

# Initial Environmental Examination

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**IND: Assam Urban Infrastructure Investment  
Program – Project 1: Guwahati Water Supply  
Subproject  
Construction of Water Storage Reservoir and Water  
Transmission Pipelines and Allied Works at Guwahati**

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

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

# Preface

During June 2011 ADB TA team finalized draft Initial Environmental Examination (IEE) Report for Guwahati water supply project covering water intake, water treatment plant, water reservoir, water transmission and distribution for Tranche 1 loan processing.

That Report was already disclosed.

Later, it was decided to consider intake, water treatment plant, raw water transmission and distribution under Tranche 2 funding and at the same time few locations of water storage reservoirs changed and accordingly route for transmission main also changed.

This is updated and revised Initial Environmental Examination report for Tranche 1 water supply subproject for Guwahati covering only Construction of Water Storage Reservoir and water Transmission pipelines and Allied works at Guwahati. Presently, both the subprojects under implementation

## WEIGHTS AND MEASURES

cm	-	centimeter
dbA	-	decibels
dia.	-	diameter
ha	-	Hectare
kg	-	kilogram
km	-	kilometer
l	-	liter
m	-	Meter
m <sup>2</sup>	-	square meter
m <sup>3</sup>	-	cubic meter
mg/l	-	Milligrams per liter
ml	-	milliliter
MLD	-	million liters per day
mm	-	millimeter
sq. km.	-	square kilometers
sq. m.	-	square meters
µg/m <sup>3</sup>	-	micrograms per cubic meter

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## ABBREVIATIONS

ADB	-	Asian Development Bank
CTO	-	Consent to Operate
DSC	-	Design and Supervision Consultant
EARF	-	Environmental Assessment and Review Framework
EMP	-	Environmental Management Plan
GDD	-	Guwahati Development Department
GRM	-	Grievance Redress Mechanism
IEE	-	Initial Environmental Examination
MFF	-	Multi tranche Financing Facility
PIU	-	Project Implementation Unit
SPS	-	Safeguards Policy Statement
UDD	-	Urban Development Department

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## EXECUTIVE SUMMARY

1. The Assam Urban Infrastructure Investment Program is a key urban infrastructure initiative of the Government of Assam (GoA), 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 drainage infrastructure. The Program uses a Multi-tranche 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, sewerage, and transportation while for Dibrugarh included drainage and solid waste management.
2. The major outputs of the Program include: (i) for Guwahati, improved water supply, and sanitation, and ii) for Dibrugarh, improved drainage, and comprehensive Solid Waste Management (SWM).
3. The Government of Assam's Guwahati Development Department (GDD) 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 set up in Guwahati and Dibrugarh. The PIUs headed by a senior technical officer and assisted by qualified and experienced officers seconded from ULBs, finance and other line departments. The PIUs responsible for the day-to-day activities of project implementation in the field and 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 Project Management Consultant Safeguards Specialist (PMC 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)/Environmental Management Plan (EMP) and the Resettlement Plan (RP) respectively. An Environment Specialist as part of the Design and Supervision Consultant (DSC) team is to assist the PIUs in updating the IEE during detailed design stage and monitoring of the subproject's EMP during the construction 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 a MFF modality.
6. The overall investments for the proposed subproject in Guwahati will be aimed at providing improved quality and regular 24 hours a day water supply to about 5,10,000 residents in the south-eastern zone of Guwahati by 2030<sup>1</sup>. This will involve 1) Expanding water production capacity through water intake works, 98 million liters per day (MLD) water treatment plant, clear water pumping and primary transmission mains, new distribution

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<sup>1</sup> The Guwahati water supply sub project ensures piped water supply 24 hours a day for nearly 5,10,000 people (by 2030) who presently depend on bore wells and water tankers which would adversely impact the ground water table in the long run and cause negative impacts on the micro-climate of the city. The assured piped water supply to individual houses when the project is completed will reduce wastage of water and transportation of water by tankers and indirectly help climate change in a positive way.

systems, six water storage reservoirs, and machinery; and installing bulk and consumer meters.<sup>2</sup> Installation of 100% new distribution pipes; limiting NRW to 15% as per the Ministry of Urban Development's (MOUD's) benchmark of 15% and the move from flat to volumetric rate tariffs will result in effective demand management and water conservation. The infrastructure improvements will be supported by awareness campaigns to promote water conservation, sustainability and cost recovery objectives.

7. Under Project 1, one of the sub project is planned as "construction of water storage reservoir for supply of drinking water and construction of Transmission of water supply pipelines in Guwahati". At present sub projects are under implementation.

8. This Initial Environmental Examination (IEE) is prepared for the said subproject. This is updated IEE depicts some changes in project locations. Construction work was already commenced and likely to be completed by 2017.

9. The subproject sites are located in existing government-owned land. NOC and permission from the Govt. department will be required for construction of storage reservoir. Process has been initiated for handing over the land to Executing Agency.

10. The process described in this document has assessed the environmental impacts of the said Guwahati Water Supply Project part. Potential negative impacts were identified during construction and operation 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) locating all facilities on government-owned land to avoid the need for land acquisition<sup>3</sup>. Regardless of these actions, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of (i) the excavation of earth and (ii) transportation of the same along high traffic roads of the city to the disposal site.

12. During the construction phase, impacts mainly arise from (i) need to dispose significant quantities of waste soil and import a similar amount of sand to support the construction works and (ii) from disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction 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 construction methods will be employed.

13. 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 construction 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.

14. Once the system is operating, most facilities will operate with routine maintenance,

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<sup>2</sup> The installation of meters in the project area will facilitate the move from the current flat rate to volumetric tariffs for water supply.

<sup>3</sup> A Resettlement Plan has been prepared in accordance with Government of India laws and ADB SPS for lands to be acquired from private owners and temporary relocations during construction

which should not affect the environment. Leaks in the reservoir and in associated pipelines will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be infrequent, affecting small areas only.

15. An Environmental Management Plan (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.

16. Mitigation will be assured by a program of environmental monitoring to be conducted during construction 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.

17. The stakeholders were involved in developing the IEE through discussions on-site and public consultation after which views expressed were 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.

18. The most noticeable long-term benefits due to the subproject are: (i) increased access to treated water supply; (ii) reduction in time and cost of collecting water; and (iii) reduction in vulnerability to water borne diseases.

19. Therefore the proposed Guwahati Water Supply subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, 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.

20. 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 (EIA) needs to be undertaken to comply with ADB SPS (2009).



## I. INTRODUCTION

### A. Overview

21. The Assam Urban Infrastructure Investment Program (AUIIP) is a key urban infrastructure initiative of the Government of Assam (GoA), 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, and solid waste management (SWM), drainage infrastructure. The Program uses a Multi-tranche 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 while for Dibrugarh included drainage, solid waste management and basic services for the poor were identified.

22. One of the major outputs of the Program is improvement of water supply system in Guwahati.

23. 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.

24. ADB classified the Project as environment Category B and accordingly initial environmental examination (IEE) is required for all subprojects. This IEE is prepared for Guwahati Water Supply Subproject "Construction of Water storage reservoir at 6 locations and laying of approx. 24.28 km treated water transmission pipelines and allied works in Guwahati" Construction work is already started in the year 2014 and to be completed in 36 months.

### B. Environmental Compliance Requirements

#### 1. ADB Policy

25. 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.

26. **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 impacts. 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.

27. **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.

28. **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.

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

## 2. Applicable Legislations

30. The implementation of the subprojects will be governed by GoI 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 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) Central Pollution Control Board (CPCB) Environmental Standards;
- (v) 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.
- (vi) Forest (Conservation) Act of 1980, its Rules and amendments;
- (vii) Assam Forest Regulation of 1891;

- (viii) Assam Forest Policy of 2004;
- (ix) The Assam Ancient Monuments and Records Act 1959; and Rules 1964
- (x) The Ancient Monuments and Archaeological Sites and Remains Act, 1958
- (xi) The Ancient Monuments And Archaeological Sites Remains (Amendment and Validation) Act, 2010
- (xii) Land Acquisition Act of 1894 and as amended in 1985.
- (xiii) Master Plan Guwahati Metropolitan Area -2025

31. The GoI 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.

### **3. Environmental Assessment Requirements**

32. The GoI 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 "construction of reservoirs and laying of transmission water mains" are 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.

### **4. National Legal Requirements**

33. **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:

- Municipal solid waste management facilities;
- New or augmentation of water treatment plants;
- New or augmentation of sewage treatment plants

34. For the said sub project- construction of water storage reservoir and laying of water transmission mains no CFE and CFO is required.

35. **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.

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

36. **Forest Legislations.** Gol and GoA 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 lands<sup>4</sup>. According to the Act, GoA requires a Forest Clearance from Gol MoEF for use of a forest land 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.

37. 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.

38. 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.

39. **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.

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

41. The District Collector or any other officer designated will function as the Land

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<sup>4</sup> 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.

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.

42. There is no requirement for acquisition of land for laying of pipelines and construction of reservoirs. 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.

## **5. Applicable International Environmental Agreements**

43. In addition, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN)<sup>5</sup>, Convention on Migratory Species of Wild Animals (CMS)<sup>6</sup>, and Ramsar Convention on Wetlands of International Importance<sup>7</sup> are applicable for selection and screening of subprojects under restricted/sensitive areas. India is a party to these conventions.

44. 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 Deeporbeel, 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 SUBPROJECT**

### **A. Need for the Subproject**

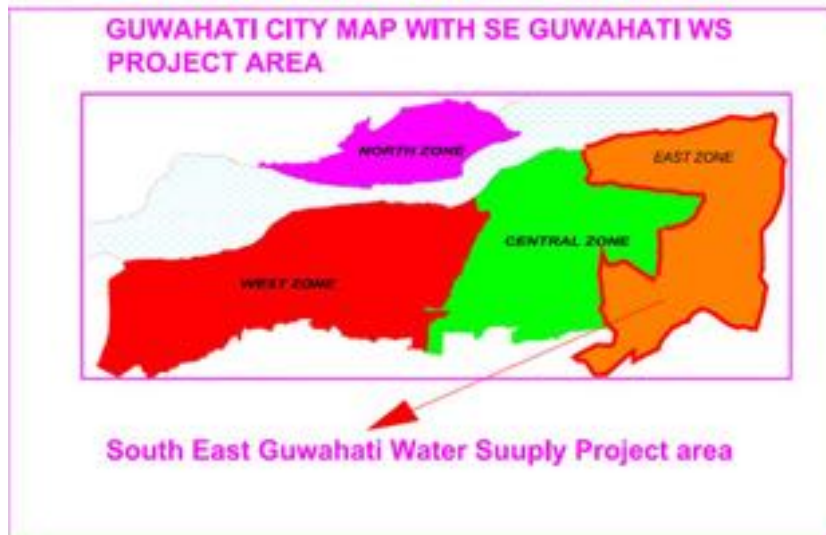
45. The Government of Assam has envisaged improvements in the water supply sector to provide access to potable water to 100% of the residents of the Guwahati Metropolitan Area (GMA). The City Development Plan (CDP) for Guwahati, prepared under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), envisions providing safe and sustainable water to its citizens at an appropriate pricing with the ultimate goal of providing 24 hours water across the city. To achieve this objective, the city has been divided into four distribution zones (Figure 1): (i) North Guwahati Zone (ii) South Guwahati West Zone (iii) South Guwahati Central Zone and (iv) South Guwahati East Zone.

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<sup>5</sup> 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

<sup>6</sup> 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.

<sup>7</sup> 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



**Figure 1: Guwahati Metropolitan Area Water Supply Zones**

46. Currently, only 40% of the population has access to central piped water supply system. Lack of adequate water supply is causing inconvenience and hardship in Guwahati. The key issues pertaining to the present systems can be summarized as follows: (i) limited coverage of the system, and dependence on non-potable water sources; (ii) non-uniform distribution, both in terms of quality and quantity of water supplied; (iii) high levels of non revenue water (NRW), and leakages in the distribution system; and (iv) low levels of cost recovery. Currently, only 40% of the population has access to central piped water supply system. Lack of adequate water supply is causing inconvenience and hardship in Guwahati. The key issues pertaining to the present systems can be summarized as follows: (i) limited coverage of the system, and dependence on non-potable water sources; (ii) non-uniform distribution, both in terms of quality and quantity of water supplied; (iii) high levels of non revenue water (NRW), and leakages in the distribution system; and (iv) low levels of cost recovery.

47. The present production capacity of 110.85 MLD, actual production of water is 73.4 MLD (66%). Out of around 74 MLD of potable water produced, 72 MLD is drawn from the river Brahmaputra and rest of about 1.5 MLD is pumped from deep tube wells installed at various locations by Guwahati Municipal Corporation (GMC). The present production from all sources (73.4 MLD) is inadequate with respect to present demand of around 150 MLD. Most of the treatment plants are also old and damaged due to which they are running much below their actual capacities. Various components are not functioning and as a result both quantity and quality are not being assured. Intake systems are old and rusted needing immediate repair and replacement. The Tranche 2 of AUIIP will add 98 MLD in 2030 and provision for extension up to 147Mld (2045).

48. The NRW in the Guwahati production and distribution system is estimated to be over 40%, resulting in a per capita availability of only about 65 litres per day with an average supply hours of 2 to 3 hours within those areas where piped water supply is available. The high NRW is because of uncontrolled leakage from the distribution system and transmission line and free flow of water from the street hydrant points. **Table 1** shows the salient features of the present water supply system.

**Table 1: Salient Features of the Guwahati Water Supply System**

Particulars	Quantities	Quantities
1.	Present population of Guwahati (2011 estimates)	1,246,082
2.	Present production capacity	110.85 MLD
3.	Present actual production	73.4 MLD
4.	Estimated unaccounted for water	40 %
5.	Overall per capita water availability at households	65 lpcd
6	Maximum supply hours	2-3 hours a day

Notes: MLD = million per liters; lpcd = liters per capita per day

49. The existing distribution system covers only a part of the GMA and is largely limited to the central part of the city. In most part of the city water supply system is not available. In some of the fringe areas, tube wells are provided although maintenance by the Assam Public Health Engineering Department (APHED), Assam Urban Water Supply and Sewerage Board (AUWSSB) and GMC<sup>8</sup> is very poor. Lack of proper planning leads to laying of undersized distribution pipes which is main reason of low pressure in the consumer end. Major leakage in the distribution system also leads to heavy contamination of water at the supply end. Consequently water borne diseases like diarrhea, dysentery, typhoid are quite common occurrence. Besides these, provisions for elements namely, chlorinators in the distribution system and bulk and consumer metering will also have to be introduced.

50. The present tariff structure for water supply is based on a flat rate charging system. GMC has tried to introduce water meter in the system but still is not fully operational. Present cost of production of GMC water is around Rs 11.00 per 1,000 liters. Although collection percentage of GMC is around 80% of water tax but the cost recovery is only up to the mark of 13%. The cost of water is quite high because of the fact that GMC has to incur a huge amount in terms of operations and maintenance (O&M) expenditure and establishment charges.

## B. Description of Subproject

51. The proposed sub project “Construction of reservoir, and treated water Transmission pipelines and allied works” is a part of Guwahati Water Supply project.

52. The work to be performed under these specifications is limited to the major works contract for construction of reservoirs including master storage reservoir at Gopal Nagar and five other storage reservoirs in the city and allied works, with associated civil works.

53. **Table 2** shows the detail locations, capacity size of the reservoirs with present land status. Site photographs for reservoirs and typical transmission route are shown in **Appendix 1**.

**Table 2: Location, Capacity and Size of Ground Level Storage Reservoir**

SI No.	Location of Reservoirs	Proposed Storage in ML	Reservoir Size (Internal)	Remarks
1	Gopal Nagar	17 ML	91 m x 24 m, 35 m x 16 m	Already handed over to executing

<sup>8</sup> Presently Guwahati Municipal Corporation (GMC), Assam Public Health Engineering Department (APHED) and Assam Urban Water Supply and Sewerage Board (AUWSSB) are responsible for water supply in Guwahati. AUWSSB is mainly supplying water in the central portion of the city. APHED is supplying water to some of the institutional consumers in the South Guwahati eastern zone. GMC has the maximum coverage of residential consumers but not in the eastern zone.

SI No.	Location of Reservoirs	Proposed Storage in ML	Reservoir Size (Internal)	Remarks
				agency
2	North Jyoti Nagar	3.2 ML	25 m X 22 m	Govt. Land (Handing over to Executing Agency in process)
3	Kenduguri	3.6 ML	32 m X 18 m	Assam State Electricity Board (ASEB) Land (Handing over letter received, agreement awaited)
4	Jonaki Nagar (Hengrabari)	13 ML	42m X 34 m	Proposal submitted to Revenue Deptt.
5	Nabajyoti Nagar Main Zone Reservoir	3.2 ML	32 m X 16m,	Govt. Land, Handing over completed
6	Basistha	5 ML	45 m X 19 m	Govt. Land (Handing over to Executing Agency in process)
<b>Total</b>		<b>45 ML</b>		

54. The total capacities of the all the reservoirs is 45 ML. The major components attended under reservoir, are as follows:

55. **Storage reservoir sub-Project details**

- Construction of approach road to the reservoir site.
- Construction of retaining wall cum Boundary wall all around the reservoir plot including Entry Gate.
- Construction of inlet and outlet chamber for storage reservoir.
- Construction of Guard room at every storage reservoir site.
- Supplying and installation of Valves( Sluice valves, Butterfly valves etc.,)
- Construction of valves chamber.

