFFICE OF THE DEPUTY COMMISSIONER::MAJULI
(REVENUE BRANCH)

E-mail ID: decmajuli@gmail.com
Date: 14-08-2020

Tel-03775274424
No. MRS.6/2020

ORDER

Perused the letter received from the State Project Director, Assam Inland Water Transport Development Society, vide letter No. AIWTDS/57/2018/81 dtd. 18/06/2019, for allotment and acquisition of land for construction of Terminal at the existing Aphalamukh Ferry Ghat of Inland Water Transport, Assam, also perused the minutes of the SDLAC meeting dated 26-12-2019 where the proposed land had been recommended vide Resolution No 3 in the allotment of land for Govt. Organizations. Subsequently, the recommendation was approved by Revenue & Disaster Management Department vide letter No. RSS.232/2020/49 dated 24.07.2020 in favour of Assam Inland Water Transport Development Society, for construction of Terminal at the existing Aphalamukh Ferry Ghat in Majuli, subject to utilization of land for the specific purpose within 3(three) years, failing which the land so allotted will automatically stand cancelled and reverted to the Government. Accordingly, a plot of Govt. land, measuring 19B-0K-15L covered by Dag No - 424(part), 649(part), 650(part), 651(part), 652(part), 653(part), 654(part), 655(part), 656(part), 657(part), 658(part), 659(part), 660(part), 661(part), 662(part), 670(part), 673(part), 678(part), 679(part) situated at Goroinari village, Majuli under Salmora Mouza of Ujani Majuli Revenue Circle in Majuli District, is allotted in favour of Assam Inland Water Transport Development Society.

Sd/-
Deputy Commissioner
Majuli

Date: 14-08-2020

Memo No. MRS.6/2020
Copy to:-

4358-65

1. The Principal Secretary to the Govt. of Assam, Transport Department, Dispur for favour of kind information
2. The Secretary to the Govt. of Assam, Revenue and Disaster Management Department, Dispur, for favour of kind information.
3. The Director of Land Records & Surveys etc. Assam, Rupnagar, Ghy-32 for favour of kind information.
4. The State Project Director, Inland Water Transport & ASPD, AIWTDS, Ulubari, Guwahati-7 for favour of kind information.
5. The Director of Land Requisition Acquisition & Reforms, Rupnagar, Ghy-32 for favour of kind information.
6. The Circle Officer, Ujani Majuli Revenue Circle, Majuli for information and necessary action. She is requested to hand over the possession of land to the EE, Inland Water Transport, Dibrugarh Division, and correct the land records accordingly with a copy to the undersigned.
7. The EE, Inland Water Transport, Dibrugarh Division, for information & necessary action. He is requested to take over the possession of land from the Circle Officer, Ujani Majuli Revenue Circle, Majuli, immediately.
8. Office file.

Deputy Commissioner
Majuli

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

[illegible]

4a.	Family assets							
4b.	Land owned (area in Acres)							
4c.	Type of house	Pucca	Kutchha			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 coverage			
x	Are there any unique Cultural/tourism centres in the village?			
y	Number of religious centres Temples/mosques/churches/ guru			
	dwaras/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 <ul style="list-style-type: none"> • 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	
	<p>Name and signature of the PRA team</p>	

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:

[illegible]

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: <ul style="list-style-type: none">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.	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Two (02) number bridges are proposed in the vicinity of the project and taken into consideration to avoid any conflicts of interest?	<ul style="list-style-type: none">It was assured that the upcoming bridges and the proposed terminals will not affect each other.
	<ul style="list-style-type: none">River development program under smart city project between Kachari Ghat and DC bungalow having a length of	<ul style="list-style-type: none">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	<ul style="list-style-type: none"> What will be the length of the stairs from terminal platform to pontoons? 	<ul style="list-style-type: none"> The length of the stairs will vary as per location.
Mr Mridul K Das (Executive Engineer) Pollution Control Board	<ul style="list-style-type: none"> 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? 	<ul style="list-style-type: none"> It was clarified that appropriate measures will be taken to control any kind of pollution.
Mr P K Das (Member AIWTDS)	<ul style="list-style-type: none"> Consultation meetings, surveys etc. shall be done in coordination and involvement of respective administration and prominent stakeholders. 	<ul style="list-style-type: none"> Suggestions will be followed.
Dr Abhinandan Saikia (TISS Guwahati)	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Compensation for land acquisition and livelihood 	<ul style="list-style-type: none"> Impacts if any occurred will be treated as per project norms.
Mr Nabin Sarma, Social Development Expert, AIWTDS	<ul style="list-style-type: none"> Approach about the labour influx and gender based inequality & violence during construction phase? 	<ul style="list-style-type: none"> 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 all 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	<ul style="list-style-type: none">• 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.

	<p>diesel genset just for pumping water.</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Appreciated the Aapda Mitra training for the local youths and suggested to avail such trainings 	
Mr. Subhram Goswamai Senior Consultant, PWC (APART Project)	<ul style="list-style-type: none"> • Provision for transport of agriculture and allied products at reduced freight charges 	

Shri Ankur Jain, (IPS) State Project Director, AIWTDS	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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:		
<p>The meeting started with a welcome note by Commodore Sri K.C. Choudhury, Honorary Advisor, Assam Inland Water Transport Development Society welcoming all the participants in the Stakeholder's meet.</p> <p>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.</p> <p>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.</p> <p>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.</p>		

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, Uluhary, Guwahati - 7; email: dir.iwtds-as@gov.in; Tel: +91361-2462677

No: AIWTD/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) Gujjan (Tinsukia), Disangmukh (Sivsagar), Ghagor (Lakhimpur), Matmora (Lakhimpur), Kacharighat (Dhubri), Aphalamukh (Majuli) and Neamati (Jorhat), two Slipways at Dikhowmukh (Sivsagar) and Dhubri along with setting 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 CUMULATIVE
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, 3 rd 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

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08.02.2023 (Wednesday)	11.00 am	Aphalamukh IWT Ferry Ghat, Majuli District

Sd/- State Project Director
Assam Inland Water Transport Development Society
Ulubari, Guwahati - 781007
Janasanyog/DF/2115/22

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Meeting Schedule

**STAKEHOLDER CONSULTATION OF
ASSAM INLAND WATER TRANSPORT PROJECT ON
ENVIRONMENTAL AND SOCIAL SAFEGUARDS STUDIES AND CUMULATIVE
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	

Institutional Stakeholders Consultation at Guwahati (07.05.2022)





Annexure – 5

**Photographs of stakeholders' meetings &
existing site conditions at Aphalamukh**

Photographs of Stakeholders Consultation

Aphlamukh and Neamati (08.02.2023)



North Guwahati and Umananda (06.02.2023)



APHALAMUKH

Aphalamukh



Available land for terminal upgradation



Existing Aphalamukh Terminal



Existing Condition



Temporary Pathway to pontoon



Works undertaken by Bramhaputra Development Board



Interaction with Brahmaputra Development Board staff



Interaction with commuters



Interaction with IWT site staff



Interaction with local Commuters



Interaction with safety and security staff



Public toilet constructed by Brahmaputra Development Board

Annexure - 6

Environmental Monitoring Report- Soil



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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Analysis	SS-260422-57	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
Sample Quantity : 2.0 Kg
Analysis Duration : 30.03.2022 to 25.04.2022

TEST RESULTS				
S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	pH (1:5 suspension)	IS:2720(Part-26)	8.24	-
2.	Electrical Conductivity @25°C (1:1suspension.)	IS:2720(Part-21)	501	µS/cm
3.	Calcium (as Ca)	STP/SOIL	2007	mg/kg
4.	Magnesium (as Mg)	STP/SOIL	372	mg/kg
5.	Sodium (as Na)	STP/SOIL	241	mg/kg
6.	Available Potassium (as K)	STP/SOIL	309	mg/kg
7.	Salinity @25°C (1:1suspension.)	STP/SOIL	281	µS/cm
8.	Organic Matter	STP/SOIL	0.91	% by mass
9.	Sodium Absorption Ratio	STP/SOIL	0.49	-
10.	Nitrogen	STP/SOIL	0.11	% by mass
11.	Available Phosphorus (as P ₂ O ₅)	STP/SOIL	155	mg/kg
12.	Bulk Density	STP/SOIL	1.25	gm /cc
13.	Organic Carbon	STP/SOIL	0.53	% by mass
14.	Particle Size Distribution	a. Sand	54.7	% by mass
		b. Clay	20.6	% by mass
		c. Silt	24.7	% by mass
15.	Exchangeable Sodium Percentage	STP/SOIL	4.78	% by mass

Notes: -

- The results given above are related to the tested sample, as received & mentioned parameters. The customer asked for the above tests only.
- Responsibility of the Laboratory is limited to the invoiced amount only.
- This test report will not be generated again, either wholly or in part, without prior written permission of the laboratory.
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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Soil Analysis	SS-260422-58	26-04-2022

Issued To: M/s Wapeos 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 (SAG2)
Sample Quantity : 2.0 Kg
Analysis Duration : 30.03.2022 to 25.04.2022

TEST RESULTS				
S. No.	PARAMETER	TEST METHOD	RESULT	UNIT
1.	pH (1:5 suspension)	IS:2720(Part-26)	7.80	-
2.	Electrical Conductivity @25°C (1:1suspension.)	IS:2720(Part-21)	493	µS/cm
3.	Calcium (as Ca)	STP/SOIL	1993	mg/kg
4.	Magnesium (as Mg)	STP/SOIL	406	mg/kg
5.	Sodium (as Na)	STP/SOIL	178	mg/kg
6.	Available Potassium (as K)	STP/SOIL	385	mg/kg
7.	Salinity @25°C (1:1suspension.)	STP/SOIL	268	µS/cm
8.	Organic Matter	STP/SOIL	1.15	% by mass
9.	Sodium Absorption Ratio	STP/SOIL	0.49	-
10.	Nitrogen	STP/SOIL	0.099	% by mass
11.	Available Phosphorus (as P ₂ O ₅)	STP/SOIL	169	mg/kg
12.	Bulk Density	STP/SOIL	1.21	gm /cc
13.	Organic Carbon	STP/SOIL	0.67	% by mass
14.	Particle Size Distribution	a. Sand	61.4	% by mass
		b. Clay	22.6	% by mass
		c. Silt	16.0	% by mass
15.	Exchangeable Sodium Percentage	STP/SOIL	4.85	% by mass

Notes: -

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Annexure - 7

Environmental Monitoring Report- Water



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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-023	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 (WAG1)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	6.97	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Electrical Conductivity	IS-3025(P-14)	226	μS/cm
4.	Turbidity	IS-3025(P-10)	<1.0	NTU
5.	Total Hardness (as CaCO ₃)	IS:3025(Part-21)	62.0	mg/l
6.	Fluoride (as F)	APHA 22 nd edit	<0.10	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.5	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	76.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	12.5	mg/l
10.	BOD (3 days at 27°C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO ₃)	IS: 3025 (P- 34)	5.0	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	148	mg/l
13.	Sulphate (as SO ₄)	IS: 3025 (P- 24)	9.0	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	7.5	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	3.5	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 22 nd 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)	0.08	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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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-024	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 (WAG2)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	6.90	-
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 CaCO ₃)	IS:3025(Part-21)	64.0	mg/l
6.	Fluoride (as F)	APHA 22 nd edit	<0.10	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.4	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	78.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	13.0	mg/l
10.	BOD (3 days at 27°C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO ₃)	IS: 3025 (P- 34)	5.5	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	150	mg/l
13.	Sulphate (as SO ₄)	IS: 3025 (P- 24)	10.0	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	7.7	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	4.0	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 22 nd 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)	0.13	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)	0.11	mg/l

Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

Branch Office :

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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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Authorized Signatory

Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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TEST CERTIFICATE

Test Report of	Report Code	Date of Issue
Water Sample	W-300322-025	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 (WAG3)
Analysis Duration	:	30/03/2022 to 25/04/2022

TEST RESULTS

S. No.	Parameter	Test Method	Results	Units
1.	pH	IS:3025(Part-11)	6.94	-
2.	Colour	IS:3025(Part-4)	<5.0	Hazen
3.	Electrical Conductivity	IS-3025(P-14)	238	µS/cm
4.	Turbidity	IS-3025(P-10)	<1.0	NTU
5.	Total Hardness (as CaCO ₃)	IS:3025(Part-21)	70.0	mg/l
6.	Fluoride (as F)	APHA 22 nd edit	<0.10	mg/l
7.	Dissolve Oxygen	IS:3025(Part-38)	6.3	mg/l
8.	Chloride (as Cl)	IS:3025(Part-32)	79.0	mg/l
9.	Calcium (as Ca)	IS: 3025 (P- 40)	16.0	mg/l
10.	BOD (3 days at 27 th C)	IS-3025 (P-44)	<2.0	mg/l
11.	Nitrate (as NO ₃)	IS: 3025 (P- 34)	6.0	mg/l
12.	Total Dissolved Solid	IS:3025(Part-16)	158	mg/l
13.	Sulphate (as SO ₄)	IS: 3025 (P- 24)	11.5	mg/l
14.	Magnesium (as Mg)	IS: 3025 (P-46)	7.3	mg/l
15.	Phosphate (as P)	IS-3025(P-31)	<0.05	mg/l
16.	Sodium (as Na)	IS-3025(P-45)	4.5	mg/l
17.	Potassium (as K)	IS-3025(P-45)	<1.0	mg/l
18.	COD (as O ₂)	IS-3025 (P-38)	8.0	mg/l
19.	Residual Sodium Carbonate	APHA 22 nd 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)	0.16	mg/l

Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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+91-9313611642, 8510081921, 7503031145, 8527870572, 7503031146, 9999794369

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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Laboratory : GT-20, Sector-117, Noida Gautam Budh Nagar - 201301

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Annexure - 8

Drinking Water & National River Water Quality Standard For Different Uses

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 hexavalent 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.

