

Initial Environmental Examination

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Package Number: AUIIP/PR-2/GUW/DR/03
(Procurement of Machinery, Equipment and Transport Vehicles for Cleaning of the Existing Drainage System)

Prepared by Guwahati Development Department & Urban Development Department, Government of Assam for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(as of 28 August 2017)

Currency unit – Indian rupee (₹)

₹1.00 = \$0.01566

\$1.00 = ₹64.8615

ABBREVIATIONS

ADB	-	Asian Development Bank
CFE	-	Consent for Establishment
CFO	-	Consent for Operation
DMSC	-	design, management and supervision consultant
EARF	-	environmental assessment and review framework
EIA	-	environmental impact assessment
EMP	-	environmental management plan
GDD	-	Guwahati Development Department
GMA	-	The Guwahati Municipal Area
GMC	-	Guwahati Municipal Corporation
GMDA	-	Guwahati Metropolitan Development Authority
GRC	-	grievance redress committee
GRM	-	grievance redress mechanism
IEE	-	initial environmental examination
MFF	-	multitranches financing facility
MoEFCC	-	Ministry of Environment, Forests and Climate Change
O&M	-	operation and maintenance
PHED	-	Public Health Engineering Department
PIU	-	public implementation unit
PWD	-	Public Works Department
SPS	-	Safeguard Policy Statement
UDD	-	Urban Development Department
WRD	-	Water Resources Division

WEIGHTS AND MEASURES

cm	-	centimeter
dbA	-	decibels
dia	-	diameter
ha	-	hectare
kg	-	kilogram
km	-	kilometer
l	-	liter
m	-	meter
m ²	-	square meter
m ³	-	cubic meter
mg/l	-	milligrams per liter
ml	-	milliliter
MLD	-	million liters per day
mm	-	millimeter

sq. km. – square kilometers
sq. m. – square meters
 $\mu\text{g}/\text{m}^3$ – micrograms per cubic
meter

NOTES

- (i) The fiscal year (FY) of the Government of India and its agencies ends on 31 March. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2017 ends on 31 March 2017.
- (ii) In this report, "\$" refers to US dollars.

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EXECUTIVE SUMMARY

1. The Assam Urban Infrastructure Investment Program (Program) is a key urban infrastructure initiative of the State Government of Assam, and aims to improve the urban environment and quality of life in the cities of Guwahati and Dibrugarh through the delivery of improved water supply, sanitation, solid waste management (SWM), drainage infrastructure. The Program uses a multitranche financing facility (MFF) modality and is being implemented over a 6-year period from 2012 to 2017. Investments under the MFF are being delivered in two tranches. For Guwahati, these included water supply, storm water drainage system of South Guwahati. For Dibrugarh, these included drainage and solid waste management.
2. The major outputs of the Program include: (i) for Guwahati, improved water supply, sanitation, improved storm water drainage system (south Guwahati), and ii) for Dibrugarh, improved drainage, and comprehensive SWM.
3. The State Government of Assam's Guwahati Development Department is the executing agency. A state-level PMU, headed by a Project Director (PD), established as the Implementing Agency which will be in-charge of overall execution and technical supervision, monitoring, and financial control of all activities under the project. Project Implementation Units (PIUs) dedicated exclusively to the project would be set up in Guwahati and Dibrugarh. The PIUs will be headed by a senior technical officer and assisted by qualified and experienced officers seconded from ULBs, finance and other line departments. The PIUs will be responsible for the day-to-day activities of project implementation in the field and will be under the direct administrative control of the PMU.
4. The PMU will have Safeguards Compliance and Monitoring Unit (PMU SCMU) to ensure mitigation of negative environmental and social impacts due to the subproject, if any. The PMU SCMU will have a Safeguards Officer (PMU SO). The PMU assisted by the Design Management and Supervision Consultant Safeguards Specialist (DMSC SS). The PIUs will each have an Environment Officer (EO) and Resettlement Officer (RO) who will be responsible for implementation of the initial environmental examination (IEE) and environmental management plan (EMP) and the resettlement plan respectively. An Environment Specialist as part of the design, management and supervision consultant (DMSC) team is to assist the PIUs in updating the IEE during detailed design stage and monitoring of the subproject's EMP during the operation and maintenance stage. ADB will review and approve all final IEEs prior to contract award.
5. ADB requires the consideration of environmental issues in all aspects of its operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. According to the SPS, environmental assessment is required for all subprojects under an MFF modality.
6. The overall investments under this package shall include i) An Operation and Maintenance Plan indicating involvement of trained operators, assisting staff, the garage space for parking of the machinery. ii) Sites identified around in the periphery of the city for dumping of the cleared silt without causing environmental damages.
7. The cost of machineries, equipment and transport vehicles to be procured is ₹188.60 million (\$ 2.83 million). The custodian of the machineries, equipment and transport vehicles will be Guwahati Municipal Corporation (GMC). Operation and maintenance (O&M) of machinery, equipment and transport vehicles shall be done by the manufacturer/ supplier for 5 years as per

the O&M plan and guidance of GMC for implementation of the Action Plan. The total O&M cost of the project has been calculated based on annual manpower cost, cost of fuel, spare parts, etc. The calculation reveals that the annual O&M cost of the machineries, equipment and transport Vehicles to be utilized for cleaning of silt from the existing drains is ₹ 37.52 million.

8. This IEE is prepared for Procurement of Machinery, Equipment and Transport Vehicles for cleaning of the existing drainage system. This IEE is prepared based on preliminary study of the disposal sites in Basistha and Adbari area which are already being used by GMC for disposal. During de-siltation works, the concerned contractor will implement the mitigation measures as given in the EMP of this IEE. Subsequently the IEE shall be updated by implementing agency (PMU and PIU with the assistance of DSMC) when de-siltation process starts within approximately one year. The updated IEE will be submitted to ADB at least three months before the de-silting activities start.

9. No subproject components are located within the forest. Survey indicates that there is no requirement of tree felling. However, if there will be a need for tree cutting during project execution, a tree-cutting permit will be obtained from the Assam Environment and Forest Department.

10. The process described in this document has assessed the environmental impacts of the disposal sites of silt and loose soil from drains. Potential negative impacts were identified during operation and maintenance of the improved infrastructure while no impacts were identified as being due to the project design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs of the infrastructure.

11. Locations and siting of the proposed infrastructures were considered to further reduce impacts. These include (i) identification of disposal sites (ii) Carrying of silt/ loose soil in water tight carrier vehicles.

12. Regardless of these actions, there may still be impacts on the environment during operation and maintenance stage. This may be because of (i) Dumping of other materials other than silt and soil in the identified disposal areas; and (ii) cleaning of channels/drains passing along roads of the city.

13 During the operation and maintenance phase, impacts mainly arise from (i) need to dispose/utilize significant quantities of waste soil (including river sediment); and (ii) from disturbance of residents, businesses, traffic and important buildings during transportation of silt/ loose soil by the contractor. These are common impacts of de-siltation in urban areas, and there are well developed methods for their mitigation. Measures such as conducting work in lean season and minimizing inconvenience by best methods will be employed.

14 There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the subproject will: (i) employ in the workforce to the extent possible, people who live in the vicinity of de-siltation sites to provide them with a short-term economic gain; and (ii) ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

15 Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Disposal of silt/ loose soil from time to time, leaks in the transport system will need to be repaired from time to time, but environmental impacts will be

much less than those of the de-siltation period as the work will be infrequent, affecting small areas only.

16 An EMP is proposed as part of this IEE which includes, (i) mitigation measures for significant environmental impacts during implementation, (ii) environmental monitoring program, and the responsible entities for mitigation, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) grievance redress mechanism. A number of impacts and their significance have already been reduced by amending the designs. Mitigation measures have been developed to reduce all negative impacts to acceptable levels.

17 Mitigation will be assured by a program of environmental monitoring to be conducted during de-siltation stages. The environmental monitoring program will ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

18 The stakeholders were involved in developing the IEE through discussions on-site and public consultation after which views expressed are to be incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

19 The most noticeable long-term benefits due to the subproject are, the subproject will significantly improve the environmental and living conditions and public health in Guwahati. In addition, the economic benefits considered due to the proposed subproject are: (i) reduction of household healthcare cost due to flooding and water logging problems; (ii) reduction in man days lost due to water logging and flooding; (iii) reduction in temporary resettlement cost due to flooding; (iv) reduction in annual cost of protection measures from flooding; and (v) reduction in road maintenance cost.

20 Therefore the proposed sub project is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, de-siltation and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

21 Based on the findings of the IEE, the classification of the Project as Category "B" is confirmed, and no further special study or detailed environmental impact assessment needs to be undertaken to comply with ADB SPS (2009).

I. INTRODUCTION

A. Overview

1. The Assam Urban Infrastructure Investment Program (Program) is a key urban infrastructure initiative of the State Government of Assam, and aims to improve the urban environment and quality of life in the cities of Guwahati and Dibrugarh through the delivery of improved water supply, sanitation, solid waste management (SWM), and improved storm water drainage system. The Program uses a multitranche financing facility (MFF) modality and will be implemented over a 6-year period from 2012 to 2017. Investments under the MFF will be delivered in two tranches. For Guwahati these included water supply, and Improved drainage system of Guwahati while for Dibrugarh included drainage, solid waste management and basic services for the poor were identified.
2. One of the major outputs of the Program is improvement of existing drainage system and reconstruction of existing channels for flood water drainage in Guwahati.
3. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. This states that ADB requires Environmental Assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.
4. ADB classified the Project as environment Category B and accordingly initial environmental examination (IEE) is required for all subprojects. This IEE is prepared for shall include i) An Operation and Maintenance Plan indicating involvement of trained operators, assisting staff, the garage space for parking of the machinery. ii) Sites identified around in the periphery of the city for dumping of the cleared silt without causing environmental damages. This sub-project including operation and maintenance will start in 2017 and continue for a period of 60 months.

B. Environmental Compliance Requirements

1. ADB Policy

5. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for Environmental Assessment are described in ADB Safeguard Policy Statement (SPS), 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, and loans involving financial intermediaries, and private sector loans.
6. **Screening and Categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impact are assigned to one of the following four categories:
 - (i) **Category A.** Projects could have significant adverse environmental impact. An EIA is required to address significant impacts.
 - (ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to

determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

- (iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- (iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all Projects will result in insignificant impacts.

7. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

8. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into Assamese for the project-affected people and other stakeholders. ADB will post the following safeguard documents on its website so affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

- (i) Final IEE upon receipt; and
- (ii) Environmental Monitoring Reports submitted by PMU/PIU during project Implementation upon receipt.

9. The above is to meet the requirements of ADB's Public Communication Policy 2011.

C. Applicable Legislations

10. The implementation of the subprojects will be governed by Government of India and State of Assam Environmental acts, rules, regulations, and standards. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether national, state or municipal/local. In addition, subprojects shall also be consistent with ADB's SPS. The following legislations are applicable to the subproject:

- (i) Environmental (Protection) Act of 1986, its rules and amendments;
- (ii) Water (Prevention and Control of Pollution) Act of 1974, its Rules, and Amendments;
- (iii) Air (Prevention and Control of Pollution) Act of 1981, its Rules and amendments;
- (iv) Municipal Solid Wastes Management Rules, 2016;
- (v) Central Pollution Control Board (CPCB) Environmental Standards;
- (vi) Construction & Demolition Waste Management Rules, 2016;
- (vii) The Environment Impact Assessment (EIA) Notification, 2006 as amended and Notification of Ministry of Environment and Forest No. L-11011/47/2011-IA.II(M) Dated 18.5.12.
- (viii) Forest (Conservation) Act of 1980, its Rules and amendments;
- (ix) Assam Forest Regulation of 1891;
- (x) Assam Forest Policy of 2004;
- (xi) The Assam Ancient Monuments and Records Act 1959; and Rules 1964
- (xii) The Ancient Monuments and Archaeological Sites and Remains Act, 1958

- (xiii) The Ancient Monuments and Archaeological Sites Remains (Amendment and Validation) Act,2010
- (xiv) Land Acquisition Act of 1894 and as amended in 1985.
- (xv) Master Plan Guwahati Metropolitan Area -2025

11. The Government of India laws cover the occupational health and safety of employees working only in factories and mines. However, the Constitution of India has provisions to ensure that the health and well-being of all employees are protected and the State has the duty to ensure protection. For this subproject, the mitigation measures are based on the World Bank Environmental, Health, and Safety (EHS) Guidelines.

D. Environmental Assessment Requirements

12. The Government of India Environmental Impact Assessment (EIA) Notification of 2006, which replaces the EIA Notification of 1994, requires environmental clearance (EC) for certain defined activities/projects. This Notification classifies the projects/activities that require EC into 'A' and 'B' categories depending on the impact potential and/or scale of project. For both category projects, prior EC is mandatory before any construction work, or preparation of land except for securing the land, is started. The said subproject components i.e. "Item rate contract for storm water drainage system of Guwahati and Allied Works at South East Guwahati" is not listed in the EIA Notification of 2006 "Schedule of Projects Requiring Prior Environmental Clearance" thus EC is not required. However, for all the quarry and mining activities environment clearance certificate is necessary.

E. National Legal Requirements

13. **Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and Amendments.** Any component of the subproject having potential to generate sewage or trade effluent will come under the purview of the Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments. Such projects have to obtain Consent for Establishment (CFE) under Section 25 of the Act from Assam Pollution Control Board (APCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures for abating the possible pollution of receiving water bodies. The following subprojects require CFE and CFO from APCB: However for this sub project CTE or CTO from APCB is not required.

- (i) Municipal solid waste management facilities;
- (ii) New or augmentation of water treatment plants; and
- (iii) New or augmentation of sewage treatment plants.

14. **Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.** The subprojects having potential to emit air pollutants into the atmosphere have to obtain CFE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 read with rules amendments from APCB before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution. The following require CFE and CTO from APCB.

- (i) All the quarries;
- (ii) Diesel generators; and
- (iii) Hot mix plants, wet mix plants, stone crushers, if installed for construction.

15. Emissions and discharges after treatment shall comply with standards notified by the CPCB. **Appendix 2** provides applicable standards for effluents, receiving water bodies, air quality, water quality, and noise levels.

16. **Forest Legislations.** Government of India and State Government of Assam make rules under the Indian Forest Act to regulate activities like (i) cutting of trees and removal of forest produce; (ii) clearing or breaking up of land for cultivation or any other purpose; and (iii) for protection and management of any portion of forest lands¹. According to the Act, State Government of Assam requires a Forest Clearance from Government of India MoEFCC for use of a forestland for non-forest purposes (means breaking up or clearing of any forest land). The Forest (Conservation) Rules of 2003 issued under this Act, provide specific procedures to be followed for obtaining the Forest Clearance.

17. Compensatory afforestation is one of the most important conditions stipulated for diversion of forest land. For obtaining approval involving 5 hectares (ha), cost of 10 times the number of trees to be removed, subject to maximum of 2500 trees per ha shall be paid. In case of plain areas, the area of the land required for compensatory afforestation, shall be equal to that of the affected forest land. In case of hills, the area of land required for compensatory afforestation shall be twice or double the area of the affected forest land.

18. In addition, the Assam Forest Regulation of 1891 and Assam Forest Policy of 2004, requires a permit for cutting of trees in non-forest land, regardless of land ownership, from the Assam Environment and Forest Department. Afforestation to the extent of two trees per each tree felled is mandatory.

19. No subproject components are located within the forest. Though survey indicates there is no requirement of tree felling but in case of any tree felling during project execution a tree-cutting permit will be obtained from the Assam Environment and Forest Department for trees to be felled on non-forest lands and on ROWs of roads along rising mains alignment.

20. **Ancient Monuments and Archaeological Sites and Remains Act, of 1958 and The Ancient Monuments and Archaeological Sites and Remains (Amendments and Validation) Act, 2010.** The Act designate areas within a radius of 100 meters (m) and 300 m from the “protected property” as “protected area” and “controlled area” respectively. For the subproject, there is no Archaeologically Protected Areas located within project influence zone.

21. **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.** The Act shall come into force on January 1, 2014 as notified by the Central Government. The Act will replace the Land Acquisition Act, 1894, a nearly 120-year-old law enacted during British rule and lays emphasis on Rehabilitation & Resettlement in cases of land acquisition. Private land acquisition is guided by the provisions and procedures under this Act. Before the acquisition of any land, the Government is required to consult the concerned Panchayat or Municipal Corporation and carry out a Social Impact Assessment in consultation with them. The Act provides a transparent process for land acquisition for industrialization,

¹ The term ‘forest land’ mentioned in Section 2 of the Act refers to reserved forest, protected forest or any area recorded as forest in the Government records. Lands which are notified under Section 4 of the India Forest Act would also come within the purview of the Act. (Supreme Court’s Judgment in the National Thermal Power Corporation’s case). It would also include “Forest” as understood in the dictionary sense (Supreme Court order dated 12.12.1996 in WP No. 202/1995-Annexure-I). All proposals for diversions of such areas to any non-forest purpose, irrespective of its ownership, would require the prior approval of the Central Government.

development of essential infrastructural facilities and urbanization by giving adequate financial compensation to the affected people.

22. The District Collector or any other officer designated will function as the Land Acquisition Officer on behalf of the Government. There is a provision for consent award to reduce the time for processing if the land owners are willing to agree on the price fixed by the Land Acquisition Officer. The option of acquiring lands through private negotiations is also available.

23. Temporary disruption of household's activity and business may be affected during pipe laying work. A Resettlement Plan has been prepared in accordance with the Land Acquisition Act and ADB's SPS 2009.

F. Applicable International Environmental Agreements

24. In addition, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN)², Convention on Migratory Species of Wild Animals (CMS)³, and Ramsar Convention on Wetlands of International Importance⁴ are applicable for selection and screening of subprojects under restricted/sensitive areas. India is a party to these conventions.

25. For the said subproject, (i) animals and plant species found in the subproject sites are not included in the IUCN Red List; (ii) will not alter bird migration; and (iii) sites are not within or adjacent to the Deepor beel, a permanent freshwater lake and a former channel of the Brahmaputra River in Assam listed under the Ramsar Convention in November 2002.

II. DESCRIPTION OF THE SUB PROJECT

A. Need of the Sub-project:

26. In the city of Guwahati flooding is a common problem in monsoon period. Heavy flooding occurs as such death of people has been reported. The main reasons are stated below.

- (i) The area suffers from flooding and water logging particularly during the monsoon period.
- (ii) Untreated or semi-treated sewage is also disposed off in to the storm water drains due to lack of proper sewerage and sanitation system in the city.
- (iii) Storm water drainages in many cases are not connected to final outfalls.

² The IUCN provides the Red List of Threatened Species (also known as the IUCN Red List or Red Data List) which is a comprehensive inventory of the global conservation status of plant and animal species. The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction

³ CMS, also known as the Bonn Convention, recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine and avian migratory species throughout their ranges. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them.

⁴ The Convention on Wetlands of International Importance (also called as Ramsar Convention) provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. According to the Ramsar list of wetlands of international Importance, there are 25 designated wetlands in India which are required to be protected. Activities undertaken in the proximity of Ramsar wetlands shall follow the guidelines of the convention

- (iv) Vertical profile of existing drains, in many cases, has not been maintained with falling gradient. This leads to stagnation, silt deposition and reduction of carrying section of the drain.
- (v) Large quantity of silt ingress from hills catchments due to denudation.
- (vi) Inadequate inlet sizes of the existing drains.
- (vii) Illegal encroachment over existing storm water drains.
- (viii) Inadequate sizes of some drains.
- (ix) Choked or non-functioning underground drains.
- (x) In some locations closed type inspection manholes have been provided over storm drains. These do not allow proper ingress of storm water nor proper maintenance access.
- (xi) HFL of river Brahmaputra and resultant backflow into the connecting primary drains

B. Project Area

1. City Profile



27. Guwahati city is the capital of Assam. It is also called the gateway to North East India as road and railway links to all the seven North–Eastern states necessarily pass through Guwahati.

28. The city is physically divided in two parts, North and South, by the River Brahmaputra. This report deals with the storm water drainage system of Guwahati City.

29. The present Guwahati Metropolitan Area is approximately 262 sq. km and is likely to be expanded further by 66 sq. km by inclusion of three more planning units as New towns.

30. Total population of Guwahati is approximately 12, 46,082 souls. The project under consideration is for existing area under Guwahati Metropolitan Development Authority (GMDA).

C. Description of the Disposal Area:

31. For disposing the dredged materials from the drains and rivers such as silt/ loose soil two

sites have been selected at Basistha and Adabari considering the negligible environmental impacts. The primary consideration for selecting these two sites is that the disposal of dredges materials which does not include any municipal solid waste and will not interfere with the environmental components like wetland, residences, reserve forests or flowing water bodies further the land is free from encumbrances and belongs to Guwahati Municipal Corporation (GMC) which does not require any land acquisition. Both the sites are well fenced with available access roads and has sufficient area to have the bulk of the dredged material to remain within the site area. The area of both the disposal sites is given in **Appendix 12**.

32. There are Government offices (Circle Office, Police station), Bus stand, commercial establishments and residences near the sites. GMC has already disposed some amount of silt and loose soil in the sites without any adverse impact to the area. At present no disposal is being done in the sites however during de-siltation works the dredged materials will be disposed-off yearly for 4 months. The environmental base data will be generated prior to starting of the dredging works. The present site photos of the two sites is given in **Appendix 4**.

1. Existing Storm Water Drainage System

33. The details of types of drains are given in **table 1** below

Table 1. Classification of Drains

S. No.	Type	Description
1	Tertiary Drain	The first level collector with smallest catchment and is located along the lanes and by lanes of the city.
2	Secondary Drain	These drains receive flows from the tertiary drains and from its own catchment.
3	Primary Drain	These are mostly natural and manmade drains which conveys the storm flow.

2. Rivers.

34. The existing river system is given in **Table 2** below.

Table 2. Existing River Systems

S. No.	Rivers	Description
1	Brahmaputra	The ultimate outfall of all draws of the city is Brahmaputra river and due to very special topographical aspect which is the genesis of Storm Water Drainage problem. The flood afflux in the river increases the flood level in the river channel near Bondajan and Bharalumukh area.
2	Bharalu	The river takes discharges from two other primary natural drains i.e. river Bahini and outfall of Borsola Beel. It is most floods prone and thus the focal point of entire Guwahati Drainage system.
3	Basistha	This river has the single largest drainage basin located at the southernmost part of the

S. No.	Rivers	Description
		Guwahati Metropolitan area, and finally discharges into Dipor beel. Near Natunbazar at Basistha Chariali, River Bahini is severed and the entire flow is diverted to River Basistha.
4	Bahini	After severance, the river Bahini continues in the original alignment parallel to Beltola Road and reaches Bharalu and R.G.B open drain near Jonali.
5	Pamohi	It actually caters to the back water of Deepor beel and functions as a stream only during rainy season.

3. Primary Drains

35. The details of primary drains are given in **table no. 3** below.

Table 3. Primary Drains

S. No.	Name of Drain	Brief Description
1.	Mora Bharalu	This drain originates at Fatasil Chowk and its outfall is in Pamohi. Resection and new gradation of Mora Bharalu was done in 1986 to divert the flow of Bharalu through Mora Bharalu to Basistha River when the sluice gate at Brahmaputra is closed.
2.	Bonda	It is actually a tributary to Brahmaputra river and is situated to the east of Guwahati city, originating for Silsako wet land.
3.	Khanapara	This is situated in the western part of Guwahati with bi-directional flow i.e. flow from Deepor Beel and back water from Brahmaputra depending upon the level of water at Brahmaputra river.

4. Secondary Drains

36. The details of secondary drains are given in **Table 4** below.

Table 4. Secondary Drains

S. No.	Name of Drain	Brief Description
1	Pubsarania- Rajgarh Area Drain	This is major covered drain; This drain is a combination of Pipe conduit and RCC Box Drain and caters to part of Chandmari, Krishna Nagar. This drain is divided into two parts, one towards Nabin Nagar and another towards Lachit Nagar.
2	Railway drain open.	This drain is mainly of two types, underground and surface drain. Most part of the surface drain is covered with RCC slabs. The underground drains are RCC Box type & pipe.