56. The ground level storage reservoirs shall be constructed, tested and commissioned as water retaining structure as per requirements and specifications given below.

**Table 3: Design Specification of Ground Level Water Storage Reservoirs**

1.	Capacity	:	Different sizes varying from 3.2 to 17 Million Litres as mentioned above.
2.	Basis of design	:	Water retaining structure as per IS 3370 (Part I to IV). Bottom fixed joint of the wall and floor and top fixed with wall and slab.
3.	Shape	:	Rectangular.
4.	Water Depth	:	6.0 Meters.
5.	Compartments	:	Two of same size by providing a



			partition wall in between. There will be interconnecting pipes between the compartments with valves for isolation.
6.	Type of roof construction	:	R.C.C. Beam and Slabs.
7.	Column footings	:	Column footings shall only be provided below floor level.
8.	Free Board	:	0.6 meters for distribution reservoirs and 1.0 m for Master Balancing Reservoir above Top Water Level (T.W.L.).
9.	Depth of foundation	:	Minimum 1.5 m below natural Ground Level (virgin soil).
10.	Minimum thickness of R.C.C. walls at top	:	300 mm.
11.	Minimum thickness of floor slab	:	R.C.C. grade of concrete will be M25. Minimum thickness of floor slab is 250 mm. No pressure relief valve will be provided.
12.	Floor finish	:	50 mm thick, M 20 (1:1.5:3).
13.	Base concrete under floor	:	M 15 (1:2:4), 150 mm thick.
14.	Haunches	:	200 mm x 200 mm haunches with reinforcement to be provided at the junction of walls (including partition wall and floor.
15.	Inlet	:	There will be one inlet to each compartment of each storage reservoir. Thus, there will be two inlets at each reservoir.
16.	Outlet	:	There will be minimum two outlets for each compartment of each storage reservoir. The I.L. of the outlet pipes will be at floor level of the reservoir.
17.	Butterfly Valves with chambers	:	There will be butterfly valves at inlets of each storage reservoir. Also, butterfly valves are to be installed at outlets in each storage reservoir with RCC valve chambers, tail pieces, flanges, etc.
18.	Scour pipes with sluice valves and over flow pipes	:	In each storage reservoir, two M.S. scour pipes of 400 mm dia with Tee in the outlet pipes will be installed. One sluice valve of 400 mm diameter shall be provided in each scour pipe. Scour pipes shall be extended for a length of 100 m by 400 mm dia NP3 pipes to discharge into a common chamber from where scoured water will be let out into nearby drain.  There will be overflow pipe in each compartment with its I.L. at T.W.L. Each pipe will discharge into the RCC chamber of scour line. RCC chamber will be covered and fitted with covers, foot rests etc.
19.	Manholes (inspection door) with frame	:	Four manholes (inspection door)

	and cover		openings with frames and covers will be provided and fixed in the roof slab, two in each compartment. In two openings, aluminium staircase will be provided for easy entry and exit. In the other two openings, plastic, encapsulated M.S. foot rests fixed, in staggered positions in the wall for entry for cleaning and maintenance purposes will be provided in the wall.
20.	Silt pits	:	One silt pit of 2 m x 2m x 150 mm deep to be provided in the floor of each compartment near outlet pipes under the manhole opening.
21.	Staircases	:	a) External: R.C.C. Dog legged staircase of 1.2 M width of each flight will be provided as per design from the finished ground level to go to the top of the roof of reservoir. b) Internal: One internal R.C.C stairs of 1m width of single flight shall be provided at each compartment for an access from roof to the floor of the reservoir.
22.	Plinth Protection	:	A plinth protection of 1.2 m in width will be provided on the outer periphery of ground reservoir as per civil specifications.
23.	Finishing	:	R.C.C. surface will be finished with 15 mm thick cement plaster in proportion 1:4 (1 cement: 4 fine sand). Two coats of water proof cement paint of approved colour and shade over one coat of primer after scraping the surface with wire brushes etc. will be provided over exposed surfaces only.
24.	Sub Soil Investigation	:	Sub soil investigation will have to be conducted again by the contractor from a firm of repute. After sub-soil investigations, a detailed report will be submitted.
25.	Ventilation	:	For proper ventilation, opening will be provided at top of side walls of reservoirs. uPVC (6KSC) pipes of 100mm diameter will be provided at a spacing of 5m on the side walls. The ventilator pipes will have a 300mm projection from the outer face of side walls and will have 90 degree downward bend at the end. The ends of the bends will be fitted with heavy duty PVC net to prevent entry of insects, birds etc. into the reservoir.
26.	Centering and Shuttering	:	Only steel plate shuttering and steel props for centering shall be used for R.C.C. work, of Storage reservoirs.

27.	Scaffolding	:	Only well designed tubular steel scaffolding shall be used for the R.C.C. work.
28.	Valve Chambers	:	Valve chambers made in R.C.C M20 (1:1.5:3) for all Butterfly as well as sluice valves will be provided with a clear space of 0.6 m from the outer face of valve on all sides. Chambers shall be 0.5 m higher than finished ground level.
29.	Level Indicator	:	Electronic Level Indicators will have to be installed in each reservoir.
30.	Lightening Arrestor	:	Lightening arrestors will be fitted in each reservoir.
31.	Construction Joints	:	200 mm in width PVC water bars having ISI mark suitable for construction joints will be provided.
32.	Parapet	:	R.C.C post for parapet wall 1 m in height, solid or perforated as per design and specifications will be provided over the roof of the reservoir.
33.	GI Pipe Railing	:	40 mm GI pipe hand railing, 3 rows fixed to RCC posts at 1.5 m spacing for a height of 1 m including painting GI pipe with two coats of anti-corrosive paint over a priming coat will be provided over all openings in the roof slab, chambers etc.
34.	Rain Water Pipes	:	200 mm diameter uPVC (6KSC) rain water pipes with all necessary fittings etc., for drainage of rain water from the roof shall be provided up to the G.L.
35.	Concrete Path around GLSR	:	Cement concrete path of 3 m width will be constructed all round the reservoir by linking with approach road to the storage reservoir. It shall consist of making sub-grade, providing and laying 150 mm thick CC 1:3:6 over flat brick soling and on top 75 mm CC 1:2:4 in camber. Both sides shall be provided with brick edging.
36.	Water Tightness Test of the Reservoir	:	The contractor shall have to arrange for water at his own cost for filling the reservoir for testing against water tightness as per method and guidelines laid in I.S. code 3370. In case the drop in water level is more than prescribed in I.S. code and the structure in the opinion of engineer-in-charge is unfit for acceptance as a water retaining structure then the contractor shall have to return all the payments received. The contractor shall have to submit a written guarantee with reference to the acceptance of above mentioned clause.

37.	Maintenance Period	:	After successful commissioning of the reservoir, the contractor shall have to maintain for a period of 12 months and any defects noticed during the said period, the contractor shall have to rectify them at his own cost. Necessary staff for operating the reservoir as per directions of the engineer-in-charge shall be and deployed by the contractor during the maintenance period and all expenses on wages of staff shall be borne by the contractor at his own cost.
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57. The approach road details for the reservoir sites are given in **Table 4** below.

**Table No 4: Approach road length and width**

SI No	Description	Length	Width (avg)
1	Gopal Nagar Approach road	460 m	3.5 m
2	North jyoti Nagar Approach road	530 m	4.5 m
3	Kenduguri Approach road	650 m	4 m
4	Jonaki Nagar Approach road	170m	4.5m
5	Nabajyoti Nagar Approach road	855 m	4.5 m
6	Basistha Approach road	150 m	4 m

58. Other scope of subproject is construction of water transmission pipeline to connect different reservoirs, Water Treatment Plant etc.

59. The work to be performed under these specifications is limited to the major works contract for supplying and laying of a treated water pumping main from water treatment plant at Sunsali Village to a master balancing reservoir at Gopal Nagar and gravity feeder mains from the master storage reservoir at Gopal Nagar to five other storage reservoirs in the city. The overall scope of work regarding the treated water pumping main and gravity feeder mains includes supplying and laying mild steel pipe line for the length of 19.290 km with internal diameter ranging from 1300mm to 800 mm In addition DI (K9) pipeline of a total length of about 4.990 km of 500-700 mm internal diameter and associated civil works are also considered.

**Table 5** shows the detail location and length of the clear water transmission mains.

**Table 5: Transmission Main details**

SI. No.	Alignment of Pipeline	Length (m)	Thickness of Pipe Shell in mm	Internal Diameter (mm)	Pipe Material
1	Water Treatment Plant to Storage Reservoir at Gopal Nagar	1560	12	1300	MS
2	Storage Reservoir at Gopal Nagar to K.B. Chowk Tapping Point	1399	12	1300	MS
3	K.B. Chowk tapping point to Forest Gate Tapping Point	3337	12	1300	MS
4	Forest Gate tapping point to Jonaki Nagar Taping Point	2873	10	1200	MS
5	Jonaki Nagar Tapping Point to Six mile Nagar Tapping Point	3912	8	900	MS
6	Sixmile Nagar Tapping point to	5915	8	700	MS

Sl. No.	Alignment of Pipeline	Length (m)	Thickness of Pipe Shell in mm	Internal Diameter (mm)	Pipe Material
	storage reservoir at Basistha				
7	K.B. Chowk Taping Point to Storage Reservoir at North Jyotinagar	1581	K-9	500	DI
8	Forest Gate Tapping point to Storage Reservoir at Kenduguri	1050	K-9	500	DI
9	Jonaki Nagar Tapping point to Storage Reservoir at Jonaki Nagar	294	8	800	MS
10	Sixmile tapping point to NabaJyoti Nagar reservoir.	2359	K-9	700	DI
<b>Total</b>		24280		500-1300	

60. The total length of transmission mains from WTP to Gopalnagar and other all the reservoirs (North jyotinagar and Jonaki nagar ,Kenduguri,Nabajyoti nagar and Basistha) is about 24.280 km. Major working components under transmission pipe laying,

- ❖ Supplying, laying, jointing, testing and commissioning of about 19.290 Km length of Mild Steel pipe line of nominal internal diameter ranging from 1300mm to 800mm.
- ❖ Supplying, laying, jointing, testing and commissioning of about 4.990 km length of gravity pipe line of Ductile Iron (Class K-9) of 500-700 mm nominal internal diameter.
- ❖ Earth work excavation, laying of bedding wherever specified, backfilling the trenches, and restoring and making good all surfaces which are damaged during excavation,
- ❖ Fixing and connecting all pipe line fixtures such as valves, bends, tees, blank flanges, tail pieces, flow meter etc., and
- ❖ Construction of all appurtenant structures including construction of road crossings, drainage crossings, pedestals, supports, anchor/ thrust blocks, valve chambers, etc.

61. As far as possible, the transmission mains and feeder mains will follow the alignment within the existing ROWs of lanes/roads in densely populated areas. Pipelines following road alignment will be buried in trenches with minimum of 1 meter (m) clear cover within the ROW, on or adjacent to the road. The maximum and minimum trench width will be 1900 mm to 1100mm and the depth will be 2450mm to 1650mm.

62. **Table 6** shows the components of the subproject based on the final design, although certain details may change with the development of the subproject progresses.

**Table 6: Description of the proposed water supply subproject Part for Guwahati city**

Component	Function	Description	Location
Ground Level Water Storage Reservoirs	Storage of treated water for distribution	➤ Total capacity of 6 water storage reservoirs – 45	• Gopal Nagar, North jyoti Nagar, Kenduguri, Jonaki Nagar, Nabajyoti Nagar, Basistha

Component	Function	Description	Location
		ML	
Clear Water Transmission Mains	Carry of treated water from Water Treatment Plant to Master Balancing Reservoir and other water storage reservoirs	➤ Total pipeline about – 24.280 km	<ul style="list-style-type: none"> <li>• Water Treatment Plant to Storage Reservoir at Gopal Nagar</li> <li>• Storage Reservoir at Gopal Nagar to K.B. Chowk Tapping Point</li> <li>• K.B. Chowk tapping point to Forest Gate Tapping Point</li> <li>• Forest Gate tapping point to Jonaki Nagar Taping Point</li> <li>• Jonaki Nagar Tapping Point to Six mile Nagar Tapping Point</li> <li>• Sixmile Nagar Tapping point to storage reservoir at Basistha</li> <li>• K.B. Chowk Taping Point to Storage Reservoir at North Jyotinagar</li> <li>• Forest Gate Tapping point to Storage Reservoir at Kenduguri</li> <li>• Jonaki Nagar Tapping point to Storage Reservoir at Jonaki Nagar</li> <li>• Sixmile tapping point to NabaJyoti Nagar reservoir.</li> </ul>

63. **Figure 2 to 7** shows location of proposed water storage reservoirs and **Figure 8** indicates proposed transmission pipeline route.