IS: 2296-1982: National River Water Quality Standards for Different Uses

S. No.	Characteristics	Tolerance Limit				
		Drinking water source with conventional treatment	Outdoor bathing	Drinking water source with conventional treatment but after disinfection	Fish culture and wildlife propagation	Irrigation industrial cooling or controlled water disposal
		A	B	C	D	E
1.	pH value	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
2.	Dissolved Oxygen (mg/l), min	6	5	4	4	-
3.	BOD (5-days at 20° C, mg/l, min	2	3	3	-	-
4.	Total Coliform Organism, MPN/100, max	50	500	5000	-	-
5.	Colour, Hazen units, max	10	300	300	-	-
6.	Odour	10	300	300	-	-
7.	Taste	Tasteless/ Unobj	-	-	-	-
8.	Total Dissolved Solids, mg/l, max	500	-	1500	-	2100
9.	Total Hardness (as CaCO ₃), mg/l, max.	300	-	-	-	-
10.	Calcium Hardness (as CaCO ₃), mg/l, max	200	-	-	-	-
11.	Magnesium Hardness (as CaCO ₃), mg/l, max	100	-	-	-	-
12.	Copper (as Cu), mg/l, max	1.5	-	1.5	-	-
13.	Iron (as Fe), mg/l, max	0.3	-	0.5	-	-
14.	Manganese (as Mn), mg/l, max	0.5	-	-	-	-
15.	Chloride (as Cl), mg/l, max	250	-	600	-	600
16.	Sulphates (as SO ₄), mg/l, max	400	-	400	-	1000
17.	Nitrates (as NO ₃), mg/l, max	20	-	50	-	-
18.	Fluorides (as F), mg/l, max	1.5	1.5	1.5	-	-
19.	Phenolic Compounds (as C ₆ H ₅ OH), mg/l, max	0.002	0.005	0.005	-	-
20.	Mercury (as Hg), mg/l, max	0.001	-	-	-	-
21.	Cadmium (as CD), mg/l, max	0.01	-	0.01	-	-
22.	Selenium (as Se), mg/l, max	0.01	-	0.05	-	-
23.	Arsenic (as As), mg/l, max	0.05	0.2	0.2	-	-
24.	Cyanide (as CN), mg/l, max	0.05	0.05	0.05	-	-

S. No.	Characteristics	Tolerance Limit				
		Drinking water source with conventional treatment	Outdoor bathing	Drinking water source with conventional treatment but after disinfection	Fish culture and wildlife propagation	Irrigation industrial cooling or controlled water disposal
		A	B	C	D	E
25.	Lead (as Pb), mg/l, max	0.1	-	0.1	-	-
26.	Zinc (as Zn), mg/l, max	15	-	15	-	-
27.	Chromium (as Cr ⁶⁺), mg/l, max	0.05	-	0.05	-	-
28.	Anionic Detergents (as MBAS), mg/l, max.	0.2	1	1	-	-
29.	Polynuclear Aromatic Hydrocarbons (as PAH)	0.2	-	-	-	-
30.	Mineral Oil, mg/l, max	0.01	-	0.1	0.1	-
31.	Barium (as Ba), mg/l, max	1	-	-	-	-
32.	Silver (as Ag), mg/l, max	0.05	-	-	-	-
33.	Pesticides	Absent	-	-	-	-
34.	Alpha emitters, uC/ml, max	10 ⁻⁹	10 ⁻⁹	10 ⁻⁹	-	-
35.	Beta emitters, uC/ml, max	10 ⁻⁸	10 ⁻⁸	10 ⁻⁸	10 ⁻⁸	10 ⁻⁸
36.	Free Ammonia (as N), mg/l, max	-	-	-	1.2	
37.	Electrical Conductance at 25°C, mhos, max	-	-	-	1000 x 10 ⁻⁶	2250 x 10 ⁻⁶
38.	Free Carbon dioxide (as CO), mg/l, max	-	-	-	61	
39.	Sodium absorption ratio	-	-	-	-	26
40.	Boron (as B), mg/l, max	-	-	-	-	-
41.	Percent sodium, max	-	-	-	-	-

Water Quality Standards (as per IS: 2296)

Class A – Drinking water without conventional treatment but after disinfection.

Class B – Water for outdoor bathing.

Class C – Drinking water with conventional treatment followed by disinfection.

Class D – Water for fish culture and wild life propagation.

Class E – Water for irrigation, industrial cooling and controlled waste disposal.

Unobj = Unobjectionable

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

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

Report No. : MSK/GHY/2022-23/1573
 Report Date : 15.01.2023
 Sample Description : Ambient Air
 Sampling Location : (AAQ-15) Aphalamukh
 Sample No. : MSKGL/ED/2022-23/09/02073-02080
 Lat/Long : 26.918069/94.288863

ANALYSIS RESULT

SL.N0.	Date of Monitoring	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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)
1	05.08.2022	56.1	35.1	6.4	17.8	0.46	22.8	11.4	<0.01	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	60.3	33.5	6.9	20.3	0.54	21.9	10.9	<0.01	<5.0	<1.0	<4.2	<0.5
3	12.08.2022	50.7	29.8	<6.0	16.4	0.38	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	52.1	27.4	<6.0	16.9	0.40	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	63.7	31.9	7.2	22.5	0.74	23.5	11.7	0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	59.2	34.8	7.0	19.6	0.66	20.7	10.3	<0.01	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	55.0	26.2	<6.0	16.4	0.46	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	63.5	35.3	<6.0	16.9	0.72	<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, 3 rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3 rd 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

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 Tel. : 91 33 40143000 / 22650006 / 22650007 Fax : 91 33 22650008
 Email : info@mitrask.com. Website: www.mitrask.com

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TEST REPORT

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

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

Report No. : MSK/GHY/2022-23/1574
 Report Date : 15.01.2023
 Sample Description : Ambient Air
 Sampling Location : (AAQ-15) Aphalamukh
 Sample No. : MSKGL/ED/2022-23/09/02081-02088
 Lat/Long : 26.917478/94.292003

ANALYSIS RESULT

SL.NO.	Date of Monitoring	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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)
1	05.08.2022	51.3	32.1	6.5	19.6	0.44	22.5	11.3	<0.01	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	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	12.08.2022	46.1	27.1	<6.0	15.8	0.42	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	51.9	27.3	6.2	17.4	0.48	21.3	10.6	<0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	55.0	27.5	6.8	20.8	0.46	23.9	12.0	<0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	53.1	31.2	<6.0	16.7	0.54	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	47.8	22.8	<6.0	15.6	0.36	<20.0	<10.0	<0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	45.6	25.3	<6.0	15.3	0.30	<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, 3 rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3 rd 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.

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 Tel. : 91 33 40143000 / 22650006 / 22650007 Fax : 91 33 22650008
 Email : info@mitrask.com, Website: www.mitrask.com

Page No. : 44 of 51

TEST REPORT

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

Report No. : MSK/GHY/2022-23/1575
Report Date : 15.01.2023
Sample Description : Ambient Air
Sampling Location : (AAQ-15) Aphalamukh
Sample No. : MSKGL/ED/2022-23/09/02089-02096
Lat/Long : 26.915899/94.295284

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

ANALYSIS RESULT

SL.NO.	Date of Monitoring	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	CO (mg/m ³)	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)
1	05.08.2022	73.1	45.7	7.5	23.1	0.76	25.1	12.5	0.02	<5.0	<1.0	<4.2	<0.5
2	08.08.2022	68.9	38.3	6.9	20.3	0.64	22.3	11.2	0.01	<5.0	<1.0	<4.2	<0.5
3	12.08.2022	74.6	43.9	7.7	24.7	0.82	26.4	13.2	0.02	<5.0	<1.0	<4.2	<0.5
4	16.08.2022	68.3	35.9	<6.0	18.1	0.66	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
5	20.08.2022	66.1	33.1	<6.0	16.9	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
6	24.08.2022	75.3	44.3	7.9	22.3	0.54	24.1	12.0	0.02	<5.0	<1.0	<4.2	<0.5
7	28.08.2022	67.2	32.0	<6.0	18.7	0.62	<20.0	<10.0	0.01	<5.0	<1.0	<4.2	<0.5
8	31.08.2022	71.4	39.7	7.3	15.9	0.56	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, 3 rd Edn. By James P. Lodge (Method-417)	Air Sampling, 3 rd 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.



- 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.

Head Office: Shrachi Centre (5th floor), 74B, A.J.C. Bose Road, Kolkata - 700 016, West Bengal, India.
Tel. : 91 33 40143000 / 22650006 / 22650007 Fax : 91 33 22650008
Email : info@mitrask.com. Website: www.mitrask.com

Page No. : 45 of 51

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/m ³)	60	60
Particulate Matter PM 10 (µg/m ³)	100	100
Sulphur Dioxide (as SO ₂) (µg/m ³)	80	80
Oxides of Nitrogen (as NO ₂) (µg/m ³)	80	80
Carbon Monoxide (as CO), (mg/m ³)	02	02
Ozone (as O ₃) (µg/m ³)	100	100
Lead (as Pb) (µg/m ³)	1.0	1.0
Ammonia (as NH ₃) (µg/m ³)	400	400
Benzene (as C ₆ H ₆) (µg/m ³)	05	05
Benzo (O) Pyrene (as BaP) (ng/m ³)	01	01
Arsenic (as As) (ng/m ³)	06	06
Nickel (as Ni) (ng/m ³)	20	20

Annexure - 11
Noise Quality Report



वाष्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम)
जल शक्ति मंत्रालय
(A Government of India Undertaking)
Ministry of Jal Shakti



ANNEXURE-V(b)

Date: 12.08.2022

Hourly equivalent noise levels - Aphalamukh terminal (Unit:dB(A))

Location	N-A1	N-A2	N-A3
6-7 AM	42	42	41
7-8 AM	43	44	43
8-9 AM	43	44	44
9-10 AM	44	45	44
10-11 AM	45	45	46
11-12 Noon	46	46	46
12 noon – 1 PM	46	47	47
1-2 PM	47	47	46
2-3 PM	48	48	47
3-4 PM	49	48	48
4-5 PM	48	49	49
5-6 PM	46	46	47
6-7 PM	45	45	47
7-8 PM	44	45	46
8-9 PM	43	43	45



Registered Office : 5th Floor, 'Kailash', 26, Kasturba Gandhi Marg, New Delhi-110001, INDIA
Ph.: +91-11-23313131, 23313132 • Fax : +91-11-23313134, 23314924
Corporate Office: 76-C, Institutional Area, Sector - 18, Gurugram - 122 015 (Haryana), INDIA
Tel. : +91-124-2399421-27 • Fax : +91-124-2397392
E-mail : ho@wapcos.co.in ; mail@wapcos.co.in • Website : <http://www.wapcos.co.in>
CIN : U74899DL1969GOI005070