S. No.	Name of Drain	Brief Description
3	Drain through Khanapara reaching Silsako Beel.	This drain originates at Jorabat area and discharges into Silsako beel after passing through Veterinary college, Panjabari etc.
4	Underground drain from Ambari to Railway open drain at Ambari	This drain carries storm runoff from lamb Road, Ambari, parts of Uzanbazar and meets Railway Culvert below B.Baruah overbridged and finally outfalls at Borsola Lake.
5	R.G Barua Road drain (From Zoo Narengi Tiniali to Bharalu river)	This RCC Open Drain originates at Zoo Narengi Tiniali and outfall is at Bharalu Primary Drain.
6	Chandmari Bharalu Secondary Drain	It carries water from several different locations like part of Chandmari, Bhaskar nagar, Rajgarh, Nabin Nagar etc. and discharges into Bharalu.
7	Underground drain along the boundary of Nabin Nagar and Anil nagar to Bharalu (via Anil nagar	This drain carries storm runoff from Anil nagar area. The total length of the drain is 1400 m.
8	Kumarpara Machkhowa area storm drain.	This drain carries storm eater from Athgaon, Machkhowa and adjoining areas. The total length of the drain is 2955 m.
9	Dr. B.Baruah to Dr. B.K.kakati road (underground box drain.)	This drain starts near Indoor Stadium near Islampur road and falls to the river Bharalu near the bridge of Agricultural deptt. office.
10	Hedyatpur area underground drain	This drain carries water from areas like Hedyatpur,Guwahati club police point etc. This drain starts from starts from Guwahati Club police point and falls at Railway open drain below railway over bridge.
9	Roadside Rupnagar area storm water drain	This drain starts from GMCH link road, continues up to Rupnagar L.P.school and discharges into Bharulu.
10	M.A.Road drain.	This is an underground box drain starts near Arya Pathsala L.P. School , Rihabari and continues up to Bharalu.
11	Islampur Underground Drain	This drain originates from Hazi musafir khana and terminates at Dr. B.K.Kakati drain. The total length is 1316 m.A part of the drain is of hume pipe.
12	Santipur Durgasarobar Area Storm water drain	This is a major drain collecting storm water via roadside drains fromDurgasorobar locality in two parts and contributes toMasjid path underground drain. The outfall point is at river Bharalu via Santipur area underground storm water drain.

S. No.	Name of Drain	Brief Description
13	Athgaon Chatribari Secondary drain	This is a major drain having three contributory drain viz. drain from Chatribari ,Athgaon and F.A.road drain. The length is 400 m (approx.) and is unlined.
14	Drain from Machkhowa vegetable market to river Brahmaputra via Idgah Maidan and Machkhowa residential area.	This drain originates near vegetable market, carries storm water form part of Machkhowa residential area and falls in Brahmaputra river. This drain back flows when the river is under HFL.
15	Lakhtokiya Chatribari Area storm water drain.	The drain originates from Fire Brigade Station, Paltanbazar and the out fall is sarusola beel. The total length is 665 m.
16	Hatigaon Channel and Hatigaon drains	This major drain originates from Basistha river near Bhetpara and meets the same river at Dakhingaon. The length of the drain is 5051 m.
17	Bishnupur Area Storm Water Drain	The origin point of this drain is at Bishnupur Bharalu Bridge and the outfall is at Mora Bharalu.The total length is 929 m and piped.
18	Drain from G.S Road to Bahini	This is an open drain with starting point near Silkalaya. This drain carries storm water from Goneshguri, Christan Basti area to Bahini river. The length is 200 m.
19	Tokobari area underground drain	This drain carries storm water from Paltanbazar and Tokobari area having length of 1.5 km.
20	Underground drain through Ajanta path Beltola to Hatigaon channel.	This drain carries storm water from Ajanta path area to Hatigaon channel. The length is 1.6 km approx.
21	Drain from Japorijag to Bahini near Goneshguri.	This drain originates from foothills of Japorojog and carries water from Japorijog, Mikirgaon, Lakshmigaon and falls at Bahini river. The length is 1.5 km approx.

37. The details of the rivers and drains are appended along with photo illustrations at **Appendixes 2 and 3.**

38. Proposed sub-project is for procurement of Machinery, Equipment and Transport Vehicles for cleaning of the existing drainage system including O&M for five years

39. The details of equipment and disposal sites are given in **Table 5** given below.

Table 5. Equipment and Disposal Sites

S. No.	Particulars	Number/ Area
1.	PC 71/EX-70/ Equivalent chain mounted excavator for barges. Complete with accessories.	2
2.	PC 50/EX-50/ Equivalent chain mounted excavator for barges. Complete with accessories.	2
3.	70-80 HP Tyre mounted Excavator with backhoe and bucket operation arrangement complete. Longer boom length preferred.	4
4.	45-50 HP Excavator with backhoe and bucket operation arrangement complete. Longer boom length preferred. ii) Tyre mounted	4
5.	Hydraulic Dumper/Tipper 12 cum (approx.) of reputed company make	10
6.	Hydraulic Dumper/Tipper 8.5 cum (approx.) of reputed company make	10
7.	Hydraulic Dumper/Tipper 3 cum (approx.) of reputed company make	30
8.	Skid Steer Loader machine to handle garbage and spoils	6
9.	D.I Pick Up Van	6
10.	Pontoon mounted Amphibian dredger with excavator Arm, Stabilizers, hydraulic self-propulsion system, cutter & suction dredger pump, attachment for pile driving, hydraulic hammer etc.	2
11.	De-silting tanker-Bolero mounted.	10
12.	Sewer/Drain cleaning machine (Power Bucket type) with hydraulic tipper with capacity of 4-6 Cum.	8
13.	Floating Silt pusher (C-86S/equivalent) for open channel/water bodies silt removal. Maximum working depth 2 m and working width up to more than 8 m, power with 42HP diesel engine, overall size 10.5 x 1.8 x 1.3 m (LWH) with pontoon	1
14.	Capacity of the disposal site for dumping of silt/ loose soil at existing dumping ground of GMC at Basistha	18700 m ³
15.	Capacity of the disposal site for dumping of silt/ loose soil at existing dumping ground of GMC at Adabari	100185 m ³

GMC=Guwahati Municipal Corporation

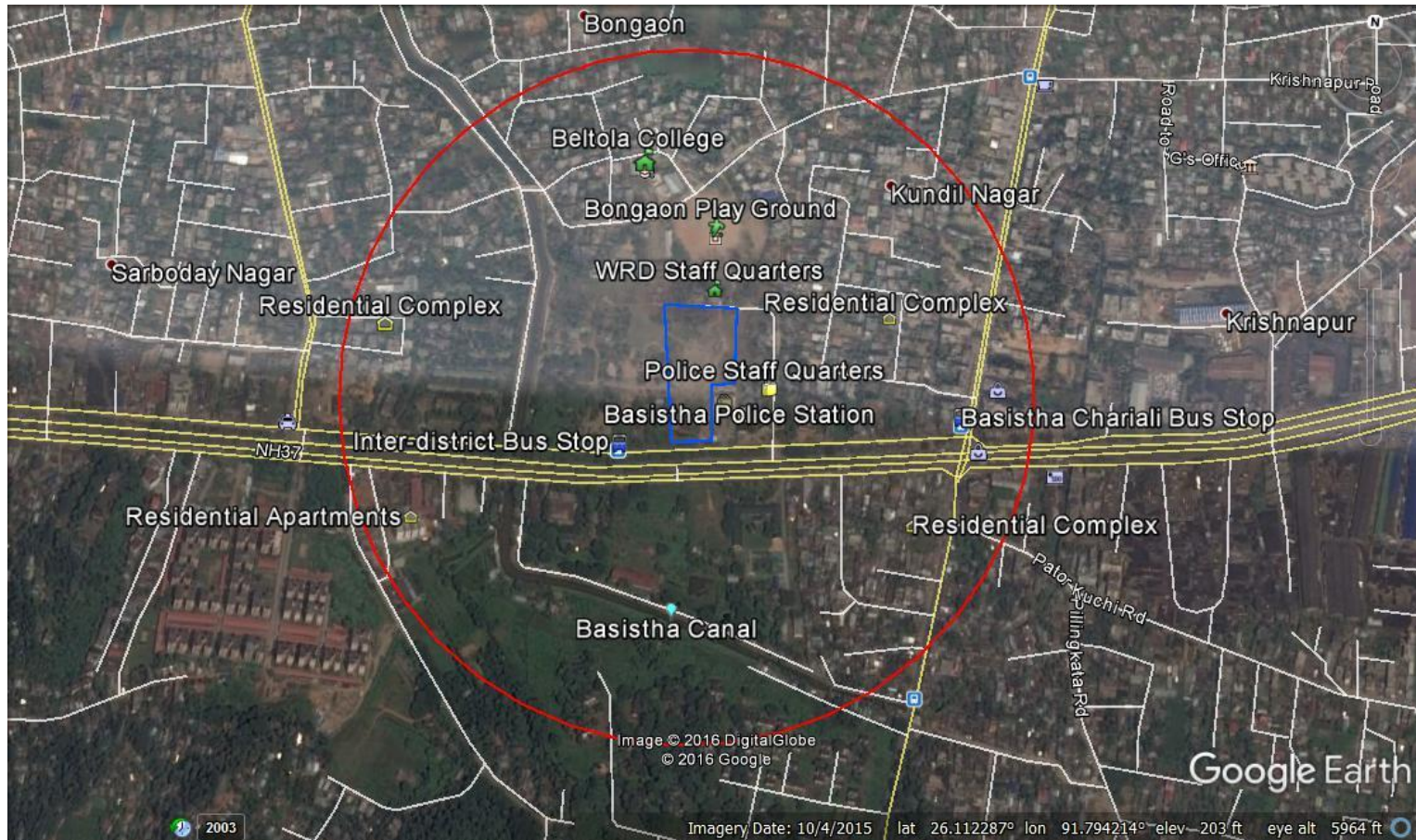
D. Implementation Schedule

40. The operation and maintenance works for dredging activities are likely to commence in 2017 and will be completed in approximately within 60 months.

E. Subproject Benefits

41. The subproject significantly improves the environmental and living conditions and public health in Guwahati. In addition, the economic benefits considered due to the proposed subproject are: (i) reduction of household healthcare cost due to flooding and water logging problems; (ii) reduction in man days lost due to water logging and flooding; (iii) reduction in temporary resettlement cost due to flooding; (iv) reduction in annual cost of protection measures from flooding; and (v) reduction in road maintenance cost. Project location map is shown in **Figure 1** and **Figure 2**.

Figure 1: Disposal Site at Adabari





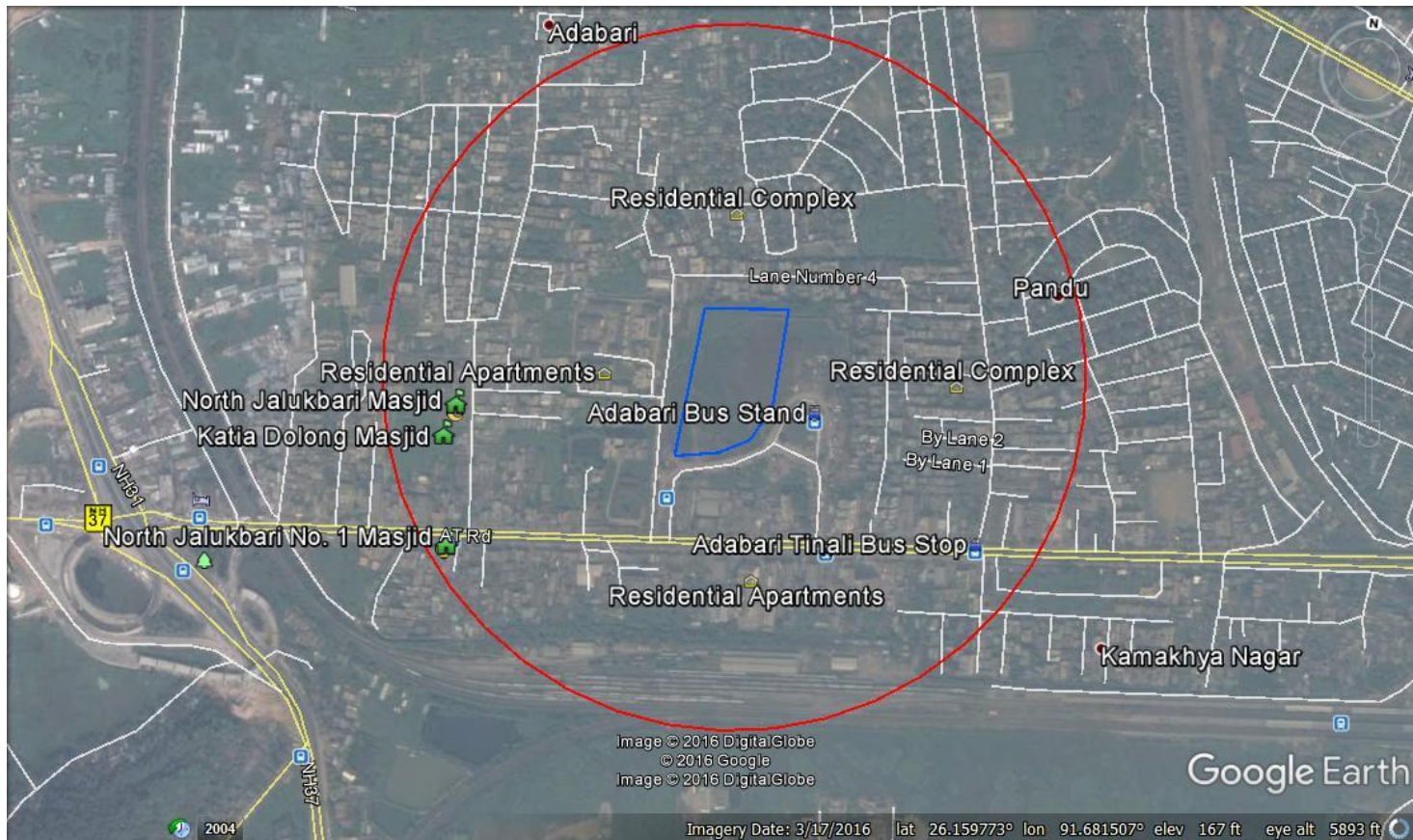


Legend	
	Basistha disposal ground boundary
	500 meters radius circle around the disposal ground

Figure 2: Disposal Site at Adabari



Legend	
	Adabari disposal ground boundary
	500 meters radius circle around the disposal ground

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Features

1. Location

42. Guwahati district is the capital of State of Assam and is located on the southern bank of Brahmaputra River. The Guwahati Municipal Area (GMA), with a total area of 262 square kilometers (sq. km) is located on both banks of Brahmaputra River dividing it into two parts - North Guwahati and South Guwahati. The State Government of Assam has proposed the Southeastern zone for assistance under the Project, which covers 71 sq. km and a total of 11 wards and some parts of 6 other wards. Map of the Guwahati city and location of wards are shown in Figure 3 and 4 respectively.



Figure 3: Map of Subproject Area- Guwahati City

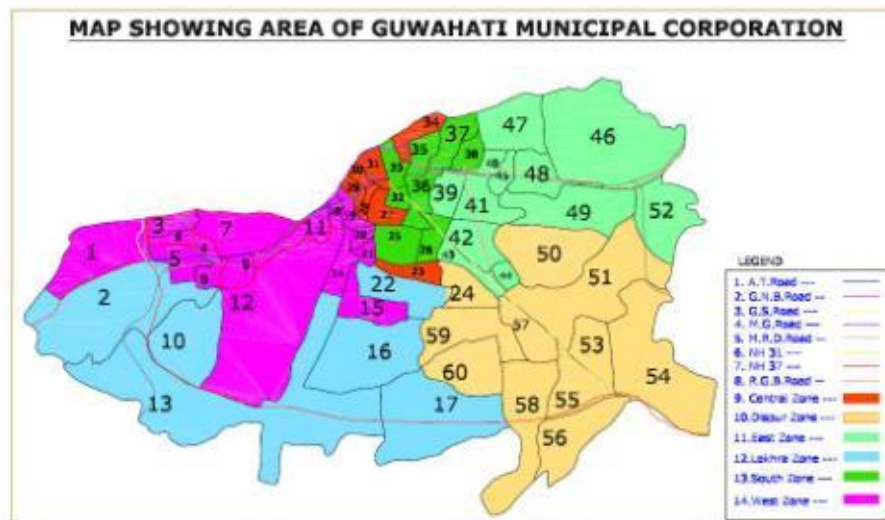


Figure 4: Guwahati Municipal Corporation Area Showing Distribution of Ward

2. Topography

43. Guwahati is located at 26⁰10' N latitude and 91⁰45' E longitude with an altitude varying between 49.5 m to 293 m above mean sea level. The average slope varies from zero degree to 18 degrees. The natural topography of the city guides flow of the rainwater towards Bharalu and Basistha Rivers.

44. The physical configuration of Guwahati exhibits a peculiar structure being located within a crescent shaped basin, surrounded by a number of hillocks. As a result, swamps and low-lying areas in between the hillocks have emerged in the landscape. These low-lying areas are often inundated during heavy rainfall.

3. Geology and Seismicity

45. Guwahati is characterized by mostly Precambrian granite gneisses, quartzite forming residual hills and occupying a major part of the landscape. Small elongated inter montane valleys with varying thicknesses of sediment fill and alluvium form the rest of the areas. There is presence of a number of paleo-channels that are perceived to be old channels linked to the Brahmaputra River towards north.

46. The Brahmaputra valley and its adjoining highlands constitute a highly active seismic zone. Guwahati falls in the Seismic Zone V, where earthquakes of magnitude 8 or more can occur i.e., the zone with highest intensity. Guwahati and its surrounding area are situated on the fringe of hard rock formation. Its vulnerability to the seismic activity⁵ is exacerbated due to congestion brought on by topography, with poorly built housing and narrow streets.

4. Climate

47. Three seasons are witnessed in Guwahati. From February to May, the weather is dry. In the month of March, the northeast wind carries the dry sand from the Brahmaputra River and makes the whole atmosphere dusty. In April and May, local rain along with thunderstorms is a common feature. The maximum and minimum temperature varies from 12° to 31°C during this period. From June to October is the southwest monsoon season with heavy rainfall. The temperature varies from 22° to 32°C in this period. November to January is the cold weather season. The average annual rainfall in Guwahati is 1637.3 mm with 87 average rainy days. About 90% of this rain occurs between April and September and July and August being the maximum rainy months.

5. Drainage

48. The whole GMA area is divided into six drainage basins, which are ultimately drained into the Brahmaputra River either directly or through various drainage channels and reservoirs. These six basins are Bharalu Basin, Dipar Basin, Silsako Basin, Foreshore Basin, North Guwahati Basin, and Kalmoni Basin.

⁵ Earthquakes measuring up to 8.7 on the Richter scale occurred here in 1897 and 1950. Between 1920 and 1980 as many as 455 earthquakes of magnitude 5 on the Richter scale were recorded in the region an average of 8 per year

6. Surface Waters

49. **Brahmaputra River.** Brahmaputra River within Assam is almost 700 km long with more than 100 tributaries. It has a total length of 28.67 km, total area of 49 sq. km and a major natural feature in Guwahati. Assam Pollution Control Board (APCB) is carrying out continuous water quality monitoring under the National Water Quality Monitoring Program and Monitoring of Indian National Aquatic Resources. Results of monitoring conducted by APCB show coliforms exceed the prescribed Government of India limits. All other parameters are within the prescribed limit. The flow data of the river is given below.

Table 6: Flow Data of Brahmaputra River in Guwahati City

S. No.	Year	River Flow in Guwahati in Season (Cume)		
		Flood	Winter	Summer
1	2003	31265	9360	6080
2	2004	28657	5659	8196
3	2005	26890	7854	3662
4	2006	21178	3869	4641
5	2007	18723	3647	6554
6	2008	25657	4520	3752
7	2009	20461	4725	11378

Source: Central Water Commission, 2011

50. Brahmaputra River water quality data is shown below.

Table 7: Water Quality of Brahmaputra River

Parameters	W1	W2
Temperature (°C)	25	25
pH	7.2	6.9
Conductivity (µmhos/cm)	107	158
Turbidity (NTU)	16	14
Dissolved Oxygen (mg/l)	7.20	7.20
Alkalinity as CaCO ₃ (mg/l)	66.00	56.0
Total Hardness as CaCO ₃ (mg/l)	68.00	68.0
Calcium as Ca ²⁺ (mg/l)	20.00	36.0
Magnesium as Mg ²⁺ (mg/l)	4.30	12.0
Chloride as Cl (mg/l)	12.00	10.00
Sulphate as SO ₄ ²⁻ (mg/l)	16.80	4.8
Nitrate as SO ₄ ²⁻ (mg/l)	0.14	0.62
Residual Chlorine (mg/l)	BDL	BDL
Phenolic Compound (mg/l)	BDL	BDL
Total Iron as Fe (mg/l)	0.50	0.16
Fluoride As F (mg/l)	0.33	0.50
Total Dissolved Solids (mg/l)	72.00	-
Arsenic as As (µg/l)	1.18	BDL
Chromium as Cr (VI) (mg/l)	BDL	-
Lead as Pb (mg/l)	BDL	-
Zinc as Zn (mg/l)	0.024	-
Copper as Cu (mg/l)	0.059	-
Cadmium as Cd (mg/l)	0.005	-

Parameters	W1	W2
Mercury as Hg (mg/l)	BDL	-
Bacteriological Parameters		
Total Coliform (MPN/100 ml)	300	860
Faecal Coliform (MPN/100 ml)	Nil	290

BDL: Below Detection Limit (Source: W1: Assam Pollution Control Board for AUIIP.

Date of collection of sample: 08/10/2012 & W2: Collected from JICA funded project, Intake point of JICA funded Guwahati Water supply project at Kharghuli).

51. **Bharalu River.** The Bharalu River originates as a small stream from the southern range of Khashi Hills and flows through the city gaining momentum in width and depth and ultimately joining Brahmaputra River. Most of the drains directly or indirectly fall into Bharalu River which is an important channel for the drainage of the city. But due to siltation, the bed level of the river has considerably risen. Results of monitoring conducted by APCB show dissolved oxygen, biological oxygen demand, and coliforms exceed the prescribed Government of India limits. All other parameters are within the prescribed limit.

Table 8. Water Quality of Bharalu at Bharalumukh Before Confluence with Brahmaputra River (During the period from 2009 to 2013)

Parameters	Month & Year of collection				
	April, 09	April, 10	April, 11	April, 12	April, 13
a. Physical Parameters:					
pH	6.9	7.4	6.8	6.8	6.8
Turbidity (NTU)	7.2	6.9	21	18.2	19.4
Conductance ($\mu\text{mho/cm}$)	533	697	734	799	836
b. Organic Parameters:					
DO (mg/l)	nil	nil	nil	0.5	nil
COD (mg/l)	56.4	54.4	160	81.2	85.7
BOD (mg/l)	6.5	30	32	15	48
c. Major Mineral Parameters:					
Chloride as Cl (mg/l)	92	36	14	156	68
PO ₄ as P (mg/l)	9.3	10	3.1	10	14.2
Sulphate as SO ₄ (mg/l)	52.6	29.4	11.8	23.2	5.6
d. Other Inorganic parameters:					
T. ALKALINITY (mg/l)	204	82	540	260	252
T. Hard ness as CaCO ₃ (mg/l)	224	92	56	156	150
Calcium as CaCO ₃ (mg/l)	168	60	38	104	110
Magnesium as CaCO ₃ (mg/l)	56	32	18	52	40
NITRATE-N (mg/l)	0.10	0.73	0.38	2.4	3.4
Total Dissolved Solid (TDS) (mg/l)	393	432	448	562	548
Total Fixed Solid (TFS) (mg/l)	102	112	206	128	115
Total Suspended Solid (TSS)(mg/l)	38	28	37	33	38
Sodium (mg/l)	4.5	31.7	41	22.8	50.5
Potassium (mg/l)	2	10.1	3.1	6.4	18.4
Fluoride (mg/l)	0.68	0.71	0.56	0.49	0.52

e. Trace Metals:					
Zinc as Zn ($\mu\text{g/L}$)	144	232	101	142	130
Copper as Cu ($\mu\text{g/L}$)	10	105	80	61	9
Lead as Pb ($\mu\text{g/L}$)	BDL	285	10	10	13
Cadmium as Cd ($\mu\text{g/L}$)	3	2	2	3	4
Nickel as Ni ($\mu\text{g/L}$)	5.9	45	20	20	BDL
Chromium as Cr (T) ($\mu\text{g/L}$)	3	46	42	33	57
Arsenic as As ($\mu\text{g/L}$)	BDL	1.13	1.4	2.2	2.2
Mercury as Hg ($\mu\text{g/L}$)	BDL	BDL	BDL	BDL	BDL
Total Iron ($\mu\text{g/L}$)	80	80	320	120	730
f. Bacteriological Parameters:					
Total Coliform (MPN/100m1)	2100	1500	2000	2300	21000
Faecal Coliform (MPN/100l)	730	720	Nil	910	2000

BDL: Below Detectable Limit

Source: Pollution Control Board, Assam

Table 9: Guwahati Municipal Corporation supply water (Place of Collection - Panbazar Water Treatment Plant, Guwahati)

Physical Parameters	Value	Acceptable limit {(BIS)10500,2012}	Standard {(BIS)10500,2012}- Permissible limit in absence of alternative source
Appearance	Almost clear	Agreeable	Agreeable
Colour	Almost clear	Colourless	Agreeable
Odour	Odourless	Agreeable	Agreeable
pH Value	7.98	6.5 – 8.5	6.5 – 8.5
Turbidity (NTU)	<5.0	1.0	Less than 5
Chemical Parameters (mg/l)			
Total Dissolved Solids	158.0	500.0	2000.0
Total Hardness (as CaCO ₃)	60.0	200.0	600.0
Total Alkalinity (as CaCO ₃)	48.0	200.0	600.0
Total Iron (as Fe)	0.02	0.3	0.3
Chloride (as Cl)	4.0	250.0	1000.0
Residual free chlorine	0.20	0.20	1.0
Fluoride (as F)	0.3	1.0	1.5
Nitrate (as NO ₃)	BDL	45.0	45.0

BDL: Below Detection Limit (Source: Guwahati Municipal Corporation, Date of collection of sample: 15/09/2012)

52. Owing to the inadequacies of piped water supply, Guwahati depends on groundwater from ring/dug wells and tube wells for drinking purposes. Groundwater quality in Guwahati has been studied with special reference to the presence of fluoride. The Brahmaputra River in the north, hills to the east and south, and alluvial soil to the west surround the city. Fluoride, above the guideline values of World Health Organization, has been found in groundwater of the eastern and southern plains of the city. The sources of fluoride and nitrate are suspected to be minerals from the Precambrian granite, which forms the basement of the city and outcrops at several

places in the city.