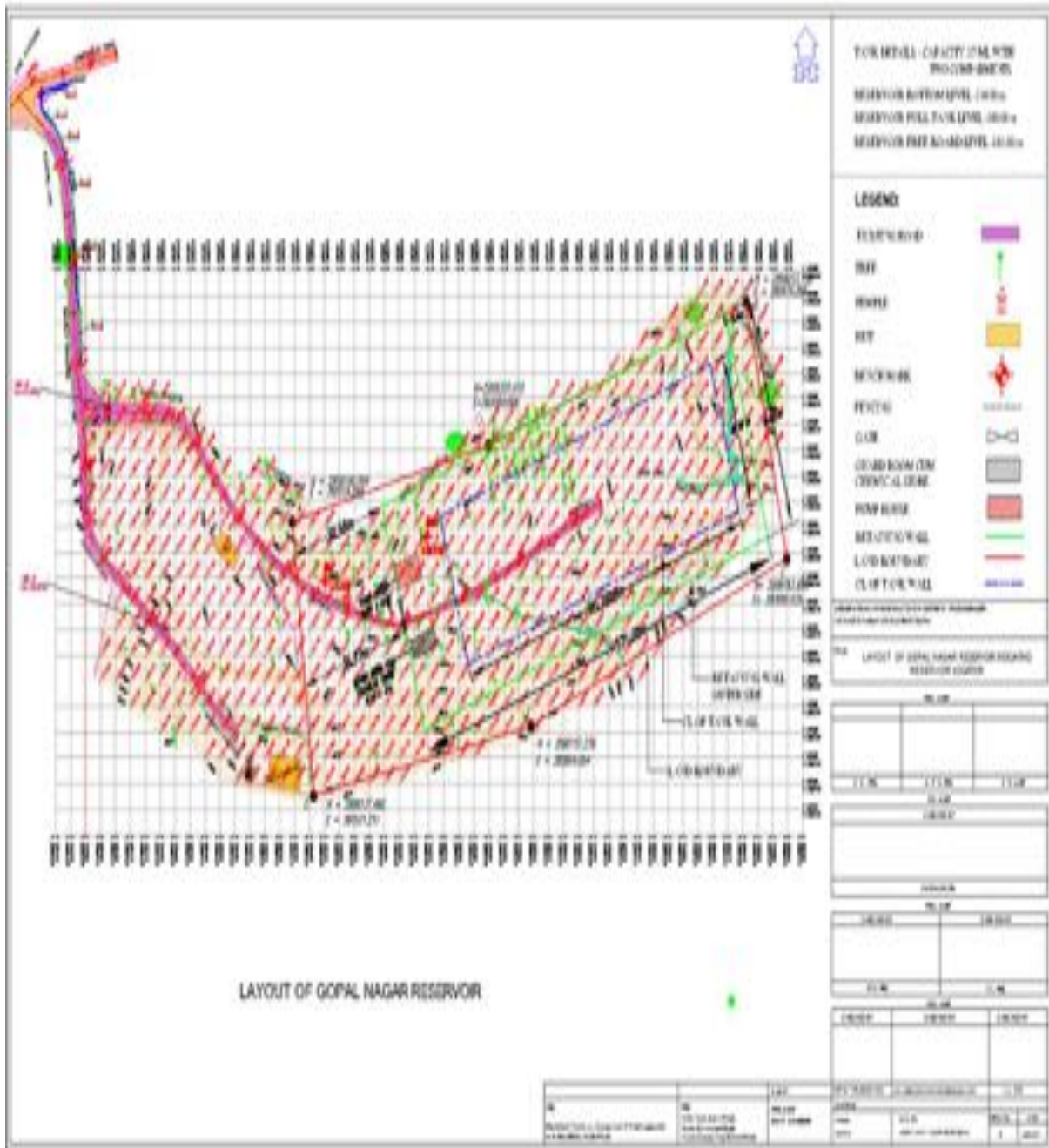


Figure 2: Reservoir at Gopalnagar with approach road

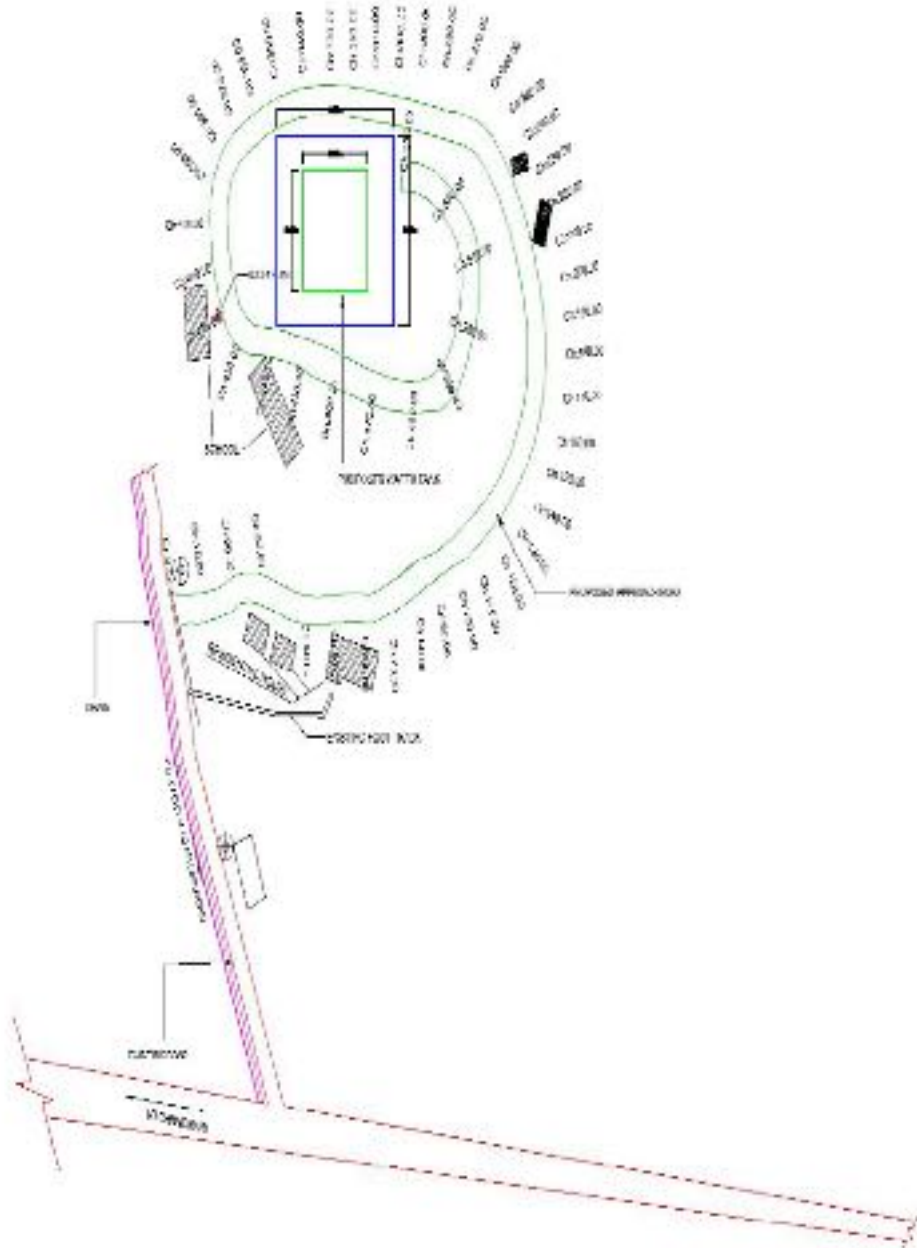


Figure 3: Reservoir at Northjyoti Nagar with approach road



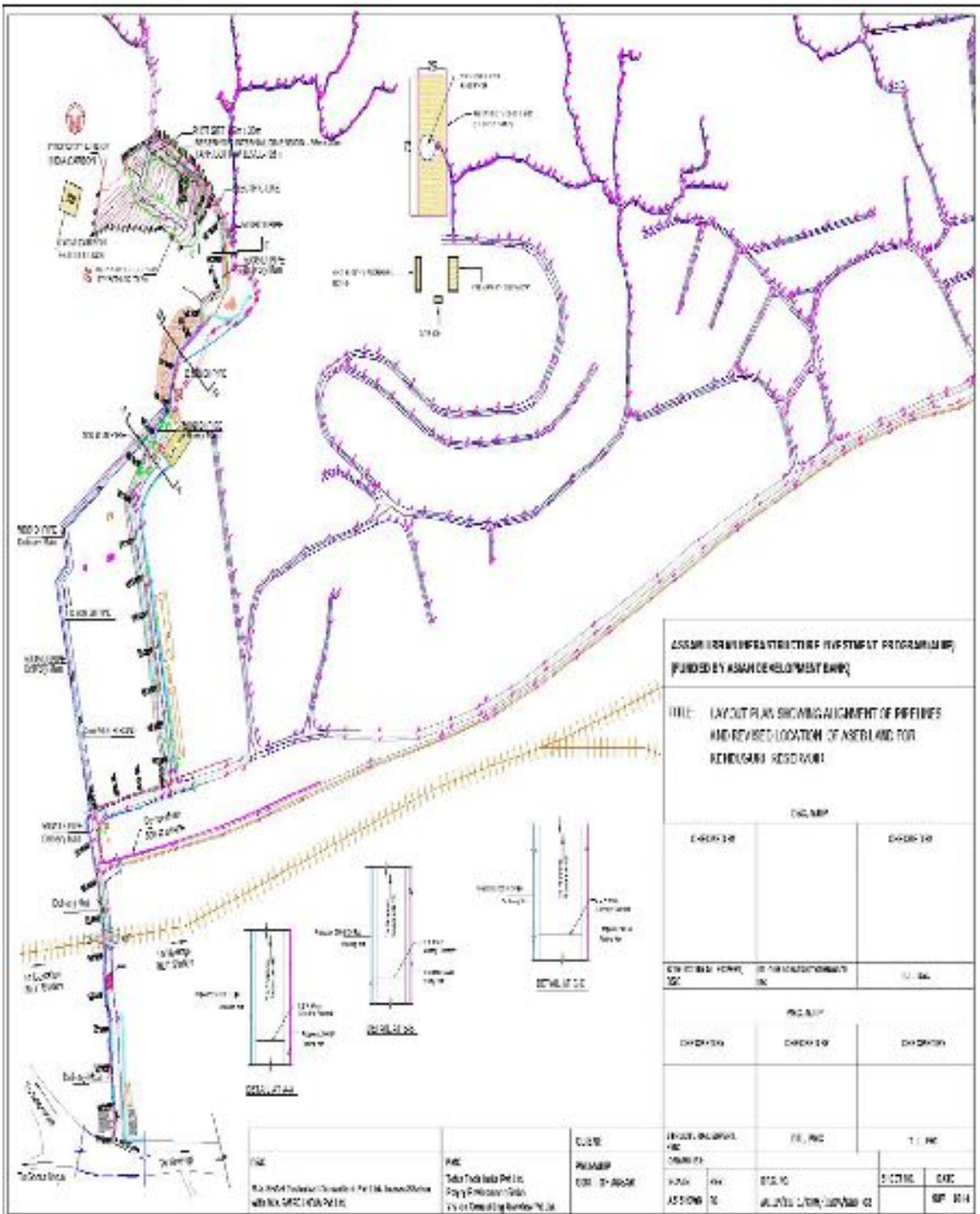


Figure 4: Reservoir at Kenduguri with approach road

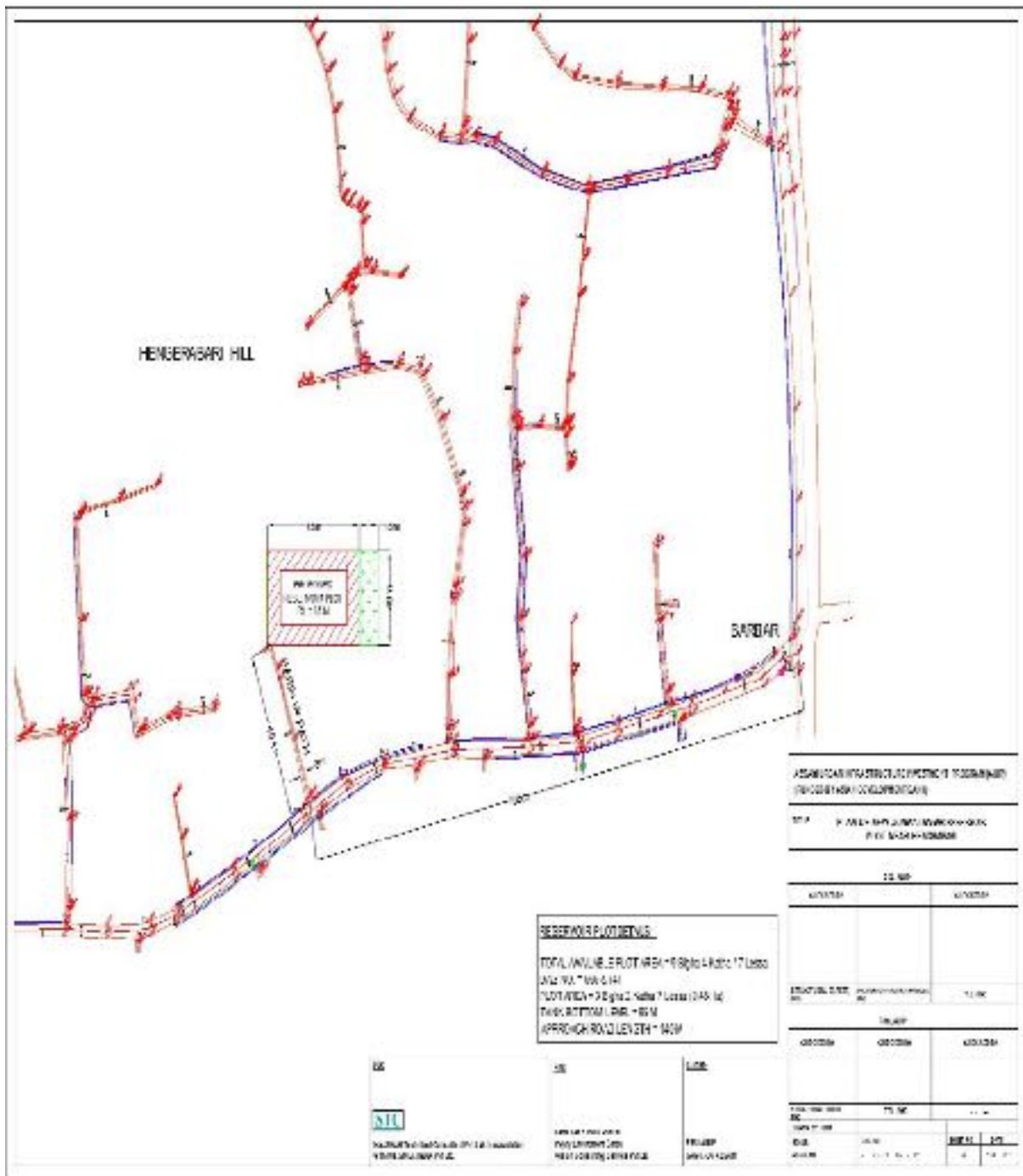


Figure 5: Reservoir at Jonaki Nagar with approach road

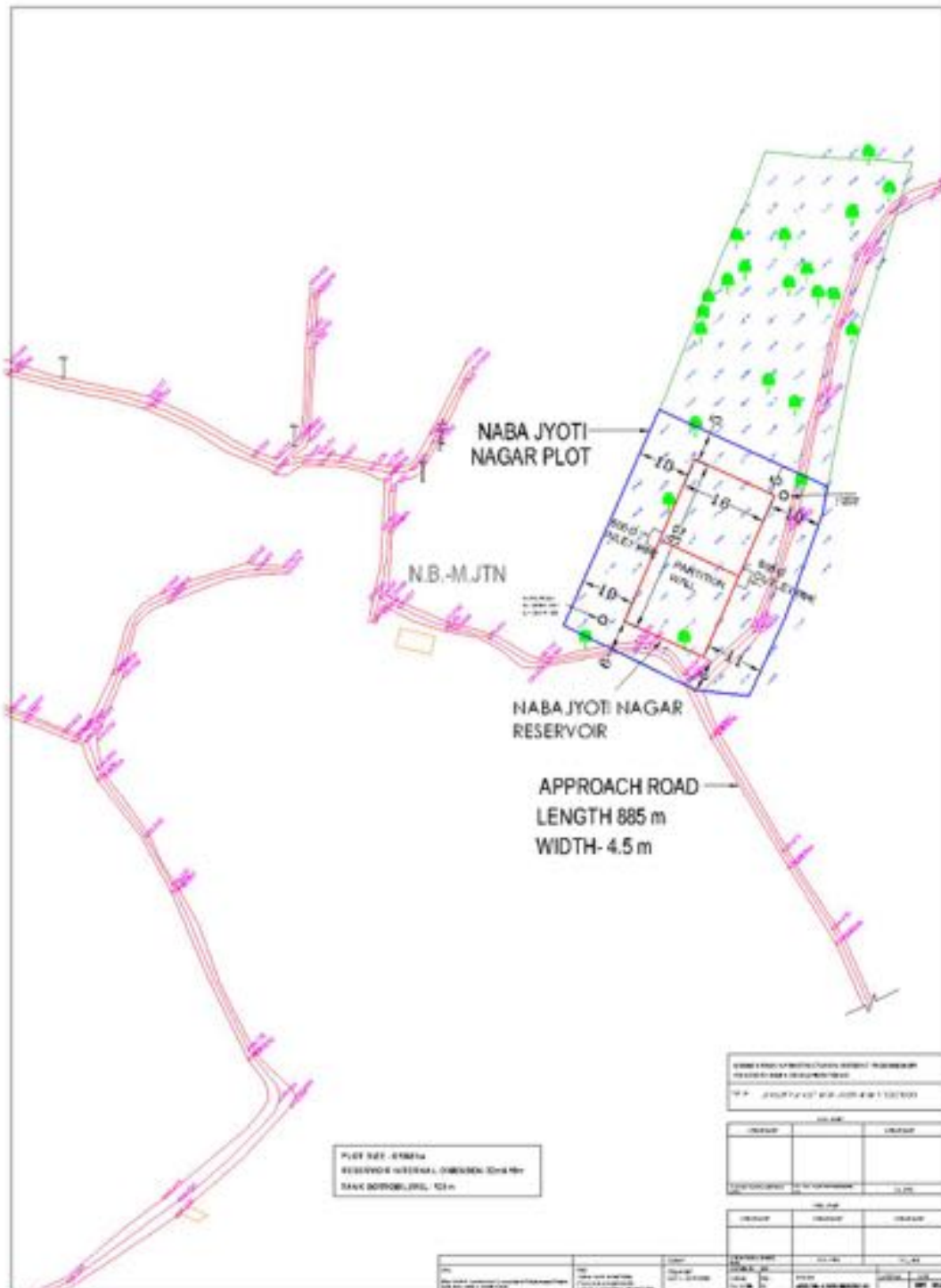


Figure 6: Reservoir at Nabajyoti nagar with approach road

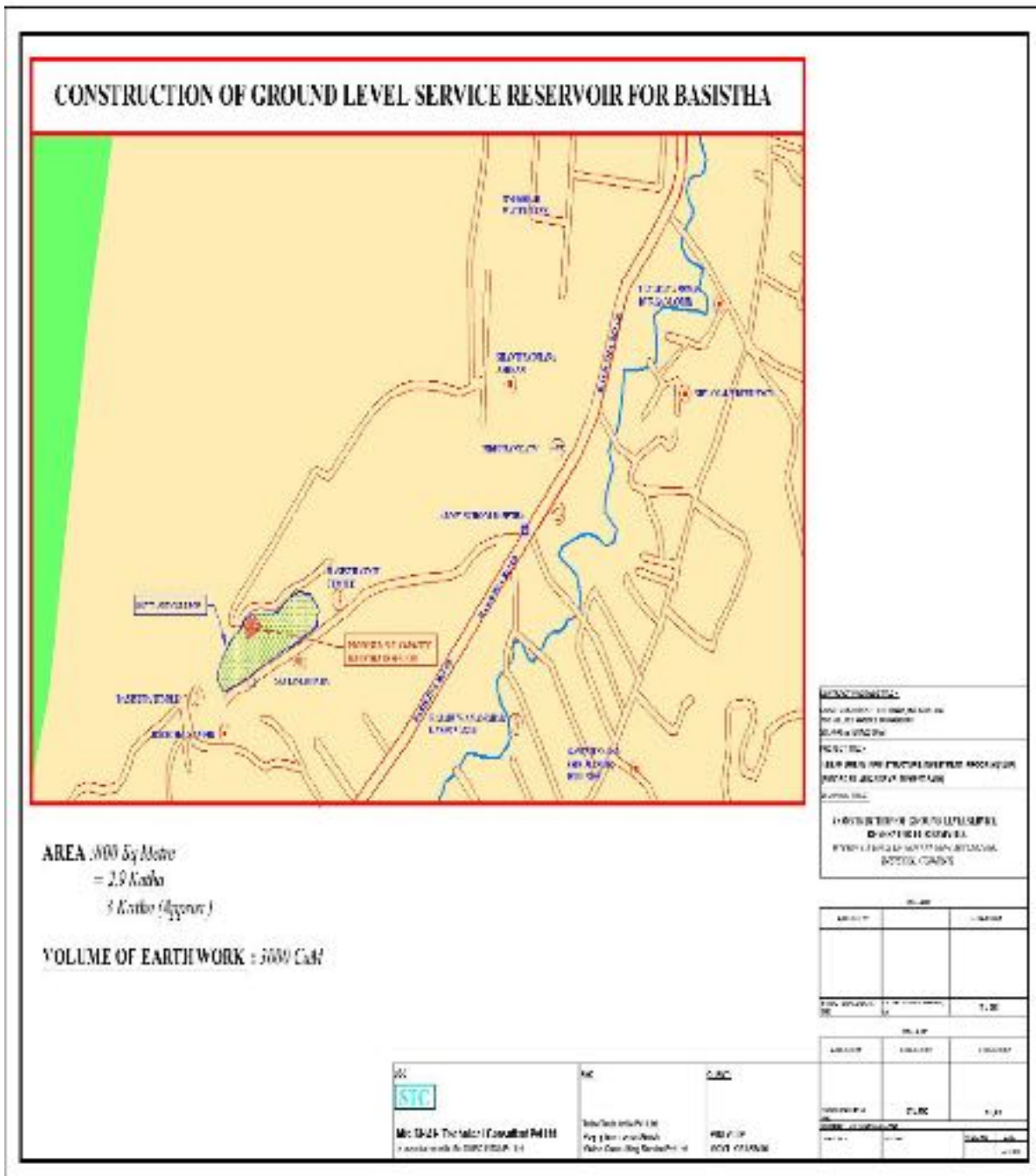


Figure 7: Reservoir at Basistha with Approach Road

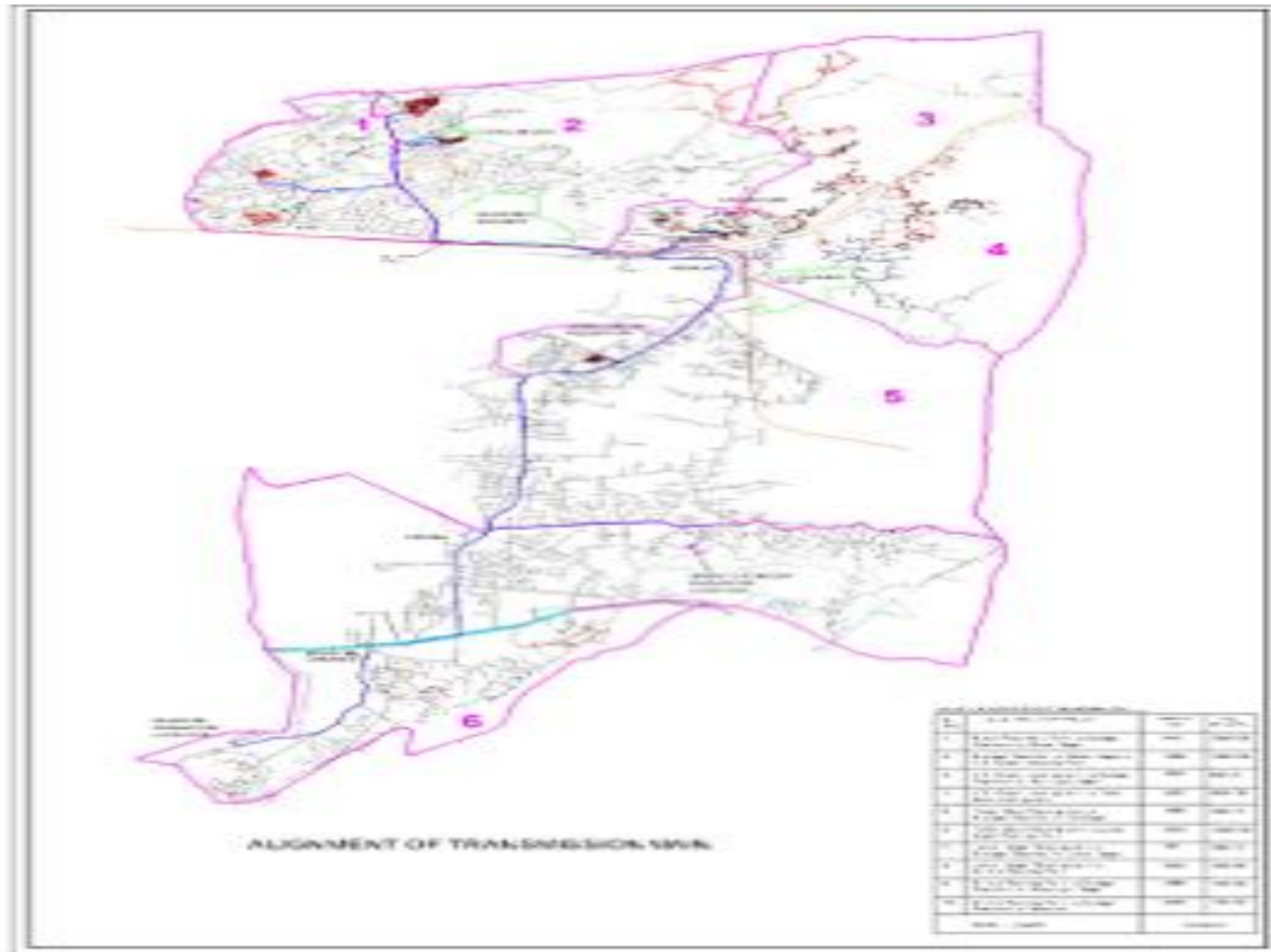


Figure 8: Proposed Clear Water Transmission Mains



### III DESCRIPTION OF ENVIRONMENT

#### A. Physical Features

##### 1. Location

64. 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 kilometer (sq km) is located on both banks of Brahmaputra River dividing it into two parts - North Guwahati and South Guwahati. The Government of Assam has proposed the South eastern 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 9 and 10** respectively.



Figure 9: Map of subproject area- Guwahati City

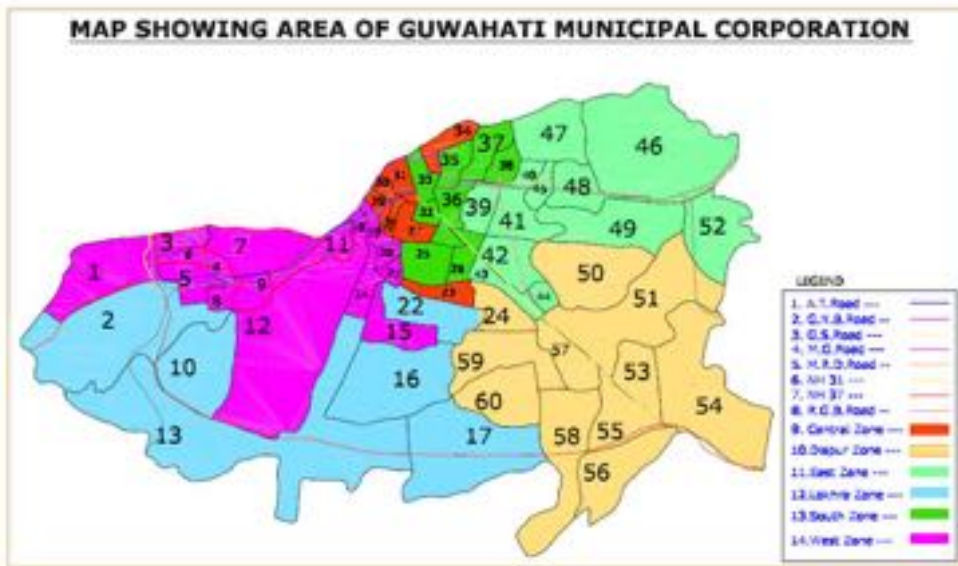


Figure 10: Guwahati Municipal Corporation area showing distribution of wards

## 2. Topography

65. 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 rain water towards Bharalu and Basistha Rivers.

66. 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

67. Guwahati is characterized by mostly Precambrian granite gneisses, quartzite forming residual hills and occupying a major part of the landscape. Small-elongated intermontane 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.

68. 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 activity<sup>9</sup> is exacerbated due to congestion brought on by topography, with poorly built housing and narrow streets.

## 4. Climate

69. 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

70. 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.

## 6. Surface Waters

71. **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

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<sup>9</sup> 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

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 Gol limits. All other parameters are within the prescribed limit. The flow data of the river is given below.

**Table 7: Flow Data of Brahmaputra River in Guwahati City**

Sl. No.	Year	River Flow in Guwahati in Season (Cumec)		
		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

72. Brahmaputra River water quality data is shown below.

**Table 8: Water Quality of Brahmaputra River (Location: Brahmaputra River near Chunshali Ferry Ghat)**

Parameters	Values
Temperature ( $^{\circ}\text{C}$ )	25
pH	7.2
Conductivity ( $\mu\text{mhos/cm}$ )	107
Turbidity (NTU)	16
Dissolved Oxygen (mg/l)	7.20
Alkalinity as $\text{CaCO}_3$ (mg/l)	66.00
Total Hardness as $\text{CaCO}_3$ (mg/l)	68.00
Calcium as $\text{Ca}^{2+}$ (mg/l)	20.00
Magnesium as $\text{Mg}^{2+}$ (mg/l)	4.30
Chloride as Cl (mg/l)	12.00
Sulphate as $\text{SO}_4^{2-}$ (mg/l)	16.80
Nitrate as $\text{NO}_3^{-}$ (mg/l)	0.14
Residual Chlorine (mg/l)	BDL
Phenolic Compound (mg/l)	BDL
Total Iron as Fe (mg/l)	0.50
Fluoride As F (mg/l)	0.33
Total Dissolved Solids (mg/l)	72.00
Arsenic as As ( $\mu\text{g/l}$ )	1.18
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
Mercury as Hg (mg/l)	BDL
<b>Bacteriological Parameters</b>	
Total Coliform (MPN/100 ml)	300
Faecal Coliform (MPN/100 ml)	Nil

BDL: Below Detection Limit (Source: Assam Pollution Control Board for AUIP, Date of collection of sample: 08/10/2012)

73. **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 Gol limits. All other parameters are within the prescribed limit.

## 7. Groundwater

74. 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 also outcrops at several places in the city.

75. 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 9: Ground water quality in and around Guwahati**

SI No	Parameters	Minimum	Maximum
1	Odour	NS	WS
2	Temperature( <sup>o</sup> 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 <sub>4</sub>	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

SI No	Parameters	Minimum	Maximum
21	Copper (mg/L)	BDL	BDL
22	Lead (Pd) (mg/L)	BDL	BDL
23	Chromium <sup>+6</sup> (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
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 IND Adept<sup>G</sup> Project- Guwahati Refinery, 2012)

## 8. Air Quality

76. Air pollution in Guwahati has increased in recent years due to growth of traffic and other urban activities. The ambient air quality is monitored at six locations under AUJIP. Secondary data near project sites are also collected from Assam Pollution Control Board and from EIA report for suspended particulate matters (PM<sub>2.5</sub> & PM<sub>10</sub>), sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) levels. At all the locations sulfur dioxide and nitrogen oxides are within the limit. **Table 10** below shows the air quality monitoring result.

**Table 10: Air Quality Monitoring Result**

Locations	Parameters (µg/m <sup>3</sup> ) (Min- Max)/ Mean			
	SO <sub>2</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
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 and intake 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)
Beltola- city area*	BDL-7.6 ( 2.8)	BDL-12.4 ( 4.9)	61.3-136.2 ( 85.7)	21.6-64.2 ( 44.0)