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 Aphalamukh site

Table- Checklist of plant species recorded from Aphalamukh site

Botanical name	Local name	Family	Habitat	IUCN Status	Division
<i>Acacia nilotica</i> (L.) Delile	Babool	Fabaceae	Tree	LC	Dicot
<i>Achyranthes aspera</i> L.	Chaff-flower	Amaranthaceae	Herb	-	Dicot
<i>Ageratum houstonianum</i> Mill.	Blueweed	Asteraceae	Herb	-	Dicot
<i>Albizia procera</i> (Roxb.) Benth.	Safed siris	Mimosaceae	Tree	LC	Dicot
<i>Albizia saman</i> (Jacq.) Merr.	Rain tree	Mimosaceae	Tree	-	Dicot
<i>Allantodia aspera</i> (Blume) Ching	Dhekiasak	Athyriaceae	Herb	-	Dicot
<i>Alstonia scholaris</i> (L.) R. Br.	Devil's tree	Apocynaceae.	Tree	LC	Dicot
<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	Sessile joyweed-	Amaranthaceae	Herb	LC	Dicot
<i>Amaranthus spinosus</i> L.	Pigweed	Amaranthaceae	Herb	-	Dicot
<i>Argemone mexicana</i> L.	Satyanashi	Papaveraceae	Herb	-	Dicot
<i>Artocarpus heterophyllus</i> Lam.	Kothal	Moraceae	Tree	-	Dicot
<i>Bambusa arundinacea</i> (Retz.) Willd.	Bara bans	Poaceae	Bamboo	-	Monocot
<i>Bambusa balcooa</i> Roxb.	Bholuka bah	Poaceae	Bamboo	-	Monocot
<i>Bauhinia vahlii</i> Wight & Arn.	Malu creeper	Caesalpiniaceae	Climber	-	Dicot
<i>Bauhinia variegata</i> L.	Kanchan	Fabaceae	Tree	LC	Dicot
<i>Boerhaavia diffusa</i> L.	Punarnava	Nyctaginaceae	Shrub	-	Dicot
<i>Bombax ceiba</i> L.	Semal	Malvaceae	Tree	LC	Dicot
<i>Callistemon lanceolatus</i> (Sm.) Sweet	Bottlebrush	Myrtaceae	Tree	-	Dicot

Botanical name	Local name	Family	Habitat	IUCN Status	Division
<i>Calotropis gigantea</i> (L.) Dryand.	Madar	Apocynaceae	Shrub	-	Monocot
<i>Carica papaya</i> L.	Papaya	Caricaceae	Shrub	DD	Dicot
<i>Cascabela thevetia</i> (L.) Lippold	Pila kaner	Apocynaceae	Shrub	LC	Dicot
<i>Cassia fistula</i> L.	Sonaru	Caesalpiniaceae	Tree	LC	Dicot
<i>Catharanthus roseus</i> (L.) G.Don	Sadabahar	Apocynaceae	Herb	-	Dicot
<i>Citrus limon</i> (L.) Osbeck	Lemon	Rutaceae	Shrub	LC	Dicot
<i>Clerodendrum glandulosum</i> Lindl.	Nephaphu	Verbenaceae	Shrub	-	Dicot
<i>Colocasia esculenta</i> (L.) Schott	kachu	Araceae	Herb	LC	Dicot
<i>Commelina benghalensis</i> L.	wandering jew	Commelinaceae	Herb	LC	Monocot
<i>Convolvulus arvensis</i> L.	Bindweed	Convolvulaceae	Herb	-	Dicot
<i>Corymbia citriodora</i> (Hook.) K.D.Hill & L.A.S.Johnson	Safada	Myrtaceae	Tree	LC	Dicot
<i>Cyanthillium cinereum</i> (L.) H.Rob.	Sahadevi	Asteraceae	Herb	-	Dicot
<i>Cymbopogon martini</i> (Roxb.) W.Watson	Rosha grass	Poaceae	Grass	-	Monocot
<i>Cyperus cyperoides</i> (L.) Kuntze	Flat Sedge	Cyperaceae	Grass	LC	Monocot
<i>Cynodon dactylon</i> (L.) Pers.	Dub	Poaceae	Grass	-	Monocot
<i>Cyperus rotundus</i> L.	Coco-grass	Cyperaceae	Grass	LC	Monocot
<i>Dalbergia sissoo</i> DC.	Sheesam	Fabaceae	Tree	LC	Dicot
<i>Datura metel</i> L.	Dhatura	Solanaceae	Shrub	-	Dicot
<i>Delonix regia</i> (Hook.) Raf.	Gulmohar	Fabaceae	Tree	LC	Dicot
<i>Dendrocalamus strictus</i> (Roxb.) Nees	Bijuli	Poaceae	Bamboo	-	Monocot

Botanical name	Local name	Family	Habitat	IUCN Status	Division
<i>Desmodium triflorum</i> (L.) DC.	-	Fabaceae	Herb	LC	Dicot
<i>Digitaria ciliaris</i> (Retz.) Koeler	Crabgrass	Poaceae	Grass	-	Monocot
<i>Digitaria sanguinalis</i> (L.) Scop.	Crabgrass	Poaceae	Grass	LC	Monocot
<i>Dioscorea bulbifera</i> L.	Air yam	Dioscoreaceae	Climber	-	Dicot
<i>Diplazium esculentum</i> (Retz.) Sw.	Dhekiasak	Athyriaceae	Herb	LC	Dicot
<i>Echinochloa colona</i> (L.) Link	Jungle ricegrass	Poaceae	Grass	LC	Monocot
<i>Eclipta alba</i> (L.) Hassk.	Kehraj	Asteraceae	Herb	LC	Dicot
<i>Eclipta prostrata</i> (L.) L.	Bhringraj	Asteraceae	Herb	LC	Dicot
<i>Eragrostis amabilis</i> (L.) Wight & Arn.	Feather lovegrass	Poaceae	Grass	-	Monocot
<i>Euphorbia hirta</i> L.	Asthma Weed	Euphorbiaceae	Herb	-	Dicot
<i>Ficus benghalensis</i> L.	Badh	Moraceae	Tree	-	Dicot
<i>Ficus religiosa</i> L.	Peepal	Moraceae	Tree	-	Dicot
<i>Fimbristylis dichotoma</i> (L.) Vahl	Fringe-rush	Cyperaceae	Grass	LC	Monocot
<i>Glinus lotoides</i> L.	Damascisa	Molluginaceae	Herb	LC	Dicot
<i>Gomphrena globosa</i> L.	Globe amaranth	Amaranthaceae	Herb	-	Dicot
<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	Kher/Sauri	Poaceae	Grass	-	Monocot
<i>Hibiscus elatus</i> Sw.	Majagua	Malvaceae	Tree	LC	Dicot
<i>Hibiscus rosa-sinensis</i> L.	Hibiscus	Malvaceae	Shrub	-	Dicot
<i>Ipomoea carnea</i> Jacq.	Besharam	Convolvulaceae	Shrub	-	Dicot
<i>Isodon ternifolius</i> (D.Don) Kudô	-	Lamiaceae	Shrub	-	Dicot
<i>Ipomoea indica</i> (Burm.) Merr.	Blue morning	Convolvulaceae	Climber	DD	Dicot

Botanical name	Local name	Family	Habitat	IUCN Status	Division
	glory				
<i>Jasminum nervosum</i> Lour.	Wild Kund	Oleaceae	Shrub	-	Dicot
<i>Lantana camara</i> L.	Lantana	Verbenaceae	Shrub	-	Dicot
<i>Leptopus cordifolius</i> Decne.	-	Euphorbiaceae	Shrub	-	Dicot
<i>Leucas aspera</i> (Willd.) Link	Thumbai	Lamiaceae	Herb	-	Dicot
<i>Mallotus pallidus</i> (Airy Shaw) Airy Shaw	Raini	Euphorbiaceae	Tree	-	Dicot
<i>Mangifera indica</i> L.	Aam	Anacardiaceae	Tree	DD	Dicot
<i>Mazus pumilus</i> var. <i>delavayi</i> (Bonati) T.L. Chin ex D.Y. Hong	Mazus	Scrophulariaceae	Herb	-	Dicot
<i>Melia azedarach</i> L.	Chinaberry tree	Meliaceae	Tree	LC	Dicot
<i>Melilotus indicus</i> (L.) All.	Sweetclover	Papilionaceae	Herb	-	Dicot
<i>Mesua ferrea</i> L.	Nahar	Calophyllaceae	Tree	-	Dicot
<i>Mikania micrantha</i> Kunth	-	Asteraceae	Herb	-	Dicot
<i>Mimosa pudica</i> L.	Lazvanti	Mimosaceae	Herb	LC	Dicot
<i>Moringa oleifera</i> Lam.	Sahjan	Moringaceae	Tree	LC	Dicot
<i>Musa × paradisiaca</i> L.	Kala	Musaceae	Shrub	-	Dicot
<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Kadam	Rubiaceae	Tree	-	Dicot
<i>Ocimum sanctum</i> L.	Tulsi	Lamiaceae	Shrub	-	Dicot
<i>Oldenlandia diffusa</i> (Willd.) Roxb.	Bonjaluk	Rubiaceae	Herb	LC	Dicot
<i>Oroxylum indicum</i> (L.) Kurz	Bhatghila	Bignoniaceae	Tree	-	Dicot
<i>Oxalis corniculata</i> L.	Sorutengacha	Oxalidaceae	Herb	-	Dicot
<i>Panicum paludosum</i> Roxb.	-	Poaceae	Grass	-	Monocot

Botanical name	Local name	Family	Habitat	IUCN Status	Division
<i>Parthenium hysterophorus</i> L.	Gajar ghas	Asteraceae	Shrub	-	Dicot
<i>Paspalum dilatatum</i> Poir.	Dallis grass	Poaceae	Grass	-	Monocot
<i>Perilla frutescens</i> (L.) Britton	Beefsteak	Lamiaceae	Herb	LC	Dicot
<i>Persicaria barbata</i> (L.) H.Hara	Field sedge	Polygonaceae	Grass	LC	Monocot
<i>Phoenix sylvestris</i> (L.) Roxb	Wild date palm	Arecaceae	Tree	-	Monocot
<i>Phyla nodiflora</i> (L.) Greene	Frog fruit	Verbenaceae	Herb	LC	Dicot
<i>Plantago major</i> L.	Buckhorn	Plantaginaceae	Herb	LC	Dicot
<i>Poa annua</i> L.	-	Poaceae	Grass	LC	Monocot
<i>Polygonum hydropiper</i> L.	Marsh pepper	Polygonaceae	Herb	LC	Dicot
<i>Polygonum microcephalum</i> D. Don	Modhusuleng	Polygonaceae	Herb	-	Dicot
<i>Portulaca oleracea</i> L.	Malbhugkhura	Portulacaceae	Herb	LC	Dicot
<i>Pongamia pinnata</i> (L.) Pierre	Karanja	Fabaceae	Tree	LC	Dicot
<i>Psidium guajava</i> L.	Amrud	Myrtaceae	Tree	LC	Dicot
<i>Ranunculus sceleratus</i> L.	Buttercup	Ranunculaceae	Herb	LC	Dicot
<i>Ricinus communis</i> L.	Arandi	Euphorbiaceae	Shrub	LC	Dicot
<i>Saccharum bengalense</i> Retz.	Munj	Poaceae	Grass	-	Monocot
<i>Saccharum spontaneum</i> L.	Wild sugarcane	Poaceae	Grass	LC	Monocot
<i>Saraca asoca</i> (Roxb.) Willd.	Ashok	Fabaceae	Tree	VU	Dicot
<i>Sesamum indicum</i> L.	Benne	Pedaliaceae	Herb	-	Dicot
<i>Setaria verticillata</i> (L.) P.Beauv.	Bristly foxtail	Poaceae	Grass	-	Monocot