7. Groundwater

53. Ground water quality data was collected from secondary published source. Samples were collected near the sub project locations at Khanapara (residential), Ruckmini Gaon (residential), Noonmati (near KV Noonmati) and Chunsali (residential). The maximum and minimum values as noted during monitoring are given below.

Table 10: Ground Water Quality In and Around Guwahati

S. No.	Parameters	Minimum	Maximum
1	Odour	NS	WS
2	Temperature(°C)	22	22.1
3	Turbidity (NTU)	6.2	8.4
4	pH	7.03	8.41
5	Conductance ms/cm	0.65	7.98
6	Total dissolved solid mg/l	145	225
7	Total suspended solid mg/l	11	20
8	Chloride (mg/l)	34.8	161.88
9	Sulphate (mg/l) as SO ₄	5.75	8.1
10	Phosphate (mg/l)	0.31	0.65
11	Fluoride (mg/l)	0.8	1.6
12	Cyanide (mg/l)	BDL	BDL
13	Calcium(mg/l)	44.8	105.8
14	Nitrate (mg/l)	0.41	0.5
15	Magnesium (mg/l)	6.81	11.68
16	Sodium(mg/l)	7.1	7.3
17	Potassium (mg/l)	2.8	3.8
18	Manganese (mg/l)	0.03	0.87
19	Zinc (mg/l)	BDL	0
20	Iron (mg/l)	0.11	0.63
21	Copper (mg/l)	BDL	BDL
22	Lead (Pd) (mg/l)	BDL	BDL
23	Chromium + ⁶ (mg/l)	BDL	BDL
24	Chromium (Total) (mg/l)	BDL	BDL
25	Cadmium(mg/l)	BDL	0.001
26	Arsenic (µg/L)	BDL	0.01
27	Cobalt (mg/l)	0.006	0.22
28	Nickel (mg/l)	BDL	0.01

S. No.	Parameters	Minimum	Maximum
29	Phenol (mg/l)	BDL	BDL
30	Total Cali farm (MPN/100 ml)	-	-
31	Faecal Califon (MPN/100ml)	-	-

BDL: Below Detection Limit, (Source: EIA Report INDAdept^G Project- Guwahati Refinery)

8. Air Quality

54. Air pollution in Guwahati has increased in recent years due to growth of traffic and other urban activities. The ambient air quality data is collected from secondary source in respect to particulate matter (PM 2.5 & PM 10), sulfur dioxide (SO₂) and nitrogen oxides (NO_x), shown in **Table 11**. At all the locations sulfur dioxide and nitrogen oxides are within the limit.

Table 11. Air Quality Monitoring Result

Locations	Parameters (µg/m ³) (Min- Max)/ Mean			
	SO ₂	NO ₂	PM ₁₀	PM _{2.5}
Guwahati Refinery Guest House*	BDL-6.10 (2.40)	BDL-13.6 (5.40)	24.8 – 78.2 (56.8)	24.2-56.2 (40.6)
Guwahati Refinery Township*	BDL-5.4 (2.3)	BDL-14.6 (2.3)	51.7-131.5 (80)	32.2-71.4 (48.4)
Near WTP site at Chunsali*	BDL-6.1 (2.6)	BDL-6.4 (2,80)	21.1-76.4 (57.3)	21.7-51.3 (34.8)
Near Proposed Intake Site Kharghuli Area**	6.0	11.0	25.0	12.0
CPCB Standard	80	80	100	60

Source: *EIA Report INDAdept^G Project- Guwahati Refinery, **: Baseline monitoring near intake site at Kharghuli of JICA funded WSSP

55. Results show that the maximum PM₁₀ value cross the standard limit 100µg/m³ at Refinery Township. The maximum values of PM_{2.5} cross the standard limit of 60µg/m³ at Guwahati refinery township area. But the average concentrations of PM₁₀ and PM_{2.5} at all the locations are within the standard limit.

9. Noise Level

56. Secondary data for ambient noise in and around the project locations are collected. **Table 12** shows noise level data of the project area.

**Table 12. Noise Levels (dBA) in the Project Area
(Day Time 6AM to 10 PM; Nighttime from 10 PM to 6 AM)**

S. No.	Noise Monitoring Station	Day time SPL (dBA)		Night time SPL (dBA)	
		Leq	Range	Leq	Range
1	Noonmati* (Guwahati Refinery main gate)	72	61-86	64	40-73
2	Noonmati* (Sector-III)	74	51-79	56	44-68

S. No.	Noise Monitoring Station	Day time SPL (dBA)		Night time SPL (dBA)	
		Leq	Range	Leq	Range
3	Noonmati Public School*(Chunsali)- nearby WTP site	64	54-81	42	36-66
4	Near APBN Barrack**	44.5	-	41.5	-
5	Right Side Hill**	40.2	-	39.8	-
6	Centre of the Hill**	42.0	-	40.2	-
7	Near Raj Bhawan**	40.2	-	38.6	-

Source: *EIA Report INDAdept^G Project- Guwahati Refinery, **: Baseline monitoring near intake site at Kharguli of JICA funded WSSP

57. Welcome1Results show that noise level is maximum at township area and above the standard.

58. After commencement of work baseline monitoring in respect to air and noise will be conducted at specific project sites.

B. Ecological features

1. Protected Areas and Reserve Forest

59. There are 9 reserve forests within GMA with a total area of 17,673.93 sq. km apart from the Deeporbeel (Ramsar wetland) having an area of 4.14 sq. km. **Table 13** presents the names of the reserve forests along with their extents.

60. No project locations are within the forest area.

Table 13: Reserve Forests in Guwahati Metropolitan Area

SI. No.	Name of Reserve Forest	Area (sq. km)
1	Garbhanga	11, 460.95
2	Gotanagar	171.00
3	Fatasil	670.44
4	Hengrabari	498.00
5	Jalukbari	97.70
6	Maliata	325.46
7	Rani	4,372.38
8	Sarania Hills	8.00
9	South Kalapahar	70.00
	Total Area	17,673.93

Source: Directorate of Forests, 2007

2. Wetlands

61. Guwahati has a large number of low lying areas and some of them have developed into lakes and water bodies. These wetlands help in mitigating the problems of flash flood, which is a common occurrence during the monsoon season. Larger water bodies are popularly known as *beels*. Those mostly serve as backyard fishing ponds to the residents particularly in rural areas. There are around 7 wetlands in and around Guwahati namely: (i) Deeparbeel; (ii) Borsolabeel; (iii) Sarusolabeel; (iv) Silsakubeel; (v) Zentiabeel; (vi) Kamrangabeel; and (vii) wetlands of Dimoria block. Deeparbeel (Ramsar wetland), Kamrangabeel, and Zentiabeel are favorite sites

for the migratory birds while Deeporbeel is the storehouse of more than 170 varieties of fishes and act as the main storm water storage basin of the city. There is no wetland located within the subproject area.

62. Deeporbeel is a former channel of Brahmaputra River located 9 km to the southwest of the city. It is a permanent fresh water lake with abundant aquatic vegetation. The lake and its surrounding swamps, comprising an area of 4.14 sq. km, have been (i) declared as a bird sanctuary on 1st January 1989; (ii) included in the Directory of Asian Wetlands; and (iii) included as a Ramsar Site. There are about 170 species of birds, 2 critically endangered, 1 endangered, 5 vulnerable and 4 near threatened recorded in Deeparbeel. No project component is within or adjacent to this protected wetland.

3. Flora and Fauna

63. Flora and fauna in the subproject alignment are those commonly found in urban and built-up areas. There are no recorded endangered or critical species in the project area. However, the common flora and fauna found in Guwahati are given in **Tables 14 & 15** below.

Table 14: Common Flora of Guwahati

S. No.	Plant Species	Family
1.	Artocarpus chaplasha	Moraceae
2.	Alphonsea ventricosa	Annoanceae
3.	Castanopsis indica	Fagaceae
4.	Canarium spp.	Burseraceae
5.	Dillenia indica	Dilleniaceae
6.	Dysoxylum procerum	Meliaceae
7.	Magnolia spp.	Magnoliaceae
8.	Mesua	Clusiaceae
9.	Stereospermum personatum	Bignoniaceae
10.	Tetrameles spp.	Tetramelaceae
11.	Actinodaphne obovata	Lauraceae
12.	Aesculus spp.	Sapindaceae
13.	Artocarpus chama	Moraceae
14.	Albizia spp.	Fabaceae
15.	Anthocephalus chinensis	Rubiaceae
16.	Duabanga grandiflora	Lythraceae
17.	Bauhinia purpurea	Fabaceae
18.	Michelia champaca	Magnoliaceae
19.	Schima wallichii	Theaceae
20.	Trewianudi flora	Euphorbiaceae
21.	Lageraroemia spp	Lythraceae

Source: EIA Report – Environment Information Center, New Delhi, 2011

64. The dredging will be done judiciously so that no trees need to be cut. In case of requirement of tree felling during implementation of the project permission will be taken from concerned authority.

Table 15: Common Fauna of Guwahati

S. No.	Scientific Name	Common Name	Name of the Family
1.	Macacamulatta	Rhesus macaque	Cercopithecidae
2.	M. assamensis	Assamese macaque	Cercopithecidae
3.	Tardigraduscougang	Slow Loris	Lorisidae
4.	Viverrazibetha	Large Indian civet	Viverridae
5.	A. binturong	Binturong	Viverridae
6.	H. urva	Crab eating mongo	Herpestidae
7.	Melogalemoschata	Ferret badger	Mustelidae
8.	Arctonyxcollaris	Hog badger	Mustelidae
9.	Rhizomyspruinosis	Hoary bamboo rat	Cricetidae
10.	Cannomysbadius	Bay bamboo rat	Spalacidae
11.	Leptoptilosdubius	Greater Adjutant Stork	Ciconiidae

Source: EIA Report – Environment Information Center, New Delhi, 2011

65. Common bird species as recorded within the Guwahati city is given in **Table 16**.

Table 16. Common Bird Species of Guwahati

Common Names	Scientific Name
Birds (Aves)	
Ruddy Shelduck	Tadorna ferruginea
Gadwall	Anas streapera
Mallard	Anas platyrhynchos
Northern pintail	Anus acuta
White pelican	Pelecanus erythrorhychos
Brown Pelican	Pelecanus occidentalis
Lesser adjutant stork	Leptoptilos javanicus
Greater adjutant stork	Leptoptilos dubius
Indian river tern	Sterna aurantia

66. Common aquatic flora and fishes as recorded in Brahamaputra is shown in Table below.

Table 17: Aquatic Flora and Fishes of Guwahati

Common Names	Scientific Name
Flora- Aquatic	
Lotus	Nelumbo nucifera
Water hyacinth	Eichhornia crassipes
Fishes (Pisces)	
Rahu	Labeo rohita
Chital	Chitala
Barali	Wallago attu
Sal	Channa marulius

C. Economic Development Features

1. Land Use

67. Built up areas in Guwahati accounts for about 50% of the land. Lands categorized as

unusable lands and vacant lands are presently categorized as green belt and water bodies/beels which accounts for about 30% of the area. Rest of the area is under public/semipublic use, special category lands and open spaces/parks.

68. All areas in the GMA have been designated as one of the 9 use-zones, which are residential, commercial, industrial, public- and semi-public, recreational, transportation, eco-sensitive zone, composite Use I and composite Use II. The Composite Use I include residential, commercial, and public- and semi-public uses, whereas Composite Use II includes residential, commercial, public- and semi-public and industrial (existing) uses. Proposed land use break up in GMA is shown in **Table 18** and in **Figure 3**. Other than the forest part and vacant hill area distribution pipeline will be laid all along the road within urban residential and commercial set up of Guwahati city.

Table 18. Proposed Land Use Break-up in GMA

S. No.	Land Use Categories	Area in Ha. (excluding New Towns)	% of Developed area	Area in Ha. (including New Towns)	% of Developed area
1	Residential	8,646	31.92%	10,383	31.65%
2	Retail Commercial	360	1.33%	447	1.36%
3	Wholesale Commercial	81	0.30%	417	1.27%
4	Industrial	518	1.91%	918	2.80%
5	Public and Semi-Public	3,270	12.07%	3,606	10.99%
6	Composite Use I	814	3.01%	814	2.48%
7	Composite Use II	300	1.11%	841	2.56%
8	Recreation & Open Space	3,324	12.3%	3,728	11.0%
9	Transportation	2,853	10.53%	3,407	10.39%
10	Eco-Sensitive / Eco Friendly Zone	6,919	25.5%	8,245	26.0%
	Total	27,085	100%	32,806	100%

(Source: Master Plan for Guwahati, 2009)

2. Trade and Commerce

69. Guwahati has the largest wholesale and retail market in the North Eastern region. The city has over 57,000 trade establishments (based on 2002 to 2003 data). All the trade establishments are registered by GMC.

3. Major Markets

70. Fancy Bazaar and Paltan Bazaar are the major market centers in the city. Fancy Bazaar is the largest wholesale and retail market in the entire North Eastern Region. All types of commodities from food grains, vegetables, fruits, household grocery items, hardware, and retail goods like clothes and stationeries are sold in this market. Paltan bazaar is the second largest market in Guwahati dealing mainly in automobile parts, tools and machineries, hardware. Besides, it is also the largest transport hub in the North Eastern region, where the Inter State Bus Terminus is located.

4. Industry

71. Guwahati is one of the major industrial centers of Assam and the North Eastern Region. The location of the Northern Frontier Railway Headquarters, Guwahati Oil Refinery at Noonmati and other heavy- and medium-size petrochemical industries have added industrial impetus to the city. Ancillary industries to the refinery like the Assam Carbon and India Carbon have also developed. There are 507 industrial units located in and around Guwahati in the industrial estates. The industrial estates are managed by the Directorate of Industries. The Assam Industrial Development Corporation is located at Banda, Bamunimaidan, North Guwahati, Rani-South and Amingaon areas.

72. Since 1971, Guwahati has also become a tea auction center, the second of its kind in India next to Kolkata.

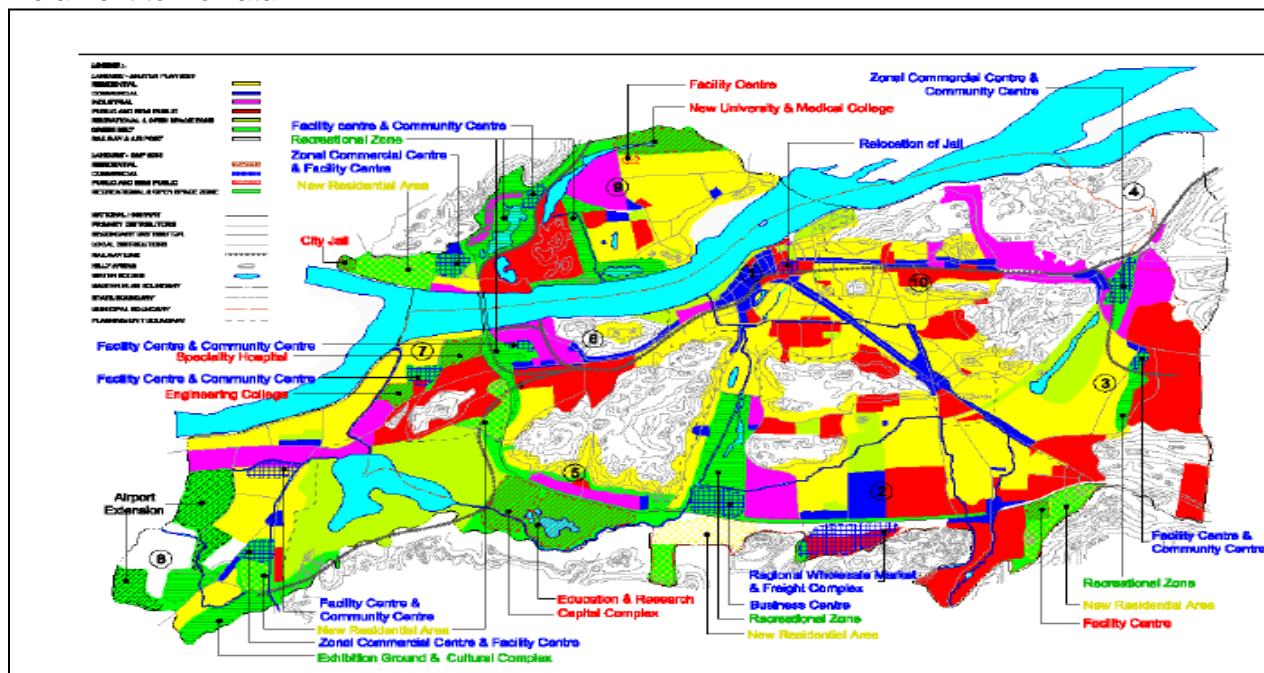


Figure 5: Proposed Land Use Plan of Guwahati

5. Physical Infrastructure

73. **Water Supply.** The primary source of water for Guwahati is the Brahmaputra River, which has flow of about 4,500 cubic meters per second. River Brahmaputra can provide as much as 78.1 billion cubic meters (or 78,100 billion liters/day) of water during monsoon and 56.12 billion cubic meters (or 56,120 billion liters/day) in non-monsoon days. The level of water remains at 48.17 meters above mean sea level for 50% of the monsoon season which lasts around 150 days. The capacity of the proposed Southeast Guwahati water intakes from the river is about 104 MLD while the proposed WTP capacity under the sub project is 98 MLD. The water supply to the city is provided by the three independent organizations namely the GMC, the Assam Public Health Engineering Department (APHED) and the Assam Urban Water Supply and Sewerage Board (AUWSSB) through their respective systems. Collectively, these systems provide potable water to only 30% of the city population. The total installed capacity water generation under GMC area is around 98 MLD considering the capacities of the treatment plants at Panbazar, Patpabhri and Hengrabari. However, the total water produced is only 79

MLD. The level of service, in terms of per capita water availability varies with 113 lpcd in the eastern part of the city and 60 lpcd in the western part. The remaining parts of GMA are dependent on tube wells, which have reported increase in iron and fluoride concentrations.

74. **Sewerage and Sanitation.** GMA does not have an integrated sewerage system except for certain establishments having their own independent systems such as colonies managed by the railway and defense authorities and the Indian Oil Corporation. In the absence of an organized system, septic tanks with or without soak pits are the most prevalent mode. Given the high subsoil water table in all but the hilly portions of the GMA, the soak pits are non-functional, thereby polluting the groundwater. In the low income areas, specifically in the 26 designated slum areas, most of the wastewater is discharged into the Bharalu River which finally drains into the Brahmaputra River. A drainage canal leading to River Brahmaputra has been noted upstream of the water intake however site inspections conducted in March and May 2011 show that the flow from this drainage is low and insignificant as compared to the flow of the river.

75. **Storm Water Drainage.** GMA can be divided into six drainage basins. The wetlands and other water bodies in GMA collectively act as the receptors of storm water during the monsoons. The natural drainage system in the GMA has been impaired due to unplanned development, encroachment onto natural wetlands and low-lying areas, blocking of the water courses and drainage channels, and compounded by loosed silt and soil from adjoining hills into these systems. Further, during monsoon, the water level of the Brahmaputra River sometimes, is higher than the ground level of the city areas, thereby inhibiting the natural flow of the city storm water into the river, further complicating the drainage problem in the city. The frequent water logging has been attributed to several reasons cited as under: (i) undulating topography; (ii) inadequacy of natural and artificial drains in carrying the storm water due to their narrowness and a rise in their bed level; (iii) encroachments over the low lying areas by new settlers on either side of the natural drains which has blocked the natural flow of the flood water to the drains; (iv) construction of buildings and roads over the manmade drains; (v) indiscriminate cutting and quarrying of hill slopes for filling up of low lying areas results in sheet wash and blockage of channels; (vi) most of the original swamps and natural water reservoirs are filled up for residential, industrial or institutional purposes. Consequently, the rain water spread over the built-up areas causes flash flood; and (vii) rising of the ground water table with the rising of the Brahmaputra reduces the rate of percolation.

76. **Solid Waste Management:** Guwahati generates Solid Waste 550 to 600 tons per day at 436 to 478 gms per capita/day. Guwahati waste Management Company (P) Ltd at present manages to collect process & dispose as per Govt. of India Municipal Solid Waste Handling rules (MSWHR, 2000) drawn 90% of the waste generated, are collected. Segregation at source is not done properly. The collected waste includes domestic (55%), commercial (18%), street sweeping and drain cleaning (15%) & rest are other dykes of wastes. Street cleaning is done by 800 sweepers covering a total road length of 639 km and 270 workers for drain cleaning. The organic waste processing capacity for the MSW facility is only 50 tons/day which much less than the actually needed i.e. between 150 to 200 ton per day. The number of various equipment used for the facility for collection are, 27 nos., dumper placers, 4 nos. open trucks, 3 nos. compactor, 58 auto trippers, 2 nos. JCB, 1 no small JCB, 1 no bulldozer, 2 nos. EX70, 1 no EX70, 350-Tricycles, and 370 nos. of metal bins and around 1000 sweepers are used for door to door collection.

77. **Transport.** The total road length of Guwahati is 1145.9 km. GMC takes up development of about 20 km of roads every year. This works out to a road density of 43 km/sq.km. There are

two major roads within the city with a length of 60 km and has an average width of 20 m. off street parking is found to be inadequate in the city. Pedestrian facilities are found to be poor and there are street vendors blocking the traffic causing congestion. Movement of goods vehicles and non-motorized transport also add to the congestion. Condition of roads for both major and minor are classified to be poor as per ULB and Line Department Survey.

78. Guwahati has public transport system run by private operators since 1961. At present, it operates on 17 routes covering almost the entire city. Eight new routes would be opened shortly. The Assam State Transport Corporation also operates city bus service in Guwahati but it covers the main routes and has limited frequency.

79. While the demand for transportation services in Guwahati has increased rapidly, supply is lagging. The GMA is constrained in terms of road space and alternative routes and as a result, severe traffic congestion problems have developed. Other issues include existence of choke points on the arteries, poor geometry of intersections, overflow of on-street parking onto ROW, presence of bus and truck terminals in densely traveled areas and inadequate attention to traffic management. Public transport system is poor, and there is a lack of mass public transport systems. Absence of a comprehensive traffic and transport plan to identify the sectoral priorities and vision for the sector, that shall enable phasing of the investments required is identified as a major gap.

D. Social and Cultural Features

1. Area and Population

80. The total area of Guwahati under the jurisdiction of GMC boundary is 216 sq. km and that of GMDA is 262 sq. km. **Table 19** gives the population of Guwahati within and outside the municipal area.

Table 19: Guwahati: Population, 2011

Urban Unit	Details
Within Municipal Limits	1037011
Outside Municipal Limits	216927
Total Master Plan Area	1253938

Source: *Census of India 2011 Assam

2. Population Growth

81. **Table 20** gives the population growth rate in Guwahati. The growth rate after a steep decline in 1981-91 has again shown a rapid increase in 1991-2001. The growth rate of population outside the municipal area has shown a consistent trend.