Khanapara- city area**	5.50- 7.75	17.75-25.0	43.0 -198.5	-----
Gopalnagar area***	8.0	13.0	37.0	21.0
Jonakinagar area***	8.0	12.0	23.0	17.0
North Jyotinagar area ***	9.0	14.0	34.0	19.0
Navajyoti Nagar***	10.0	17.0	34.0	20.0
Kenduguri***	7.0	16.0	34.0	21.0
Basistha***	9.0	15.0	36.0	23.0
<b>CPCB Standard</b>	<b>80</b>	<b>80</b>	<b>100</b>	<b>60</b>

(Source: \*EIA Report IND Adept<sup>G</sup> Project- Guwahati Refinery, \*\*: Assam Pollution Control Board, \*\*\*: Under AUJIP project, baseline monitoring 2013-14)

77. Results show that the maximum PM<sub>10</sub> value cross the standard limit 100µg/m<sup>3</sup> at Refinery Township, Beltola and Khanapara. The maximum values of PM<sub>2.5</sub> cross the standard limit of 60µg/m<sup>3</sup> at Guwahati refinery township area and Beltola city area. But the average concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> at all the locations are within the standard limit.

### 9. Noise Level

78. The ambient noise level is being monitored at six locations under AUIP. Secondary data near project sites are also collected from Assam Pollution Control Board and from EIA report. **Table 11** shows noise level data of the project area.

**Table 11: Noise Levels (dBA) in the Project area (Day time 6AM to 10 PM; Nighttime from 10 PM to 6 AM)**

Sr. No.	Noise Monitoring Station	Day time SPL(dBA)		Night time SPL (dBA)	
		Leq	Range	Leq	Range
1	Bamunimaidam*	92	71-105	81	47-10
2	Noonmati* (Guwahati Refinery main gate)	72	61-86	64	40-73
3	Noonmati* ( Sector-III)	74	51-79	56	44-68
4	Noonmati Public School*(Chunsali)	64	54-81	42	36-66
5	Beltola	88	60-92	68	42-78
6	Gopalnagar area**	42	-	39	-
7	Jonakinagar area**	45	-	38	-
8	North Jyotinagar area **	39	-	38	-
9	Nabjyoti Nagar**	46	-	40	-
10	Kenduguri**	48	-	37	-
11	Basistha **	43	-	39	-

(Source: \*EIA Report INDAdept<sup>G</sup> Project- Guwahati Refinery, \*\*: Assam Pollution Control Board, \*\*\*: Under AUIP project, baseline monitoring 2012-14)

79. The maximum day time noise level was 92 dBA at Bamunimaidam and maximum night time noise level (81dBA) was also found at Bamunimaidam. Minimum noise level was recorded at North Jyoti nagar area. Commercial activity at Bamunimaidan area, Noonmati and Beltola area is may be reason of high noise levels at those locations.

### B. Ecological features

#### 1. Protected Areas and Reserve Forest

80. 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 12** presents the names of the reserve forests along with their extents. No project site is located within the forest.

**Table 12: Reserve Forests in Guwahati Metropolitan Area**

Sl. 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

Sl. No.	Name of Reserve Forest	Area (sq km)
8	Sarania Hills	8.00
9	South Kalapahar	70.00
	<b>Total Area</b>	<b>17,673.93</b>

Source: Directorate of Forests, 2007

## 2. Wetlands

81. 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.

82. 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 1 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 alignment of transmission pipeline are within or adjacent to this protected wetland.

## 3. Flora and Fauna

83. 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 areas and this sub project does not cover any forest land. However the common flora and fauna found in Guwahati are given in **Tables 13 & 14** below.

**Table 13: Common Flora of Guwahati**

Sr. No.	Plant Species	Family
1.	<i>Artocarpus chaplasha</i>	Moraceae
2.	<i>Alphonsea ventricosa</i>	Annoanceae
3.	<i>Castanopsis indica</i>	Fagaceae
4.	<i>Canarium spp.</i>	Burseraceae
5.	<i>Dillenia indica</i>	Dilleniaceae
6.	<i>Dysoxylum procerum</i>	Meliaceae
7.	<i>Magnolia spp.</i>	Magnoliaceae
8.	<i>Mesua</i>	Clusiaceae
9.	<i>Stereospermum personatum</i>	Bignoniaceae
10.	<i>Tetrameles spp.</i>	Tetramelaceae
11.	<i>Actinodaphne obovata</i>	Lauraceae
12.	<i>Aesculus spp.</i>	Sapindaceae
13.	<i>Artocarpus chama</i>	Moraceae

Sr. No.	Plant Species	Family
14.	<i>Albizia spp.</i>	Fabaceae
15.	<i>Anthocephalus chinensis</i>	Ruhiac,eae
16.	<i>Duabanga grandiflora</i>	Lythraceae
17.	<i>Bauhinia purpurea</i>	Fabaceae
18.	<i>Michelia champaca</i>	Maguoliaceae
19.	<i>Schima wallichii</i>	Theaceae
20.	<i>Trewianudi flora</i>	Euphorbiaceae
21.	Lageraroemia spp	Lythraceae

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

**Table 14: Common Fauna of Guwahati**

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

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

84. Preliminary estimate indicates requirement of tree felling for construction of reservoirs and approach road except for Jonaki nagar. Already trees are removed from Gopal nagar reservoir site. Forest dept. will finalize tree felling numbers after their joint survey. Table below shows expected number of tree felling. As per present design there is no requirement for tree felling for laying of transmission mains. In case it is required, necessary permission will be taken from forest dept.

**Table 15: Number of tree felling requirement for the sub project**

SI No.	Name of Reservoir site & Approach road	No. of trees to be felled	
		Site	Approach road
1	Gopal Nagar	72	1
2	North Jyoti Nagar	73*	9
3	Kenduguri	4	19
4	Jonaki Nagar	Nil	Nil
5	Nabajyoti nagar	5	Nil
6	Basistha	6	Nil

NB: Includes 21 nos. of small grown trees at North Jyotinagar

## C. Economic Development Features

### 1. Land Use

85. 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.