Botanical name	Local name	Family	Habitat	IUCN Status	Division
<i>Shorea robusta</i> Gaertn.	Sal	Depterocarpaceae	Tree	LC	Dicot
<i>Sida acuta</i> Burm.f.	Teaweed	Malvaceae	Herb	-	Dicot
<i>Smilax zeylanica</i> L.	Tikonibarua h	Smilacaceae	Climber	-	Dicot
<i>Solanum americanum</i> Mill.	Bhakuritita	Solanaceae	Shrub	-	Dicot
<i>Solanum erianthum</i> D. Don	Mullein nigh tshade	Solanaceae	Shrub	-	Dicot
<i>Solidago gigantea</i> Aiton	Giant goldenrod	Asteraceae	Herb	-	Dicot
<i>Stellaria media</i> (L.) Vill.	Morolia	Caryophyllaceae	Herb	-	Dicot
<i>Stenotaphrum secundatum</i> (Walter) Kuntze	Buffalo turf	Poaceae	Grass	LC	Dicot
<i>Syzygium cumini</i> (L.) Skeels	Borjamu	Myrtaceae	Tree	LC	Dicot
<i>Syzygium fruticosum</i> DC.	Bon Jamu	Myrtaceae	Tree	-	Dicot
<i>Tamarindus indica</i> L.	Imli	Fabaceae	Tree	LC	Dicot
<i>Tectona grandis</i> L.f.	Teak	Verbenaceae	Tree	-	Dicot
<i>Tridax procumbens</i> (L.) L.	Coatbuttons	Asteraceae	Herb	-	Dicot
<i>Ziziphus jujuba</i> Mill.	Bogori	Rhamnaceae	Tree	LC	Dicot

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

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

Annexure - 14

**Photographs of common plant species
observed during the study**

**PHOTOGRAPHS OF COMMON PLANT SPECIES OBSERVED DURING FLORISTIC
SURVEY (APHALAMUKH TERMINAL)**



Mangifera indica



Calotropis gigantean



Leucas aspera



Moringa oleifera



Argemone Mexicana



Phoenix sylvestris



Ipomoea carnea



Artocarpus heterophyllus



Clerodendrum glandulosum



Ricinus communis



Colocasia esculenta



Datura metel



Eclipta alba



Solanum americanum



Bombax ceiba



Lantana camara

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.

Partha Regu
Dr. Partha Regu

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असम ASSAM

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.

L 620994

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

- The Parties agree to work together and co-operate in good faith and to fully participate in achieving the objective of this MOU;
- None of the services, financing or resources set out in clauses 4 or 5 shall be deemed to be a commitment of funds; and
- 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:

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

Partha Sengupta
Dr. Partha Sengupta



Contd.....

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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.

Signature
Dr. M. S. Kumar

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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.

*Partha Jyoti
Dr. Partha Jyoti*



Contd....

Official Use

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.

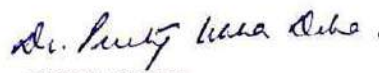
This MOU shall be effective as of the date first written above.



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
Rekola Guwahati-28

Annexure - 16

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* spp., *Barbus* spp., *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 μ Pa 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.

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

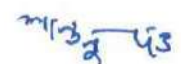


A. List of Authorized Recyclers in Assam of Used oil and waste oil (Schedule-IV, SI-20)

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, SI-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.	<p>The Contractor shall</p> <ul style="list-style-type: none">• 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
		<ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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
		<ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor Shall</p> <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • 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	<p>Groundwater at shallow depths is contaminated with arsenic and hence not suitable for drinking purposes.</p> <p>Depletion and pollution of groundwater resources</p>	<p>The Contractor Shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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
		<p>drainage system to avoid drainage congestion</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 turfs/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 gullyng.	The Contractor shall <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> 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,.	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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
		<p>this regard, make an emergency oil spill containment plan to be supported with enough equipment, materials and human resources</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> follow mitigation measures proposed in ECoP 3 : Water Resources Management and EC4: Drainage Management
	Filling of ponds for site preparation will impact the fishes.	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> follow mitigation measures proposed in ECoP 3 : Water Resources Management and EC4: Drainage Management
	Filling of ponds for site preparation will impact the fishes.	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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
		<ul style="list-style-type: none"> 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>Contractor shall provide the following facilities in the campsites</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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
		<p>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.</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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 repellent sprays during monsoon.

Project Activity/ Impact Source	Environmental Impacts	Mitigation Measures/ Management Guidelines
		<ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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 (contractor 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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.	<p>hazards in the work areas,</p> <ul style="list-style-type: none"> • 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	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<p>The Contractor shall provide the following facilities in the campsites to improve health and hygienic conditions as mentioned in ECoP 17 Construction Camp Management</p> <ul style="list-style-type: none"> • 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
		<ul style="list-style-type: none"> • 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	<p>The Contractor shall follow the following ECoPs to reduce health risks to the construction workers and nearby community</p> <ul style="list-style-type: none"> • 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.	<p>The Contractor shall</p> <ul style="list-style-type: none"> • 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 covered sheds. This soil shall be used for green belt plantation. Lower layers of excavated soil shall be re-used within the site for filling purpose, construction of approach & internal roads & railway link. If any extra soil is remained, then that should be disposed of to the approved debris disposal site.

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 be segregated into recyclable and non-recyclable waste. Recyclable waste shall be stored in the covered area and shall be sold to authorized vendors regularly. Non-recyclable waste shall be disposed at approved debris site in covered vehicles.

4. Municipal Waste

Municipal waste will be generated from labour camp. Dustbins for recyclable and non-recyclable waste shall be provided in labour camp area. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be disposed through authorized agency in area responsible for waste collection and management. Waste generated requires proper management so as to minimize the negative impacts on environment. Concept of reduce, reuse and recycle shall be followed at site. The rejected waste should be disposed in a secured manner. Thus a site should be identified for disposal of the rejected waste.

4.1 Selection of Disposal Sites:

The locations of Disposal sites have to be selected such that: Disposal sites are located at least 1000 m away from sensitive locations like settlements, water body, notified forest areas, wildlife/bird/dolphin sanctuaries or any other sensitive locations. Disposal sites shall not contaminate any water sources, rivers etc so the site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.

Public perception about the location of debris disposal site has to be obtained before finalizing the location. Permission from the village/local community is to be obtained for the Disposal site selected. Environment Engineer of 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 as per law as required for renting/leasing for the particular land for the sand deposition. DC office will annually assess the rent for the land and claim fund from the PMU to disburse to the lessees.

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 record of 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 / Waste Material

The Contractor shall take the following precautions while disposing off the waste material. During the site clearance and disposal of debris, the Contractor will take full care to

ensure that public or private properties are not affected, there is no dwellings around the dumpsite and that the traffic is not interrupted. The Contractor will dispose debris only to the identified places or at other places only with prior permission of Engineer-in-Charge of works. In the event of any spoil or debris from the sites being deposited on any adjacent land, the Contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer-in-Charge of works. The Contractor will at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris. Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.

Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition. Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Engineer-in-Charge of works.

During the debris disposal, Contractor will take care of surrounding features and avoid any damage to it. The debris should not be disposed along the bridges & culverts and near the water bodies. While disposing debris / waste material, the Contractor will take into account the wind direction and location of settlements to ensure against any dust problems. Contractor should display the board at disposal site stating the name of project, usage of the site and type of debris being disposed. A guard shall be kept at disposal site to prevent any unauthorized disposal of waste at the debris disposal site. Material should be disposed through covered vehicles only. No contaminated/hazardous/e-waste shall be disposed at the debris disposal site.

4.3 Record Keeping

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

4.4 Guidelines for Rehabilitation of Disposal Sites

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

4.5 Penalties

Stringent action & penalties should be imposed 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 of the construction and labour camp for keeping the health & Safety of workers and impacts of setting up such camps on the local community in consideration while developing and establishing such camp. This plan is prepared in reference to the Workers accommodation: processes and standards (A guidance note by IFC and EBRD). The plan aims to promote "safe and healthy working conditions, and to protect and promote the health of workers."

2.0 Selection and layout of construction camp

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

3.0 Facilities at workers' camps

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

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

3.1 Attendance & Working hours

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

3.2 Site Barricading

Site should be completely barricaded from all the sides to prevent entry of outsiders and animals into the site. Entry gate should be provided at the site and labour camp which should be guarded by security guard. All workers should be issued ID cards and entry of outsiders shall be maintained in the register at the gate. Board should be displayed at the site and the labour camp, the name of project, capacity of project, authority carrying out projects, restriction of entry without authorization, no smoking zone and associated risks. Plant operation shall be restricted to 6:00 Am to 10:00 PM

3.3 Clean Water Facility

Potable water shall be provided for construction labour for drinking & cooking purpose. Cleanwater shall be provided for bathing, cleaning and washing purpose. Water quality testing for drinking water provided for workers shall be carried out on monthly basis. Water dispensers should be cleaned on monthly basis. Adequate water per person should be provided at site for drinking, cooking, 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 and any other material for cooking or any other purpose shall strictly be prohibited at the site. Separate utensil washing area should be provided with proper drainage system. Kitchen waste should be daily cleaned and disposed off. Water storage facility at kitchen should be covered and cleaned on monthly basis. Kitchen area should be away from washing, toilets and bathing area.

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

3.5 Clean Living Facility for the Workers

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

3.6 Sanitation Facilities

Construction camps shall be provided with sanitary latrines and urinals. Toilets provided should have running water availability all the time. Bathing, washing & cleaning areas shall be provided at the site for construction labour. Washing and bathing places shall be kept in clean and drained condition. Adequate nos. of bathing & toilet facility should be provided at site and should not exceed 1 unit per 15 person. Toilets and bathing facility should be closed to the camps

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

filled and at the time of closure. Pest management should be carried out at the camps if the area is infected by any pests. Adequate lighting should be ensured in camp area especially during night time. The area should be guarded by security guard to minimize the crime and thefts.

3.7 Waste Management Facilities

Waste generated should be segregated at the site by providing the different colour bins for recyclable and non-recyclable waste. Recyclable waste shall be sold to authorized vendors and non-recyclable shall be handed over to authority responsible in area for waste management.

Waste management for construction site shall be as per waste management plan proposed in EMP. Waste management area should be cleaned on regular basis to avoid germination of flies, mosquitoes, rodents and other pests.

3.8 Rest Area for Workers at Site

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

3.9 Adequate Illumination & Ventilation

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

3.10 Safe Access Road for Labour Camps

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

3.11 Health care Facilities:

First aid box, first aid room and personnel trained in first aid (certified first-aider) shall be available at labour camp and site all the time (24X7). Equipment in first-aid box shall be maintained as per 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 emergency personnel, 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. Workers shall have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.

3.12 Crèche Facility & Play School

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

3.13 Fire-Fighting facilities

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

3.14 Emergency Assembly Area

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

4.0 Activities prohibited at site

- Activities which should be strictly prohibited at site shall include Open burning of wood, garbage and any other material at site 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 by safety officials and during the trainings
- Adoption and proper usage of PPEs all the time as required
- Operation of the plant and machinery between 10 pm to 6 am unless approved by team leader
- No animal (wild or domestic or bird) shall be harmed by any construction worker in any condition at site and nearby areas
- Cutting of tree without permission of team leader/authorized person
- No indigenous population shall be hurt or teased

5.0 Guidelines for night time working at the site.

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

6.0 Record keeping & Maintenance

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

7.0 Auditing & Inspection

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

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

10.0 Closure of the Construction Site and Construction labour Camps

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

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

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

Annexure - 20

Risk Assessment & Disaster Management Plan

RISK ASSESSMENT

The risk assessment has been conducted following the guidelines underlined in the Environmental Impact Assessment Guidance Manual for Ports & Harbours by the MoEFCC 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.

Risk Assessment for Aphalamukh Terminal

The risk assessment for the Aphalamukh 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.
- Aphalamukh has been considered as category-2 under soil erosion. This implies moderate erosion potential as per the DPR. The riverbank at the terminal site locations experiencing moderate erosion is grouped under this category. The time history satellite images show moderate shift of riverbank at terminal sites due to bank erosion. For these terminal sites, riverbank protection is both technically and economically viable. Due to the moderated stability in

the riverbank, either a flexible or fixed terminal operation facility will be considered as a suitable solution.

- In terms of traffic categorisation, Aphalamukh has been considered under Category A- Ro Pax vehicles with four and two wheelers with foot passengers.
 - Under this category, the ferry terminals shall be planned with consideration of safe and efficient movement of the four and two-wheeler vehicles and foot passengers on the Ro -Pax 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.