82.

Table 20: Guwahati: Annual Average Growth Rate of Population (%)

Urban Unit	1971-81	1981-91	1991-01	2001-11
Within Municipal Limits	16.1	0.6	3.3	28.33
Outside Municipal Limits	2.4	3.9	3.2	

Source: Census of India, Rural-Urban Distribution of Population, and Provisional Population Totals of Respective States, 2011

83. A very high proportion of population (24%) in Guwahati is migrants. Being a regional center, all major facilities are housed in this city. It serves as a hinterland to the whole of the North Eastern Region. The literacy rate in Guwahati has shown an improvement from 70.6% in 1991 to 77.8% in 2001. The share of scheduled tribes is comparatively lower as compared to other project cities. The share of Schedule caste (SC) population to total population is 6.3% and of ST is 4.1% as per census.

3. Health

84. With the lack of sanitation facilities, poor coverage of the drinking water supply and stagnant water there are a large number of water borne health risks in Guwahati. Records from the Assam Department of Health illustrate these concerns very well. Often diarrheal diseases go unreported and only the more serious cases merit attention. Even then the patterns identified show the presence of these diseases throughout the year. This could be attributed to the consumption of contaminated water, poor hygiene and unsanitary living conditions as all these reported cases in 2006 shows very high incidence of enteric fevers in June, the period when the monsoon is present in its full fury in the city. This perhaps may also be due to contamination of the drinking water sources with sewage and waste. This is possible in areas where water logging would be leading to contamination of potable water in vulnerable sections of the water supply network. The classification 'enteric fever' would include typhoid cases. Contamination of domestic water supplies occurs through many routes. The lack of a proper sewerage system has implications on water quality.

85. According to a study on the North East, of the 16 genera of mosquitoes found in the region 15 are found in Assam. While not all of them may find suitable habitats in Guwahati or be carriers of disease, the present unsanitary conditions can make an appropriate habitat for some of them. Malaria and Japanese encephalitis are the 2 water vector diseases the city authorities are monitoring. There have been a few deaths reported due to malaria.

4. Tourism

86. Guwahati has a number of temples, which are important tourist destinations. Some of these are the (i) Kamakhya temple on top of the Nilachal hills that is an important center for tantric form of Hinduism and Saktism; (ii) Umananda on the peacock island, in the middle of the Brahmaputra; and (iii) Nabagraha and Sukleshwar are notable places of Hindu pilgrimage. Other places of tourist importance in Guwahati are Bhubaneshwari Temple, Vasistha Ashram, Balaji temple, Planetarium, the State Museum, Science Museum, State Zoological Park cum Botanical Garden, and Srimanta Sanakardeva Kalashetra. The number of domestic tourists has increased considerably while foreign tourist inflow has remained constant in the past three years.

5. Slums

87. There are nine slums in the GMC area, all of which are notified. Four slums are on private lands, and five are on Government lands. All the slums occupy 77,300 sq. meters of lands. About 2% of the city's population resides in slums.

6. Sensitive Receptors

88. There are number of sensitive receptors like residential area, Government offices, Markets and Public transport stations are located nearby the proposed two disposal sites. **Table 21** shows the list of sensitive receptors. During transportation of silt/ loose soil safety

arrangement needs to be maintained.

Table 21. Sensitive receptors near the disposal sites

S. No.	Disposal Sites	Receptors within 50m	Receptors within 100m	Receptors within 500m
1.	Basistha Disposal Site	Basistha circle office and Water Resource Department staff quarters	Residential houses, commercial establishments, bongaon playground	Beltola college, residential complexes, Basistha canal
2.	Adabari Disposal Site	Residential houses	Residential houses, commercial establishments	Residential houses, commercial establishments, Masjids

Source: Google Earth and site visits

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

89. This section of the IEE reviews possible subproject-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. The ADB SPS (2009) requires that impacts and risks will be analyzed during operational and maintenance stages in the context of the subproject's area of influence. As defined previously, the primary impacts from this subproject will result from (i) De-siltation of silt/ loose soil from drains; (ii) main routes/intersections which will be traversed by silt/ loose soil carrying vehicles. The secondary impact areas are: (i) entire Guwahati area outside of the delineated primary impact area; and (ii) entire GMC and GMA in terms of over-all environmental improvement.

90. The ADB Rapid Environmental Assessment Checklist for Urban Development was used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is found in **Appendix 3**. All the proposed subproject components will interact physically with the environment.

91. In the case of this subproject the following are observed: (i) most of the individual elements are relatively small and involve straightforward operation and maintenance, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the De-siltation process, and are produced because that process is invasive, involving De-siltation of silt/ loose soil movements; and (iii) partly being located in the built -up area of GMC and GMA, will not cause direct impact on biodiversity values and no felling of trees required. The subproject will not require any private land acquisition, and all the sub project components will be on Govt. owned land. Resettlement Plan as such is not required.

A. Dredging – Location and Design

92. **Location.** Location impacts include on-site biophysical array and encroachment/impact either directly or indirectly on adjacent environments. The subproject components are proposed primarily within the RoW of the existing rivers and government. land. No private land acquisition is required for which no separate Resettlement Plan is required.

93. **Design of the Proposed Components.** The urban area of GMC and GMA is very flat, the proper slope will be provided in the Conduit pipe and box culvert. Therefore, for an efficient flow, lined drain is a must with the concept of maximum conveyance which will lead to a wider

channel. For the design of natural drains, the most important parameter is the peak discharge which is dependent on intensity duration relationship. As information on discharge is not available for Guwahati, rainfall based approach has been adopted. The peak discharge computed by rational method has been used for design purpose (M/S Tahal Consulting Engineers). The Pump House will be constructed on flat Govt. owned land. Due consideration has been given to the issue of future expansion of the town in selecting the value of relevant model parameters. Environmental considerations were discussed with specialists responsible for the engineering aspects, and as a result some measures such as covering of drain to prevent disposal of solid waste into the drains have already been included in the designs of the infrastructure.

B. Dredging Methodology

94. The main objective is to clean the deposited silt/ loose soil from the existing drainage system to minimize the flooding situation. The approximate quantum of silt to be cleaned from existing drains and water bodies is approximately 52000 m³ per year and will decrease in successive years. The existing disposal sites (Adabari and Basistha) have a combined disposal capacity of 118885 m³. The dredged materials will be silt/ loose soil as no hazardous waste is disposed in the drains/ river to attract Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016, as such no adverse environmental impact is anticipated.

95. GMC, GMDA and Water Resources Division (WRD), with their limited resources are engaged in the task of cleaning the exiting major drains and major channels. GMC engaged contractors for cleaning the major drains using backhoes and dumpers including manual cleaning of the road side drains. Lifting of RCC cover slab and cleaning of the road side drains manually is cumbersome, hazardous and creates inconvenience to the people during the cleaning operation. GMC budget for cleaning of the major drains is ₹; 140 million per year. Efforts taken up by GMC are not sufficient and time consuming for cleaning of the deposited silt from the drains.

96. The dredging activity shall include i) An Operation and Maintenance Plan indicating involvement of trained operators, assisting staff, the garage space for parking of the machinery. ii) Sites identified around in the periphery of the city for dumping of the cleared silt without causing environmental damages.

C. Dredging Impacts

97. Dredging activities are associated with site cleaning, disposal of dredged soil, earth works, machinery, vehicles, and workers' health and safety. During dredging activities following impacts may occur (i) Physicochemical changes in the component of the environment (ii) A temporary mucky environment (iii) Possibility of communicable diseases (iv) Altered topography (v) Flood from high water speed (vi) Contamination due to suspended sediments (vii) Effects on Land Cover/Land Use. It also includes the erosion, dust, noise, traffic congestion and waste production associated with the dredging activities.

98. To mitigate the impacts, following measures will be followed:

- (i) The physiochemical changes and contamination due to suspended sediments in the river will be temporary in nature and would not have any long-lasting effect on the environment;
- (ii) It will be ensured that the mucks will be removed, transported (in covered vehicles) and disposed to the identified disposal site periodically;
- (iii) Awareness programs shall be organized for the workers and nearby residents on

- various possible communicable diseases;
- (iv) There will be no altered topography and effects on land cover/land use since the dredging activities will be carried out within the existing right of way of the rivers;
- (v) The dredging will be carried out in order to increase the carrying capacity of the rivers to mitigate the flood problems inside the city and the high-speed water will be discharged into the River Brahmaputra; and
- (vi) In case any plastic or other non-bio-degradable waste are recovered during dredging activities, it will be ensured that the waste materials will be segregated and disposed in the MSW disposal site at Boragaon.

99. However, if during the dredging activities, any hazardous components are identified, subsequently the IEE will be updated with an adequate EMP in accordance with the Government of India's Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016.

100. Although dredging activities in the subproject involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites in the built-up areas of GMC and GMA area may result in temporary, short-term impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. Physical impacts will be reduced by the method of working and scheduling of work, whereby the subproject components will be (i) constructed by small teams working at a time; and (iii) any excavation done near sensitive area like school, religious places and house will be protected as per standard norms⁶.

101. **Sources of Materials.** Significant amount of gravel, sand, and cement may be required for this subproject. The O&M contractor will be required to:

- (i) Use material sources permitted by government;
- (ii) Verify suitability of all material sources and obtain approval of Design and Supervision Consultant (DMSC); and
- (iii) Submit to DMSC on a monthly basis documentation of sources of materials.

102. **Air Quality.** It is most certain that work will be conducted during dry season, so there is potential for generation of dust from the excavation of dry soil, backfilling, and transportation to disposal, and from the import and storage of large quantities of aggregates. Therefore, it is important that this large quantity of soil/Silt/ loose soil will be handled and disposed of without causing further impacts on air quality, which already shows presence of high levels of particulate matter in the town. Emissions from vehicles, equipment, and machinery used for excavation will induce impacts on the air quality in the dredging sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) but temporary and during O&M activities only. To mitigate the impacts, O&M contractors will be required to:

- (i) Prevent/minimize dust generation (i) by removing the waste soil immediately from the site;
- (ii) Consult with DMSC on the designated areas for stockpiling of clay, soils, gravel;
- (iii) Damp down exposed dry soil and any stock piled on site by spraying with water

⁶ Occupational Health and Safety of employees working only in factories and mines have been specifically covered in GOVERNMENT OF INDIA laws. However, the Constitution of India has provisions to ensure that the health and well-being of all employees are protected and the State has the duty to ensure protection. For this subproject, the mitigation measures were based on the World Bank Environmental, Health, and Safety (EHS) Guidelines.

- when necessary during dry weather;
- (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and
- (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.

103. **Surface Water Quality.** Guwahati receives high intensity rains during monsoons and there are a number of natural and man-made drainage channels crisscrossing the town. Runoff from the excavated areas and material and waste soil stocks likely to deteriorate the water bodies. This impact will however be considered only during rainy season. Digging up of road and land for pumping house will produce excess soil which needs to be disposed of properly. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, O&M contractor will be required to:

- (i) Avoid excavation activities during monsoon. Ensure that works complete before onset of monsoon;
- (ii) Minimize on-site storage of waste soil/other materials;
- (iii) Use of Dug soil in filling up of WTP site;
- (iv) Avoid stockpiling of earth/dry Silt/ loose soil fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (v) Prioritize re-use of excess spoils and materials in the O&M works. If spoils will be disposed, consult with DMSC on designated disposal areas;
- (vi) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (vii) Dispose any wastes generated by O&M activities in designated sites; and
- (viii) Conduct surface water quality inspection according to the Environmental Management Plan (EMP).

104. **Noise Levels.** O&M works will be on settlements/residences, along and near schools, and areas with small-scale businesses. The sensitive receptors are the general population in these areas. Increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials, and people. Impact is negative, short-term, and reversible by mitigation measures. The O&M contractor will be required to:

- (i) Plan activities in consultation with DMSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (iii) Minimize noise from dredging equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
- (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

105. **Existing Infrastructure and Facilities.** Digging works can damage existing infrastructure located if any near the road. It is therefore important that O&M contractors will be required to:

- (i) Obtain from DMSC the list of affected utilities and operators; and
- (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

106. **Landscape and Aesthetics.** The O&M works will produce excavated soil, excess construction materials, and solid waste such as removed concrete, wood, and plants, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. Improper disposal may further affect topography, water quality, soil quality and sensitive areas. These impacts are negative but short-term and reversible by mitigation measures. The O&M contractor will be required to:

- (i) Prepare and implement Waste Management List;
- (ii) Avoid stockpiling of excavated drain Silt/ loose soil;
- (iii) Coordinate with GMC for beneficial uses of excess soil or immediately dispose to designated areas;
- (iv) Plan to use excess soil for development of land for WTP site;
- (v) Recover used oil and lubricants and reuse or remove from the sites;
- (vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (viii) Request DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

107. As per design it is estimated that 52000 m³ (approx./year which will decrease progressively in coming years) quantity of dug soil, needs to be disposed.

108. **Accessibility.** All activities are located in the urban settlement areas. Hauling of dredging materials and operation of equipment on-site can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The O&M contractor will be required to:

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Keep the site free from all unnecessary obstructions;
- (v) Drive vehicles in a considerate manner;
- (vi) Coordinate with Guwahati Traffic Department for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours;
- (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of O&M works and contact numbers for concerns/complaints;
- (viii) Provide planks in cases where access to shops and businesses is disrupted by digging activities; and
- (ix) Expedite O&M works in front of shops and business houses to minimize any access disturbances.

109. **Terrestrial flora and fauna.** Preliminary survey shows that there will be no requirement of felling of trees.

110. Afforestation by plantation of about 500 trees will be considered as an environment conservation measures.

111. **Social and Cultural Resources.** There is no risk of O&M work in the town discovering material of historical or archaeological importance. The O&M contractor will be required to:

- (i) Plan activities in consultation with DMSC so that O&M works are conducted during periods of the day which will result in least disturbance;
- (ii) Expedite O&M works in temple areas to minimize any access disturbances;
- (iii) Keep the temple areas free from all unnecessary obstructions; and
- (iv) Notify affected sensitive receptors by providing sign boards informing nature and duration of O&M works and contact numbers for concerns/complaints.

112. **Socio-Economic – Income.** The subproject components will be located more or less in government-owned land with minimum private land acquisition. O&M works will impede the access of residents to specific site in limited cases. The potential impacts are negative and moderate but short-term and temporary. The O&M contractor will be required to:

- (i) Leave spaces for access between mounds of excess soil;
- (ii) Provide walkways and metal sheets where required to maintain access across for people and vehicles;
- (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;
- (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- (v) Provide sign boards for pedestrians to inform nature and duration of O&M works and contact numbers for concerns/complaints.

113. **Socio-Economic – Employment.** Manpower will be required during the O&M stage. This can result to generation of contractual employment and increase in local revenue. Thus, potential impact is positive and long-term. The O&M contractor will be required to:

- (i) Employ majority of the labor force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) If available, secure construction materials (if any required) from local market.

114. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from dredging activities. Potential impacts are negative and long-term but reversible by mitigation measures. The O&M contractor will be required to:

- (i) Develop and implement site-specific Health and Safety (H&S) Plan⁷ which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment particularly helmet, gumboot, hand gloves and nose mask; (c) H&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (iii) Provide medical insurance coverage for workers;
- (iv) Secure all installations from unauthorized intrusion and accident risks;
- (v) Provide supplies of potable drinking water;
- (vi) Provide clean eating areas where workers are not exposed to hazardous or

⁷ For this subproject, the Construction Contractor may follow the World Bank EHS Guidelines

- noxious substances;
- (vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (x) Ensure moving equipment is outfitted with audible back-up alarms;
- (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
- (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

115. **Work Camps.** Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Consultation with respective design engineers revealed that it is unlikely that work camps are required for this subproject. In the case that it will be needed, the O&M contractor will be required to:

- (i) Consult with DMSC before locating subproject offices and sheds;
- (ii) Minimize removal of vegetation and disallow cutting of trees;
- (iii) Provide water and sanitation facilities for employees;
- (iv) Prohibit employees from cutting of trees for firewood;
- (v) Train employees in the storage and handling of materials which can potentially cause soil contamination;
- (vi) Recover used oil and lubricants and reuse or remove from the site;
- (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (ix) Request DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

116. **Community Health and Safety.** Hazards posed to the public, specifically in high pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites at isolated area, hence health and safety risk to community is the minimum. Potential impact is negative but short-term and reversible by mitigation measures. The O&M contractor will be required to:

- (i) Plan routes to avoid times of peak-pedestrian activities;
- (ii) Liaise with DMSC in identifying risk areas on route cards/maps;
- (iii) Maintain regularly the vehicles and use of manufacturer-approved Parts to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- (iv) Provide road signs and flag persons to warn of dangerous conditions, in case of

- location near the road; and
- (v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-operational hours.

117. **Social and Cultural Resources.** For this subproject, excavation will occur at specific isolated location, so it could be that there is a low risk of such impacts. Nevertheless, the O&M contractor will be required to:

- (i) Stop work immediately to allow further investigation if any finds are suspected;
- (ii) Inform DMSC if a find is suspected, and take any action they require ensuring its removal or protection in situ; and
- (iii) Request DMSC or any authorized person with archaeological/historical field training to observe excavation.

D. Operation and Maintenance impacts

118. The drainage network will require maintenance, as silt inevitably collects in areas of low flow over time. Any repairs or maintenance work can be conducted without ecological impacts as there is no significant flora and fauna within the immediate vicinity of the subproject sites.

119. The dredged materials are basically silt/ loose soil and no environmental impacts are envisioned during transportation and storing since the dredged material is not a hazardous waste. There will be very little supernatant water because dredging will be done mechanically and most of the supernatant water will fall in the drain itself. Also the dredged material will be carried in closed vehicles to the disposal sites. There are no wetlands, aquifers or watercourses or rivers within 100m radius of the disposal sites.

120. **Economic Development.** Although drainage maintenance could result in shops losing some business if the work means that access is difficult for customers, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. It should therefore not be necessary to compensate for such losses. Nevertheless, GMC will:

- (i) Inform all residents, businesses and sensitive receptors about the nature and duration of any work well in advance so that they can make preparations if necessary; and
- (ii) Plan the work to avoid traffic disruption as far as possible, and road diversions can be organized if necessary.

121. Maintenance works could cause some temporary disruption of activities at locations such as schools, hospitals, temples, etc., so the same precautions as employed during the O&M period should be adopted. GMC will:

- (i) Complete work in these areas quickly; and
- (ii) Consult municipal authorities, custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

E. Cumulative Impact Assessment

122. The cumulative impact assessment (CIA) examined the interaction between the

subproject's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing and reasonably foreseeable future projects or activities. The subproject's potential cumulative effects were considered with respect to Valued Components (VCs) in the categories of environmental and socio-economic in the following areas:

- (i) Of any potential residual subproject effects that may occur incrementally over time;
- (ii) Consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the subproject;
- (iii) Potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed subproject; and
- (iv) Future developments that is reasonably foreseeable and sufficiently certain to proceed.

123. The subproject IEE has identified the VCs as air quality, water (surface and groundwater) quality, noise, traffic management, social-economic and socio-community, and human health. There are no foreseeable projects that will overlap with the subproject. The spatial boundary of the subproject is the area along the alignment and the existing ROWs. The temporal boundary can be considered as the whole GMA.

124. Air quality effects will occur during O&M activities. Consequently, although emissions of common air contaminants (CAC) and fugitive dust may be elevated in proximity to active work sites, this impact will be short-term and localized to the immediate vicinity of the alignment. Greenhouse Gas (GHG) emissions may increase as a result of the subproject activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, landfilling of residual wastes). Given the subproject's relatively minor contribution to CAC and GHG emissions during O&M activities, the overall significance rating of both these potential residual effects is considered to be negligible.

125. During O&M activities, noise levels in the immediate proximity of most work sites are expected to increase. The duration of this exposure will be relatively brief. This exposure represents a temporary, localized, adverse residual effect of low to moderate significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during O&M activities. Noise levels associated with the subproject activities will be largely imperceptible as the drainage network is located in relatively small sites within the town proper.

126. Land use/traffic management concerns will occur spatially during O&M activities. During O&M activities, site-specific mitigation measures will be implemented to address temporary disruptions to land use and access in the vicinity of the alignment such as road and sidewalk closures, traffic delays and detours, parking modifications, and increased volumes of O&M activities –related traffic. There should be improved traffic movement along the alignment once O&M activities are completed. Since the subproject will be built in developed land and existing roads, it will not conflict with existing or planned land use. However, following improvement in infrastructures and services, added residential developments, commercial and business facilities and increased densities are expected to develop and enhance the subproject area. This can be considered a long-term cumulative benefit of the subproject, as living conditions would be improved.

127. Adverse impacts such as localized disruption of vehicle traffic and pedestrian movements in areas along the alignment, and elevated particulate matter emissions in proximity to work sites, elevated noise and vibration levels and visual impacts will occur during O&M activities. These

short-term effects will be mitigated by providing alternate travel routes or alternating traffic movements and, where possible, access to businesses, schools and residences. However, upon completion of O&M activities, the socio-community will benefit from improved storm water management system. This is considered a long-term cumulative benefit.

128. The subproject, when considered with other projects in the same watershed, may result in cumulative impacts to surface and groundwater quality from increased surface impermeability and resultant runoff. The O&M activities could result in increased erosion from exposed soil areas. However, it is reasonably assumed that new O&M activities associated with future projects will be required to meet national, state, and local O&M activities at least as rigorous as those required at present. Therefore, the potential for cumulative impacts to water quality and soils is deemed to be less than significant.

129. No adverse residual effects to human health will occur as a result of subproject O&M activities. While exposure to elevated noise levels and fugitive dust and CAC emissions will occur in proximity to subproject work sites during O&M activities, due to their short-term, localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

V. INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITY

A. Implementation Arrangements

130. The State Government of Assam's Guwahati Development Department will be the executing agency. A state-level PMU, headed by a full-time Project Director, will be established as the implementing agency which will be in-charge of overall execution and technical supervision, monitoring, and financial control of all activities under the project.

131. Project implementation units (PIUs) dedicated exclusively to the project would be set up in Guwahati and Dibrugarh. The PIUs will be headed by a senior technical officer and assisted by qualified and experienced officers seconded from ULBs, finance and other line departments. The PIUs will be responsible for the day-to-day activities of project implementation in the field and will be under the direct administrative control of the PMU. The PIU in Guwahati will have synergies and a coordination mechanism with the PIUs for JNNURM and JICA projects.

132. The PMU will have a Safeguards Compliance and Monitoring Unit (PMU SCMU) to ensure mitigation of any environmental and social impacts due to the subproject. The PMU SCMU will have a Safeguards Officer (PMU SO) who will have the following responsibilities: (i) address environmental and social safeguards issues; (ii) implement of the EARF/resettlement framework/IPF; (iii) monitor physical and on-physical activities under the Project; (iv) monitor implementation of safeguards plans; (v) guide the PIUs as and when necessary; and (vi) endorse/submit periodic monitoring reports⁸ received from DMSC to the PMU PD, who will then submit these to ADB. The PMU will seek State Government of Assam's clearance for submission and disclosure of the environmental and social monitoring report to ADB. It will also coordinate with national and state agencies to resolve inter-departmental issues, if any.

⁸ The monitoring report will focus on the progress of implementation of the IEE/EIA and EARF, resettlement plan/resettlement framework and IPP/IPF, issues encountered and measures adopted, follow-up actions required, if any, as well as the status of compliance with subproject selection criteria, and relevant loan covenants.

133. The PMU will be assisted by the DMSC Environment and Social Safeguards Specialists. The DMSC specialists will (i) review and finalize all reports in consultation with the PMU SO; (ii) provide project management support, (iii) assure the technical quality of design and construction, (iv) prepare EIA/IEE/resettlement plan/indigenous peoples plan reports; and (iv) provide advice on policy reforms. In addition, the DMSC will assist the PMU on the procurement needs and other project implementation aspects and shall play a central role in ensuring capacity building on environmental management of the PMU, contractors, and line departments through capacity development support and training.

134. The PIUs will each have an Environment Officer and Resettlement Officer who will be responsible for implementation of the EMP in each EIA/IEE and the resettlement plan/indigenous peoples plan respectively. Both officers will undertake surveys and record their observations throughout the O&M periods to ensure that safeguards and mitigation measures are provided as intended. Both will be responsible for (i) implementing and monitoring safeguards compliance activities, public relations activities, gender mainstreaming activities and community participation activities; (ii) obtaining statutory clearances and obtaining NOCs from government agencies /other entities and entering agreements with them for use of their land; and (iii) coordinating for obtaining ROW clearances with related State and National agencies.