86. 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 includes 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 16** and in **Figure 11**. Other than vacant hill area transmission pipeline will be layed all along the road within urban residential and commercial set up of Guwahati city. **Table 17** shows land use along the proposed transmission main alignment.

**Table 16: Proposed Land Use break-up in GMA**

Sl. 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%
	<b>Total</b>	<b>27,085</b>	<b>100%</b>	<b>32,806</b>	<b>100%</b>

(Source: Master Plan for Guwahati, 2009)

**Table 17: Land use along Proposed Transmission Main**

Land use	Length in m
Residential and Hill area	7253
Hill area	3500
Residential cum hill area	3051
Industrial area	2789
Residential & Composite-1	1438
Residential, Public, & Semi public area	3597
Industrial & Semi public	341
Semi public	749

<b>Land use</b>	<b>Length in m</b>
Commercial & Warehouse	200
Public & semi public	420
Public, Semi public & Composite-1	942
<b>TOTAL</b>	<b>24280</b>

## **2. Trade and Commerce**

87. 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**

88. 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**

89. 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.

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

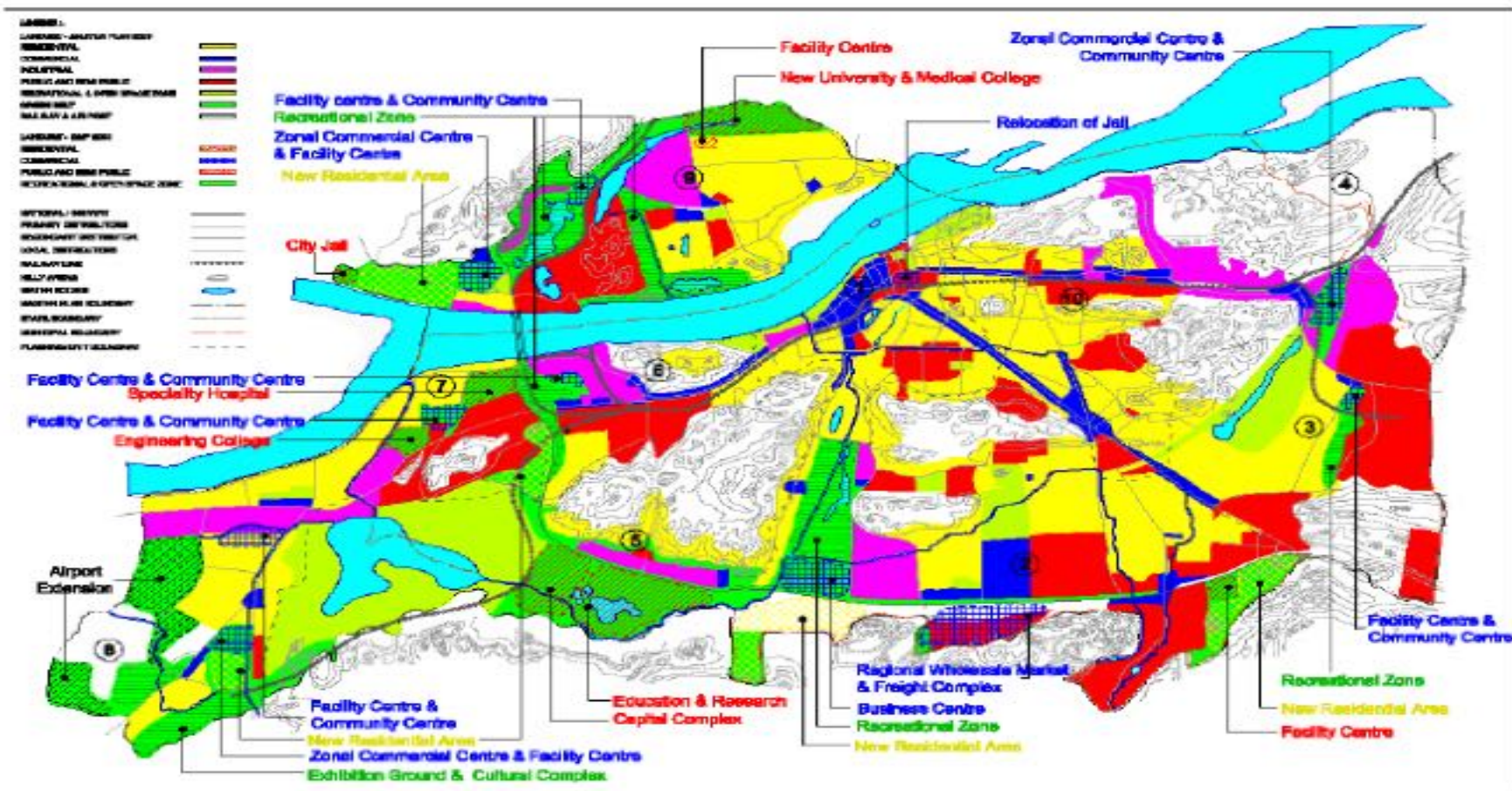


Figure 11: Proposed Land use Plan of Guwahati



## 5. Physical Infrastructure

91. **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 South east 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 APHED and the 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.

92. **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.

93. **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 disposal of solid wastes 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.

94. **Solid Waste Management:** Guwahati generates Solid Waste 550 to 600 tons per day @ 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 include 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 tripper, 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.

95. **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.

96. 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.

97. 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**

98. The total area of Guwahati under the jurisdiction of GMC boundary is 216 sq km and that of Guwahati Metropolitan Development Authority (GMDA) is 262 sq km. **Table 18** gives the population of Guwahati within and outside the municipal area.

**Table 18: 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

99. **Table 19** 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.

**Table 19: 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

100. 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

101. 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.

102. 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

103. 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 Bhuvaneshwari 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

104. 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

105. There are number of sensitive receptors like religious place, health facility and educational institutes are located nearby the proposed water reservoir and transmission mains. **Table 20** and **Table 21** show the list of sensitive receptors nearby the reservoirs and along the pipeline zones, respectively. During construction safety arrangement needs to be maintained at those locations.

**Table 20: Sensitive receptors at the reservoir site and approach road**

SI No	Water reservoirs site	Details
1.	Storage reservoir Gopal Nagar	1. Mandir 2. Residences
2.	Northjyoti Nagar reservoir	1. Pub Jyotinagar High School 2. Kali Mandir 3. Residences
3.	Kenduguri reservoir ( ASEB)	1. Power Distribution office (ASEB) 2 ASEB High school 3. Namghar 4. Residences
4.	Jonaki Nagar Reservoir (Hengarabari)	1. Crematoria. 2. Residences
5.	Storage reservoir at Basistha.	1. Basistha Mandir 2. PWD inspection bungalow 3. Primary school 4. PHE water supply 5. Residences. 6. Art and Craft college
6.	Storage Reservoir at Nabajyoti Nagar.	1. Mandir 2. Residences

**Table 21: Sensitive receptors along transmission pipeline**

SI No	Alignment of pipe line	Details
1	WTP To Storage Reservoir at Gopal Nagar.	Nil
2	Storage reservoir Gopal Nagar to K.B. Chowk Tapping point.	1. Kali Mandir 2. Jagannath Mandir 3. Durga Mandir 4. Sani Mandir

SI No	Alignment of pipe line	Details
		5. Shrimanta Sankardev Vidyalaya, Madhabpur 6. Madhabpur Namghar 7. Indian Red Cross Society
3	K.B. Chowk Tapping point to forest gate tapping point.	1. Guwahati Refinery High School 2. Bishnu Mandir 3. Guwahati Refinery Health Centre 4. Guwahati Refinery Hospital 5. Noonmati Prathamik Vidyalaya 6. Janata Hindi Vidyalaya
4	Forest gate tapping point to Jonaki Nagar Tapping point.	1. E.G. Nursing Home 2. Vidyamandir Junior College 3. Narangi Junior College 4. Narangi Prathamik Vidyalaya 5. Narangi M.E. School 6. Ganesh Mandir 7. Narangi Ansalik Mahavidyalaya 8. Shrimanta Sankardev Namghar 9. Glacier School 10. Kids Planat School 11. Genius Academy 12. Shiv Mandir
5	Jonaki Nagar Tapping point to Sixmile Nagar tapping point.	1. Pratiksha Hospital 2. Sankardev sisu vidya Niketan 3. Natinal Institute of Film, televission & theatre 4. Institute of Hotel Management 5. Suman Academy 6. Rahman Hospital 7. D. D. Baruah college
6	Six mile Nagar tapping point to storage reservoir at Basistha.	1. GNRC Hospital 2. Jayanagar Rajahuwa Namghar 3. Agile Hospital 4. North East Regional Institute Of Management 5. Paramount High School 6. Army Institute of Nursing 7. 151 Base Hospital 8. Guwahati Blind High School 9. Army Public School 10. Shri Ram Mandir 11. Govt. college of Arts & Craft, Basistha 12. Siv Mandir
7	K.B. Chowk Tapping point to Storage Reservoir at North jyoti Nagar.	Primary school
8	Forest gate tapping point to storage reservoir at Kenduguri (ASEB).	ASEB high school
9	Jonaki Nagar tapping point to Storage reservoir at Jonaki Nagar.	ASEB high school
10	Six mile tapping point to storage reservoir at Nabajyoti Nagar.	1. Majjhit 2. Hiteswar Saikia College 3. Kabarsthan 4. Defordhil School 5. Sankardev Kalakhetra 6. Guwahati Psycriatic Hospital 7. P. Baruah Nursing School 8. Saraswati Hindi L.P. & M.E. School 9. Regional Institute of Paramedical Technology

#### IV ANTICIPATED IMPACTS AND MITIGATION MEASURES

106. 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. ADB SPS (2009) require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the subproject's area of influence. As defined previously, the primary impact areas are (i) water reservoir and transmission pipeline sites; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) entire Guwahati area outside of the delineated primary impact area; and (ii) entire Guwahati district in terms of over-all environmental improvement.

107. The ADB Rapid Environmental Assessment Checklist for Water Supply was used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is enclosed in **Appendix 2**. The proposed subproject components will interact physically with the environment.

108. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) mostly being located in the built-up areas of Guwahati city, will not cause direct impact on biodiversity values. The subproject will be in properties held by the local government and access to the sub projects locations is thru public ROW and existing roads.

##### **A. Pre-construction: Location and Design**

109. **Design of the Proposed Components.** The Central Public Health and Environment Engineering Organization (CPHEEO) manual suggests a design period of 15/30 years. The water supply components were designed following the recommendations of the CPHEEO Manual for Water and Water Supply.

110. **Impacts** arise from the design of the project including the technology used and scale of operation.

111. Impacts associated with the planning mainly depend on the site selection. Location impacts include on-site biophysical array and encroachment / impact either directly or indirectly on adjacent environments. It also includes the impacts on the people who might lose their homes or livelihoods due to the development of the proposed site.

112. Structure in seismic zone V- Design impact & mitigation: While a structure is designed all possible load combination are considered those may come into structure. This includes seismic load also. In zone V like Guwahati the ground vibration is maximum. Corresponding to this the Peak Ground Acceleration (PGA) is provided in the relevant code for seismic design (Indian Standard, IS 1893: 2002). As per this PGA and the seismic acceleration response curve is given in the code and other factors like Response Reduction Factor and Importance Factor as per the same code the seismic analysis is done and structures are designed accordingly. As the ground acceleration is maximum in zone V, the cost of the structure also becomes high for provision of higher reinforcement etc. As per the

seismic design philosophy laid in IS: 1893, 2002, the structure are designed such a way that it can withstand all Design Basis Earthquake (DBE) which are basically minor and medium ground shaking and it should not collapse but have cracks which are repairable during Maximum Considered Earthquake (MCE) which are basically major shaking. Thus as per the provision of the seismic code the structure are designed in such a way that in no case it will collapse. The present structures are also designed in line with the above provision of the IS 1893.

113. **Encroachment into private properties, forestland and cutting of trees and damage to vegetation.** Construction works in the Guwahati city area, the pipelines are mostly to be laid on or along the roads in the un-used vacant land adjacent to the roads within the ROW. In narrow roads where there is no vacant land adjoining road, pipeline will be buried within the roadway. However, considering the narrow and busy lanes, temporary impacts are likely during construction stage.

114. Water storage reservoirs are located at isolated places; there is no locational impact due to selection of reservoir sites.

115. The sub project locations are outside the forest area, no impact is expected on biodiversity. The following measures are to be implemented to minimize any impacts during implementation of the project:

- Identify and assess the livelihood and resettlement impacts, including temporary impacts, through resettlement planning process. Implement measures as recommended by the Resettlement Plan (RP).
- Materials required for the work should be stored in proper area and transported to the site as and when required manually;
- No equipment generating excessive noise shall be used for construction.

116. Site selection of 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. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be, sites already permitted by Mining Department. If other sites are necessary, these would to be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of the GMC. If additional quarries will be required after construction is started, then the Construction Contractor shall use the mentioned criteria to select new quarry sites, with written approval of GMC. Selected quarry areas are listed below.

**Table 22: Selected quarry areas**

Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
			Surfaced	Unsurfaced	Surfaced	Unsurfaced
Barpathar Quarry	Boulder, Stone	Quarry to Basistha	Surfaced	2.00	Surfaced	22.00
			Unsurfaced	0.00		

Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
	Aggregate & stone dust	Temple	Katcha	0.00	Unsurfaced	0.00
		Basistha Temple To Site	Surfaced	20.00		
			Unsurfaced	0.00		
			Katcha	0.00		
<b>TOTAL LEAD (km) =</b>					22.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Nineth Mile Earth Quarry	Soil for roadworks	Quarry to Khanapara	Surfaced	5.00	Surfaced	20.00
			Unsurfaced	0.00		
			Katcha	0.00		
		Khanapara to Site	Surfaced	15.00	Unsurfaced	0.00
			Unsurfaced	0.00		
			Katcha	0.00		
<b>TOTAL LEAD (km) =</b>					20.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Saygaon , kukurmara river bank of Bramhaputra	Sand	Kukurmara to Site	Surfaced	70.00	Surfaced	70.00
			Unsurfaced	0.00		
			Katcha	0.00		
<b>TOTAL LEAD (km) =</b>					70.00	
Name of Quarry	Material	Road	Distance in km		Total Distance (in km)	
Guwahati paltan Bazar	Cement Steel Pipe,brick	Paltan Bazar to Site	Surfaced	21.00	Surfaced	21.00
			Unsurfaced	0.00		
			Katcha	0.00		
<b>TOTAL LEAD (km) =</b>					21.00	

## B. Construction Impacts

117. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. Construction impacts are associated with site cleaning, earth works, physical construction related materials movements and works, machinery, vehicles and workers. It also includes the erosion, dust, noise, traffic congestion and waste production associated with the construction activities.

### **Construction Method (Water Storage Reservoir)**

118. Excavation will be done as per the execution drawing for excavation by adopting standard procedures by using Excavators (JCB POCLAIN). The Excavation will be carried out in methodical manner by providing proper approach roads with adequate slopes for machinery movement. Wherever the excavation is not possible by machines – manual excavation by workmen will be carried out.

119. Consolidation will be carried out by knowing the exact geo-technical characteristics



of the site. Compaction and consolidation of earth will be carried out upto the desired level of consolidation by adopting standard procedures. The necessary compaction test will be conducted.

120. Before carrying out any concreting works necessary approval of client/consultant in the pour card will be obtained . Bill of materials and Bar bending schedules as per the approved drawings will be prepared and kept ready.

121. The shuttering plates of proper sizes with proper finish or new plywood (waterproof) of adequate thickness will be used along with scaffolding pipes and clamps.

122. All concreting works will be carried out as per the Mix design hence required materials such as coarse sand, stone aggregates and cement will be sent to the design laboratories. After receipt of design mix from approved labs, all concrete works will be taken up accordingly. Only one type of cement will be used in one mix. The quality of cement will generally confirm the required IS specification.

123. At the time of placing concrete at every stage required test cubes will be taken and it will be kept under proper curing. These cubes will be tested in the Site laboratory in the presence of client/consultant on 7/14/28 days sampling and testing shall be as per respective specification under the supervision of client/consultant.

124. After completing concrete work required curing arrangements are kept ready. Curing will be carried out as per the IS. The de-shuttering of formwork of concrete surface will be as per IS 456 without any deviations.

125. After the completion of the super structure the required finishes viz. plastering, water proof plastering & other amenity works as per the specifications. Finally the entire building will be white washed besides application of necessary approved color shade.

126. Project site will have a laboratory which will be equipped with various testing machines including cube testing machines, sieve analysis unit, measuring jars, weighing balance etc.

#### ***Construction Method (Transmission Mains)***

127. About 24. 280 km lengths of clear water transmission main pipeline are proposed under this subproject. Pipelines that are traversing private properties/built-up areas will be aligned adjacent to the roads in the un-used vacant land within the ROW. In narrower roads where there is no land available, the trenches will be dug into the edge of the road. The transmission main pipelines laid on or along the road will be buried underground. The pipeline laid underground will be provided a clear cover of 1m. The trenches will have a maximum and minimum width of 1900 mm to 1100 mm and a depth of 2450 mm to 1650 mm.