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.

Hazards during construction

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

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 easily accessible location of Aphalamukh a minimum mobilization period of 1.5 months has been allowed for the site set-up.

The other activity 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 months 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.

The riverine activities will be most affected due to the on-set of monsoons, June to September.

- construction of riverine facilities

The construction of the approach bund and shore protection works will mainly depend upon the planning and timely procurement of rock. This work will be affected during the monsoon; however, some progress has been assumed considering a few dry spells.

A single ramp has been planned at Aphalamukh, however, difficulties in accessing the location are envisaged and a period of 14 months has been considered for the same. Very low productivity for the ramp construction has been assumed during the monsoon period considering its riverine nature of work.

- landside development.

A total of 13 months has been allotted for the construction of the landside facilities at Aphalamukh. This includes a period of 4 months for the area development and about 9 months for the terminal building including other utilities and finishing.

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.

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.

Fabric form Mattress solution methodology

Initially riverbank steep slopes trimmed to achieve ideal slope where the placing of the riverbank erosion protection component becomes easy, and which gets good stability. On the trimmed surface of riverbank non-woven Geotextile shall need to be placed. The geotextile shall be needle punched made of polyester staple fibre. Finally, the fabric form mattress shall place over the geotextile surface. The fabric form mattress shall be filled with suitable filler material, in this case cement mortar considered as filler material shall be laid on geotextile base. The minimum ultimate strength of the fabric form mattress filled with cement mortar should be 75 kN/m.

Linkspan Parallel to Sloping Bund

The terminal would be a combination of floating pontoon, guide piles, linkspan and sloping access bund. The main advantage of this option the linkspan can supported with intermediates supports to counter the heavy super imposed loads of the vehicle

Key activities

Key items of work include floating pontoon as the berthing facility, mooring and anchoring of the pontoon, linkspan, approach slope bund, associated landside infrastructure, miscellaneous works, general and other items.

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.

- Hazards due to ramp structures

For Aphalamukh 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.

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 +68m in the river to +86m 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. 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 8.4: Simplified Risk Matrix

Probability Days of operation	Severity			
	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		
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

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.

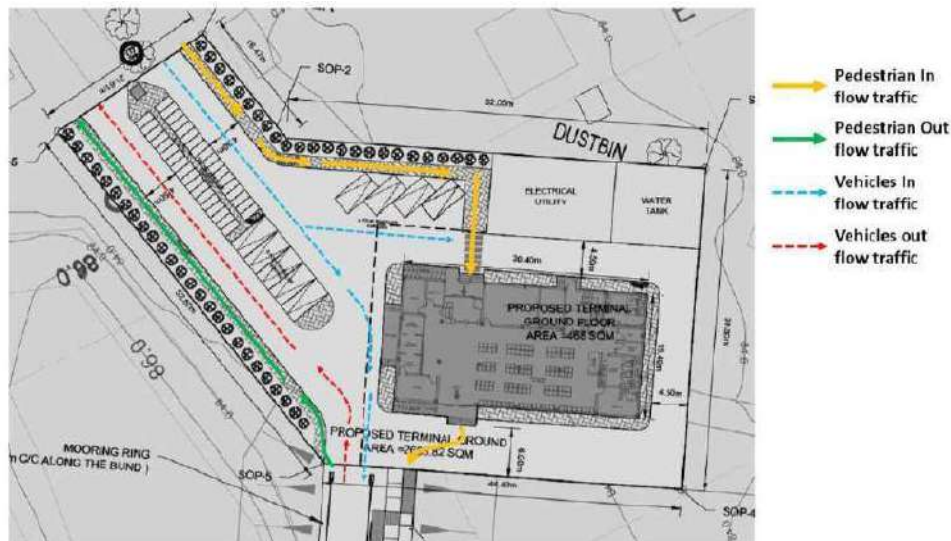


Figure 8.4: Traffic safety management plan

Electrical panel room

An area has been demarcated to cater space for panel room, metering room, DG and transformer which will cater electrical supply to entire complex. The DG area and transformer will be RC platform with chain link fencing all around for security.

Emergency power required by emergency loads shall be made available by Emergency Diesel Generator (EDG) located in a separate room adjacent to the Electrical Room. EDG will be directly connected to emergency bus section of Switchgear and all emergency loads shall be fed from this bus section. Incomer breaker of EDG shall be Normally Open (NO). EDG shall start automatically after failure of normal power supply, however shut down of EDG shall be manual. Under emergency condition normal load (fed from on normal bus section) from Switchgear shall be shed off due to under voltage and Emergency load shall be connected. Emergency load shall also be in operational condition even during availability of normal power supply.

Earthing

The PV module structure components shall be electrically interconnected and shall be grounded. Earthing shall be done in accordance with IS 3043-1986, provided that earthing conductors shall have a minimum size of 6.0 mm² copper, 10 mm² aluminium or 70 mm² hot dip galvanised steel. Unprotected aluminium or copper-clad aluminium conductors shall not be used for final underground connections to earth electrodes.

Fire Management

Reference Standards

Fire system comprises of fire detection, alarm and control system and fire protection system. The fire detection and protection system for the terminal infrastructure (such as pontoon/approach trestle/building/transformer/DG set etc.) are proposed to be designed, manufactured, and tested in accordance with latest applicable Indian Standards (IS) / NFPA (National Fire Protection Association, an American national Standard) / LPA (Loss Prevention Association of India) / Fire Protection Manual as stated below except where modified and/or supplemented by this specification.

Fire and portable water storage tank

Overground RCC water storage tanks with pump room has been considered for storage of domestic and firefighting water.

Fire water storage twin tank

The static storage for firefighting has been recommended at 100KL as per NBC 2016 Norms. The fire water storage reservoir is divided into two equal compartments of 50

KL each, allowing easy cleaning, inspection, repair, and maintenance of the fire water storage tank. The pipes will be of Galvanized Iron material and nominal diameter of 150 mm. All underground utilities will have RCC NP3 type encasing, especially near entrance and exit of terminal and over road crossings.

It is proposed to select the fire pump of 2850 l/min. Thus, two pumps, one main pump (common for hydrant and sprinkler) and one common standby pump having capacity of 2850 l/min. In addition to that, one jockey pump of capacity 180 lpm will also be provided. Fire water pump's "inlet / suction pipe size" and "discharge pipe size" is selected as 150mm and 125mm diameter respectively. Main pump shall be AC operated and another pump, as standby shall be diesel engine driven. The water storage twin compartment is internally connected by pipes and isolating valve. Pressure in the fire hydrant pump will be at 4.5 kg/cm² to ensure adequate pressure at all hydrants.

External Hydrants

External hydrants shall be provided all around the Complex and all around the building. The hydrants shall be controlled by a sluice valve or butterfly valve. Each external hydrant hose cabinet shall be provided with a drain in the bottom plate.

Risk Reduction Measures

- The facility will operate two different sub-facilities namely the riverine side facility and the landside facility.
- The riverine side facility should be inspected on daily basis for any structural or mechanical faults or malfunctioning.
- All the structures are as per the IS and NBC 2016.
- The buildings are in accordance with local fire safety rules.
- The electrical fittings and fixtures are as per the local environment considering proximity to river.
- Regular preventive maintenance checks are conducted.
- Structural integrity as well as other safety interlocks are properly checked on regular basis.
- There should be provision of alarms and hooters in the facility
- There is round the clock strong security vigil inside the premises
- High mast light or adequate power back up should be provided for safety provisions
- There should not be any flammable, hazardous or toxic materials stored at the site without prior approval of the factory inspector if the quantity is above Schedule 3 of the MSIHC Rules 1989, amended 2000. For other smaller quantities, MSDS should be adequate with proper firefighting facilities.
- The site would operate a DG set. This should be in accordance with the extant CPCB guidelines and should operate within permissible limits as prescribed under the EP Rules 1989. The stack of DG should be adequate in height for

preventing any downwash of the emissions. The area of DG sets should be demarcated and properly fenced.

- The transformer area should be properly designed as per the IS and electrical codes.
- It is recommended to stop the construction activities in water part during breeding season of the Gangetic dolphin (for example piling, shore protection works and dredging, etc.) in between mid of March to Mid of June.

Disaster Management Plan

At Load/Discharge Port/Terminal/Jetty/Location

General

The disaster management plan provides an overall guidance on prevention of human induced disaster and preparedness during a natural hazard.

The Disaster Management Act, 2005 was enacted to provide the requisite institutional mechanisms for formulating and monitoring the implementation of Disaster Management Plans, ensuring measures by various wings of the Government for preventing and mitigating the effects of disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation.

An integrated, multi-hazard approach to disaster risk reduction should be factored into policies, planning and programming related to relief, rehabilitation, and recovery activities in post-disaster and post-conflict situations in disaster-prone situation.

There is also a need for proactive measures, bearing in mind that the phases of relief, rehabilitation and reconstruction following a disaster are windows of opportunity for the rebuilding of livelihoods and for the planning and reconstruction of physical and socio-economic structures, in a way that will build community resilience and reduce vulnerability to future disaster risks.

Measures specific to Aphalamukh site.

- The approach to the present jetty and ferry is temporary and pose a hazard to passengers. There might be slips, trips, and falls during construction phase due to temporary brick laying approach.
- The Aphalamukh site has sufficient land parcel for construction of passenger jetty terminal. However, provisions for emergency power and first aid should be maintained on-site.
- The construction plan should counter the safe disposal of construction wastes.
- Proper illumination is necessary during the construction.
- The approach road should be demarcated and strengthened for smooth passage of personnel and materials.
- Jorhat is susceptible to floods, so as is Aphalamukh. Therefore, a proper flood resistance design and structure for the proposed terminal could be explored for minimising the damage to structures.

Natural hazards

The facility should consist of emergency communication channels through radio equipments. The installation of weather stations would assist the control room personnel for assessing climatic conditions with a fair degree of confidence for planning adequate emergency preparedness. The passenger terminal should establish hot lines with the local emergency responders such as police, fire, hospitals and district magistrate office. The Aphalamukh terminal experiences floods. Therefore, it is essential to plan and prepare for any natural hazards such as heavy rains, earthquakes, landslides and floods. Proper communication would greatly assist in saving resources, staff, public and infrastructure. The terminal should provide for evacuation measures for such scenarios for transporting public to safe sites in the shortest possible time. The site should house public announcements in Hindi, English and local languages. This also means that the public disclosures regarding important emergency numbers as well as local contact at all critical points should be displayed at the site. The site emergency controller should initiate mutual safety agreements with passenger vessels for evacuation as well as transfer of public in the event of any natural hazards. The site should regularly monitor the increase in water levels for any anomaly, both in the short time as well as long time frames.

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.
- To ensure, the depth of water alongside the Ro-Ro jetty/terminal is adequate for berthing at all times.
- The status of the river, the tidal variation and currents strength and direction are within safe limits for operation of Ro-Ro vessels.
- The terminal/jetty can be safely used throughout the year with seasonal variations
- 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
- If handling any Hazardous cargo – All safety measures are taken, required permissions are obtained and all National, State and Local regulations should be complied with.
- Vehicles are properly stowed/parked and secured on the Ro-Ro / Ro-Pax vessel for the intended passage.
- The risk of pollution and that all measures are taken to reduce risk of pollution caused due to operations.
- To ensure, additional safety regulations like that of PESO, etc are complied with.
- The terminal is provided with adequate safety equipment's 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
- 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 as followed:

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.
- 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.

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.

Terminal Security Rules, to be observed by all visitors:

- 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.

Emergency Coordination

The Emergency Operation Taskforce and their corresponding functions during any disaster management cycle is enclosed as :

National Disaster Management Guidelines, Boat Safety, September, 2017

In many of the states, transport through rivers and their tributaries is a lifeline of many people. Boats, motorized and non motorized, are used to carry people, vehicles, animals and goods. The boat accident generally occurs due to the poor training, dangerous working practices, and inadequate regulations and near non-existent enforcement etc. National Disaster Management Authority (NDMA) has prepared National Disaster Management Guideline on Boat Safety in consultation with state and other stakeholders. The guidelines addresses all facets of boat safety such as weather forecasting & early warning system, safety standards & specifications, regulatory and legal issues, search & rescue, capacity development and do's & don'ts for boat safety etc.