135. As per DBO contract, the environment officer of contractor will be responsible for updating of IEE and field implementation of EMP. DMSC's environment specialist will advise contractor's environment officer during updating of IEE and field implementation of EMP. DMSC's specialist will oversee implementing and monitoring safeguards compliance activities, public relations activities, gender mainstreaming activities and community participation activities. DMSC's specialist will do field monitoring at least fortnightly and advice contractor for additional/ rectification of mitigation measures as per ground condition. DBO contractor will be responsible for obtaining statutory clearances and obtaining NOCs from government agencies /other entities. PMU/PIU/DMSC will assist contractor in this aspect.

136. Environment Specialists will also be appointed as part of the DMSC teams to (i) assist contractor for updating of IEE in the detailed design stage; (ii) assist contractor in the monitoring of EMP during construction stage; and (iii) prepare EIAs/IEEs for new subprojects, where required to comply with national law and/or ADB procedure. **Figure 6** shows the implementation arrangement for environment and resettlement safeguards.

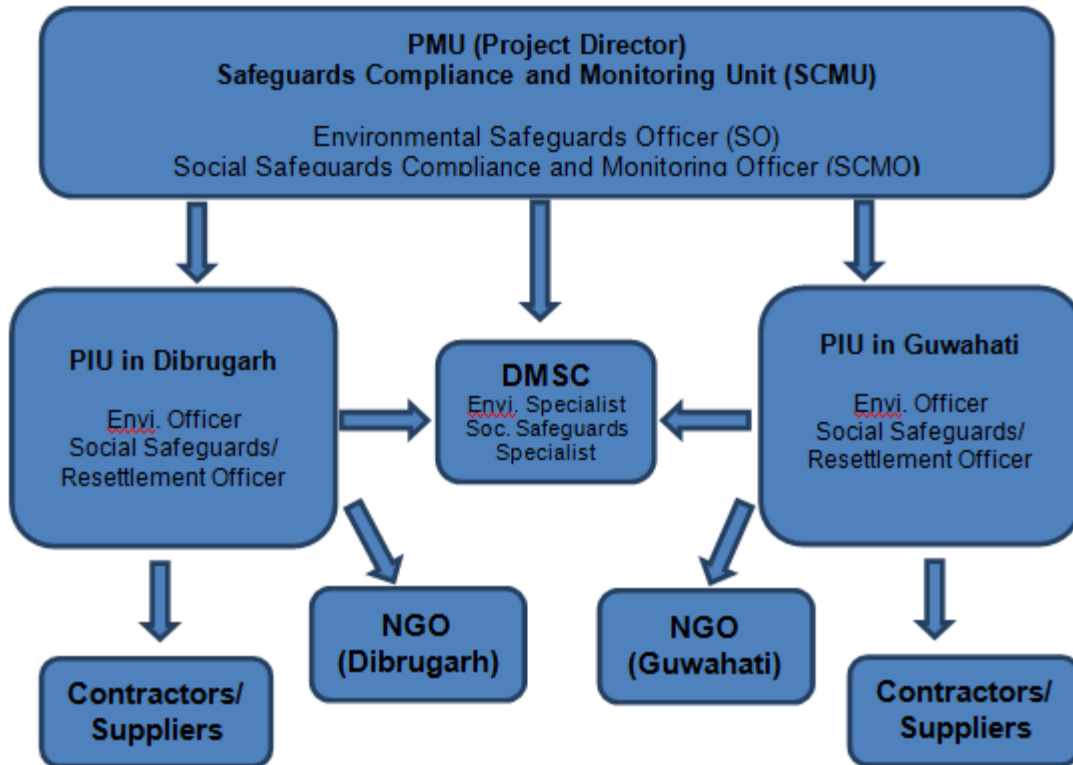


Figure 6: Safeguards Institutional Arrangement

B. Monitoring and Reporting

137. The PMU will monitor and measure the progress of EMP implementation. The monitoring activities will be corresponding with the Project's risks and impacts and will be identified in the EIAs/IEEs for the subprojects. In addition to recording information of the work, deviation of work components from original scope, the PMU and PIUs will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

138. DMSC will submit monthly monitoring and implementation reports in prescribed formats (**Appendix 13 and 15**) to PIU, who will take follow-up actions, if necessary. PIU will submit the quarterly monitoring and implementation reports to PMU who will then submit to the PD. The PMU will submit semi-annual monitoring reports to ADB. The suggested semi-annual environmental monitoring report format is in **Appendix 6**. Project budgets will reflect the costs of monitoring and reporting requirements. For projects, likely to have significant adverse environmental impacts during operation, reporting will continue at the minimum on an annual basis. Monitoring reports will be posted in a location accessible to the public.

139. ADB will review project performance against the EA's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the Project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

140. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

- (i) conduct periodic site visits for projects with adverse environmental or social impacts;
- (ii) conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants for projects with significant adverse social or environmental impacts;
- (iii) review the periodic monitoring reports submitted by EA to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- (iv) work with EA to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the legal agreements, and exercise remedies to re-establish compliance as appropriate; and
- (v) prepare a project completion report that assesses whether the objective and desired outcomes of the safeguard plans have been achieved, taking into account the baseline conditions and the results of monitoring.

C. Institutional Capacity

141. There is low capacity to implement projects in accordance with ADB safeguard requirements in both project cities. The ULBs do not have environmental/social safeguards personnel, capacity to handle environmental/IR/IP impacts, gender and vulnerability issues. The DMSC will be responsible for training of PMU and PIUs staff on aspects such as environmental planning/resettlement planning/implementation, social protection and gender, including the specific recording, reporting and disclosure requirements.

142. The DMSC environmental specialist will provide the basic training required for environmental awareness and management in accordance with both ADB and government requirements. Specific modules customized for the available skill set shall be devised after assessing the capabilities of the target participants and the requirements of the Project. The entire training will cover basic principles of environmental assessment and management; mitigation plans and programs, implementation techniques, monitoring methods and tools. Typical modules that will be present for the training session would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in urban development projects; (iii) review of IEEs and Integration into the subproject detailed design; (iv) improved coordination within Nodal Departments; (v) monitoring and reporting system. The proposed training program along with the frequency of sessions is presented in **Table 22**.

Table 22. Training Program for Environmental Management

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
A. Pre-O&M Stage					
Sensitization Workshop	Introduction to Environment: Basic Concept of environment Environmental Regulations and Statutory requirements as per Government of India and ADB	Secretaries, Chief Engineer, Superintendent Engineers of PWD, PHED and UDD, the Development Commissioner, Chairman, CEO of GMC and Project Director (PD) and PIUs Environmental Officers (EOs)	Workshop	½ Working Day	Design Management and Supervision Consultant (DMSC)

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
Session I					
Module I	Introduction to Environment: <ul style="list-style-type: none"> ✓ Basic Concept of environment ✓ Environmental Regulations and Statutory requirements as per Government of India 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Lecture	¼ Working Day	Design Management and Supervision Consultant (DMSC)
Module II	Environmental Considerations in Urban Development Projects: <ul style="list-style-type: none"> ✓ Environmental components affected by urban development in operation and maintenance stages ✓ Activities causing pollution during operation and maintenance stages ✓ Environmental Management Good Practices in Urban 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Workshop	¼ Working Day	Design Management and Supervision Consultant (DMSC)
Module III	Review of IEE and its Integration into Designs: <ul style="list-style-type: none"> ✓ IEE Methodology ✓ Environmental Provisions in the EMPs ✓ Implementation Arrangements ✓ Methodology of Assessment of Pollution Monitoring ✓ Methodology for site selection of 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Lecture and Field Visit	½ Working Day	Design Management and Supervision Consultant (DMSC)
Module IV	Improved Coordination with other Departments: <ul style="list-style-type: none"> ✓ Overview of the Project ✓ Environmental and Social Impacts ✓ Statutory Permissions ✓ Procedural Requirements ✓ Cooperation and Coordination with other 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Lecture / Interactive Sessions	½ Working Day	Design Management and Supervision Consultant (DMSC)

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
	Departments.				
Module V	Special Issues in the Project <ul style="list-style-type: none"> ✓ Bio-Diversity Assessment and Conservation ✓ Geomorphological Assessment and Slope Protection ✓ Statutory Permissions– Procedural Requirements ✓ Consultation and Counseling 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Lecture	½ Working Day	Design Management and Supervision Consultant (DMSC)
B. O&M Stage					
Session II					
Module VI	Role during O&M <ul style="list-style-type: none"> ✓ Roles and Responsibilities of officials/ contractors/ consultants towards protection of environment ✓ Implementation Arrangements ✓ Monitoring mechanisms 	Engineers of PWD, PHED and UDD, ULBs, PMU (Technical Unit) and PIUs EOs	Lecture / Interactive Sessions	½ Working Day	Design Management and Supervision Consultant (DMSC)
Module VII	Monitoring and Reporting System	PMU (Technical Unit) and PIUs EOs	Lecture / Interactive Sessions	½ Working Day	Design Management and Supervision Consultant (DMSC)

Notes: APCB – Assam Pollution Control Board; CFE – Consent for Establishment, CFO – Consent for Operation, DMSC – Design Management and Supervision Consultant, EAC - Environmental Appraisal Committee, EARF – Environmental Assessment and Review Framework, EC – Environmental Clearance, EIA – Environmental Impact Assessment, EMP – Environmental Management Plan, IEE – Initial Environmental Examination, MoEFCC – Ministry of Environment, Forest and Climate Change, NOC – No Objection Certificate, PHED - Public Health

Engineering Department, PIU - Public Implementation Unit, PMU - Project Management Unit, PWD – Public Works Department, REA – Rapid Environmental Assessment, SEAC – State Environment Assessment Committee, SEIAA – State Environment Impact Assessment Authority, STP – sewage treatment plant, TOR – Terms of Reference, UDD - Urban Development Department, ULB - Urban Local Body

VI. GRIEVANCE REDRESS MECHANISM

143. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate the resolution of affected people’s concerns, complaints and grievances about the social and environmental performance at the level of the Project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project. The grievance redress mechanism and procedure is depicted in **Figure 7** below. The project-specific GRM is not intended to bypass the government’s own redress process; rather it is intended to address affected people’s concerns and complaints promptly, making it readily accessible to all segments of the affected people and is scaled to the risks and impacts of the project.

144. The PMU and PIUs will make the public aware of the GRM through public awareness campaigns. Grievances can be filed in writing using the Complaint Register and Complaint Forms (**Appendix 6**) or by phone with any member of the PMU or PIU. The contact phone number of the respective PIUs and the PMU will serve as a hotline for complaints and will be publicized through the media and placed on notice boards outside their offices and at O&M sites. The safeguard documents made available to the public in an accessible version will include information on the GRM and will be widely disseminated throughout the corridor by the safeguards officers in the PMU and PIUs with support from the NGO engaged to implement the C&P.

145. **First tier of GRM.** The PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The Resettlement Officer and Environmental Officer in each PIU will be designated as the key officers for grievance redress. Resolution of complaints will be done within seven working (7) days. At this stage, the Resettlement Officer and Environmental Officer will inform the PMU’s Safeguards Compliance and Monitoring Unit (SCMU) for additional support and guidance in grievance redress matters. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.). Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

- (i) Initial grievance sheet (including the description of the grievance) with an acknowledgement of receipt given to the complainant when the complaint is registered;
- (ii) Grievance monitoring sheet with actions taken (investigation, corrective measures); and
- (iii) Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

146. The updated register of grievances and complaints will be available to the public at the PIU office, O&M sites, and other key public offices along the project corridor. Should the grievance remain unresolved it will be escalated to the second tier.

147. **Second Tier of GRM.** The Resettlement Officer and Environmental Officer in each PIU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the PMU's Safeguards Compliance and Monitoring Unit who will pass unresolved complaints upward to the Grievance Redress Committee (GRC)⁹, which has been established by the PMU's SCMU. A hearing will be called with the GRC, if necessary, where the affected person can present his/her concern/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on GRC. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

148. The PMU SCMU officers will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.

149. Third tier of GRM. In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress through the union Parishad or ward committees or in the appropriate court of law. The PIUs or GRC will be kept informed by the district, municipal or national authority.

150. The safeguard monitoring reports will include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending).

151. The GRM notwithstanding, an aggrieved person shall have access to the country's legal system at any stage. This can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

152. In the event that the established GRM is not in a position to resolved the issue, the affected persons can also use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's Developing Member Countries. The ADB Accountability Mechanish information will be included in the Project Information Document to be distributed to the affected communities, as part of the project GRM.

153. **Costs:** All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the PMU.

⁹ The GRC consists of the following persons: (i) Project Director; (ii) representative of the affected person(s); (iv) representative of the local Deputy Commissioners office (land); and (v) representative of APCB (for environmental-related grievances). The functions of the local GRC are as follows: (i) resolve problems quickly and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public safety as well as social and resettlement related issues such as land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

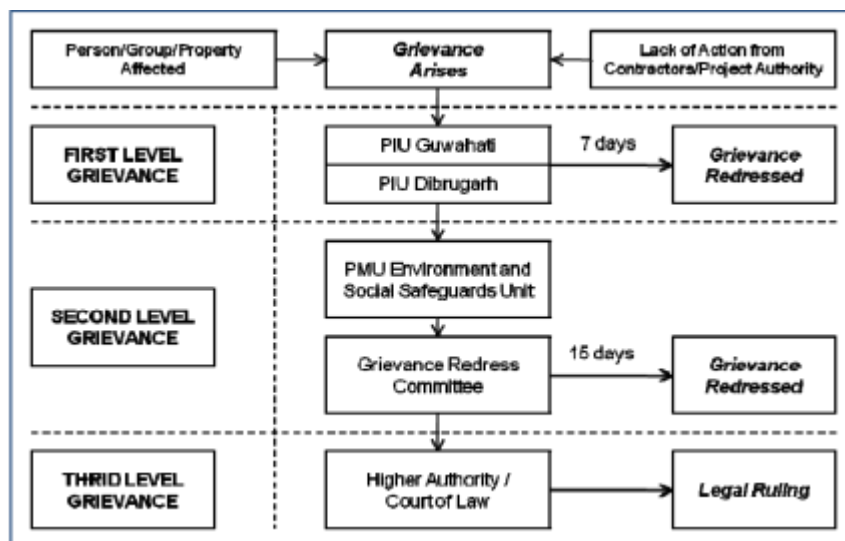


Figure 7: Grievance Redress Mechanism

VII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Process for Consultation

154. Detailed consultations were held with the local community and the representatives from GMC and GMDA. These consultations provide input for finalization of the project components as well as helps in understanding the need of the stakeholders for incorporation in the subproject components. The following stakeholders were consulted:

- (i) Officials of various Government Departments;
- (ii) Community people of slums;
- (iii) Elected representatives and technical staff from GMC and GMDA;
- (iv) Ward commissioner of the respective ward; and
- (v) Local communities of different wards.

155. The tools for consultation included formal meetings, structured discussions, focus group discussions apart from questionnaire administered for a sample population. These consultations included specific discussions on issues pertaining to need for improvement of drainage systems in the city. The priorities for improvement varied across the various localities in the city.

156. The details of primary consultations held in Guwahati are presented in **Table 23**. A sector wise summary of the issues and **action plan** particularly relevant to the situation analysis of the project is presented below. Apart from the other infrastructure issues the problem of recurrent flooding due to the improper drainage system was discussed during the consultation process. The community has expressed their views on the proposed improvement measures within the area and also in the other parts of the town.

Table 23: Details of Consultations During Subproject Preparation

S. No	Type of consultation	Stakeholder	Area, ward	Venue of consultation	Number of participants	Date	Time duration
Community/representatives/official							
1	Community Discussion	Settlers of Basistha and Circle Office Guwahati.	Guwahati	Basistha	8	17.10.16	12.00 PM
2	Community Discussion	Settlers of Anandanagar, Adabari Bus Stand	Guwahati	At Anandanagar	9	17.10.16	1.15 PM

B. Future Consultation and Disclosure

157. The public consultation shall be a continuous process and will continue in future during subproject implementation. The DMSC will be appointed to handle this key aspect of the program, who will conduct a wide range of activities in relation to all subprojects in each town, to ensure that the needs and concerns of stakeholders are registered, and are addressed in subproject design, operation or maintenance where appropriate. The program of activities include the following:

- (i) Public meetings with affected communities to discuss and plan work program and allow issues to be raised and addressed once the O&M activities have started; and
- (ii) Smaller-scale meetings to discuss and plan O&M works with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

158. For the benefit of the community the summary IEE will be translated in Assamese and made available at: (i) ULB office; (ii) District Magistrate Office; and, (iii) PMU; and (iv) PIUs. Hard copies of the IEE will be kept in public locations accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE will be placed in the official website of the PMU/State Government and the official website of ADB after approval of the IEE by Government and ADB. The PMU will issue Notification on the locality-wise start date of implementation of the subproject. The notice will be issued by the PMU in local newspapers one month ahead of the implementation works. Copies of the IEE will be kept in the PMU and PIU offices and will be distributed to any person willing to consult the IEE.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

159. The potential impacts identified and assessed and the mitigation measures formulated to minimize those impacts to acceptable levels identified in the earlier sections are summarized in the following tables. The table also delegates the responsibility of implementing mitigation to various agencies involved in the program implemented as listed above.

A. Environmental Mitigation Plan

160. **Tables 24 to 25** show the potential adverse environmental impacts, proposed mitigation measures, responsible parties. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

B. Environmental Monitoring Program

161. **Tables 26 to 27** show the proposed environmental monitoring program for this subproject. It includes all relevant environmental parameters, location, method of monitoring, indicators/standards of monitoring including frequency and responsibility of monitoring.

Table 24. Anticipated Impacts and Mitigation Measures – Pre-operation & Maintenance Stage

Field	Anticipated Impact	Mitigation measures	Responsible for Mitigation	Monitoring of mitigation
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during O&M phases; and (ii) Require O&M contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	DMSC/ Contractor	(i) List of affected utilities and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions
Traffic Management	Impede traffic flow during O&M activities	(i) Prepare a traffic management strategy during pre-O&M phase.	DMSC/ Contractor	Ensure Traffic Management strategy is included in bidding documents.
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	(i) Consult Archaeological Survey of India (ASI) or concerned department in Guwahati to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) Develop a protocol for use by the O&M contractors in conducting any excavation work, to ensure that any chance finds are recognized and	DMSC/ Contractor	Chance Finds Protocol

Field	Anticipated Impact	Mitigation measures	Responsible for Mitigation	Monitoring of mitigation
O&M work camps, hot mix plants (if any required), stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	<p>measures are taken to ensure they are protected and conserved.</p> <p>(i) Prioritize areas within or nearest possible vacant space in the subproject location;</p> <p>(ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, and drinking water supply systems;</p> <p>(iii) Do not consider residential areas;</p> <p>(iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community.</p>	PMU/PIU and DMSC to determine locations prior to award of O&M contracts.	List of selected sites for O&M work camps, hot mix plants (if any required), stockpile areas, storage areas, and disposal areas.
Sources of Materials	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.	<p>(i) Prioritize sites already permitted by the Mining Department;</p> <p>(ii) If other sites are necessary, inform O&M contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of PMU/PIU and</p>	PMU/PIU and DMSC to prepare list of approved quarry sites and sources of materials	<p>(i) List of approved quarry sites and sources of materials;</p> <p>(ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.</p>

Field	Anticipated Impact	Mitigation measures	Responsible for Mitigation	Monitoring of mitigation
		(iii) If any additional quarries are required after O&M is started, inform O&M contractor to obtain a written approval from PMU/PIU.		
Disposal sites of dredged soil and silt	Dredging activities will generate large amount of loose soil and silt which needs to be disposed in designated area away from sensitive receptors	Identify agreed sites with local officials to dispose of dredge	PMU/PIU and DMSC/ Contractor	PMU, PIU, and DMSC to ensure sites are agreed with local officials and in locations which are away from sensitive receptors.

DMSC = Design and Supervision Consultant, PMU = Project Management Unit; PIU = Project Implementation Unit

Table 25. Anticipated Impacts and Mitigation Measures – Operation & Maintenance Stage

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment PMU/PIU; (iii) If any additional quarries are required after O&M has started, obtain written approval from PMU/PIU; and; (iv) Submit to DMSC on a monthly basis documentation of sources	GMC and O&M Contractors	O&M Contractor documentation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Air Quality	Emissions from vehicles, equipment, and machinery used for excavation resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	<p>of materials.</p> <p>(i) Consult with PMU/PIU/DMSC on the designated areas for stockpiling of O&M materials;</p> <p>(ii) Carry out air quality monitoring;</p> <p>(iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; and transport the same to disposal site immediately.</p> <p>(iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and</p> <p>(v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.</p>	O&M/ DMSC	<p>(i) Location of stockpiles;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Heavy equipment and machinery with air pollution control devices</p>
Traffic Management	Impede traffic flow during O&M	(i) Implement a traffic management strategy (if required- partly closed) during the O&M phases.	GMC and O&M Contractors	DMSC to ensure traffic management measures are implemented and traffic is not significantly impeded during O&M period.
Surface water quality	Mobilization of settled materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during O&M works can	(i) Avoid stockpiling of excess soil especially during the monsoon season unless covered by tarpaulins or plastic sheets;	GMC and O&M Contractors	<p>(i) Areas for stockpiles, storage of fuels and lubricants and waste materials;</p> <p>(ii) Number of silt traps installed along drainages</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	contaminate nearby surface water quality.	<p>(ii) Prioritize re-use of excess spoils and materials in the O&M works. If spoils will be disposed, consult with PMU/PIU/DMSC on designated disposal areas;</p> <p>(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;</p> <p>(v) Dispose any wastes generated by O&M activities in designated sites- Basistha and Adabari ; and</p> <p>(vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>		<p>leading to water bodies;</p> <p>(iii) Records of surface water quality inspection;</p> <p>(iv) Effectiveness of water management measures.</p>
Noise Levels	Increase in noise level due to dredging work -moving and excavation equipment, and the transportation of equipment, materials, and people	<p>(i) Plan activities in consultation with PMU/ PIU/ DMSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;</p> <p>(ii) Require horns not be used unless it is necessary</p>	GMC and O&M Contractors	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of silencers in noise-producing equipment and sound barriers.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>to warn other road users of the vehicle's approach;</p> <p>(iii) Minimize noise from dredging equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor,</p> <p>(iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s; and</p> <p>(v) Carry out noise level monitoring</p>		
Ecological resources – Terrestrial	Felling of the trees – affect terrestrial ecological balance	(i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree felling is required, obtain tree-cutting permit from forest and environment dept., (iii) Require to plant three (3) native trees for every one (1) that is removed; and (iv) Prohibit employees from cutting of trees for firewood.	GMC and O&M Contractors	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species
Existing Infrastructure and Facilities	Disruption of service (if any) and damage to existing infrastructure at specified project location	(i) Obtain from PMU/PIU/DMSC the list of affected utilities and operators if any; (ii) Prepare a contingency	GMC and O&M Contractors	Existing Utilities Contingency Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		plan to include actions to be done in case of unintentional interruption of service		
Dredging activities	During dredging activities following impacts may occur (i) Physicochemical changes in the component of the environment (ii) A temporary mucky environment (iii) Possibility of communicable diseases (iv) Altered topography (v) Flood from high water speed (vi) Contamination due to suspended sediments (vii) Effects on Land Cover/Land Use.	<p>(i) The physiochemical changes and contamination due to suspended sediments in the river will be temporary in nature and would not have any long lasting effect on the environment;</p> <p>(ii) It will be ensured that the mucks will be removed, transported (in covered vehicles) and disposed to the identified disposal site periodically;</p> <p>(iii) Awareness programs shall be organized for the workers and nearby residents on various possible communicable diseases;</p> <p>(iv) There will be no altered topography and effects on land cover/land use since the dredging activities will be carried out within the existing right of way of the rivers;</p> <p>(v) The dredging will be carried out in order to increase the carrying capacity of the rivers to mitigate the flood problems inside the city</p>	GMC and O&M Contractors	DMSC to monitor contractors on dredging activities