128. The trenches will be excavated using heavy equipment such as backhoes and bulldozers. Excavation in hard surfaces like cement concrete roads will be supplemented by pneumatic drill. Excavated soil will be placed nearby and a bed of sand or gravel - obtained from local quarries, will be placed at the bottom of the trench. Pipes (brought to site on trucks and stored on nearby unused land) will be placed in the trench over the clean soil or sand bedding using a small rig. Pipes will be joined by hand, after which excavated soil will be replaced around and on top of the pipe manually.

## **Construction Impacts**

129. **Sources of Materials.** Significant amount of gravel, sand, and cement will be required for this subproject. The construction contractor will be required to:

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

130. **Air Quality.** Emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality in the construction 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 construction activities only. To mitigate the impacts, construction contractors will be required to:

- Consult with DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
- Excavation for pipeline and water storage reservoirs will be carried out along with development of WTP land (presently low land) so that dug/overburden material is used immediately,
- Avoiding the need to stockpile on site;
- Damp down exposed soil and any stockpiled on site by spraying with water When necessary during dry weather;
- Use tarpaulins to cover sand and other loose material when transported by trucks; and
- Fit all heavy equipment and machinery with air pollution control devices which are operating correctly

131. **Surface Water Quality.** Guwahati receives high intensity rains during monsoons and there are a number of natural and man-made drainage channels crisscrossing the city to carry the runoff safely. Runoff from the excavated areas and material and waste soil stocks likely to contain silt, and this silt runoff will deteriorate the water bodies by silting. Large-scale silting is likely to lead to flooding. This impact will however be considered only during rainy season. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with DSC on designated disposal areas;
- Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- Place storage areas for fuels and lubricants away from any drainage

leading to water bodies;

- Dispose any wastes generated by construction activities in designated sites; and
- Conduct surface quality inspection, particularly for river water according to the Environmental Management Plan (EMP).

132. **Noise Levels.** There are no health facilities, scheduled or unscheduled historical, archaeological, paleontological, or architectural sites near the construction sites. However, construction works will be on settlements, 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 construction contractor will be required to:

- Plan activities in consultation with DSC so that activities with the Greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; and
- Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor.

133. **Existing Infrastructure and Facilities.** Excavation works can damage existing infrastructure/ utilities located alongside roads. It is therefore important that construction contractors will be required to:

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

134. **Landscape and Aesthetics.** The construction works will produce excess excavated, excess construction materials, and solid waste such as removed concrete, wood, trees and plants, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- Prepare and implement Waste Management List;
- Avoid stockpiling of excess excavated soils;
- Coordinate with GMC for beneficial uses of excess excavated soils  
Or immediately dispose to designated areas;
- Recover used oil and lubricants and reuse or remove from the sites;
- 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 DSC to report in writing that the necessary environmental Restoration work has been adequately performed before acceptance of work.

135. Preliminary estimate indicates that 73,346 m<sup>3</sup> (approx.) of excess earth will be generated due to construction of storage reservoir and approach road. **Table 23** Shows the quantity of earth/loose soil to be generated in each reservoir site and approach road and an excess earth amounting to 18543.8 m<sup>3</sup> (approx.) will be generated while laying transmission lines.

**Table 23: Excess Earth details for Reservoirs and Approach Road**

SI No	Location	Description	Quantity (Approx.)
1.	Gopal Nagar	Reservoir	30,000 Cum
		Approach Road	1028 Cum
2.	Jonaki Nagar	Reservoir	5500 Cum
		Approach Road	1200 cum
3.	North jyoti Nagar	Reservoir	3685 Cum
		Approach Road	10,017 Cum
4.	Kenduguri	Reservoir	5800 Cum
		Approach Road	1400 Cum
5.	Nabajyoti Nagar	Reservoir	2816 Cum
		Approach Road	7700 Cum
6.	Basistha	Reservoir	3000 Cum
		Approach Road	1200 Cum

136. As depth of filling at WTP site (under the same program) is 4 m high covering 28942 Sqm areas, so the excavated material from storage reservoir, approach road and transmission mains can be used for filling up of land at proposed WTP site. First preference is utilization of excess/ excavated earth locally for land development.

137. **Landslides.** Since the reservoir sites are in hilly areas within slopes, the excavation activities in the hills can lead to slope disturbance leading to soil slip and landslide in the affected area if proper protection measures are not taken during construction activities. Excavation of hill tops during monsoon season can also add to the problem. However, this can be minimized by observing necessary protection measures as suggested below:

- Identify the landslide susceptible areas within the subproject alignment
- Avoid excavation in hilly /susceptible areas and take appropriate protection measures against the landslide/landslip before start of the excavation at hilly and slopes susceptible to landslide
- Stagger the work in small sections
- Ensure safe stacking of the construction materials and excavated earth over flat Surface and provide bund around the stacked area
- Remove the excess soil immediately from the site
- Minimize on-site storage. Bring construction sand/gravel only when required

- Do not carry out excavation works during monsoon

138. **Surface and Groundwater Quality.** Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. To ensure that water will not pond in pits and voids near subproject location, the construction contractor will be required to conduct excavation works on non-monsoon season.

139. **Accessibility.** Some of the roads in the subproject sites are narrow thus hauling of construction materials and operation of equipment onsite can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- Schedule transport and hauling activities during non-peak hours;
- Locate entry and exit points in areas where there is low potential for traffic congestion;
- Keep the site free from all unnecessary obstructions;
- Drive vehicles in a considerate manner;
- Coordinate with Guwahati Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours. **Appendix 3** shows the sample transport management plan which needs to be apply during construction of reservoir & approach road and laying of pipelines
- Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact number concerns/complaints.
- Provide planks across trenches in front of businesses, and ensure works are completed quickly to avoid disruption
- Avoid full street closure as per design

140. **Socio-Economic - Income.** Construction works will impede the access of residents and businesses to specific sites. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

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

141. **Socio-Economic - Employment.** Manpower will be required during the 36 months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

- Employ majority of the labor force, or to the maximum extent, local Persons with in the 2-km immediate area if manpower is available; and
- If available, secure construction materials from local market.

142. **Occupational Heaths and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- 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<sup>10</sup> for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- Provide medical insurance coverage for workers;
- Secure all installations from unauthorized intrusion and accident risks;
- Provide supplies of potable drinking water;
- Provide clean eating areas where workers are not exposed to hazardous obnoxious substances;
- 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;
- 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;
- Ensure the visibility of workers through their use of high visibility vests

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<sup>10</sup> Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

when working in or walking through heavy equipment operating areas;

- Ensure moving equipment is outfitted with audible back-up alarms;
- 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
- Disallow worker exposure to noise level greater than 85 dBA for duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

143. **Maintaining Core Labour Standard.** The Contractor and DSC/PMU are responsible for ensuring that international CLS<sup>11</sup> –as reflected in national labor laws and regulations are adhered to. PMU/ PIU is ultimately responsible for monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. ADB will carry out due diligence – during loan review missions - to ensure that executing and implementing agencies and contractors comply with applicable (national) core labor standards and labor laws. PMU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites. These will be monitored as part of the project's safeguards reporting requirements.

144. **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 construction contractor will be required to:

- Plan routes to avoid times of peak-pedestrian activities.
- Liaise with DSC in identifying risk areas on route cards/maps.
- Maintain regularly the vehicles and use of manufacturer-approved Parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road.
- Provide protective fencing around open trenches, and cover any open

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<sup>11</sup> Core Labor Standards (CLSs) are a set of four internationally recognized basic rights and principles at work: (i) freedom of association and the right to collective bargaining; (ii) elimination of all forms of forced or compulsory labor; (iii) effective abolition of child labor; and (iv) elimination of discrimination in respect of employment and occupation.

trench with metal planks during non-construction hours.

145. **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 DSC revealed that it is unlikely that work camps are required for this subproject. In the case that it will be needed, the construction contractor will be required to:

- Consult with DSC before locating project offices, sheds, and construction plants;
- 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 DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

146. **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 construction contractor will be required to:

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

### **C. Operation and Maintenance (O&M) impacts**

147. Presently three institutions are responsible for water supply in Guwahati City namely GMC, APHED, and AUWS&SB. AUWS&SB is mainly supplying water in the part of the central portion of Guwahati city. In the South Guwahati eastern zone only PHED is supplying water to some of the institutional consumers. GMC has the maximum coverage of residential consumers but not in the eastern zone.

148. The GMC has a Water Works Branch comprising about 155 staff headed by a superintending engineer and supported by a compliment of executive engineers, inspectors, pump operators, fitters, filter operators, electricians, valve regulators,



mechanics, foremen, gang-men and other technical support staff. This represents a staff ratio of about 7 staff per 1,000 connections. However, this does not include the administrative, financial and accounting staff needed to operate and manage the water supply service but assigned in other branches of the local government. The actual staff/connection ratio is probably considerably higher.

149. The main O&M activities of the refurbished infrastructure will be detection and repair of leaks and pipe bursts. These are, however, likely to be minimal as proper design and selection of good quality pipe material should mean that leaks are minimal. Leak repair work will be similar to the pipe laying work as earlier explained. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

150. Recurrence of blockage and leakage problems. Although impact is likely to be minimal due to new and well-designed efficient system, it should be ensured that leak detection and restoration time is minimized to the extent possible.

#### **D. Cumulative Impact Assessment**

151. 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 interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The subproject's potential cumulative effects were considered with respect to Valued Components (VCs) in the categories of environmental, socio-economic, and heritage resources in four areas:

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

152. The subproject IEE has identified the VCs as air quality, water (surface and Groundwater) quality, noise, geophysical (hydrogeological), 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 Guwahati city.

153. Given the water supply requirement in Guwahati will be met and the source from Brahmaputra is considered adequate<sup>12</sup>, there are no significant cumulative impacts

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<sup>12</sup> River Brahmaputra can provide as much as 78.1 billion cubic meters (or 78,100 billion liters) of water during monsoon and 56.12 billion cubic meters (or 56,120 billion liters) in non-monsoon days. These quantities are

expected on the future water supply.

154. Air quality effects will occur during construction. 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 project activities (i.e., vehicle and equipment operation, disposal of excavated material, landfilling of residual earth). Given the subproject's relatively minor contribution to CAC and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible during construction.

155. During construction 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 annoyance to spatially located receptors during construction. Noise levels associated with the project operations will be largely imperceptible as the water pipelines are located in relatively small sites within the city proper.

156. Land use/traffic management concerns will occur spatially during construction. During construction, 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 construction-related traffic. There should be improved traffic movement along the alignment once construction is completed. Since the subproject will be built in undeveloped/ vacant land earmarked for water pipeline laying purposes and reservoir construction purposes, 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.

157. Adverse impacts such as localized disruption of vehicle traffic and pedestrian movements in areas along the alignment, and elevated CAC and fugitive dust emissions in proximity to work sites, elevated noise and vibration levels and visual impacts will occur during construction. 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 construction the socio-community will benefit from improved water supply system. This is considered a long-term cumulative benefit.

158. No adverse residual effects to human health will occur as a result of subproject construction or operation. While exposure to elevated noise levels and fugitive dust and CAC emissions will occur in proximity to subproject work sites during construction, due to their short-term, localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health. The subproject operations will benefit the general public by contributing to the long-term improvement of water supply system and

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equivalent to 433.9 billion liters per day during monsoon and 311.8 billion liters per day during non-monsoon season.

community livability in Guwahati.

## **V INSTITUTIONAL ARRANGEMENTS AND RESPONSIBILITY**

### **A. Implementation Arrangements**

159. The Government of Assam's Guwahati Development Department (GDD) will be the executing agency. A state-level PMU, headed by a Project Director, 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.

160. Project Implementation Units (PIUs) dedicated exclusively to the project 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.

161. 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/RF/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 reports<sup>13</sup> received from PMC to the PMU PD, who will then submit these to ADB. The PMU will seek 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.

162. The PMU will be assisted by PMC Safeguards Specialist (PMC SS). The PMC SS 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/RP/IPP reports; and (iv) provide advice on policy reforms. In addition, the PMC SS 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.

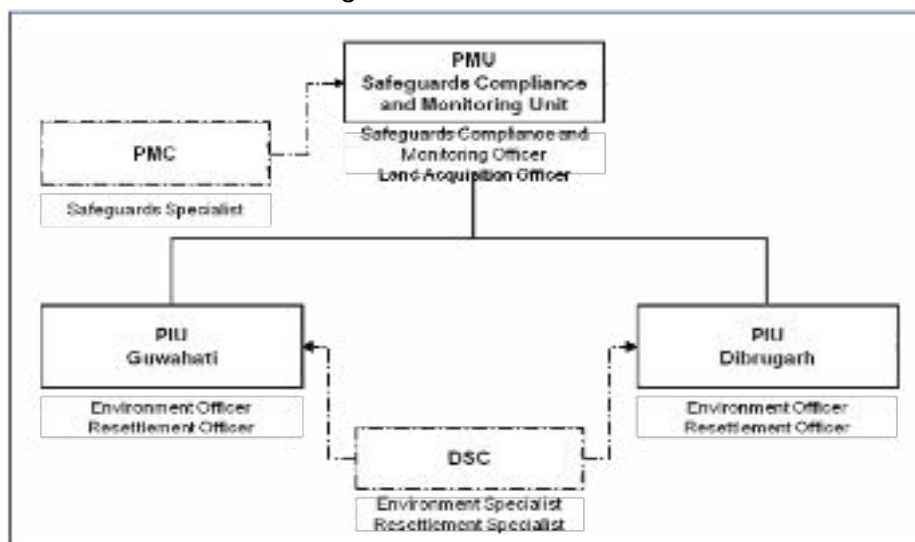
163. The PIUs will each have an Environment Officer and Resettlement Officer who will be responsible for implementation of the EMP in each EIA/IEE and the RP/IPP respectively. Both officers will undertake surveys and record their observations throughout the construction period to ensure that safeguards 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

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<sup>13</sup> The monitoring report will focus on the progress of implementation of the IEE/EIA and EARF, RP/RF 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.

/other entities and entering into agreements with them for use of their land; and (iii) coordinating for obtaining ROW clearances with related State and National agencies.

164. Environment Specialists will also be appointed as part of the DSC teams to (i) update the existing IEEs in the detailed design stage; (ii) assist 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 12** shows the implementation arrangement for environment and resettlement safeguards.



**Figure 12: Safeguards Institutional Arrangement**

## B. Monitoring and Reporting

165. 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.

166. DSC will submit monthly monitoring and implementation reports 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 monitoring report format is attached in **Appendix 4**. 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.

167. 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.

168. 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:

- ✓ conduct periodic site visits for projects with adverse environmental or social impacts;
- ✓ conduct supervision missions with detailed review by ADB's safeguard specialists/officers or consultants for projects with significant adverse social or environmental impacts:
- ✓ review the periodic monitoring reports submitted by EA to ensure that adverse impacts and risks are mitigated as planned and as agreed with ADB;
- ✓ 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
- ✓ 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**

169. There is low capacity to implement projects in accordance with ADB safeguard requirements in both project cities. The Guwahati Municipal Corporation (GMC) do not have environmental/ social safeguards personnel, capacity to handle environmental/IR/IP impacts, gender and vulnerability issues. The PMC 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.