The important aspects to be considered for the proposed projects are highlighted as below:

Safety standards for Mechanized Boats

In mechanized boats, safety standards must be followed as the top priority especially to ensure that machinery failure is avoided to avert potential disasters. It must also be ensured that propulsion machinery is reliable and may not be stranded in mid waterways due to machinery failure. An important safety measure for mechanized boats is the possibility to apply reverse thrust which may be achieved by means of gears that may enable boat operators to quickly stop the boat for avoiding possible collision. In addition, prevention of fire and explosion in boats should also be ensured important safety measures for mechanical boats.

In order to maintain general safety measures in mechanized boats, the major thrust should be on protecting people from the imminent danger of machineries. The moving parts and hot surfaces are to be protected so as to minimize danger to people during normal movement of vessels. All fuel tank vents should be fitted with a 'flame gauze' and carried above the tank top level, to above a height of personnel standing next to the engine or to a level where there is no danger of escaping fuel or vapour. A valve or cock, which can be shut from a position outside the engine space should be fitted in the fuel feed pipe, as close to the fuel tanks as possible. Petrol tanks for outboard motors should have quick connection shutoff devices.

Safety measures for fuel storage

In mechanized boats, safety measures for fuel storage tanks should be undertaken with utmost caution and safety. The following precautions are recommended for fire safety of storage tanks in mechanized boats.

- The storage container should be composed of metal and fitted in such a manner that the possibility of leaks/spills may be averted.
- The container should be stored upright and secured to prevent shifting or fall over with the movement of the vessel. They should also be located away from the direct sources of heat and should be made of fire resistant materials.
- The container should be properly labeled according to contents like materials stored, hazard signs, no smoking/ignition sources etc.

Safety Measures for Petrol Engines and Petrol Fuels

The fixed petrol tanks of more than 2.5 liters should not be located within one metre of any engine or heating appliance unless insulated and protected by fire resistant materials. It is recommended not to use glass or plastic fuel sight gauges. The fuel level indicators should be designed in such a way that it should not allow fuel to escape

in the event of damage. All the fixed fuel feed pipes should be of metallic type. The flexible pipes should be of fire resistant materials.

Charging Devices

Arrangements of charging facilities for batteries should be ensured on board, so that boats machineries are started /operated through batteries smoothly . In other boats where battery is the sole means of starting the engine, provisions be made duplicate batteries with change over switches for emergency uses.

Lighting Arrangements

When lighting within the vessel is provided through a centralized electrical system , an alternative source of lighting should be provided for emergency use. This may be ensured by means of torches provided on board. Alternative source of lighting is to be ensured for the movement of people, deployment of life saving appliances and to work on essential machinery.

Steering Arrangements

Each vessel should be provided with effective means of steering. Emergency steering arrangements are recommended where there are safety risks of passengers due to main steering failure. This may be in the form of a tiller which can be attached to the rudder stock or steering oar depending on the area of operation.

Bilge Pumping/ Drainage Arrangements

All the vessels plying in the waterways should have means of bilge pumping either by a power driven pump or a hand pump so that all compartments can be drained during emergency. In machinery spaces, a holding tank is recommended for oily bilges to prevent water pollution. In case of small open boats operating in areas with small wave height of less than 0.6 m, drainage with the help of bailers or buckets may be sufficient.

Life Saving Equipments

Each boat should have approved life saving equipments sufficient for the number of persons that can be carried on board. IRS/MMD approved lifesaving appliances such as life jackets, life buoy etc. confirming to latest SOLAS/LSA Code requirement along with identification/marketing details on the product (Also Refer Annexure-I to Chapter 3 for details). It should be mandatory to keep the following life saving equipments on every mechanized boats/vessels.

Life Buoys

A minimum of 4 Life Buoys for vessels up to 25 meter length, 6 Life Buoys for vessels of 25 to 45 meters length and 8 Life Buoys for more than 45 meters length should be carried in vessels.

Life Jackets

Though Life Jackets are not required for vessels operating in areas of less than 0.6 meters wave height, however in other areas, life jackets are to be carried for all passengers and crews.

Life Rafts

In case of vessels operating in areas of more than 1.2 meter wave height, sufficient number of life rafts for accommodating people on board is recommended. While keeping all life saving equipments, it is essential to ensure periodic maintenance and servicing following manufacturer's recommendations. In a similar manner, 'First Aid' box should be kept on board for passengers and crew members like mechanized boats.

Fire Safety Measures

Since mechanized boats are largely operated by means of electrical and mechanical devices, there are more chances of catching fire, thus well structured fire fighting system must be essentially maintained in mechanized boats. The following equipments are required to be kept in vessels.

- **Fire pump**

A vessel of 6 meter and above in length should carry hand pumps or power driven pumps with hose connections capable of delivering a jet of water to any part of the vessel through hose and nozzles.

- **Fire Extinguishers**

At least one multipurpose portable fire extinguisher to a recognized standard is to be carried in all vessels, which is to be kept outside the engine space. In addition, one multipurpose fire extinguisher should be placed at each exit from accommodation spaces to open decks. In addition, Fire Buckets and Lanyards are also to be provided in the boats. It is recommended that all fire fighting equipments are to be maintained in good conditions.

Like non mechanized boats, the following items should not be carried on board in all the mechanized boats -

- a) Lamps powered by liquefied gas or liquid oil
- b) Vaporizing oil burner stoves
- c) Solid fuel heaters
- d) Devices fitted with wick burners
- e) Liquefied gas devices

Smoking shall be strictly prohibited in the boats.

Navigation and Communication Aids

The provisions of navigation and communication arrangements should be managed in the same manner like non mechanized boats.

Anchoring and Mooring arrangements for mechanized boats should also follow the pattern of non-mechanized boats.

Implementation Plan- Roles & Responsibilities of various agencies

Non-mechanized boats:

The responsibility of the implementation of safety standards and specifications primarily rest with the state governments. The Inland Waterways Authority of India (IWAI) may be requested to extend the scope of application of model rules to non-mechanized boats, which could then be adopted by state governments. The respective departments in all the concerned states may be empowered to implement the rules.

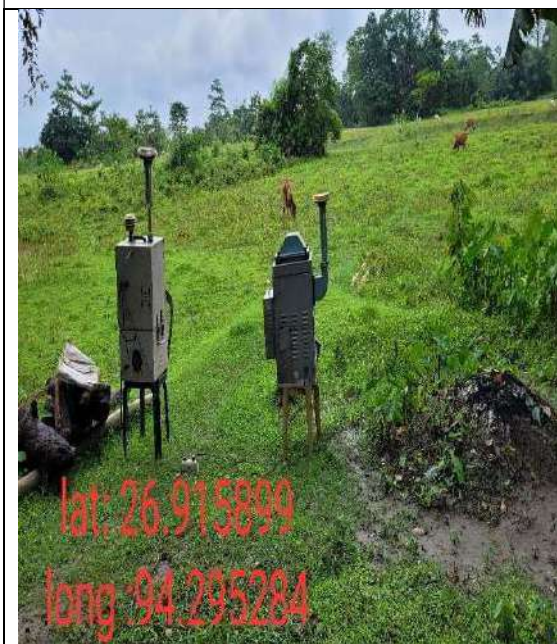
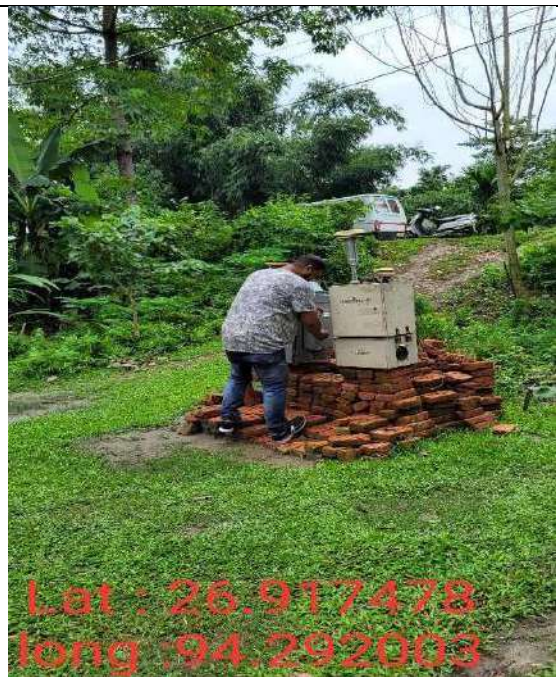
Mechanized boats:

The responsibility of the implementation in case of mechanized boats also rests with the state governments following the similar pattern of non mechanized boats. The state government may also requires to update rules in line with the “model rules of IWAI “.Government departments with qualified personnel such as Inland Waterways Transport department, ports and harbors department, captain of ports etc. would be responsible for implementation of the rules. The Governments may also use the services of their maritime boards, wherever established for this purpose.

Annexure -21

Environment Monitoring Photographs

Environmental Monitoring Photographs- Aphalamukh Terminal







Annexure - 22

Safety Practices During Construction

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.

Annexure - 23

Slope Stability Report by IIT-G & Gabion Mattress design
calculation



Program : D-Geo Stability
Version : 18.2.2.32619
Company : Royal HaskoningDHV

===== BEGINNING OF DATA =====

Calculation model : Bishop
Default shear strength : C phi

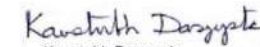
LAYER BOUNDARIES
=====

Boundary no. | Co-ordinates [m]


8 - X -	-120.00	-76.26	-67.38	-37.43	-36.44	-21.92
8 - Y -	-8.93	-8.41	-8.27	6.71	6.70	6.71
8 - X -	-20.93	-6.68	5.48	16.91	17.90	32.43
8 - Y -	6.71	-0.41	1.00	6.70	6.70	6.70
8 - X -	33.43	43.80	52.75	60.07	120.00	
8 - Y -	6.70	1.52	3.52	3.81	3.81	
7 - X -	-120.00	-76.26	-67.38	-37.43	-36.44	-36.44
7 - Y -	-8.93	-8.41	-8.27	6.71	6.70	6.33
7 - X -	-21.92	-21.92	-20.93	-6.68	5.48	16.91
7 - Y -	6.33	6.71	6.71	-0.41	1.00	6.70
7 - X -	17.90	32.43	33.43	43.80	52.75	60.07
7 - Y -	6.70	6.70	6.70	1.52	3.52	3.81
7 - X -	120.00					
7 - Y -	3.81					
6 - X -	-120.00	-76.26	-67.38	-37.43	-36.44	-36.44
6 - Y -	-8.93	-8.41	-8.27	6.71	6.70	6.33
6 - X -	-21.92	-21.92	-20.93	-6.68	5.48	16.91
6 - Y -	6.33	6.71	6.71	-0.41	1.00	6.70
6 - X -	17.90	17.90	32.43	32.43	33.43	43.80
6 - Y -	6.70	6.33	6.33	6.70	6.70	1.52
6 - X -	52.75	60.07	120.00			
6 - Y -	3.52	3.81	3.81			
5 - X -	-120.00	-76.26	-76.26	-67.24	-38.06	-20.30
5 - Y -	-8.93	-8.41	-8.91	-8.77	5.83	5.83
5 - X -	-6.78	5.65	17.01	33.29	43.73	52.75
5 - Y -	-0.93	0.51	6.20	6.20	0.98	3.02
5 - X -	52.75	60.07	120.00			
5 - Y -	3.52	3.81	3.81			
4 - X -	-120.00	-76.26	-76.26	-67.24	-6.57	15.15
4 - Y -	-8.93	-8.41	-8.91	-8.77	-6.03	-4.47
4 - X -	43.73	52.75	52.75	60.07	120.00	
4 - Y -	0.98	3.02	3.52	3.81	3.81	
3 - X -	-120.00	-66.93	-6.15	15.53	52.95	120.00
3 - Y -	-11.02	-11.02	-8.19	-6.67	1.47	1.93
2 - X -	-120.00	-66.86	-5.79	15.96	53.13	120.00
2 - Y -	-12.93	-12.77	-10.03	-8.87	-0.50	-0.50
1 - X -	-120.00	120.00				
1 - Y -	-21.00	-21.00				



Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India


Kaustubh Dasgupta
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati

23 May 2023


Dr. Arindam Dey
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India

```

0 - X - | -120.00  120.00
0 - Y - | -50.00  -50.00