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>and the high speed water will be discharged into the River Brahmaputra;</p> <p>(vi) In case any plastic or other non-bio-degradable waste are recovered during dredging activities, it will be ensured that the waste materials will be segregated and disposed in the MSW disposal site at Boragaon.</p>		
Disposal sites of dredged loose soil and silt	<p>Dredging of the rivers and drains will generate large amounts of dredged material (i.e., only loose soil and silt, refer Appendix 14) which needs to be disposed at designated sites (Adabari and Basistha).</p> <p>Preliminary design indicates generation of 52,000 cum of dug soil.</p>	Dispose the dredged loose soil and silt at pre-identified agreed upon sites (Basistha and Adabari disposal sites). Both the sites will be provided with boundary walls.	GMC and O&M Contractors	DMSC to monitor contractors on disposal of dredged loose soil and silt at pre-identified agreed site
Landscape and Aesthetics	Solid wastes as well as excess dredged materials	<p>(i) Prepare and implement Waste Management List;</p> <p>(ii) Avoid stockpiling of excess excavated dredged loose soil and silt;</p> <p>(iii) Coordinate with GMC for beneficial uses of excess loose soil and silt or immediately dispose to designated areas (Adabari</p>	GMC and O&M Contractors	<p>(i) Waste Management List; (ii) Complaints from sensitive receptors;</p> <p>(iii) PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		and Basistha); (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish; and (vii) Request PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.		
Accessibility	Traffic problems and conflicts near project locations and haul road	(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; (ii) Schedule transport and hauling activities during non- peak hours; (iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Keep the site free from all unnecessary obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with	GMC and O&M Contractors	(i) Traffic Management Strategy; (ii) Complaints from sensitive receptors; (iii) Number of signages placed at subproject location

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>Guwahati Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours;</p> <p>(vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of O&M works and contact numbers for concerns/complaints.</p> <p>(viii) Provide planks across excavated roads in front of businesses houses and residences, and ensure works are completed quickly to avoid disruption, and</p> <p>(ix) Avoid full street closure</p>		
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	<p>(i) Leave spaces for access between mounds of soil/ silt;</p> <p>(ii) Provide walkways and metal sheets where required for people;</p> <p>(iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;</p> <p>(iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and</p>	O&M Contractor/ DMSC	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Number of walkways, signages, and metal sheets placed at subproject location.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(v) Provide sign boards for pedestrians to inform nature and duration of O&M works and contact numbers for concerns/complaints.		
Socio-Economic Employment	- Generation of contractual employment and increase in local revenue	(i) Employ at least 50% of the labor force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and	GMC and O&M Contractors	(i) Employment records; (ii) records of sources of materials
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment such as helmet, gumboot, safety belt, gloves, nose mask and ear plugs; (c) H&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for	GMC and O&M Contractors	(i) Site-specific Health and Safety (H&S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>workers;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p> <p>(viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>(ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(x) Ensure moving equipment is outfitted with audible back- up alarms;</p> <p>(xi) Mark and provide sign boards for hazardous areas</p>		disposal.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p>		
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<p>(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with PMU/PIU/DMSC in identifying high-risk areas on route cards/maps. (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. (iv) Provide road signs and flag persons to warn. (v) Provide protective fencing around drain, and</p>	GMC and O&M Contractors	<p>(i) Traffic Management Strategy;</p> <p>(ii) Complaints from sensitive receptors</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>cover any open trench with metal planks during non-O&M hours;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site; (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and</p> <p>(ix) Request PMU/PIU/DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		
Camp sites (if needed)	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	<p>(i) Consult PMU/PIU/DMSC before locating project offices and sheds;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees;</p> <p>(iv) Prohibit employees from cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil</p>	GMC and O&M Contractors	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for employees ; and</p> <p>(iii) PMU/PIU/DMSC report writing that the camp has been vacated and restored to pre-project conditions</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		contamination; (vi) Recover used oil and lubricants and reuse or remove from the site; (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request PMU/PIU/DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.		
Social and Cultural Resources	Risk of archaeological chance finds	(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request PMU/PIU/DMSC or any authorized person with archaeological field training to observe excavation; (iii) Stop work immediately to allow further investigation if any finds are suspected; and (iv) Inform PMU/PIU/DMSC if a find is suspected, and take any action they require ensuring its removal or	GMC and O&M Contractors	Records of chance finds

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		protection in situ.		
General maintenance	General impact	(i) Conduct work during non- monsoon period; and (ii) Cover or wet excavated material to prevent dusts.	GMC and O&M Contractors	Complaints from sensitive receptors

DMSC = Design Management and Supervision Consultant, H&S = health and safety, RPM = respirable particulate matter,, SPM = suspended particulate matter, GMC = Guwahati Municipal Corporation; PMU = Project Management Unit; PIU = Project Implementation Unit

Table 26. Pre-operation & Maintenance Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Utilities	As per site requirement	DMSC	(i) List of affected utilities if any and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions	Checking of records	(i) List of affected utilities and operators prepared; (ii) Requirement for a contingency plan for service interruptions included in bid documents	Once	PMU/PIU/ DMSC
O&M work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	As per site requirement	DMSC to determine locations prior to award of O&M contracts.	List of selected location for O&M work camps, hot mix plants (if any required), stockpile areas, storage areas, and	Checking of records	List of selected sites for O&M work camps, hot mix plants (if any required), stockpile areas, storage areas, and disposal areas provided to O&M	Once	PMU/PIU/DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			disposal areas.		contractors prior to commencement of works.		
Sources of Materials	As per site requirement	DMSC to prepare list of approved quarry sites and sources of materials	(i) List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary	Checking of records	(i) List of approved quarry sites and sources of materials provided to O&M contractors (ii) Bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	Once	PMU/PIU/DMSC
Disposal sites of dredge materials (silt/ loose soil)	As per site requirement	DMSC to ensure sites are agreed with local officials and in locations which are away from sensitive receptors.	(i) Identify agreed sites with local officials to dispose of dredge (Basistha and Adabari)	Confirmation of site and checking records	Sites are agreed with local officials and in locations which are away from sensitive receptors.	Once	PMU/PIU/DMSC
Orientation training program for implementation of EMP by contractor	Working location	DMSC	(i) Checking whether contractor gain knowledge after training-through	Confirmation of training program	Supply of materials related to EMP application and training record	Before starting of the physical activity and continued	PMU/PIU/DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			question answer season			till completion of work	

DMSC = Design and Management Supervision Consultant, O&M = operation and maintenance, PMU = Project Management Unit; PIU = Project Implementation Unit

Table 27. O&M Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Occupational Health and Safety	Subproject location	GMC and O&M Contractors	Complaints from sensitive receptors	(i) Records of training; (ii) H&S Plan approved by GMC	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU
Sources of Materials	Quarries and sources of materials	O&M Contractor	O&M Contractor documentation	(i) Checking of records; (ii) visual inspection of sites	(i) Sites are permitted; (ii) Report submitted by O&M contractor monthly (until such time there is excavation work)	Monthly submission for O&M contractor As needed for DMSC	DMSC
Air Quality	O&M sites and areas designated for stockpiling of materials	O&M Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices	(i) Checking of records; (ii) visual inspection of sites	(i) Stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly	Monthly for checking records	DMSC in coordination with Pollution Control Board
Surface Water Quality	(i) O&M sites; (ii) areas for stockpiles,	O&M Contractor	(i) Areas for stockpiles, storage of fuels and lubricants	visual inspection	(i) Designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and	Monthly	DMSC in coordination with Pollution Control Board

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	storage of fuels and lubricants and waste materials;		and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) records of surface water quality inspection; (iv) effectiveness of water management measures		silt from O&M activities		
Noise Levels	(i) O&M sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	O&M Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers	(i) Checking of records; (ii) visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	Monthly	DMSC in coordination with Pollution Control Board
Existing Utilities and Infrastructure	O&M sites	O&M Contractor	(i) Existing Utilities Contingency Plan	(i) Checking of records; (ii) visual inspection	Implementation according to Utilities Contingency Plan	As needed	DMSC
Landscape and Aesthetics	(i) O&M sites; (ii) areas for stockpiles, storage of fuels and	O&M Contractor	(i) Waste Management List; (ii) complaints from sensitive receptors; (iii)	(i) Checking of records; (ii) visual inspection	(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) complaints from	Monthly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	lubricants and waste materials; (iii) work camps		PMU/PIU/DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.		sensitive receptors satisfactorily addressed.		
Accessibility	(i) O&M sites; (ii) traffic haul road	O&M Contractor	(i) Traffic Management Strategy; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject location.	Visual inspection	(i) Implementation of Traffic Management Strategy, if required; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	Monthly	DMSC
Socio-Economic - Income	O&M sites	O&M Contractor	(i) Employment records; (ii) records of sources of materials	Visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets provided; and (iii) signages visible and located in designated areas	Quarterly	DMSC
Socio-Economic - employment	O&M sites	O&M Contractor	i) Employment records; (ii) records of sources of materials	Checking of records	Number of employees from Guwahati should be equal or greater than 50% of total workforce	Quarterly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Occupational Health and Safety	O&M sites	O&M Contractor	(i) Site-specific Health and Safety (H&S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (x) sign boards for hazardous areas such as energized	(i) Checking of records; (ii) visual inspection	(i) Implementation of H&S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; and (v) % of moving equipment outfitted with audible back-up alarms	Quarterly	DMSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.				
Community Health and Safety	O&M sites	O&M Contractor	(i) Traffic Management strategy; (ii) complaints from sensitive receptors	Visual inspection	(i) Implementation of Traffic Management strategy; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DMSC
Work Camps	Work camps	O&M Contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) PMU/PIU/DMSC report in writing that the camp has been vacated and restored to pre-project conditions	Visual inspection	(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DMSC

BOD = biological oxygen demand, DMSC = Design and Management Supervision Consultant, H&S = health and safety, RPM = respirable particulate matter, GOI= Government of India, SPM = suspended particulate matter; PMU = Project Management Unit; PIU = Project Implementation Unit

C. Environmental Management Plan Costs

158. **Design.** The subproject is assessed to have no as such design or location impacts. However, there will be requirement for plantation of trees as environment conservation measure. There will be no tree cutting in the project as per the present assessment. Tree plantation cost is included in project cost.

159. **Construction (if any required).** The Contractor's cost for site establishment, preliminary activities, construction, and defect liability activities will be incorporated into the contractual agreements, which will be binding on him for implementation. The air quality, water quality and noise level monitoring of construction and defect liability phases will be conducted by the contractor.

160. The activities identified in environmental monitoring program mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU/DMSC with the assistance of DMSC, costs of which are part of project management.

161. **Operation.** The operational phase mitigation measures will be the responsibility of GMC operation agency, and include standard operating practices. No additional costs operating costs for monitoring are envisioned.

162. The costs of these various inputs are shown in **Table 28**.

Table 28: Indicative Cost for EMP Implementation

Component	Description	Number	Cost per Unit (₹)	Cost (₹)	Source of Funds
Legislation, Permits and Agreements	Consent to Establish and Consent to Operate for plants and machinery of the contractor.	As required	Not Applicable	Not Applicable	These consents are to be obtained by contractor on his own cost.
Tree plantation	Environment improvement plantation	About 500 trees	600/-	30000.00	Project Management cost/ PMU
Public consultations and information disclosure during implementation	Information disclosure and consultations during pre-O&M and O&M phase.	As required	Lump sum	4,0000.00	By contractor
Providing access to commercial establishments and properties.	Providing access, in case of access disruptions, to affected properties.	As required	Contractor's liability	Not applicable	Covered in Engineering cost
Dust Suppression at	Application of dust suppression	As required	Lump sum	100,000.00	By contractor

Component	Description	Number	Cost per Unit (₹)	Cost (₹)	Source of Funds
subproject sites	measures during O&M phase.				
Protection measures against noise pollution	Construction of noise walls (as per requirement)	As required	Lump sum	100,000.00	By contractor
Traffic management	Safety Signboards, delineators, traffic regulation equipment, flagman, temporary diversions, etc.	Wherever required	Not applicable	Not applicable	Covered in engineering cost Covered under engineering design
Air-O&M phase	Once before start of O&M works as identified by DMSC. Continued semi-annually for 2.5 years	20	7,000 per sample	140,000.00	By contractor
Noise-O&M phase	Once before start of O&M works as identified by DMSC. Continued semi-annually for 3 years	20	1,000 per sample	20,000.00	By contractor
Water-Siltage testing	Once in a Year for two sites identified by DMSC for 5 years	10	10,000 per sample	1,00,000	By contractor
Loose soil/silt testing from river bed	Once in a Year for one location identified by DMSC for 5 years	5	20,000 per sample	1,00,000	By contractor
Total				6,30,000.00	

IX. FINDINGS & RECOMMENDATIONS

163. The IEE process described in the earlier sections of this report assessed the environmental impacts of all components proposed under the subproject. Potential negative impacts were identified related to design, location, operation and maintenance of the subproject. Negative impacts due to the design, location and operation and maintenance are assessed to be minimal.

164. The potential adverse environmental impacts are mainly related to the O&M period, which can be minimized by the proposed mitigation measures and environmentally sound engineering and operation and maintenance practices. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. The recommended contract clauses for the O&M contractors are attached as **Appendix 11**.

165. As stated above, most impacts are due to de-siltation; this is because de-siltation work is to be carried out within the town. The important impacts identified are dust and noise generation from de-siltation activities; impacts due to disposal of large quantities of de-siltation waste; disturbance and inconvenience to local people due to de-siltation of drains and water bodies.

166. These impacts are mostly temporary in nature and can be effectively avoided or mitigated by observing appropriate mitigation measure as defined in the EMP. The mitigation measures includes following the existing alignment of drains along roads, scheduling appropriately and working section-wise, wetting of soil and de-siltation area to reduce the dust; immediate transport of excess soil; scheduling of activities to reduce noise impacts; special precaution near sensitive areas like schools and hospitals and Government buildings; and traffic diversions and public information to reduce the impact. Proper safety measures during de-siltation activities to ensure worker as well public safety.

X. CONCLUSIONS

167. All components proposed under this subproject involve de-siltation and simple operation. No significant environmental impacts are anticipated. In most cases, environmental issues identified are typical for the type of de-siltation components, and a range of proven mitigation strategies exist to address them, and are outlined in the EMP.

168. This IEE has assessed all potential environmental impacts associated with the subproject. There are no impacts that are significant or complex in nature or which need an in-depth study to assess the impact or to develop the mitigation measures. The environmental impacts identified are manageable, and PMU and PIU will implement the mitigation measures as stated in the EMP. The subproject, therefore, does not warrant further environmental study. Based on the findings of the IEE, it can be seen that no adverse or harmful impacts of any significance are expected and so a full scale EIA is not required. The subproject is confirmed to be Category B consistent with ADB's Safeguard Policy Statement (2009) and an IEE is determined to be a sufficient level of environmental examination.

APPENDIX 1: CENTRAL POLLUTION CONTROL BOARD (CPCB) APPLICABLE ENVIRONMENTAL STANDARDS

General Standards for Discharge of Environmental Pollutants: Effluents

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids mg/l. max.	100	600	200	(a) For process waste water 100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, max. 3mm. (b) Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 5°C above the receiving water temperature			shall not exceed 5°C above the receiving water temperature
6.	Oil and grease, mg./l, max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH ₃) mg/l. max	100			100
10.	Free ammonia (as NH ₃), mg/l. max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27°C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
14.	Mercury (As Hg), mg/l, max.	0.01	0.01		0.01
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd) mg/l. max	2.0	1.0		2.0
17.	Hexavalent chromium (as Cr. +6). mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu) mg/l, max	3.0	3.0		3.0
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C ₆ H ₅ OH) mg/l, max	1.0	5.0		5.0
28.	Radioactive materials: (a) Alfa emitters microcurie/ml, max. (b) Beta emitters micro curie/ml, max.	10 ⁻⁷	10 ⁻⁷	10 ⁻⁸	10 ⁻⁷
		10 ⁻⁶	10 ⁻⁶	10 ⁻⁷	10 ⁻⁶

S. No.	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
29.	Bio-assay test	90% Survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30.	Manganese (as Mn)	2 mg/l	2 mg/l		2 mg/l
31.	Iron (as Fe)	3 mg/l	3 mg/l		3 mg/l
32.	Vanadium (as V)	0.2 mg/l	0.2 mg/l		0.2 mg/l
33.	Nitrate Nitrogen	10 mg/l			20 mg/l

These standards shall be applicable for industries, operations or process other than those industries operations or process for which standards have been specified in schedule of the Environment Protection Rules, 1989

CPCB Primary Water Quality Criteria

Designated-Best-Use	Class of Water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 50 per 100MI ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq6 mg/l ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 2 mg/l
Outdoor bathing (organized)	B	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 500 per 100mL ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq5 mg/l ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 3 mg/l
Drinking water sources after conventional treatment and disinfection	C	<ul style="list-style-type: none"> ❖ Total Coliform Organisms: MPN # 5000 per 100mL ❖ 6 # pH # 9 ❖ Dissolved Oxygen: \geq4 mg/l ❖ Biochemical Oxygen Demand (5 days @ 20°C): # 3 mg/l
Propagation of wildlife and fisheries	D	<ul style="list-style-type: none"> ❖ 6.5 # pH # 8.5 ❖ Dissolved Oxygen: \geq4 mg/l ❖ Free ammonia (as N): # 1.2 mg/l
Irrigation, industrial cooling, controlled waste disposal	E	<ul style="list-style-type: none"> ❖ # pH # 8.5 ❖ Electrical conductivity at 25°C: #2250 micro mhos/cm ❖ Sodium absorption ratio: Max 26

Designated-Best-Use	Class of Water	Criteria
		❖ Boron: Max 2 mg/l

Indian Standards for Drinking Water - Specification (BIS 10500: 2012)

S. No.	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
Essential characteristics			
1.	Colour, (Hazen units, Max)	5	25
2.	Odour	Unobjectionable	Unobjectionable
3.	Taste	Agreeable	Agreeable
4.	Turbidity (NTU, Max)	5	10
5.	pH Value	6.5 to 8.5	No Relaxation
6.	Total Hardness (as CaCO ₃) mg/l, Max	300	600
7.	Iron (as Fe) mg/l Max	0.3	1.0
8.	Chlorides (as Cl) mg/l Max.	250	1000
9.	Residual, free chlorine, mg/l Min	0.2	--
Desirable Characteristics			
10.	Dissolved solids mg/l Max	500	2000
11.	Calcium (as Ca) mg/l Max	75	200
12.	Magnesium (as Mg) mg/l Max.	30	100
13.	Copper (as Cu) mg/l Max	0.05	1.5
14.	Manganese (as Mn) mg/lit, Max	0.10	0.3
15.	Sulfate (as SO ₄) mg/l Max	200	400
16.	Nitrate (as NO ₃) mg/l Max	45	100
17.	Fluoride (as F) mg/l Max	1.0	1.5
18.	Phenolic Compounds (as C ₆ H ₅ OH) mg/l Max.	0.001	0.002
19.	Mercury (as Hg) mg/l Max	0.001	No relaxation
20.	Cadmium (as Cd) mg/l Max	0.01	No relaxation
21.	Selenium (as Se) mg/l Max	0.01	No relaxation
22.	Arsenic (as As) mg/l Max	0.05	No relaxation
23.	Cyanide (as CN) mg/l Max	0.05	No relaxation
24.	Lead (as Pb) mg/l Max	0.05	No relaxation
25.	Zinc (as Zn) mg/l Max	5	15
26.	Anionic detergents (as MBAS) mg/l Max	0.2	1.0
27.	Chromium (as Cr ⁶⁺) mg/l Max	0.05	No relaxation
28.	Polynuclear aromatic hydro carbons (as PAH) g/lit, Max	--	--
29.	Mineral Oil mg/l Max	0.01	0.03
30.	Pesticides mg/l, Max	Absent	0.001
31.	Radioactive Materials		
	i. Alpha emitters Bq/l, Max	--	0.1
	ii. Beta emitters pci/l, Max	--	1.0

S. No.	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
32	Alkalinity mg/l Max	200	600
33	Aluminium (as Al) mg/l,Max	0.03	0.2
34	Boron mg/l Max	1	5

Ambient Air Quality Standards

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt.)	Method of Measurement
Sulphur Dioxide	Annual Average *	50 µg / m ³	20 µg / m ³	Improved West & Gaeke method
(SO ₂)	24 hours Average**	80 µg/m ³	80 µg/m ³	Ultraviolet Fluorescence
Oxides of Nitrogen	Annual Average *	40 µg / m ³	30 µg / m ³	Jacobs & Hochheiser
(NO _x)	24 hours Average**	80 µg/m ³	80 µg/m ³	modified (NaOH – NaAsO ₂) method Gas Chemiluminescence
Particulate	Annual Average *	60 µg / m ³	60 µg / m ³	Gravimetric
Matter (PM ₁₀)	24 hours Average**			TOEM
(Size <10 µm)		100 µg/m ³	100 µg/m ³	Beta Attenuation
Particulate	Annual Average *	40 µg / m ³	40 µg / m ³	Gravimetric
Matter (PM _{2.5})	24 hours Average**			TOEM
(Size <2.5 µm)		60 µg/m ³	60 µg/m ³	Beta Attenuation
Ozone (O ₃)	8 hours average **	100 µg/m ³	100 µg/m ³	UV photometric
	1 hour **	180 µg/m ³	180 µg/m ³	Chemiluminescence Chemical method
Lead (Pb)	Annual Average *	0.5 µg / m ³	0.5 µg/m ³	AAS method after sampling using EPM 2000 or equivalent filter paper
	24 hours Average**	1.0 µg / m ³	1.0 µg/m ³	
Carbon Monoxide (CO)	8 hours Average** 1 hour **	2.0 mg/ m ³ 4.0 mg/ m ³	2.0 mg/ m ³ 4.0 mg/ m ³	Non Dispersive Infrared Spectroscopy
Ammonia (NH ₃)	Annual Average *	100 µg / m ³	100 µg / m ³	Chemiluminescence

Pollutant	Time Weighted Average	Industrial, Residential, Rural and Other Areas	Sensitive Area (Notified by Central Govt.)	Method of Measurement
	24 hours Average**	400 µg / m ³	400 µg / m ³	Indophenol blue method
Benzene (C ₆ H ₆)	Annual Average *	5 ng/ m ³	5 ng/ m ³	Gas Chromatography continuous analyzer
				Adsorption & desorption followed by GC analysis
Benzo(o)pyrene particulate phase only	Annual Average *	1 ng/ m ³	1 ng/ m ³	Solvent extraction followed by GC/HPLC analysis
Arsenic (As)	Annual Average *	6 ng/ m ³	6 ng/ m ³	AAS/ICP method after sampling using EPM 2000 or equivalent filter paper
Nickel (Ni)	Annual Average *	20 ng/ m ³	20 ng/ m ³	AAS/ICP method after sampling using EPM 2000 or equivalent filter paper

Source: Central Pollution Control Board, New Delhi, Notification dated 18th November 2009

Notes: * Indicate Annual Arithmetic Mean of Minimum 104 measurement in a year measured twice a week, 24 hourly at uniform intervals** 24 hourly / 8 hourly/1 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed by not on two consecutive days

Standards for Diesel Generator Sets: Stack Height

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

$$H = h + 0.2x \text{ ÖKVA}$$

H = Total height of stack in metre

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

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorised as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Ht. of the building + 1.5 metre
50-100 KVA	Ht. of the building + 2.0 metre
100-150 KVA	Ht. of the building + 2.5 metre
150-200 KVA	Ht. of the building + 3.0 metre
200-250 KVA	Ht. of the building + 3.5 metre
250-300 KVA	Ht. of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

Noise Standards

Noise limits for domestic appliances and dredging equipment at the manufacturing stage in dB(A).

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Diesel generator for domestic purposes	85
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

National Ambient Noise Standards The Noise Pollution (Regulation and Control) Rules, 2000

Area Code	Category of Area	Limit 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 is reckoned in between 6 a.m. and 10 p.m.

Note-2 Night time is reckoned in between 10 p.m. and 6 a.m.

Note-3 Silence zone is an area comprising not less than 100 m around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority

Note-4 Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

APPENDIX 2: EXISTING STORM WATER DRAINAGE SYSTEM

Classification of Drains

Storm water drains have been classified into three categories

Tertiary Drain

It is the first level collector drain which has smallest sub-catchment of its own. This drain is normally located along the lanes and by-lanes of the city and in some cases also along some of the major roads.

Secondary Drain

It is the drain which receives flows from the tertiary drains, other secondary drains and also from its own catchment.

Primary Drain

It is the mostly the natural drain which conveys the storm flows to other major natural drain.

In some cases large manmade drains functioning as primary conveying channels, such as the Bashistha River channelized stretch are also categorized as primary drains.

1. Rivers, Existing Drains and Water Bodies:

River

River Brahmaputra

River Brahmaputra is the ultimate outfall of all primary drains of the city. It is due to the very special topographical aspect of the River Brahmaputra which is the genesis of the storm water drainage problems of Guwahati city.

The River Brahmaputra, approaches Guwahati through a wide channel of more than 5 km width. At the North East entry of the river to the city the river encounters a severe constricted flow area of only about 800m wide. There is a further constriction to about 500m width, between Amingaon and Pandu Railway station upstream of the Brahmaputra Bridge. This leads to: Flood afflux in the River Brahmaputra, on the upstream of the N-E side of city, thereby increasing the flood level in the river channel near Bondajan and upstream of that point.