170. The PMC's safeguards specialist and DSC's 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 24**.

**Table 24: Training Program for Environmental Management**

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
<b>A. Pre-Construction Stage</b>					
Sensitization Workshop	<b>Introduction to Environment:</b> ✓ Basic Concept of environment ✓ Environmental Regulations and Statutory requirements as per Government of India and ADB	Secretaries, Chief Engineer, Superintendent Engineers of PHED and UDD, the Development Commissioner, Chairman, CEO of DMB and Project Director (PD) and PIUs Environmental Officers (EOs)	Workshop	½ Working Day	Project Management Consultant Safeguards Specialist (PMC SS) and DSC Environmental Specialist (DSC ES)
<b>Session I</b>					
Module I	<b>Introduction to Environment:</b> ✓ Basic Concept of environment ✓ Environmental Regulations and Statutory requirements as per Government of India and ADB	Engineers of, PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture	¼ Working Day	PMC SS and DSC ES
Module II	<b>Environmental Considerations in Urban Development Projects:</b> ✓ Environmental components affected by urban development in construction and operation stages ✓ Activities causing pollution during construction and operation stages ✓ Environmental Management Good Practices in Urban Infrastructure Projects	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Workshop	¼ Working Day	PMC SS and DSC ES
Module III	<b>Review of IEE and its Integration into Designs:</b> ✓ IEE Methodology ✓ Environmental Provisions in the EMPs ✓ Implementation Arrangements ✓ Methodology of Assessment of Pollution Monitoring ✓ Methodology for site selection of borrow areas, waste disposal areas etc.	Engineers of, PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture and Field Visit	½ Working Day	PMC SS and DSC ES

Program	Description	Participants	Form of Training	Duration/ Location	Conducting Agency
Module IV	<b>Improved Coordination with other Departments:</b> <ul style="list-style-type: none"> <li>✓ Overview of the Project</li> <li>✓ Environmental and Social Impacts</li> <li>✓ Statutory Permissions</li> <li>✓ Procedural Requirements</li> <li>✓ Cooperation and Coordination with other Departments.</li> </ul>	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture / Interactive Sessions	½ Working Day	PMC SS and DSC ES
Module V	<b>Special Issues in the Project</b> <ul style="list-style-type: none"> <li>✓ Bio-Diversity Assessment and Conservation</li> <li>✓ Geomorphological Assessment and Slope Protection</li> <li>✓ Statutory Permissions–Procedural Requirements</li> <li>✓ Consultation and Counseling</li> </ul>	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture	½ Working Day	PMC SS and DSC ES
<b>B. Construction Stage</b>					
<b>Session II</b>					
Module VI	<b>Role during Construction</b> <ul style="list-style-type: none"> <li>✓ Roles and Responsibilities of officials/ contractors/ consultants towards protection of environment</li> <li>✓ Implementation Arrangements</li> <li>✓ Monitoring mechanisms</li> </ul>	Engineers of PHED and UDD, GMC, PMU (Technical Unit) and PIUs EOs	Lecture / Field visit/ Interactive Sessions	½ Working Day	PMC SS and DSC ES
Module VII	Monitoring and Reporting System	PMU (Technical Unit) and PIUs EOs	Lecture / Interactive Sessions	½ Working Day	PMC SS and DSC ES

Notes: DSC – Design and Supervision Consultant, EC – Environmental Clearance, EIA – Environmental Impact Assessment, EMP – Environmental Management Plan, EO- Environment Officer, ES- Environment Specialist, FAM – Facility Administration Memorandum, IEE – Initial Environmental Examination, MoEF – Ministry of Environment and Forest, NOC – No Objection Certificate, PHED - Public Health Engineering Department, PIU - Public Implementation Unit, PMC - Project Management Consultants, PMU - Program Management Unit, REA – Rapid Environmental Assessment, SS- Safeguard Specialist, UDD - Urban Development Department, ULB - Urban Local Body

## VI CONSULTATION, INFORMATION DISCLOSURE, AND GRIEVANCE REDRESS MECHANISM

### A. Public Consultations Conducted

171. A series of consultations were conducted with different categories of stakeholder including (i) the Chairman and ward members; and (ii) local communities, local residents, shopkeepers and businesspeople living and working alongside the roads/lanes, government officials, NGOs, and villagers in the immediate vicinity of the subproject sites. Ad hoc

discussions were also held on site with people and communities who could be affected or benefited by the subproject, so that views could be expressed in a less formal setting. The main objective of the public consultation was to identify the stakeholders, to identify additional sources of water, to understand the local needs, preferences of basic infrastructure facilities and to draw up plans to improve the quality of life through better water supply system in Guwahati city. Location wise public consultation details shown in **Appendix 5**.

172. The local people have appreciated the water supply proposal of the government and they have ensured that they will cooperate with the EA during project implementation. They want the project to be started immediately to ensure safe water supply to them. The major issues raised during the public consultations are summarized as follows:

- Proposed water supply project should ensure enough supply of drinking water;
- Efforts should be made by the government to maintain the drinking water supply round the clock ;
- Livelihood affected households should be given adequate assistance in the mode of cash compensation;
- Local people should be employed by the contractor during construction work;
- Adequate safety measures should be taken during construction work;
- Proper arrangements should be made for access to houses and shops during construction throughout the construction period.
- There is some landslide and subsidence problem which should be addressed properly in design.

## **B. Future Consultation and Disclosure**

173. The public consultation shall be a continuous process and will continue in future also. The PMU/PIU will extend and expand the consultation and disclosure process during implementation. An experienced NGO will be appointed to handle this key aspect of the program, who will conduct a wide range of activities in relation to all subprojects, to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The program of activities will be developed during the detailed design stage, and is likely to include the following:

### **1. Consultation during construction:**

- ✓ Public meetings with affected communities to discuss and plan work programmers and allow issues to be raised and addressed once construction has started
- ✓ Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

### **2. Project disclosure:**

- ✓ Public information campaigns (via newspaper, TV and radio) to explain the project to the wider city population and prepare them for disruption they may experience once the construction program is underway;
- ✓ Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents



- in local language;
- ✓ Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and
- ✓ Providing a mechanism through which comments can be made.

### C. Grievance Redress Mechanism

174. 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 13** 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.

175. 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 construction 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.

176. **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.

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

178. **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).<sup>14</sup> The GRC will be established by the PMU's SCMU before commencement of site works. 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.

179. 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.

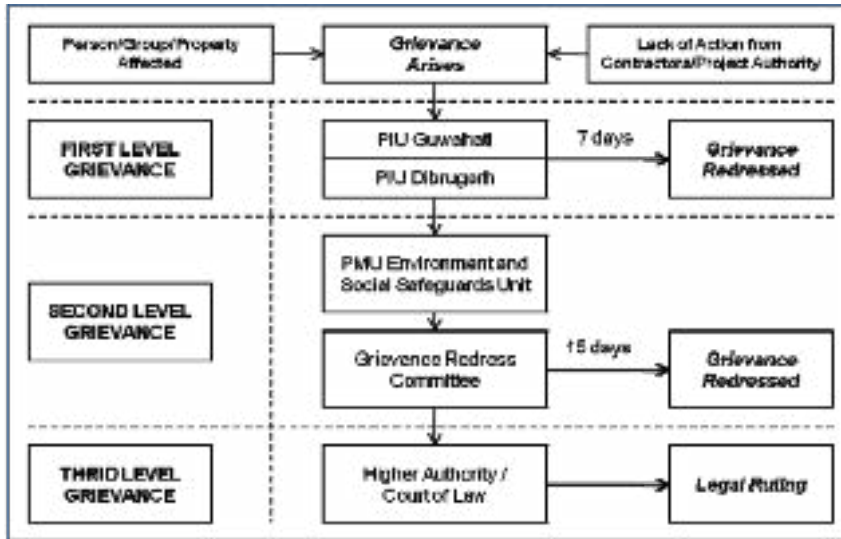
180. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIUs (first tier) or GRC (second tier), the affected person can seek alternative redress through the union Parishad or ward committees or in the appropriate court of law. The PIUs or GRC will be kept informed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

181. 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).

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

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<sup>14</sup> The GRC will consist 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 13: Grievance Redress Mechanism**

## VII ENVIRONMENTAL MANAGEMENT PLAN

183. 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

184. **Tables 25 to 27** show the potential adverse environmental impacts, proposed mitigation measures, responsible parties. This EMP included in the bid documents and will be further reviewed and updated during implementation.

### B. Environmental Monitoring Program

185. **Tables 28 to 30** 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. Monitoring activities during the detailed engineering design stage will form part of the baseline conditions of the subproject sites and will be used as the reference for acceptance of restoration works by the construction contractors.

**Table 25: Anticipated Impacts and Mitigation Measures – Pre-construction 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 construction phase; and  (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	DSC	(i) List of affected utilities and operators;  (ii) Bid document to include requirement for a contingency plan for service interruptions
Structure stability in seismic zone V	Affect during earthquake	Design and analysis as per the Peak Ground Acceleration (PGA) and the seismic acceleration response curve and other factors like Response Reduction Factor (RRF) and Importance Factor (IF) as per the Indian Standard code	DSC/ PIU	(i) Checking of design report – consideration of design measures to minimize earthquake risk
Water Supply	Health risk due to closure of water supply during connection	(i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration); and  (ii) In coordination with GMC, provide alternative potable water to affected households and businesses for the duration of the shut-down if any	DSC	(i) Schedule of closure if any; (ii) delivery of potable water to affected people by GMC
Traffic Management	Impede traffic flow during construction	(i) Prepare a traffic management plan during preconstruction phase.	DSC	Ensure Traffic Management Plan is finalized before implementation. Draft Traffic Management Plan is prepared and attached as <b>Appendix 3</b>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	<p>(i) Consult Archaeological Survey of India (ASI) or concerned department in Guwahati to obtain an expert assessment of the archaeological potential of the site;</p> <p>(ii) Consider alternatives if the site is found to be of medium or high risk;</p> <p>(iii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.</p>	DSC	Chance Finds Protocol
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors along transmission pipeline laying area	<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; and</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 DSC to determine locations prior to construction	List of selected sites for construction work camps, hot mix plants, 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	<p>(i) Prioritize sites already permitted by the Mining Department;</p> <p>(ii) If other sites are necessary, inform construction contractor that it</p>	PMU/PIU and DSC to prepare list of approved quarry sites and sources of	<p>(i) List of approved quarry sites and sources of materials;</p> <p>(ii) Bid document to include requirement for verification of</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	patterns, ponding and water logging, and water pollution.	is their responsibility to verify the suitability of all material sources and to obtain the approval of PMU/PIU and  (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PMU/PIU.	materials	suitability of sources and permit for additional quarry sites if necessary.

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

**Table 26: Anticipated Impacts and Mitigation Measures – Construction 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 additional quarries will be required after construction has started, obtain written approval from PMU/PIU; and  (iv) Submit to DSC on a monthly basis documentation of sources of materials.	Construction Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery	(i) Consult with PMU/PIU/DSC on the designated areas for	Construction Contractor	(i) Location of stockpiles; (ii) Complaints from sensitive receptors;

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons	<p>stockpiling of clay, soils, gravel, and other construction materials;</p> <p>(iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;</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>		<p>(iii) Heavy equipment and machinery with air pollution control devices;</p> <p>(iv) Ambient air for respirable particulate matter (RPM- PM10 &amp; PM2.5) and suspended particulate matter (SPM);</p> <p>(v) Vehicular emissions such as sulphur dioxide (SO<sub>2</sub>), nitrous oxides (NO<sub>x</sub>), carbon monoxide (CO), and hydrocarbons</p>
Traffic Management	Impede traffic flow during construction	(i) Implement a traffic management plan during preconstruction phase.	Construction Contractor	DSC to ensure traffic management measures are implemented and traffic is not significantly impeded during construction period.
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water quality.	<p>(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;</p> <p>(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PMU/PIU/DSC on designated disposal</p>	Construction Contractor	<p>(i) Areas for stockpiles, storage of fuels and lubricants and waste materials;</p> <p>(ii) Number of silt traps installed along drainages leading to water bodies;</p> <p>(iii) Records of surface water quality inspection;</p> <p>(iv) Effectiveness of water management measures;</p> <p>(v) For inland water:</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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 construction activities in designated sites; and</p> <p>(vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>		<p>suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.</p>
Noise Levels	<p>Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people</p>	<p>(i) Plan activities in consultation with PMU/PIU/DSC 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 to warn other road users or animals of the vehicle's approach;</p> <p>(iii) Minimize noise from construction equipment by using vehicle silencers,</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of silencers in noise -producing equipment and sound barriers;</p> <p>(iii) Equivalent day and night time noise levels</p>



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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.		
Ecological resources – Terrestrial	Felling of the trees – affect terrestrial ecological balance	(i) Minimize removal of vegetation and disallow cutting of trees;  (ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation,  (iii) Require to plant three (3) native trees for every one (1) that is removed; and  (iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.	Construction Contractor	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species and aquatic fauna/animal
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PMU/PIU/DSC the list of affected utilities and operators if any;  (ii) Prepare a contingency plan to include actions to be	Construction Contractor	Existing Utilities Contingency Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		done in case of unintentional interruption of service		
Landscape and Aesthetics	The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character.	<ul style="list-style-type: none"> <li>(i) Storage areas will be properly fenced off.</li> <li>(ii) Prepare and implement Waste Management List;</li> <li>(iii) Avoid stockpiling of excess excavated soils;</li> <li>(iv) Coordinate with GMC for beneficial uses of excess excavated soils of about 91889 cum or immediately dispose/ use to designated areas;</li> <li>(v) Recover used oil and lubricants and reuse or remove from the sites;</li> <li>(vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</li> <li>(vii) Remove all wreckage, rubbish;</li> <li>(viii) Retain mature trees on and around the site where possible;</li> <li>(ix) Cluster construction activities on site on a specific area to avoid "sprawl";</li> </ul>	Construction Contractor	<ul style="list-style-type: none"> <li>(i) Waste Management List; (ii) Complaints from sensitive receptors;</li> <li>(iii) PMU/PIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</li> </ul>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>(x) Unwanted material and litter will be removed on frequent basis;</p> <p>and</p> <p>(xi) Request PMU/PIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</p>		
Accessibility	Traffic problems and conflicts near project locations and haul road	<p>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;</p> <p>(ii) Schedule transport and hauling activities during non- peak hours;</p> <p>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</p> <p>(iv) Keep the site free from all unnecessary obstructions;</p> <p>(v) Drive vehicles in a considerate manner;</p> <p>(vi) Coordinate with Guwahati Traffic Office for temporary road diversions and with for provision of</p>	Construction Contractor	<p>(i) Traffic Management Strategy;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Number of signages placed at subproject location</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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 construction works and contact numbers for concerns/complaints.</p> <p>(viii) Provide planks across trenches in front of businesses, 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;</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> <p>(v) Provide sign boards for</p>	Construction Contractor	<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
		pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		
Employment Generation	<ul style="list-style-type: none"> <li>• The subproject will provide employment opportunities for local people during construction.</li> <li>• Expectations regarding new employment will be high especially among the unemployed individuals in the area.</li> <li>• Laborers gathering at the site for work can be a safety and security issue, and must be avoided.</li> <li>• The training of unskilled or previously unemployed persons will add to the skills base of the area.</li> </ul>	<ul style="list-style-type: none"> <li>(i) The use of labor intensive construction measures will be used where appropriate;</li> <li>(ii) Employ local (unskilled) labor if possible;</li> <li>(iii) Training of labor to benefit individuals beyond completion of the subproject; and</li> <li>(iv) Recruitment of labors will take place offsite.</li> </ul>	Construction Contractor	<ul style="list-style-type: none"> <li>(i) Employment records;</li> <li>(ii) records of sources of materials</li> </ul>
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 like helmet, gumboot, safety belt, gloves, nose musk and	Construction Contractor	<ul style="list-style-type: none"> <li>(i) Site-specific Health and Safety (H&amp;S) Plan;</li> <li>(ii) Equipped first-aid stations;</li> <li>(iii) Medical insurance coverage for workers;</li> <li>(iv) Number of accidents;</li> <li>(v) Supplies of potable drinking water;</li> </ul>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>ear plugs; (c) H&amp;S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Ensure that qualified first- aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the project site;</p> <p>(iii) Provide medical insurance coverage for workers;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(v) Provide supplies of potable drinking water at working sites;</p> <p>(vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and</p> <p>(vii) Provide H&amp;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>(vi) Clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) record of H&amp;S orientation trainings</p> <p>(viii) personal protective equipments;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<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 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</p>		

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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.		
Core Labour Standard (CLS)- safety and compliance	Impact on health of contractor's labour	Monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. PMU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.	Construction Contractor	All records, documents related to health & safety of labours
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during	(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with	Construction Contractor	(i) Traffic Management Strategy;



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	material and waste transportation	<p>PMU/PIU/DSC in identifying high-risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of manufacturer- approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p> <p>(iv) Provide road signs and flag persons to warn.</p> <p>(v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours. potentially cause soil contamination;</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 (such as buildings, shelters, and latrines) which are no</p>		(ii) Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>longer required; and</p> <p>(ix) Request PMU/PIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		
Office, Work Camps & storage	Temporary air, land and noise pollution from operation of camp & machine, water pollution from storage and use of fuels, oils, solvents, and lubricants	<p>(i) Consult with PIU/ DSC before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees/labours;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(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</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for employees; and</p> <p>(iii) PIU/ DSC report in 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
		structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request DSC/ PIU 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/DSC 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/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.	Construction Contractor	Records of chance finds

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

**Table 27: Anticipated Impacts and Mitigation Measures – Operation and Maintenance Stage**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
General	General impact	(i) Refill and re-compact	GMC and O&M	Complaints from

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		trenches soil and backfilled sand will be removed to expose the leaking junction or pipe; (ii) Conduct work during non- monsoon period; and (iii) Cover or wet excavated material to prevent dusts.	Contractors	sensitive receptors
Social and Cultural Resources	Temporary disruption of activities	(i) Consult the city authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; (ii) Complete work in sensitive areas quickly; (iii) 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.	GMC and O&M Contractors	Complaints from sensitive receptors
Land Uses	<ul style="list-style-type: none"> <li>With augmentation of water supply system, the presently water scarce areas can be put to their utmost possible use.</li> </ul>	Regular maintenance and monitoring of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.	GMC and O&M Contractors	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	<ul style="list-style-type: none"> <li>• The proposed project is expected to facilitate an integrated development approach to the area thereby improving the overall quality of life.</li> <li>• The proposed development is expected to bring about positive economic benefits in the medium- to long-term.</li> <li>• Local businesses and educational facilities, etc. are likely to benefit from the subproject.</li> </ul>			
Health and Safety	<ul style="list-style-type: none"> <li>• Improvement of water supply system is expected to significantly enhance the quantity and quality of the supplied water.</li> <li>• Reduction in leakages will ensure adequate supply of potable drinking water minimizing contamination risks with corresponding reduction in health risks to the citizens.</li> </ul>	<ul style="list-style-type: none"> <li>• Undertake regular monitoring and maintenance of water supply infrastructure.</li> </ul>	GMC and O&M Contractors	Complaints from sensitive receptors

H&S = health and safety, O&M = operation and maintenance, GMC = Guwahati Municipal Council

**Table 28: Pre-construction Environmental Monitoring Program**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Baseline Environmental Condition – Ambient Air Quality and noise	Subproject location	Contractor	Establish baseline values of (i) respirable particulate matter (RPM) and (ii)CO, SO <sub>2</sub> & NOx	Air sample collection and analyses by in-house laboratory or accredited 3rd party laboratory	GOI Ambient Air Quality Standards	Once prior to start of construction	PMU/PIU
Baseline Environmental Condition - Water Quality	Subproject location	Contractor	Establish baseline values of suspended solids (TSS), pH biological oxygen demand (BOD), faecal coliform	Water sample collection and analyses by in-house laboratory or accredited 3rd party laboratory	GOI Water Quality Standards	Once prior to start of construction	PMU/PIU
Utilities	As per site requirement	DSC	(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
Water Supply Cessation	As per site requirement	GMC	(i) schedule of closure; (ii) delivery of GMC of potable water to affected people	Checking of records	(i) Tentative schedule of closure made known to affective people 2 weeks prior to cessation of water supply;  (ii) Coordination with	Once	PMU/PIU, DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
					GMC for supply of potable water to 100% affected people		
Social and Cultural Heritage	As per site requirement	PMU/PIU and DSC	Chance Finds Protocol	Checking of records	Chance Finds Protocol provided to construction contractors prior to commencement of activities	Once	PMU/PIU/PMC
Traffic flow management planning	As per site requirement	PMU/PIU and DSC	Traffic Management Plan	Checking of Traffic Management Plan (TMP)	Documents/ maps showing area of intervention and application of TMP	Quarterly	PMU/PIU/PMC
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	As per site requirement	PMU/PIU and DSC to determine locations prior to award of construction contracts.	List of selected location for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works.	Once	PMU/PIU/PMC
Sources of Materials	As per site requirement	PMU/PIU and DSC 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 construction contractors  (ii) Bid document included requirement for verification of suitability of sources and permit for	Once	PMU/PIU/PMC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
					additional quarry sites if necessary.		