```

PL-LINES
=====

Pl-line no. | Co-ordinates [m]

```

1 - X - | -120.00  120.00
1 - Y - |   5.03   5.03

```

Unit weight of water used for calculation: 9.81 [kN/m3]
The groundwater level is determined by Pl-line number 1

SOIL PROPERTIES
=====

Layer no. | Material name

```

8 | Concrete
7 | Concrete
6 | Reno Mattress
5 | Core Fill
4 | Loose Silty Sand
3 | Med to Den Silty Sand
2 | Med to Den Silty Sand
1 | Den Silty Sand

```

Layer number	Gam usat [kN/m3]	Gam sat [kN/m3]	Pl-line top	Pl-line bottom
8	24.00	25.00	1	1
7	24.00	25.00	1	1
6	20.00	21.00	1	1
5	20.00	21.00	1	1
4	18.00	19.00	1	1
3	18.50	19.50	1	1
2	18.50	19.50	1	1
1	19.00	20.00	1	-

Layer number	Cohesion [kN/m2]	Phi [degrees]	Dilatancy [degrees]	S [-]	POP [kN/m2]	m [-]
8	250.00	42.00	12.00	-	-	-
7	250.00	42.00	12.00	-	-	-
6	15.00	44.00	14.00	-	-	-
5	15.00	42.00	12.00	-	-	-
4	0.00	30.00	0.00	-	-	-
3	0.00	34.00	4.00	-	-	-
2	0.00	34.00	4.00	-	-	-
1	0.00	38.00	8.00	-	-	-

Layer number	Su top [kN/m2]	Su bot. [kN/m2]	Su grad. [kN/m2/m]	POP top [kN/m2]	POP bot. [kN/m2]	Gamma LEM [-]
8	-	-	-	-	-	-
7	-	-	-	-	-	-
6	-	-	-	-	-	-
5	-	-	-	-	-	-
4	-	-	-	-	-	-
3	-	-	-	-	-	-
2	-	-	-	-	-	-
1	-	-	-	-	-	-

CENTER POINT GRID AND TANGENT LINES

=====

```

X co-ordinate grid left           :  -65.00 [m]
X co-ordinate grid right          :   50.00 [m]
Number of grid points in X - direction :  15

Y co-ordinate grid bottom         :    7.18 [m]
Y co-ordinate grid top            :   41.69 [m]
Number of grid points in Y - direction :    8

Y co-ordinate tangent smallest circle :  -9.30 [m]
Y co-ordinate tangent biggest circle  : -31.30 [m]
Number of circles per grid point :  15

```

No fixed points input.

```

Total number of center points in the grid:  120
Total number of slip circles in the grid :  1800

```

UNIFORM LOAD

=====

Uniform load number	Magnitude [kN/m]	X start [m]	X end [m]	Distrib. degrees	Load Type
1	10.00	-36.44	-21.92	0.00	Permanent
2	10.00	17.20	32.43	0.00	Permanent

EARTHQUAKE

=====

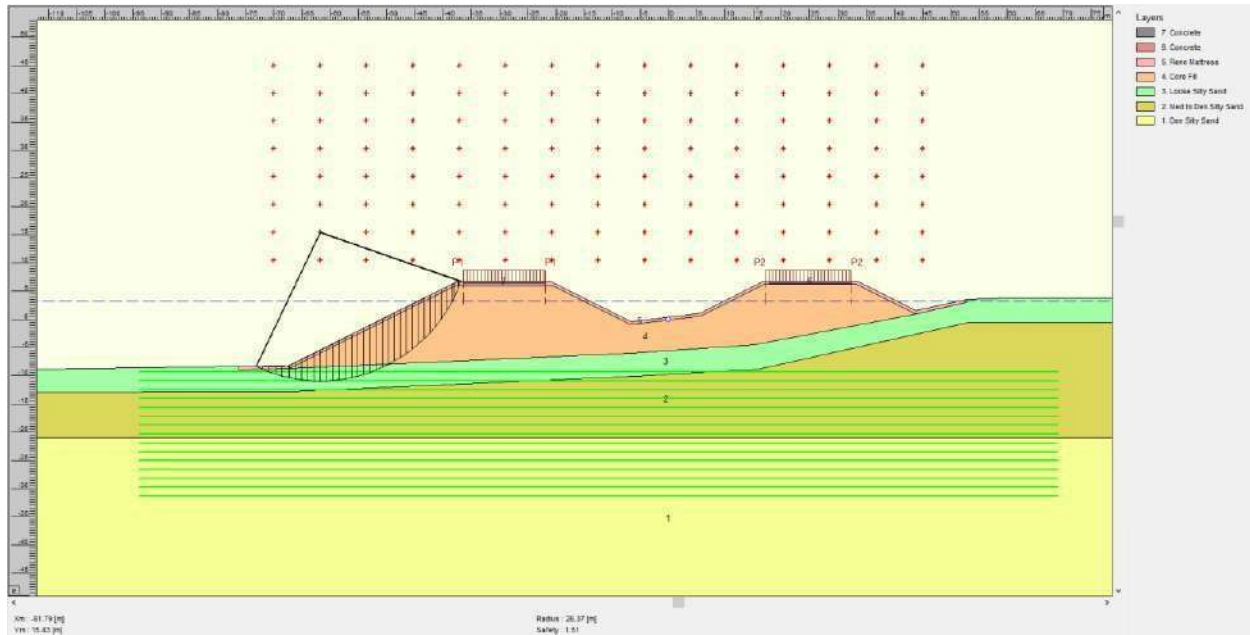
Horizontal factor [g]	Vertical factor [g]	free water coefficient [-]
0.1200	0.0600	0.0000

```

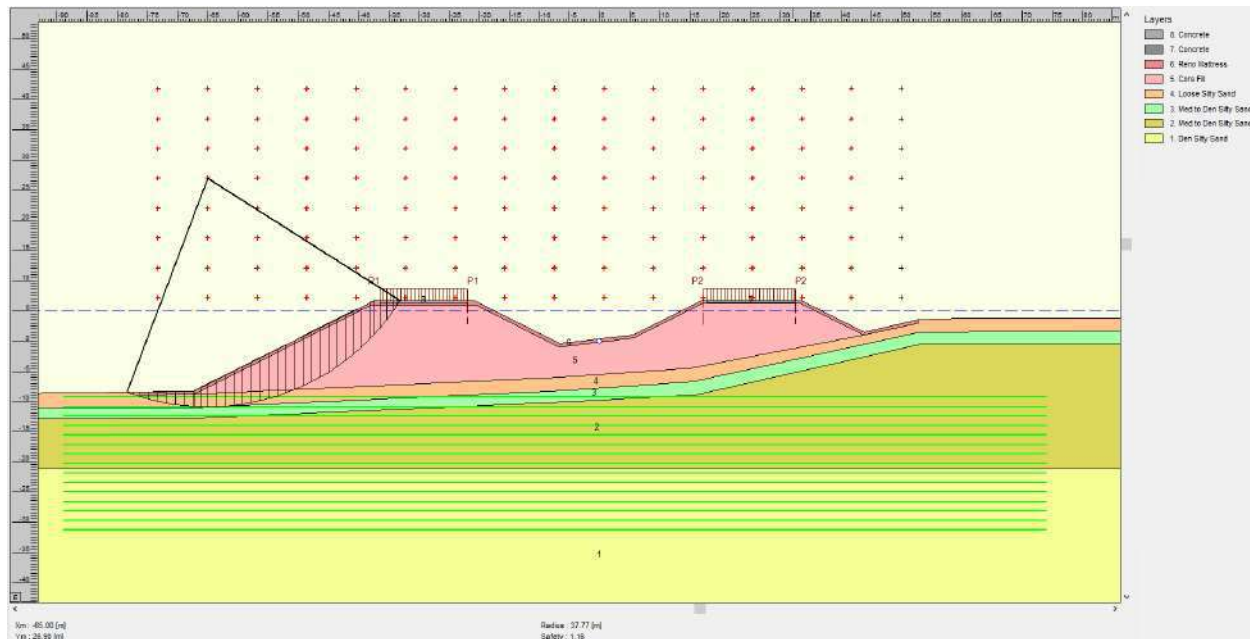
***** The input has been tested, and is correct. *****
*****

```

Static Case: FoS ~ 1.51




Seismic Case: FoS ~ 1.16




Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India


Kaustubh Dasgupta
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
23 May 2023


Dr. Arindam Dey
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India

DESIGN OF LAUNCHING APRON & SCOUR DEPTH CALCULATION

(As per IRC SP 116:2018)

PROJECT NAME: Launching apron design
 PROJECT NUMBER:
 CLIENT: AIWT Assam
 LOCATION: Neamati, Guwahati
 REFERENCE SECTION:
 DATE: 7/9/2022
 REVISION: R0

CALCULATION OF SCOUR DEPTH**INPUTS**

1 Design Discharge =	= 64619.00	cumecs	Note:
2 Maximum Velocity as per H.F.L	= 6.00	m/s	Given
3 Silt Factor	= 0.80		Given
4 Level of H.F.L	= 87.72	m	Assumed fine sand from IRC 78
5 LWL	= 81.13	m	Given
6 Unit weight of rock fills, γ_s	= 26.00	kN/m ³	Given

Calculation

According to clause 7.4 of IRC:SP:116:2018, the mean depth of scour below HFL (D) shall be calculated in accordance to the provisions

DEPTH OF SCOUR BELOW H.F.L. (D) = $0.473 \cdot (Q/f)^{1/3}$

Where,

Q=Discharge
 f=Silt factor

Hence, Depth of scour below HFL $D = 0.473 \cdot (Q/f)^{1/3}$ **20.45 m**

MAXIMUM DEPTH OF SCOUR (Dmax)

1	Scour Depth below H.F.L.(Dmax)	= $1.5 \cdot D$ 30.67 m ($1.5 \cdot d_{sm}$)
2	Scour Depth below L.W.L.(Dmax)	= Scour Depth below H.F.L. - (H.F.L. - L.W.L.) 24.07 m

SHAPE AND SIZE OF APRON

3	Length of Launching Apron	= $1.5 \cdot$ maximum scour depth below bottom of gabion mattress (L.W.L.) 36.11 m
	Provide Launching Apron of length	37.00 m

MATTRESS THICKNESS CALCULATION**1. Velocity criteria**

Refer IRC:SP:116:2018, Annexure II, CLAUSE 7.2

Table II-1 Indicative Thickness of Gabion Mattress in Relation to Water Velocity [20]

Type	Thickness (m)	Stone size (m)	d_{50} (m)	Critical Velocity (m/s)	Limiting Velocity (m/s)
Revet mattress	0.15-0.17	0.07-0.10	0.085	3.5	4.2
		0.07-0.15	0.11	4.2	4.5
	0.23-0.25	0.07-0.10	0.085	3.6	5.5
		0.07-0.15	0.12	4.5	6.1
Gabion	0.3	0.07-0.12	0.1	4.2	5.5
		0.10-0.15	0.125	5.0	6.4
	0.5	0.10-0.20	0.15	5.8	7.6
		0.12-0.25	0.19	6.4	8.0

Therefore, Maximum velocity = 6.00 m/sec

Recommended value for thickness can be taken as =

0.5 m

Arindam Dey
 26.05.2023

Dr. Arindam Dey
 Associate Professor
 Department of Civil Engineering
 Indian Institute of Technology Guwahati
 Guwahati-781039, Assam, India

Professor
 Professor

Department of Civil Engineering
 Indian Institute of Technology Guwahati
 Guwahati-781039, Assam, India

Kaustubh Dasgupta
 Kaustubh Dasgupta
 Associate Professor
 Department of Civil Engineering
 Indian Institute of Technology Guwahati

23 May 2023

2. Tractive Force Theory:

Refer : IRC:SP:116:2018 Clause 7.3

Shear stress on revert mattress placed on channel bed or bank:-

$\tau_b = K_1 K_b Y_w Y S_f$

Where

τ_b = Design shear stress (kN/m²)

Y_w = Unit weight of water (kN/m³)

Y = Maximum depth of water on revetment (m)

S_f = Slope of energy grade line

K_1 = Slope factor

1 - for horizontal

0.75 - for sloped surface

K_b = Bend coefficient . Ranges from 1.05 to 2.0

Bend coefficient is function of Radius of carvature 'Rc' and Top width 'T'

$K_b = 2$

For $2 \geq Rc/T$

$K_b = 2.38-0.206(Rc/T)+0.0073(Rc/T)^2$

For $10 > Rc/T > 2$

$K_b = 1.05$

For $10 \geq Rc/T$

Considering,

$K_b = 1.05$

$K_1 = 0.75$

$S_f = 0.0020$

$Y_w = 9.81$ kN/m³

Maximum depth of water on revetment, $Y = 6.60$ m

Note:

Straight stretch

Sloped surface

Assumed

Therefore,

Design shear stress , $\tau_b = 0.10$ kN/m²

Allowable Shear stress for the revert mattress :

τ_{All} - Allowable shear stress for the different thickenss of revert mattress are as follows:

Thickness of revert Matterss in m	*Allowable shear stress in N/m ²	Allowable shear stress in kN/m ²
Reno mattress - 0.17m	224	0.224
Reno mattress - 0.23m	268	0.268
Reno mattress - 0.30m	336	0.336
Gabion mattress - 0.50m	470.4	0.4704
Gabion mattress - 1.00m	470.4	0.4704

* Data as per Maccaferri test results and litrature

Therefore ,

Allowable shear stress for the 0.5 m thick mattress is

$\tau_{All} = TRUE$ kN/m²

$\tau_{All} > \tau_b$

Hence, SAFE

Resulting levels obtained referring Inputs

High Flood Level = 87.72 m
Deepest Scour level = H.F.L. - Scour depth below H.F.L.
57.05 m
HFL 87.72 m
L.W.L. 81.13 m
MSL 57.05 m

Provided length of Launching Apron

37.00 m

Toe wall is required to support the bank revetment and prevents undermining.