The dip in the flood level caused due to high velocity in the channel is regained due to afflux caused by this further constriction of section and there is flood afflux again near the Bharalumukh area.

River Bharalu, River Bahini

Bharalu River flows through the centre of the city. The gross physical catchment of Bharalu River is about 42 sq. km.

River Bharalu takes in discharges from two other primary natural drains viz. the River Bahini, which contributes about 13 sq. km of the catchment; the Borasola Bil outfall.

The flows reaching the River Bahini, from the catchment of the Narakasur Hills via the Ganeshgudi-Kahilipara-Assam secretariat road contribute about 3.2 sqkm of steep denuded hill catchment which causes sudden deluge.

It is most flood prone and is thus the focal point of the entire Guwahati drainage system. Unplanned developments have blocked the natural drainage pattern in this basin. The Basin is almost flat with several pockets of low-lying areas. During heavy rain, there is a back flow of water from Bharalu Channel into the adjoining low lying areas which submergence for long durations.

Photo illustration at Appendix 3.

About 35% of the drain length in the Bharalu stretch has concrete side walls. The remaining portion of the drain is kutcha. The drain is carrying untreated or semi-treated wastewater and industrial effluents. The carrying capacity of the drain is reduced considerably due to encroachments, deposition of silt and loose soil, growth of weeds, crossing of service pipelines and inadequate opening at the bridges and culverts along the stretch of the drain. This results in flooding and water logging in various locations such as Rajgarh, Anil Nagar, Nabin Nagar and Lachit Nagar. At R.G. Baruah Road crossing the projection of the lower slab of the road bridge together with crossings of service pipelines has obstructed the flow through the drain and reduced its carrying capacity.

A number of shops and commercial establishments have encroached the drain in Fatasil area. The existing width of the drain in the Bharalu stretch varies approximately from 10m to 18m. However, the width of the drain increases to 36.31m at the outfall point. Water from the Brahmaputra River backflows into the drain particularly during the monsoon season when the high flood level (HFL) of the river exceeds the full supply level (FSL) of the drain. In order to minimize the flood problem in the adjacent location due to such backflow, sluice gates have been provided near the outfall of the drain. Part of the flood is pumped to the downstream end.

River Bashistha, Hathinala, Pamohi and Deepor Bil

This is the largest single drainage basin located at the southern most part of the Guwahati Metropolitan Area. River Basistha finally discharges into Dipor Bil.

The river Basistha and Ummariyang (later known as Bahini) originate from the hills of Meghalaya and flow north-easterly through the southern boundary of Guwahati city. Near Natun Bazar at Basistha Chariali, the river Bahini is severed and the entire flow is diverted to the River Basistha.

River Bahini channel continues in its original alignment, after the severance, and collects run-off from the adjoining areas (including some hilly regions) parallel to Beltola road and ultimately reaches confluence point of Bharalu river and RGB open drain near Jonali; with flows from the truncated catchment.

The Basistha River at Bhetapara is divided into two parts in order to cater combined discharge. One part is directly from diversion point to Dakhingaon and other part by excavating a channel, later known as Hatigaon Channel, from Bhetapara to meet the first part at Dakhingaon. This drain was constructed in the year 1986-87 with an intension to relieve State Capital Dispur from temporary flood and water logging.

Photo illustration at Appendix 3.

The Pamohi drain is actually a backwater of Deepor Bil and functions as a stream only during lean season. It is actually an outfall to Dipor bil downstream of the confluence of Mora Bharalu river and Basistha Drain near NH37 (Pic) Water from the Ddeepor Bil backflows to Pamohi drain particularly during the monsoon when the HFL of the bil exceeds the FSL of the drain.

During lean season Pamohi appears as an alluvial drain running mostly in the cultivation land on both the flanks. However, Irregular section & vegetation growth along the entire stretch of the drain has caused obstruction to the natural flow and has reduced its capacity. Approximate length of the drain is 6.5 KM.

2. Primary Drains

Mora Bharalu River

This is an important drain in Guwahati city having its origin near Fatasil Chowk. Mora Bharalu River has outfall into the Pamohi Drain. Mora Bharalu used to carry storm water discharges from Fatasil, Athgaon, Gopinath Nagar and Dhirenpara area of the city. Resection and regradation of Mora Bharalu was done in the year 1986 from Fatasil Ambari Bazar to NH37 with an aim to divert the flow of Bharalu through Mora Bharalu to Basistha River when the sluice gate at Bharalumukh is closed. The total length of this reach is 6.5 km. This is an unlined drain all along its length. Vegetation growth and deposition of garbage make the drain partially ineffective of its performance.

Bondajan Primary Drain

Bondajan primary drain is a tributary of the Brahmaputra River on its southern bank. The drain is situated to the east of Guwahati and originates from a natural wetland called Silsako Lake.

Almost in every year, a vast area of the Silsako Basin is flooded during the monsoon. The primary reasons associated with the flooding of the basin are:

1. Backflow of water from the Brahmaputra River into the Bondajan primary drain.
2. Diminishing of water retaining capacity of the Silsako Lake mainly because of encroachments and deposition of loose soil and silt.

Sluice gates are provided near the outfall end of the drain to stop the backflow from Brahmaputra River. The gate is located at about 2 km from the outfall point at Holigaon village near a railway crossing. The gate is presently in working condition. It has 2.484 m opening and 6 m width at middle portion, where as width of the drain at this location is 31 m. This creates constriction of the section for the discharge of accumulated flood in Silsako Bil to River Brahmaputra during low water levels of the River Brahmaputra.

Khanajan Primary Drain

The Khanajan Drain is a major primary drain in the western part of Guwahati. This functions as a cross connecting drain with bi-directional flow. That is when the water level in Brahmaputra River is low, the flow of water is from Deepor Bil to the Brahmaputra river and when the water level in Brahmaputra river is high the flow of water is from the Brahmaputra river to Deepor Bil. To prevent excess back flow, there is one Sluice Gate bridge of 4 meters in width at approx. 0.50 Km from

the river. The total length of the Khanajan drain is 5906.00 meters.

The drain originates from the Deepor Bil Lake and passes through Khanamukh area, Dharapur Jengarbari, Garigaon area of western side of Guwahati meets the River Brahmaputra in Khanamukh area. There is a gravel road running parallel on the right bank of the drain up to crossing of NH 37. The drain is unlined in the entire stretch. However, vegetation / weeds growth along the entire stretch of the drain has caused obstruction to the natural flow and has reduced its capacity.

3. Secondary drains- South Guwahati

The existing secondary drains are mainly of two types (i) Surface Drains and (ii) Underground Drains. Most of the surface drains are covered with RCC slabs and the rest are open channels. The underground drains are of two types RCC Box and Pipe Conduit. Most of the existing secondary drains are not functioning properly mainly due to deposition of silt and garbage, improper slope and outfall, inadequate carrying capacity and irregular maintenance. Brief description of these secondary drains along with their existing conditions is provided as under.

PubSarania – Rajgarh Area Secondary Drain

This is a major secondary covered drain carrying storm water from parts of Chandmari, drain carrying storm water from Krishna Nagar and from the foothill of Sarania Hill on the eastern side. The drain is divided into two parts; one towards Nabin Nagar/Anil Nagar underground drain and the other reaching Lachit Nagar Underground drain. The total length of this drain is 3700 m.

Existing condition: Most stretches of the drain are clogged with silt and garbage and most of the manholes are covered with bitumen surface of the road.

Photo illustration at Appendix-3

The Drain is a combination of pipe conduit (N.P.3 Hume Pipe) and R.C.C. Box drain. This underground drain carries storm water from entire Lachit Nagar and southern part of Sarania Hill catchment area through drains meeting it at different locations. This drain starts from Lachit Nagar G.S. Road junction and terminates at river Bharalu through B.T. College Road. Approximate length of the drain is 1 km.

Existing condition: This drain receives major portion of storm runoff from the Sarania provided by the WRD, Govt. of Assam at a location of about 0.50 Km ahead of its outfall point at the River Brahmaputra. The sluice gate is in operating condition. A RCC Road Bridge is being constructed on the drain near Faculty High School. Three RCC Bridges exist on the drain within the IIT campus. The condition of these bridges is good. A number of secondary drains are indirectly contributing to this primary drain through the Rangagarh Lake. Hill on its Northern side. The runoff carries huge load of silt and vegetations which ultimately deposited in the drain. This results in reduction of carrying capacity of the Water from the Brahmaputra River backflows to Ghorajan particularly during the monsoon when the HFL of the River exceeds the FSL of the drain. In order to minimize the flood problem due to such backflow, the aforesaid sluice gate has been provided. However, vegetation / weeds growth along the entire stretch of the drain has caused obstruction to the natural flow and has reduced its capacity. Total length of the drain is 2639m drain. Some of the existing manholes of the drain are broken.

Railway Open Drain

The existing secondary drains are mainly of two types (i) Surface Drains and (ii) Underground Drains. Most of the surface drains are covered with RCC slabs and the rest are open channels. The underground drains are of two types RCC Box and Pipe

Conduit. Most of the existing secondary drains are not functioning properly mainly due to deposition of silt and garbage, improper slope and outfall, inadequate carrying capacity and irregular maintenance. Brief description of these secondary drains along with their existing conditions is provided as under.

(From Voltas point near Sadin Office to B. Baruah over bridge)

This is an RCC open drain and was constructed in 2004. It carries storm water from parts of Nabagraha Hill, Chandmari, Krisha Nagar and Silpukhri area. It flows through the railway culvert below the B.Baruah Over Bridge and passes through Hedayatpur and ultimately outfalls at Borsola Lake through Solapara. The total length of the drain is 1324 m.

Existing condition: This drain initially was quite effective as a result of which a large area was relieved from temporary flood and waterlogging. But gradually the effectiveness of the drain is reduced due to deposition of silt and debris carried by the storm runoff from Krishna Nagar, Chandmari and Silpukhri area. The actual area of the Borsola Lake where the drain outfalls is reduced significantly due to encroachment and garbage dumping should be encroachment free. This has reduced the water holding capacity of the lake. Immediate attention is therefore needed to restore the lake.

Photo illustration at Appendix-3

Drain through Khana para reaching Silsako passing through Panjabari area

The origin of this drain is at Jorabat area. It enters GMDA boundary near S.B.I. Khanapara and then passing through Veterinary College it reaches Panjabari near office of Directorate of Panchayat and Rural Development. After that it crosses Panjabari road through a box culvert and then finally running through Juripar area it ultimately reaches Silsako Bill. Drain in the southern part of NH37 which carries storm water from Meghalaya hills also contributes to this drain in Khanapara area through box culvert.

Existing condition: The portion of the drain from its origin to the office of Directorate of Panchayat and Rural Development is kutcha. From the starting point of Juri Par Road to the Kabaristan the drain is R.C.C. After that the remaining portion of the drain is kutcha and the course is also not well defined as it passes through the nearby low laying areas to reach Silsako Bil.

The drain carries lot of silt (mainly sand Particles) during storm runoff from the hills of Khanapara and nearby Meghalaya. Deposited silt has considerably reduced the carrying capacity of the drain. Areas in Juri Par become waterlogged as a result during heavy storm. However, from the Directorate of Panchayat and Rural Development office point some of the water is proposed to be diverted through proposed new drain along Bagharbari Road. This will minimize the water logging problem in Juripar area.

Underground drain from Ambari via parts of GNB to Railway open drain at Ambari

This drain carries storm runoff from Lamb Road area, Ambari and parts of Uzan Bazar Area. This drain originates from the Lamb Road Area then meets the railway culvert below B.Baruah over bridge and finally outfalls at Borsola Lake.

Existing condition: This is an underground RCC Box drain. Flow through the drain is obstructed due to its sharp bends (almost 90 degree) near Textile Institute and Near A.G.P. office, reduction of its section at the outfall point at the railway open drain and interception at several points by Hume pipes. Moreover, the manhole openings are inadequate for manual cleaning. Because of all these factors the drain is clogged at various points in Ambari area due to deposition of wastes.

R. G. Baruah Road Drain (From Zoo Narengi Tinali to Bharalu River)

This is a RCC open drain. The origin point of this drain is at Zoo Narengi Tinali and outfall is at Bharalu primary drain. This is one of the major open secondary drains collecting storm/waste water from Guwahati Refinery, Noonmati. Bamunimaidan area through railway drain running along the railway line at Bamunimaidan, Bhaskar Nagar area and ultimately meeting it at Zoo Narengi Tinali. Water from Narikal Basti, Ambikagiri Nagar also contributes to this drain. Parts of water from Rajgarh and Chandmari area are also contributing to this drain. This drain meets Bharalu at Jonali the meeting point of Bharalu and Bahini River. The total length of the drain is 1,000 m.

Existing condition: The major reasons of ineffectiveness of this drain are: a) deposition of loose soil and silt that reduces the carrying capacity of the drain, b) HFL of the drain is higher than the surrounding area causing back flow, c) obstruction of flow at the outfall point due to silt deposition and inadequate opening of outlet and d) obstruction of flow through the drain due to construction of low level cross structures on the drain. This causes inundation in the R.G Baruah Road and adjacent localities during heavy rainfall.

Chandmari Bharalu Secondary drain (via Bhaskar Nagar, Rajgarh, Nabin Nagar, Anil Nagar)

This drain was constructed by T & CP Department and it carries water from several different locations like Part of Chandmari area, Bhaskar Nagar, Rajgarh, Nabin Nagar, part from PubSarania and Anil Nagar. The total length of this drain is **4954 m**.

Existing condition: The drain outfalls to Bharalu primary drain. A sluice gate is provided at the outfall point but it is not working for last couple of years. The manholes opening are too small for manual cleaning and their conditions are also very poor and there is no cover in some of the manholes. Following pictures show the existing condition of the manholes.

Underground drain along the boundary of Nabin Nagar and Anil Nagar to Bharalu (via Anil Nagar)

This drain carries storm runoff of Anil Nagar area. A part of drain's flow towards the Chandmari Bharalu Secondary drain and the remaining part of the drain's flow is towards the Bharalu primary drain. Total length of the drain is 1,400 m.

Existing condition: The major reason of ineffectiveness of this drain is deposition of garbage's

that reduces the carrying capacity of the drain. The manhole openings are inadequate for manual cleaning. The existing sluice gate at the outfall point of the drain to Bharalu Primary Drain is in dilapidate condition. As a result back flow from the Bharalu primary drain takes place during the peak flow condition. The present condition of the sluice gate is shown in Picture.

Photo illustration at Appendix 3.

Kumarpara Mashkhowa Area Storm Drain (Athgaon ROB to Bharalu)

The total length of this drain is 2995 m. The route of this drain is from Athgaon ROB and continues along the road towards Mashkhowa vegetable market by passing through a culvert in front of Mashkhowa Masjid and ultimately reaches the drain passing along the Idgah Maidan to reach river Bharalu.

Existing condition: The drain section is reduced considerably due to encroachment for some stretches of the drain near the vegetable wholesale market at Mashkhowa. Moreover, due to dumping of garbage, free flow of storm water is hampered considerably. The existing water supply pipes across the drain at various locations also create obstruction to the flow. The level of the adjacent KRC Road is lower than the HFL of the Bharalu primary drain.

Dr. B. Baruah to Dr. B. K. Kakati Road Drain (Underground Box Drain)

This drain starts near Indoor Stadium at the junction point of Islampur road and flows towards Ulubari Chariali via Kachari Basti and ultimately falls to the river Bharalu near the bridge of Agricultural Department Office.

Existing condition: The drain is functioning partially due to deposition of garbage and it has not been maintained over the years. Back flow from the Bharalu River takes place during the peak flow condition. However, a stretch of approximately 300m of underground box drain is connected to this drain with an intention to flash out storm water from Milanpur and Suhagpur area of Rihabari but due present condition of this drain, the purpose has not been served.

Hedyatpur Area Underground Drain

This drain was constructed by T & CP Department and it carries water from several different locations like Part of Hedyatpur area and Guwahati Club Police Point. The size of the drain is approximately 3.0m wide and 4.0m depth. This drain starts from Guwahati Club Police Point and falls at Railway open drain below Railway over bridge.

Existing condition: This is an underground RCC Box drain. Almost 75% of this drain section is filled up with silt and garbage. Manholes for maintenance of the drain are of insufficient size.

Road Side Rupnagar Area Storm Water Drain

This is an open lined drain of trapezoidal section which originates from GMCH link road and continues upto Rupnagar L.P. School. The main intention behind construction of this drain is to carry storm water from Rupnagar area and to discharge it to river Bharalu.

Existing condition: This drain is not continuous all throughout its length.

M.A. Road Drain

This is an underground box drain, starts near Arya Pathsala L.P. School, Rihabari and continues upto Bharalu River near R.C.C. Bridge at Serapbhatti along the left side of M.A. Road. There is a sluice gate at the outfall point of the drain which is in damaged condition.

Existing condition: The alignment of the drain is perfect but due to deposition of silt and garbage over a long period of time, this drain is not properly functioning. The manholes opening are too small for manual cleaning and their conditions are also very poor.

Islampur Underground Drain

This is an underground drain and the drain originates in front of Hazi Musafirkhana and terminates near Indoor Stadium in Dr. B.Baruah to Dr. B.K.Kakati Road Drain. The total length of the drain is 1316m. The width at the outfall point is 3.2m. The Drain is a combination of pipe conduit (Hume Pipe) and

R.C.C. Box drain.

Existing condition: The flow through the drain is obstructed due to deposition of garbage. The manholes opening are too small for manual cleaning and their conditions are also very poor.

Santipur Durgasarobar Area Storm Water Drain

This is a major drain which carries storm water from part of Durgasarobar locality. One part of storm water (eastern part) from Durgasarobar hill is intercepted by road side drain and continues till the R.C.C. culvert in front of MES colony. Again the other part of storm water (western part) from Durgasarobar hill is collected by Road side drain in front of Durgasarobar M.E. School and take a sharp bend to reach the same R.C.C. culvert of MES colony. Both the drains ultimately contribute to the Masjid path underground drain which outfall point is at river Bharalu via Santipur Area Underground storm water drain.

Existing condition: The flow through the drain network is obstructed due to deposition of garbage.

R.C.C. culvert in front of MES Colony is not adequate to pass the storm water. Encroachment of the drain behind M.E. School affects the smooth functioning of the drain.

Athgaon Chatribari Secondary Drain

This is a major drain having three contributory drains viz. drain from Chatribari, drain from Athgaon and drain from F.A. Road and having outfall point at river Bharalu. The length of the drain is approximately 400m and is unlined. Its size is approximately 3.0m x 3.0m.

Existing condition: The flow through this drain is obstructed to some extent due to garbage deposition. Encroachment of the drain near Athgaon Kabaristan area reduces the size of the drain. Moreover, backflows of water from the Bharalu River in to the drain particularly during the monsoon when the HFL of the River exceeds the FSL of the drain causes temporary flood and water logging to the adjoining areas of Kumarpara F.A. Road locality.

Drain from Mashkhowa vegetable market to river Brahmaputra via Idgah Maidan and Mashkhowa residential area

This is a major drain originates near vegetable market carries storm water from part of Mashkhowa residential area and out falls to river Brahmaputra through a box culvert of G.N.B. road near Poddar Tyer.

Existing condition: Although this is an important drain but due to encroachment near outlet of the drain, the present size is approximately 1m x 1m. Free flow of the drain is being hampered by deposition of garbage. During monsoon, when the water level of Brahmaputra goes above the FSL of the drain, back flow to this drain.

Lakhtokiya Chatribari Area Storm Water Drain:

The total length of this drain is 665 m. The origin point of this drain is near Fire Brigade Paltan Bazar Office and outfall point is at Sarusola Bil. The drain is lined and open up to Police Reserve where it crosses the A.T. Road through a Box Culvert and than from Himat Singh petrol pump, it is underground. Average section of the drain is 2m x 2m.

Existing condition: Underground portion of the drain has no manhole cover for which it is not cleaned from the day of its construction around 18 years ago. Moreover there is encroachment at the outfall point.

Hatigaon Channel Hatigaon Drains

This is a major drain which originates from Basistha River near Bhetapara and finally meets the same River at Dakhingaon. This drain was constructed in the year 1986-87 with an intension to relieve State Capital Dispur from temporary flood and water logging. Length of the drain is approximately 5051 m.

Existing condition: Originally this drain section was Kutcha. But recently, WRD Department, Assam has taken up the task of lining the entire stretch of the drain in order to provide smooth flow through the drain. During monsoon, when the water level of this drain goes up, back flow from this drain to the connected drains is observed.

Bishnupur Area Storm Water Drain

The condition of Bishnupur area underground drain is not very good, lots of garbage points has been noticed beside the drain. The origin point of this drain is at Bishnupur Bharalu Bridge that outfall at Mora Bharalu River. The total length was 929 m. This is totally a pipe drain.

Drain from G.S. Road to Bahini

This is an important drain carrying storm water from Ganeshguri Chariali, and Christian Basti area to Bahini River. This is an open drain having starting point near Silkaloya, Christian Basti. Approximate length of the drain is 200m

Existing condition: This is a lined drain. Deposition of silt and garbage has reduced the carrying capacity of the drain.

Tokobari Area Underground Drain

This is an underground drain constructed by T& CP department to carry storm water from parts of Paltan Bazar and Tokobari area. Approximate length of the drain is 1.5 Km having section 2m x 2m.

Existing condition: Sizes of manhole covers of the drain are insufficient as a result the efficiency of the drain has been reduced by deposited garbage.

Underground drain through Ajanta Path Beltola to Hatigaon Channel

The drain was constructed to carry storm water from Ajanta path area locality to Hatigaon Channel. Approximate length of the drain is 1.6 Km having section 2m x 2m.

Existing condition: Sizes of manhole covers of the drain are insufficient making it difficult to remove deposited garbage.

Drain from Japorigag to Bahini near Ganeshguri

The drain originates from foothills of Japorigog hill and than carrying storm water from Japorigog, Mikir Gaon, Lakshmi Gaon falls at Bahini River behind office of the Urban Water Supply. Approximate length of the drain is 1.5 Km having section 1.5m x 2m. The drain is lined and rectangular in shape.

Existing condition: The drain is almost filled up with deposited silt and garbage.

Photo illustration at Appendix-3

Appendix 3: Photos of Existing Systems



Bharalu River

Pic:Unlined Bharolu river



Pic: Confluence of Morabharalu and Bashishta Drain



Pic: Junction of Bharalu River & Mora Bharalu



Lachit Nagar Area Storm Drain



Pic: Sluice gates at Lachit Nagar



Pic : Borsola Lake



Pic: Anil Nagar drainage pumping arrangements (drainage)



Pic: Anil Nagar Drainage pumping arrangements including sluice gate



Existing Drainage Pumping station near Pragjyotish College on Bharalu River



Outfall of Existing Drainage Pumping station near Pragjyotish College discharging to Bharalu River



Sluice Gate (5 Nos. shutters) of existing drainage pumping station (Downstream of river Bharalu)



Proposed location of the New Drainage Pumping Station



Proposed location of Sluice gate near Bharalu Mukh



Confluence of Bharalu River & River Brahamaputra



Bahralu River under Railway track

Appendix 4: Photos of the Project Locations



Photo 1: Basistha disposal site



Photo 2: Basistha disposal site



Photo 3: Adabari disposal site



Photo 4: Adabari disposal site



Photo 5: Access road to Basistha disposal site



Photo 6: Access road to Adabari disposal site

Appendix 5: Rapid Environmental Assessment Checklist

Screening Questions	Yes	No	Remarks
a. Project siting Is the project area			
▪ Densely populated?	✓		Built-up area in Guwahati accounts for about 50% of the land. The project will cover South Guwahati's East Zone (total area of 71 km ²) which have a 0.202 million population in 2001 and projected population of 0.64 million by 2040. This translates to a population density of 2,845 inhabitants per square kilometer in 2001. Dibrugarh is an emerging town and population distribution shows DMB area is densely populated. According to the 2011 census Dibrugarh has a population of 1,327,748 and a population density of 393 inhabitants per square kilometer.
▪ Heavy with development activities?		✓	Guwahati is predominantly residential, commercial, and public and semi-public areas as per the Land Use Zoning Plan 2025 of GMDA. Dibrugarh has tea processing industries, rice, saw mills and other light manufacturing industries.
▪ Adjacent to or within any environmentally sensitive areas?		✓	
• Cultural heritage site		✓	
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
b. Potential environmental impacts will the project cause...			
• Encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		✓	Not applicable.
• Encroachment on precious ecology (e.g. sensitive or protected areas)?		✓	Not applicable.
• Alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?		✓	Not anticipated.
• Deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	✓		Run-off during construction will be more. Anticipated during construction activities. The impacts are negative but temporary, short-term, site-specific and not significant within a relatively small area and reversible through mitigation measures specified in the EMP. Construction contractors will be prohibited from stockpiling loose materials along drain channels and will be required to immediately dispose any waste materials.