The launching apron is assumed to launch in 2H:1V post scouring

IRC:SP:116:2018 , CLAUSE 7.4

FILTER MEDIA DESIGN

A translational layer of fabric placed between the underlined soil and the structure prevents the migration of soil particles through the voids present in the structure.

Synthetic fabric filters have found considerable use as alternatives to granular filters.

Further,

Considering MoRTH Section 700, IRC 59 Page 28.

Geotile Type-1 is well suited for placement beneath mattress and characterized by a high resistance to installation damage, high water permeability, resistance to ultraviolet degradation and to biological & chemical environments normally found in soils.

Ref. As per MoRTH Section 700 - Table 700-1

Survivability and Endurance Criteria

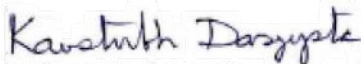
Considering Type I and Elongation at failure > 50%

Strength Parameters	Standards	Mactex N 60.1 or Equivalent Properties	As Per MORTH 700
Grab Strength in Newton (N)	ASTM D4632	910	900
Tear Strength in Newton (N)	ASTM D4533	375	350
Burst Strength in Newton (N)	ASTM D3786	2413	1700
Puncture Strength in Newton (N)	ASTM D6241	2380	2000

Mac Tex N 60.1 or any Equivalent filter satisfies the Survivability/Durability criteria can be used.

***Note:**

Any variation in the inputs mentioned shall be first intimated to design engineer, and as such the provided design shall not be valid.


Kaustubh Dasgupta
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati

23 May 2023


26.05.2023
Dr. Arindam Dey
Associate Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India


Professor
Department of Civil Engineering
Indian Institute of Technology Guwahati
Guwahati-781039, Assam, India

Annexure – 24

GoA Notification for declaring Majuli as Biodiversity Heritage Site

GOVERNMENT OF ASSAM
ENVIRONMENT & FORESTS DEPARTMENT
DISPUR, GUWAHATI-6

No. FRW 57/2005 Vol-II 14

Dated Dispur, the 29th March, 2017

NOTIFICATION

In exercise of the power conferred by sub section (1) of section-37 of the Biological Diversity Act, 2002 (No.18 of 2003) and Rule 24(1) of the Assam Biodiversity Rules 2010, the Government of Assam hereby notifies Majuli as 'Majuli Biodiversity Heritage Site' as detailed in the schedule given below:

1. **Short Title:** This notification may be called "Declaration of Majuli as Biodiversity Heritage Site (BHS). It shall come into force on the date of publication in the Assam Gazette.
2. **Extent of application:** This notification shall apply within the administrative boundary of Majuli District.
3. **The total area covered:** 875 Sq. Km
4. **GPS coordinates:** The co-ordinates of Majuli qualifying the extreme points in the North, South, East, West boundaries and centre are as follows:

Sl. No.	Latitude	Longitude	Direction
1	26° 58' 30.268" N	94° 2' 23.180" E	NW
2	27° 3' 1.588" N	94° 10' 16.040" E	N
3	27° 5' 59.835" N	94° 16' 45.799" E	N
4	26° 53' 46.073" N	93° 57' 25.340" E	W
5	26° 57' 59.475" N	94° 10' 26.105" E	C
6	27° 1' 21.972" N	94° 17' 47.452" E	C
7	27° 10' 59.178" N	94° 33' 48.374" E	NE
8	26° 50' 57.455" N	94° 0' 11.644" E	SW
9	26° 50' 45.120" N	94° 6' 13.571" E	S
10	26° 53' 3.278" N	94° 17' 45.343" E	S
11	26° 57' 49.773" N	94° 24' 12.447" E	S
12	27° 8' 50.634" N	94° 35' 41.669" E	SE

5. Boundaries: Majuli Biodiversity Heritage Sites

North : Lakhimpur District

South : Jorhat District

East : Sivasagar & Dibrugarh Districts

West : Sonitpur District.

6. This comes into effect from the date of publication in the official Gazette.

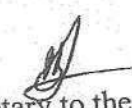
By order in the name of the Governor,

Sd/- P.K. Borthakur, IAS,
Principal Secretary to the Govt. of Assam
Environment & Forest Department
Dated Dispur, the 29th March, 2017

Memo No No. FRW 57/2005/Vol-II/14 A
Copy for kind information to:

- I
1. Principal Secretary, Department of Environment and Forests, Assam
 2. Principal Chief Conservator of Forests & HoFF, Assam
 3. Principal Chief Conservator of Forests (Wildlife), Assam
 4. Deputy Commissioner, Majuli District
 5. Addl. PCCF (RE & WP), Assam
 6. Addl. PCCF (Wetlands), Assam
 7. Addl. PCCF (UAZ), Assam
 8. Conservator of Forests, EAC, Jorhat
 9. Divisional Forests Officer, Jorhat Forest Division
 10. Divisional Forests Officer, Social Forestry, Golaghat
 11. P.S to Hon'ble Minister, Environment & Forests, Assam
 12. P.P.S to Hon'ble C.M. Assam, Dispur, Guwahati-6
 13. P.S. to all Hon'ble Ministers, Assam, Dispur Guwahati-6
 14. S.O. to Chief Secretary, Assam.
 15. P.S. to Secretary to the Govt. of Assam, Department of Environment and Forests,
 16. The Director, Printing & Stationery, Govt. Press, Bamunimaidan, Guwahati-21 for
favour of publication of the above notification in the next issue of the Assam
Gazette.
- II
1. Chairman-Assam State Biodiversity Board
 2. Member Secretary- Assam State Biodiversity Board
- III
1. Chairman, National Biodiversity Authority, Chennai
 2. Secretary, National Biodiversity Authority, Chennai
 3. Director, Zoological Survey of India, Kolkata
 4. Director, Botanical Survey of India, Kolkata

By order etc.,


Deputy Secretary to the Govt. of Assam
Environment & Forest Department

Annexure - 25

Disposal of Ship-wastes and L&FS

Ship Liquid Waste Quantification

Statement for Vessel Lubricant oil waste for Neamati Aphalamukh Kamalabari Route									
S.no.	Type of vessel	No. of units (in running condition)	Mobil oil(in L)	Diesel Generator oil(in L)	Hydraulic oil(in L)	Gear oil(in L)	Total Lubricants consumption(in L)	Wastage of Lubricant oil(Assuming 85% of total consumption)(in L)	Remarks
		A	B	C	D	E	$F=A*(B+C+D+E)$	$G=85\% \text{ of } F$	
1	Catamaran	2	55	14	2	7	156	132.6	Oil change after running for 300 hrs or 1 month
2	RPL	1	60	24	2	7	93	79.05	Oil change after running for 500 hrs or 3 months
3	Ropex	4	60	24	2	7	372	316.2	Oil change after running for 500 hrs or 3 months
						Total wastage (after every 3 months)		793.05	
						Total wastage(per year)		3172.2	

Quantity of Waste oil/Liquid Effluent		
Density of oil	900	Kg/cum
Mass of oil	1320	Kg
Volume of oil	1.47	cum

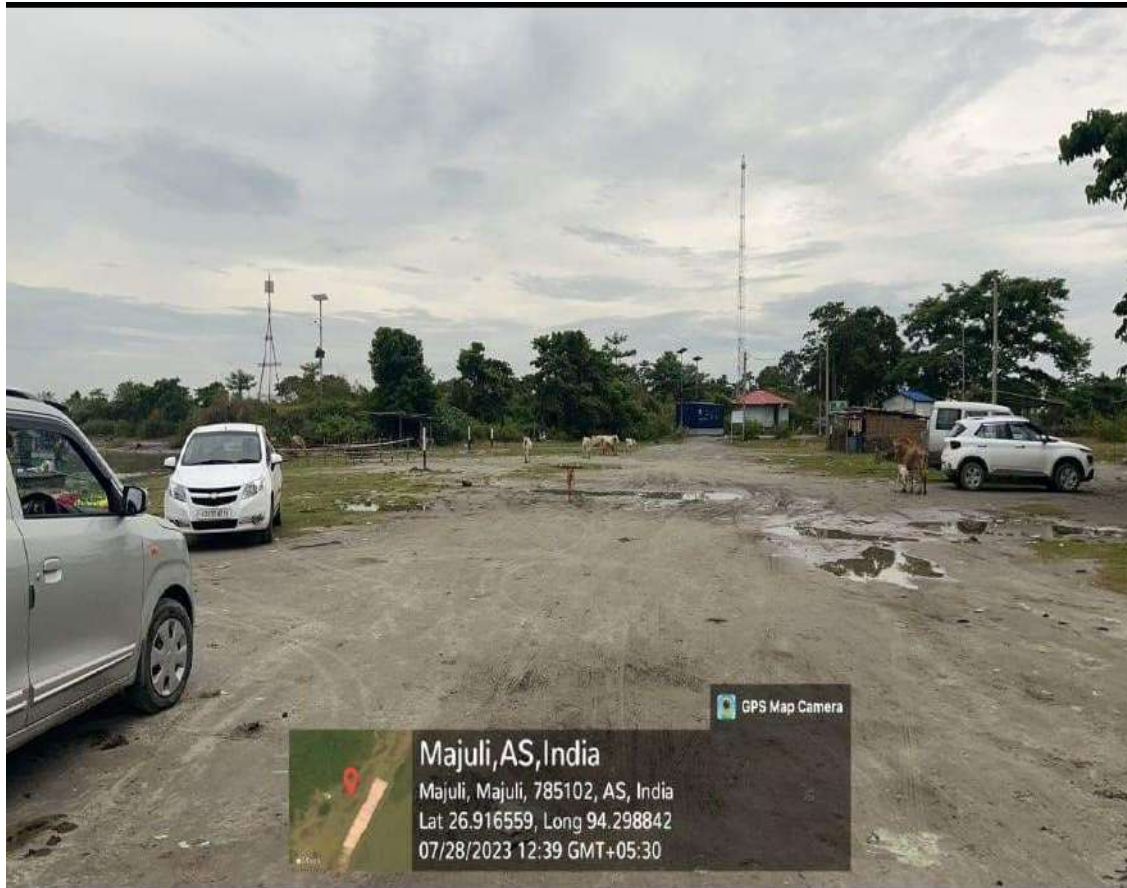
Waste Oil Storage tank Dimension				
S.No.	L(m)	B(m)	H(m)	Volume(cum)
1	1.2	1.2	1.2	1.728



Figure: Storage Tank

Annexure - 26

**Photograph of Aphalamukh Project Site with No
Encroachment**



**Encroachment free Site for Construction of Passenger Ferry
Terminal at Aphalamukh, Majuli**



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](mailto:environment@wapcos.co.in)