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> Increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing? 	✓		Anticipated during construction activities. The impacts are negative but temporary, short-term, site-specific and not significant within a relatively small area and reversible through mitigation measures specified in the EMP. Construction contractors will be prohibited from stockpiling loose materials along drain channels and will be required to immediately dispose any waste materials.
<ul style="list-style-type: none"> Risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation? 		✓	Not applicable. Construction will not involve use explosives and chemicals. Excavation will be done manually. Construction contractors will be required to implement health and safety (H&S) plan.
<ul style="list-style-type: none"> Noise and vibration due to blasting and other civil works? 	✓		Blasting activities is not anticipated. However, noise due to other civil works is anticipated during construction activities. The impacts are negative but temporary, short-term, site-specific and not significant within a relatively small area and reversible through mitigation measures specified in the EMP.
<ul style="list-style-type: none"> Dislocation or involuntary resettlement of people? 		✓	Dislocation is not anticipated. However, during pipe-laying work, temporary economic displacement is anticipated. An RP has been prepared to mitigate these temporary impacts.
<ul style="list-style-type: none"> Dislocation and compulsory resettlement of people living in right-of-way? 		✓	Dislocation is not anticipated. However, during pipe-laying work, temporary economic displacement is anticipated. An RP has been prepared to mitigate these temporary impacts.
<ul style="list-style-type: none"> Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups? 		✓	Not applicable. The subproject will not affect indigenous peoples or other vulnerable group. The subproject will be beneficial to women and children as flooding will be reduced resulting to reduction of household healthcare cost, person-days lost, and temporary resettlement due to flooding and water logging problems.
<ul style="list-style-type: none"> Other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress? 		✓	Not applicable.
<ul style="list-style-type: none"> Hazardous driving conditions where construction interferes with pre-existing roads? 	✓		Construction contractors will be required to implement traffic management plan and coordinate with local authority.
<ul style="list-style-type: none"> Poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI and HIV/AIDS) from workers to local populations? 		✓	Construction contractors will be required to provide sanitation facilities and ensure proper waste management at all times. Contracts will include provisions on STI and HIV/AIDS.
<ul style="list-style-type: none"> Creation of temporary breeding habitats for diseases such as 		✓	Construction contractors will be required to ensure cleanliness at all times to prevent breeding of mosquitoes and rodents.

Screening Questions	Yes	No	Remarks
those transmitted by mosquitoes and rodents?			
<ul style="list-style-type: none"> Accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials? 		✓	Not applicable.
<ul style="list-style-type: none"> Increased noise and air pollution resulting from traffic volume? 		✓	Not anticipated. For noise and dust coming from construction activities, these impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Construction contractors will be required to coordinate with the local traffic police.
<ul style="list-style-type: none"> Increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road? 		✓	Not anticipated.
<ul style="list-style-type: none"> Social conflicts if workers from other regions or countries are hired? 		✓	Priority in employment will be given to local residents.
<ul style="list-style-type: none"> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		✓	Improved management systems through capacity building and institutional development will ensure reduced burden on services and infrastructure. Construction contractors will be required to provide workers camp with water supply and sanitation. DMB will provide manpower to operate the improved system.
<ul style="list-style-type: none"> Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction? 		✓	Not applicable. Construction will not involve use of explosives and chemicals.
<ul style="list-style-type: none"> Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? 		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

Climate change and disaster risk questions	Yes	No	Remarks
The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks			
<ul style="list-style-type: none"> Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes? 	✓		Project location may experience flooding during high rain season.

▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?		✓	No
▪ Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		✓	No
▪ Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		✓	No

Appendix 6: Semi-Annual Environmental Monitoring Report Format (Operation and Maintenance of Guwahati Drainage)

INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number	Roles
1. PMU				
2. PIUs				
3. Consultants				

- Overall project and sub-project progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Contract Status (specify if under bidding or contract awarded)	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M) ¹⁰	If On-going Construction	
				%Physical Progress	Expected Completion Date

¹⁰ If on-going construction, include %physical progress and expected date of completion

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COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS¹¹

Package No.	Subproject Name	Statutory Environmental Requirements ¹²	Status of Compliance ¹³	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish ¹⁴

COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise IEE Documentation Status

Package Number	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
	Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

¹¹ All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the “remarks” column.

¹² Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

¹³ Specify if obtained, submitted and awaiting approval, application not yet submitted

¹⁴ Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.

Package-wise Contractor/s' Nodal Persons for Environmental Safeguards

Package Name	Contractor	Nodal Person	Email Address	Contact Number

- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

Summary of Environmental Monitoring Activities (for the Reporting Period)¹⁵

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

¹⁵ Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with CEMP/ EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

- Briefly describe the approach and methodology used for environmental monitoring of each sub-project.

MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

- Discuss the general condition of surroundings at the project site, with consideration of the following, whichever are applicable:
 - Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
 - Identify if muddy water is escaping site boundaries or if muddy tracks are seen on adjacent roads.
 - Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these are intact following heavy rain;
 - Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area in the Appendix.
 - Confirm spill kits on site and site procedure for handling emergencies.
 - Identify any chemical stored on site and provide information on storage condition. Attach photograph.
 - Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
 - Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
 - Provide information on barricades, signages, and on-site boards. Provide photographs in the Appendix.
 - Indicate if there are any activities being under taken out of working hours and how that is being managed.
- Briefly discuss the basis for environmental parameters monitoring.
- Indicate type of environmental parameters to be monitored and identify the location.
- Indicate the method of monitoring and equipment used.
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements.

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 µg/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/l	TSS mg/l	TN mg/l	TP mg/l

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity µS/cm	BOD mg/l	TSS mg/l	TN mg/l	TP mg/l

Noise Quality Results

Site No.	Date of Testing	Site Location	L _{Aeq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	L _{Aeq} (dBA) (Monitoring Results)	
			Day Time	Night Time

GRIEVANCE REDRESS MECHANISM

- Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).

COMPLAINTS RECEIVED DURING THE REPORTING PERIOD

- Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.

APPENDIXES

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors
- Others

Appendix 7: Sample Grievance Registration Form

(To be available in Hindi, Assamese or any other local languages, if any)

The AUJIP welcomes complaints, suggestions, queries and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing **(CONFIDENTIAL)** above your name. Thank you.

Date		Place of registration			
Contact Information/Personal Details					
Name		Gender	<input type="checkbox"/> Male <input type="checkbox"/> Female	Age	
Home Address					
Village / Town					
District					
Phone no.					
E-mail					
Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of Official registering grievance)	
If ver: <input type="checkbox"/> Note/Letter <input type="checkbox"/> E-mail <input type="checkbox"/> Verbal/Telephonic	
Reviewed by: (Names/Positions of Official(s) reviewing grievance)	
Action Taken:	
Whether Action Taken Disclosed:	<input type="checkbox"/> Yes <input type="checkbox"/> No
Means of Disclosure:	

Appendix 8: Public Consultation Details

Consultation: 1

Subproject: Procurement of Machinery, Equipment and Transport Vehicles for cleaning of the existing drainage system., Guwahati

- Stagnation of drainage water at the locality - due to non-clearance of drain
- Flooding of the area- whether due to heavy rain frequency or restriction of flow
- Status of drain - covered or uncovered? What's their requirement
- Practice for disposal of solid waste in the drain or not
- Whether they have combine dry weather and storm water flow? or separate sewage collection system
- Possibility of impact on public movement during O&M phases - What's their requirement?
- Problem associated with odor
- Views on minor disturbances - air & noise pollution during O&M
- Forest or restricted area nearby the project area

Area: Basistha, Guwahati

Date and time: 17.10.16 from 12.00PM

Table 1. Issues of the Public Consultation

S. No.	Key Issues/demands	Perception of Community	Action to be taken
1	Stagnation of drainage water at the locality.	Yes, there is stagnation of water due to partial non clearance of the drains.	The people wants regular cleaning of the drains.
2	Flooding of the area.	Flooding is caused during due to heavy rain.	Immediate flushing out of stagnated water from the area.
3	Status of drain	The road side drains are covered, the main water flowing channels are open.	The uncovered drains of the locality should be covered.
4	Practice for disposal of solid waste.	Generally, the solid wastes are disposed in municipal dust bins however sometimes it has been observed that the general mass throws away solid wastes in non-designated areas as well.	Mass awareness programme should be conducted by NGOs in this respect
5	Whether they have combine dry weather and storm water flow?	Yes it is a combined flow one.	There should be separate channel for sewage disposal and treatment.
6	Possibility of impact on public movement during O&M phase.	During de-siltation phase there will be some temporary impact as perceived by the people.	EMP shall be applied during the de-siltation period.

7	Problem associated with Odor	Yes, low to moderate smell occurs sometimes after the flood.	The odor problem will not be there when there is no stagnation.
8	Views on minor disturbances - air & noise pollution during O&M	The people of the locality states that there will be some problem due to noise and air pollution during de-siltation.	The people of the locality requested to look into the matter and apply EMP strictly.
9	Forest or restricted area nearby the project area	No forest area or restricted area are involved in the project.	None.

Attendance Sheet

ATTENDANCE SHEET FOR PUBLIC CONSULTATION
ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM (AUIIP)

Name of the Sub-project:

District: KAMRUP

Date: 17/10/16








Time: 12:00 pm

Venue/Area: Basistha Land fill area

Total Participants - Male: 8

Female: 0

Total: 8

SN	Name	Sex (M/F)	Occupation	Social Category 1. SC 2. St 3. OBC 4. Gen 5. Other	Signature	Address (Ph no.)
1	P. Medhi	M	Supervisor Contractor	4		7896547503
2	Schiram Rohan	M	office boy circle office	1		8011958202
3	HONDER SINGH TERANG	M	office boy circle office	4		8486717932
5	BARUN PITUKAN	M	Basistha circle office	4		7399668307
6	Dhirej Das	M	Basistha circle office	4		848645279
7	Moommoon Talukdar	M	Service (WRO)	4		9859094749
8	Chousahaj Turung	M	Service	2		9954274220
9						

N.B All persons are the residents of Basistha area.

Summary of outcome: Local people are very much interested in the proposed project. They requested to complete the project as early as possible. All sorts of co-operation are expected from local residents. During dumping, there is necessity to apply mitigation measures as per the Environment Management Plan.

Consultation-2

Subproject: Procurement of Machinery, Equipment and Transport Vehicles for cleaning of the existing drainage system., Guwahati

- Stagnation of drainage water at the locality - due to non-clearance of drain
- Flooding of the area- whether due to heavy rain frequency or restriction of flow
- Status of drain - covered or uncovered? What's their requirement.
- Practice for disposal of solid waste in the drain or not
- Whether they have combine dry weather and storm water flow? or separate sewage collection system
- Possibility of impact on public movement during O&M phase – What's their requirement?
- Problem associated with odor
- Views on minor disturbances - air & noise pollution during O&M
- Forest or restricted area nearby the project area

Area : Anandanagar, Adabari

Date and time : 17. 10.2016 from 1.15 PM

Table: Issues of the Public Consultation

S. No.	Key Issues/demands	Perception of Community	Action to be taken
1	Stagnation of drainage water at the locality.	Yes, there is stagnation of water due to partial non clearance of the drains.	The people wants regular cleaning of the drains.
2	Flooding of the area.	Flooding is caused during due to heavy rain.	Immediate flushing out of stagnated water from the area.
3	Status of drain	The road side drains are covered, the main water flowing channels are open.	The uncovered drains of the locality should be covered.
4	Practice for disposal of solid waste.	Generally the solid wastes are disposed in municipal dust bins however sometimes it has been observed that the general mass throws away solid wastes in non-designated areas as well.	Mass awareness programme should be conducted by NGOs in this respect

5	Whether they have combine dry weather and storm water flow?	Yes it is a combined flow one.	There should be separate channel for sewage disposal and treatment.
6	Possibility of impact on public movement during O&M phase .	During de-siltation phase there will be some temporary impact as perceived by the people.	EMP shall be applied during the de-siltation period.
7	Problem associated with Odor	Yes, low to moderate smell occurs some times after the flood.	The odor problem will not be there when there is no stagnation.
8	Views on minor disturbances - air & noise pollution during O&M	The people of the locality states that there will be some problem due to noise and air pollution during de-siltation.	The people of the locality requested to look into the matter and apply EMP strictly.
9	Forest or restricted area nearby the project area	No forest area or restricted area are involved in the project.	None.

Attendance Sheet

ATTENDANCE SHEET FOR PUBLIC CONSULTATION
ASSAM URBAN INFRASTRUCTURE INVESTMENT PROGRAM (AUIIP)

Name of the Sub-project _____

District: **KAMRUP** Date: **17/10/16** Time: **1:15 pm**

Venue/Area: **ADABARI Bus Stand / ANANDANAGAR**

Total Participants – Male: **8** Female: **1** Total: **9**

SN	Name	Sex (M/F)	Occupation	Social Category 1. SC 2. St 3. OBC 4. Gen 5. Other	Signature	Address (Ph no.)
1	Ujjal Begari	M	Business	4	Ujjal Begari	7896731232
2	Sadham Hussain	M	Business	4	Md Assad	NA
3	Md. ARSAD	M		4	Sadham	
5	ABDUL HADQUE	M	Ten stall	4	Abdul Hadque	9085735881
6	YAKUB ALI	M	Rtd Railway Employee	5	Yakub Ali	—
7	Zahid Ali	M	Business	4	Zahid Ali	7664085167
8	Zul Hussain Ali	M	Shop owner	4	✓	—NA
9	Saheida Begum	F	M/W.	4	✓	—NA

N.B All persons are the residents of Anandanagar, Adabari area.

Summary of outcome: Local people are very much interested in the proposed project. They requested to complete the project as early as possible. All sorts of co-operation are expected from local residents. During dumping, there is necessity to apply mitigation measures as per the Environment Management Plan.

Photo Illustration of Public Consultation



APPENDIX 9: RECOMMENDED CONTRACT CLAUSES FOR THE O&M CONTRACTORS

1. Sources of Materials (fuel/oil etc.)

- (i) Use material sources permitted by government;
- (ii) Verify suitability of all material sources and obtain approval of Design Management and Supervision Consultant (DMSC); and
- (iii) Submit to DMSC on a monthly basis documentation of sources of materials.

2. Air Quality.

- (i) Prevent/minimize dust generation by removing the silt/ loose soil immediately from the site;
- (ii) Consult with DMSC on the designated areas for stockpiling of dredged materials;
- (iii) Excavate the foundations at the same time as the access roads (if needed) are built so that dug material is used immediately, avoiding the need to stockpile on site;
- (iv) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (v) Use tarpaulins/ covered vehicle to cover dredged materials when transported; and
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.

3. Surface Water Quality

- (i) Avoid excavation activities during monsoon. Ensure that works complete before onset of monsoon
- (ii) Minimize on-site storage of silt/ loose soil
- (iii) Avoid stockpiling of silt/ loose soil especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (iv) Consult with DMSC on designated disposal areas for disposal of excess silt/ loose soil;
- (v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (vi) Dispose any wastes generated by O&M activities in designated sites; and
- (vii) Conduct surface water quality inspection according to the Environmental Management Plan (EMP).

4. Noise Levels.

- (i) Plan activities in consultation with DMSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (iii) Minimize noise from O&M equipments by using vehicle silencers, noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
- (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.
- (v) Existing Infrastructure and Facilities.

- (vi) Obtain from DMSC the list of affected utilities and operators;
- (vii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services

5. Landscape and Aesthetics.

- (i) Prepare and implement Dredged Materials Management List;
- (ii) Avoid stockpiling of excess excavated silt/ loose soil;
- (iii) Coordinate with GMC for beneficial uses of excess excavated silt/ loose soil or immediately dispose to designated areas;
- (iv) Recover used oil and lubricants and reuse or remove from the sites;
- (v) Manage solid waste in O&M work camps according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vi) Request DMSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

6. Accessibility.

- (i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (ii) Schedule transport and hauling activities during non-peak hours;
- (iii) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (iv) Keep the site free from all unnecessary obstructions;
- (v) Drive vehicles in a considerate manner;
- (vi) Coordinate with Guwahati Police Traffic Department for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and
- (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of O&M works and contact numbers for concerns/complaints.

7. Socio-Economic – Income.

- (i) Leave spaces for access between mounds of silt/ loose soil;
- (ii) Provide walkways and metal sheets where required to maintain access across for people and vehicles;
- (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;
- (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and
- (v) Provide sign boards for pedestrians to inform nature and duration of O&M works and contact numbers for concerns/complaints.

8. Socio-Economic – Employment.

- (i) Employ majority of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) If available, secure O&M materials from local market.

9. Occupational Health and Safety.

- (i) Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (iii) Provide medical insurance coverage for workers;
- (iv) Secure all installations from unauthorized intrusion and accident risks;
- (v) Provide supplies of potable drinking water;
- (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (x) Ensure moving equipment is outfitted with audible back-up alarms;
- (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
- (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced activity.

10. Community Health and Safety.

- (i) Plan routes to avoid times of peak-pedestrian activities.
- (ii) Liaise with DMSC in identifying risk areas on route cards/maps.
- (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- (iv) Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road.

11. Work Camps (if needed).

- Consult with DMSC before locating project offices and sheds;
- Minimize removal of vegetation and disallow cutting of trees;
- Provide water and sanitation facilities for employees;
- Prohibit employees from cutting of trees for firewood;
- Train employees in the storage and handling of materials which can potentially cause soil contamination;
- Recover used oil and lubricants and reuse or remove from the site;
- Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- Remove all wreckage, rubbish, or temporary structures which are no longer required; and

- Request DMSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

12. Social and Cultural Resources.

- Stop work immediately to allow further investigation if any finds are suspected
- Inform DMSC if a find is suspected, and take any action they require ensuring its removal or protection in situ
- Request DMSC or any authorized person with archaeological/historical field training to observe excavation

APPENDIX 10: NOC FROM GMC FOR USE OF DISPOSAL SITES



OFFICE OF THE GUWAHATI MUNICIPAL CORPORATION
Garage Branch :: Dr. B. Baruah Road :: Ulubari :: Guwahati-7

No: GGR/57/2000-01/Pt-I/ 11 & 7

Date: 18-10-16

No Objection certificate

This is to certify that excavated earth/silt from the de-siltation works of Guwahati City will be disposed at the place shown below:

Sl. No.	Name of Place	Area available	Remarks
1	Proposed Garage Campus at Basistha	9,350.00 Sqm	2.00 mtr depth of fill
2	Vacant low lying place at Adabari Bus Station	40,074.00 Sqm	2.5 mtr depth of fill



[Signature]
 18/10/16
 Engineer in Charge
 Garage Branch, GMC

APPENDIX 11: ENVIRONMENTAL MONITORING AND EVALUATION (MONTHLY)

SECTOR:
MONTH/YEAR:
PROJECT (PACKAGE): LOAN NO.
WORKING LOCATION:
DATE OF OBSERVATION:
NAME OF THE MONITORING PERSON FROM DMSC (DESIGNATION):

S. No.	Environmental Issues	Level of Application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
1. Mitigation/protection of Land Environment							
1a	Proper storage of dredging materials and petroleum products – avoidance of land pollution						
1b	Site stability particularly near slope and slide prone area						
2. Mitigation/protection of Air Environment							
2a	Water sprinkling at O&M site for arresting dust (if any during dry period)						
2b	Cover or damp down sand stockpiled at site						
2c	Covering of materials carrying vehicles-reducing dust hazard						

S. No.	Environmental Issues	Level of Application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
2d	Vehicles and Equipments having Pollution Under Control Certificate						
3. Mitigation of Noise							
3a.	Regular maintenance of noise producing equipment						
3b.	At sensitive locations enclosures provided around generator set and other noise producing machinery						
3c.	Use of ear plug by the workers at noise generating location						
4. Mitigation/protection of Water Environment							
4a.	Protection of water bodies nearby the project site by application of suitable mitigation measures- not to discharge waste water in nearby water body						
5. Mitigation/protection of Biological Environment							
5a.	Plant and maintain three trees for every one removed- in case of tree felling (if any)						
6. Mitigation of Socio-economic Environment							

S. No.	Environmental Issues	Level of Application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
6a.	Level of mitigation measures for local people- placement of caution tape and barricade at excavated area						
6b.	Avoidance of pick traffic hour and festive season for carrying of materials like pipe						
6c.	Arrangement of employment at least 50% of workforce from communities near sites						
7. Mitigation of overall environment, safety and health							
7a.	Use of Personal Protective Equipment like helmet, gumboot, gloves, nose mask, safety belt and earplugs at working place						
7b.	Use of safety net at tank site						
7c.	Arrangement of proper staircase for movement of labour						
7d.	Labour camps with proper sanitation, water supply and solid waste management facility						

S. No.	Environmental Issues	Level of Application of EMP					Suggestion/Remarks
		Poor	Below Satisfactory	Partially satisfactory	Satisfactory	Excellent	
7e.	Arrangement of First Aid box and fire extinguisher at Labour camp and site office and First Aid box at all working sites						
7f.	Use of modern vehicles and machinery and maintain as specified						
7g.	Placement of public information board with mention of safety requirement at working places						
7h.	Use of covered, leak proof vehicle for transportation of silt/ loose soil to disposal sites						
8. Mitigation of Sensitive environment							
8a.	Level of protection at religious, cultural and historic sites if any nearby						
8b.	Maintaining working schedule by avoiding sensitive time						

APPENDIX 12: MINUTES OF MEETINGS WITH PCBA



Pollution Control Board, Assam

(Department of Environment & Forests : : Government of Assam)

অসম প্ৰদূষণ নিয়ন্ত্ৰণ পৰিষদ

(অসম চৰকাৰৰ বন আৰু পৰিৱেশ বিভাগ)

(An ISO 9001:2008 & BS OHSAS 18001:2007 Certified Organisation)

MINUTES OF THE MEETING HELD ON 3rd NOVEMBER, 2016 AT THE OFFICE CHAMBER OF THE MEMBER SECRETARY, POLLUTION CONTROL BOARD ASSAM

The officials present: Following officials from Pollution Control Board, Assam and Assam Urban Infrastructure Investment Program, Govt. Of Assam attended the meeting:

1. Sri B.K. Baruah, Member Secretary, PCBA.
2. Sri M.M.I. Borah, PM, AUUIP.
3. Sri C. Bhadury, S&CO., AUUIP.
4. Sri Anirban Das, Sr. Env. Engineer, PCBA.
5. Sri Gokul Bhuyan, Sr. Env. Engineer, PCBA.
6. Sri Kulen Talukdar, Env. Engineer, PCBA.

After threadbare discussion regarding disposal of loose soil and silt from the dredging activities of the rivers and drains of Guwahati, at Basisiha and behind Adabari Bus stand Maligaon (designated sites), it is resolved that the loose soil and silt may be disposed in these two sites since no municipal solid waste and hazardous waste, which attracts Municipal Solid Waste (Management and Handling) Rule, 2000 as well as Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 are disposed in these rivers and drains.

(B.K. Baruah)

(M.M.I. Borah)

(C. Bhadury)

(Anirban Das)

(Gokul Bhuyan)

(Kulen Talukdar)



APPENDIX 13: ENVIRONMENTAL MONITORING AND EVALUATION (DAILY)

AUIIP ENVIRONMENTAL MONITORING AND EVALUATION DAILY REPORT FORMAT Daily observation Table – Environmental Safeguard Package: _____ For the Month of _____																																
Sr.No	ISSUES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Use of display board at site																															
2	Use of caution tape, board and board at excavated site																															
3	Use of PPE like helmet, gumboot, gloves, nose mask, safety belt by labourer																															
4	Sprinkling of water (no of times/ volume) as per requirement																															
5	Waste disposal from construction site																															
6	Slope protection at slide prone area																															
7	Availability of First Aid Box at site																															
8	Non engagement of labour less than 18 yrs age																															
Signature of HSE Officer of Contractor																																
Compliance should be drawn after visiting maximum location Observation by concerned contractor Yes- Done, No- Not Done, NR- Not required, (Reason in short in case of not done), PC- Partialy Completed, NA-Not applicable Blank space indicates NO WORK IN PROGRESS																																
(Name & Signature of HSE Officer of Contractor)																																
Verification with Date along with non compliance, if any																																
(Name & Signature of Environment Specialist of DMSC)																																
(Name and Signature of Environment Officer of PIU/PMU)																																