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

**Table 29: Construction Environmental Monitoring Program**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	Quarries and sources of materials	Construction Contractor	Construction Contractor documentation	(i) Checking of records; (ii) visual inspection of sites	(i) Sites are permitted; (ii) Report submitted by construction contractor monthly (until such time there is excavation work)	Monthly submission for construction contractor As needed for DSC	DSC
Air Quality	Construction sites and areas designated for stockpiling of materials	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices; (iv) ambient air for respirable particulate matter (RPM- PM2.5 & PM10) and suspended particulate matter (SPM); (v) vehicular	(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	DSC in coordination with Pollution Control Board



Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			emissions such as sulphur dioxide (SO <sub>2</sub> ), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)				
Surface Water Quality	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants 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; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.	Visual inspection	(i) Designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities	Monthly	DSC in coordination with Assam Pollution Control Board
Noise Levels	(i) Construction	Construction	(i) Complaints	(i) Checking of	(i) Complaints	Monthly	DSC in

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Contractor	from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers	records; (ii) visual inspection	from sensitive receptors satisfactorily addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary		coordination with Assam Pollution Control Board
Existing Utilities and Infrastructure	Construction sites	Construction Contractor	(i) Existing Utilities Contingency Plan	(i) Checking of records; (ii) visual inspection	Implementation according to Utilities Contingency Plan	As needed	DSC
Traffic	Construction sites	Construction Contractor	(i) ensure traffic management plan is part of contract documents and being implemented	(i) Checking of records; (ii) visual inspection	Implementation according to traffic management plan	As needed	DSC
Landscape and Aesthetics	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction Contractor	(i) Waste Management List; (ii) complaints from sensitive receptors; (iii) PMU/PIU/DSC to report in writing that the necessary environmental restoration work has been	(i) Checking of records; (ii) visual inspection	(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management List; (iii) complaints from sensitive receptors satisfactorily addressed.	Monthly	DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			adequately performed before acceptance of work.				
Accessibility	(i) Construction sites; (ii) traffic haul road	Construction 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	DSC
Socio-Economic Income	Construction sites	Construction Contractor	(i) Complaints from sensitive receptors; (ii) number of walkways, signages, and metal sheets placed at subproject location.	Visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets provided (iii) signages visible and located in designated areas	Quarterly	DSC
Socio-Economic employment	Construction sites	Construction Contractor	(i) Employment records; (ii) records of sources of materials	Checking of records	Number of employees from Guwahati equal or greater than 50% of total workforce	Quarterly	DSC
Ecological	Construction	Construction	Record related of	(i) Checking of records; (ii)	(i)Complaints from	Quarterly	DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
resources – Terrestrial	sites	Contractor	tree felling	visual inspection	sensitive receptors; (ii) checking of conservation management plan for tree species and aquatic fauna/ animal		
Occupational Health and Safety	Construction sites	Construction 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	(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; (v) % of moving equipment outfitted with audible back-up alarms	Quarterly	DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			equipment outfitted with audible back-up alarms; (x) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.				
Core Labour Standard	Construction sites	Construction Contractor	Monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. PMU/ PIU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and	(i) Checking of records; (ii) visual inspection	Implementation of Core Labour Standard	Quarterly	DSC, PIU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.				
Community Health and Safety	Construction sites	Construction Contractor	(i) Traffic Management Strategy; (ii) complaints from	Visual inspection	(i) Implementation of Traffic Management Strategy;	Quarterly	DSC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			sensitive receptors		(ii) complaints from sensitive receptors satisfactorily addressed		
Work Camps	Work camps	Construction Contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) PMU/PIU/DSC report in writing that the camp has been vacated	Visual inspection	(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DSC
Chance Finds	Construction sites	Construction Contractor	Records of chance finds	Checking of records	Implementation of Chance Finds Protocol	As needed	DSC

BOD = biological oxygen demand, DSC = Design Supervision Management 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

**Table 30: Operation and Maintenance Environmental Monitoring Program**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
General Maintenance work	subproject location	GMC and O&M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Accessibility	subproject location	GMC and O&M Contractors	Complaints from sensitive	Checking of records	Complaints from sensitive	As needed	PMU/PIU

<b>Field</b>	<b>Location</b>	<b>Responsible for Mitigation</b>	<b>Monitoring of Mitigation</b>	<b>Method of Monitoring</b>	<b>Indicators/ Standards</b>	<b>Frequency</b>	<b>Responsible for Monitoring</b>
			receptors		receptors satisfactorily addressed		
Land Uses	subproject location	GMC and O&M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Health and Safety	subproject location	GMC and O&M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU

CPCB = Central Pollution Control Board; O&M = operation and maintenance, GMC = Guwahati Municipal Council PMU = Project Management Unit; PIU = Project Implementation Unit



### C. Environmental Management Plan Costs

186. The subproject is assessed to have no design or location impacts except felling of few trees within reservoir sites and approach road location. The proposed mitigation measure include planting and maintaining of three trees for each tree felled, and therefore cost of implementing measure will be additional and needs to be part of subproject. The actual amount may vary and shall be decided by the Forest Department processing of the forest clearance. However, provision of a lump sum amount has been kept for compensatory plantation.

187. Construction stage impacts are typical for the construction activity and mitigation provided is mainly in terms of good construction practices like water sprinkling to arrest dust generation, clearing of excess soil, which will be incorporated into the Bill of Quantities and construction contractor's documents which will be binding during implementation. Therefore there will be no additional costs of environmental management beyond the contractor's costs which are absorbed in the overall project costs for civil works. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of operation agency, therefore there are no additional costs.

188. The monitoring proposed mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU, costs of which are part of project management. The air quality and noise level monitoring of construction phase will be conducted by the contractor, since this is an additional cost, and therefore it needs to be part of subproject cost. The environmental management and monitoring costs are summarized in **Table 31**.

**Table 31: Indicative Cost for Environmental Management and Monitoring**

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	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	Contractor cost as per requirement
Public consultations and information disclosure	Information disclosure and consultations during preconstruction and construction phase.	As required	Lump sum	1,00,000	Pre construction – Consultant, During construction - Concerned Contractor
Providing access to commercial establishments and properties.	Providing access, in case of access disruptions, to affected properties.	As per requirement	Contractor's liability	Not applicable	Covered under engineering cost
Dust Suppression at subproject sites	Application of dust suppression measures during construction phase for reservoir, approach road and transmission main sites	As required	Lump sum	4,00,000	Concerned Contractor
Traffic management	Safety Signboards, delineators, traffic regulation	Wherever required throughout	Contractor's liability	Not applicable	Covered in engineering cost

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
	equipments, flagman, temporary diversions, etc	subproject corridor			
Baseline Monitoring	Site preparation and preliminary activities				
Air	Once before start of construction works at 6 locations near pipeline laying area and 12 locations near reservoir & approach road	18 samples	8,000 per sample	1,44,000	Covered under engineering design and cost - Concerned Contractor
Noise	Once before start of construction works at 6 locations near pipeline laying area and 12 locations near reservoir & approach road	18 samples	1,000 per sample	18,000	Covered under engineering design and cost - Concerned Contractor
<b>Construction Monitoring</b>					
Air	Quarterly at 16 locations near project sites for atleast 2 years	128 samples	8,000 per sample	10,24,000	Covered under engineering design and cost - Concerned Contractor
Noise	Quarterly at 16 locations near project sites for atleast 2 years	128 samples	1,000 per sample	1,28,000	Covered under engineering design and cost - Concerned Contractor
<b>Defect Liability Period</b>					
Air	Twice at 12 locations near project sites for 1 year	24 samples	8,000 per sample	192,000	Covered under engineering design and cost - Concerned Contractor
Noise	Twice at 12 locations near project sites for 1 year	24 samples	1,000 per sample	24,000	Covered under engineering design and cost - Concerned Contractor
Any unanticipated impact due to subproject implementation (including compensation for tree felling)	Mitigation of any unanticipated impact arising during construction phase and defect liability period.	Lump sum	Lump sum	5,00,000	As requirement per - PMU
<b>TOTAL (INR) Rupees twenty five lakh thirty thousand only</b>				<b>25,30,000.00</b>	
				<b>TOTAL (US\$)</b>	<b>42,167</b>

## **VIII FINDINGS AND RECOMMENDATIONS**

189. The Initial Environmental Examination (IEE) assessed the environmental impacts of all components proposed under the Guwahati Water Supply Subproject mainly water storage reservoir and water transmission main part. Potential negative impacts were identified related to design, location, construction and operation of the subproject. Negative impacts are assessed to be minimal.

190. The potential adverse environmental impacts of the proposed reservoir and transmission mains subproject are mainly related to the construction period, which can be minimized by the mitigating measures and environmentally sound engineering and construction practices.

191. As stated above, most impacts are due to construction; this is because construction work related to pipe laying is to be carried out in the main roads within the city including populated areas. The important impacts identified are:; generation of dust and noise from construction activities; disturbance to traffic flows; impacts due to disposal of large quantities of surplus soil; disturbance and inconvenience to local people due to trenching along the road; impact on road-side hawkers and vendors; public safety; interference and damage to other infrastructure facilities, landslide or landslip due to excavation along hill slopes.

192. These impacts are mostly temporary in nature and can be effectively avoided or mitigated by observing the proposed mitigation measures. The mitigation measures includes careful alignment of pipelines in order to minimize the impact, following existing alignment along roads, laying of pipeline over ground to avoid excavation and cutting of trees, minimizing the construction area, wetting of soil and construction area to reduce the dust; immediate transport of excess soil; beneficial use of excess soil; scheduling of activities to reduce the noise impacts; special precaution near to sensitive areas like schools and hospitals as well along hill slopes, and, traffic diversions and public information to reduce the impact. Proper safety measures during construction activities for ensuring worker's as well public safety.

193. It is recommended for preparation of a construction site management plan incorporating the suggested mitigation measures and environmental monitoring program is also recommended for ensuring site specific safeguard measures.

## **IX CONCLUSIONS**

194. This IEE has assessed all potential environmental impacts associated with the subproject. There are no impacts that are significant or complex in nature, or that need an in- depth study to assess the impact. Thus, the subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, 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.

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

Photo Illustration



**Gopal nagar reservoir site- reservoir under construction**

- There are residences around the site as well as in the approach road
- Tree felling done
- Excess earth already removed



**North jyotinagar reservoir site**

- The site is situated on a hillock.
- There is requirement of few tree felling
- Pub Jyotinagar High School is nearby the project site, there are residences in the approach road as well as surrounding the site.



**Kenduguri reservoir site**

- The reservoir is in a small hillock inside the Bijulinagar (A.S.E.B.)
- There are namghar, school residences, guest house of M/S India Carbon and
- Electrical installations near the site and approach road.
- Few tree felling is required



**Jonakinagar reservoir site**

- The site is situated in a hillock on Hengrabari area.
- There are residences in the approach road.
- A crematoria is there near the site .
- No tree cutting is involved in the site as well in the approach road



**Nabjyotinagar Reservoir site**

- The site is situated in Nabajyotinagar hillock
- The site is a flat one
- Few tree felling is required
- There are few residences in the approach road and some residences are observed away from the site



**Basistha Reservoir site**

- The site is situated in a small hillock
- Few tree felling is required
- There is Govt. art and craft college, hostel of the college, residences, crematoria in the area



**Typical transmission pipeline route**



**Typical transmission pipeline route**



**Typical transmission pipeline route**



**Typical transmission pipeline route**





Typical transmission pipeline route



Typical transmission pipeline route



Typical transmission pipeline route



Typical transmission pipeline route



Typical transmission pipeline route



Typical transmission pipeline route

## APPENDIX 2

### RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST

**Guwahati Water Supply Subproject: Construction of water storage reservoirs and laying of water Transmission mains and allied works**

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 <sup>2</sup> ) which have a 0.202 million population in 2001 and projected population of 0.64 million by 2040.
▪ Heavy with development activities?		√	The subproject areas cover predominantly residential, commercial, and public and semi public area as per the Land use zoning plan –2025 of GMDA..
▪ Adjacent to or within any environmentally sensitive areas?		√	The hills and large water bodies are categorized as eco-sensitive zones in the Guwahati Metropolitan Area (GMA) Comprehensive Master Plan – 2025 (CMP- 2025). Other than this there is no as such sensitive area nearby the project site
• Cultural heritage site		√	No as such nearby
• Protected area		√	No protected area nearby
• Wetland		√	Not applicable
• Mangrove		√	Not applicable
• Estuarine		√	Not applicable
• Buffer zone of protected area		√	No
• Special area for protecting biodiversity		√	None of the subproject component sites are in special area for protecting biodiversity.
• Bay		√	Not applicable
b. Potential environmental impacts will the project cause...			
▪ Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		√	The existing water supply source is the Brahmaputra River. The existing environmental condition of the river is good. No industries/ agricultural activities are present upstream of the water intake. As vegetation in the water intake area is good, soil erosion runoff draining towards the water source is insignificant
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	There will be no impact on the cultural monuments as the proposed project scope and location

Screening questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>▪ Hazard of land subsidence caused by excessive ground water pumping?</li> </ul>		√	Not applicable. Groundwater will not be used as source
<ul style="list-style-type: none"> <li>▪ Social conflicts arising from displacement of communities?</li> </ul>		√	Displacement of communities is not required in this subproject. However during transmission pipe-laying, small-scale displacement will be required which will be temporary in nature. A Resettlement Plan (RP) has been developed to mitigate these temporary impacts. The subproject does not require acquisition of a private land. The owner will be compensated according to government and ADB policies.
<ul style="list-style-type: none"> <li>▪ Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?</li> </ul>		√	The main source of raw water is the Brahmaputra River. The average discharge of the river is 4,500 m <sup>3</sup> /sec and flows nearly full for a considerable length of time. The level of water remains at 48.17 m above mean sea level (MSL) for 50% of the days out of 150 monsoon days. Water quantity is sufficient and additional abstraction from the river will not have significant impact. Groundwater will not be used as source.
<ul style="list-style-type: none"> <li>▪ Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?</li> </ul>		√	Not applicable
<ul style="list-style-type: none"> <li>▪ Delivery of unsafe water to distribution system?</li> </ul>		√	The subproject will provide new pipes to prevent leakages and contamination.
<ul style="list-style-type: none"> <li>▪ Inadequate protection of intake works or wells, leading to pollution of water supply?</li> </ul>		√	Not applicable
<ul style="list-style-type: none"> <li>▪ Over pumping of ground water, leading to salinization and ground subsidence?</li> </ul>		√	Not applicable for surface water source
<ul style="list-style-type: none"> <li>▪ Excessive algal growth in storage reservoir?</li> </ul>		√	Not applicable as per scope of work
<ul style="list-style-type: none"> <li>▪ Increase in production of sewage beyond capabilities of community facilities?</li> </ul>		√	AUIIP includes sewerage system improvement. The subsequent tranches will include improvement in the collection and conveyance of sewerage and construction of a sewerage treatment plant that can accommodate wastewater for the next 20 years.
<ul style="list-style-type: none"> <li>▪ Inadequate disposal of sludge from water treatment plants?</li> </ul>		√	Not applicable as per scope of work.
<ul style="list-style-type: none"> <li>▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?</li> </ul>		√	Not applicable as per scope of work
<ul style="list-style-type: none"> <li>▪ Impairments associated with transmission lines and access roads?</li> </ul>	√		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP will ensure measures are included to mitigate the impacts.



Screening questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>▪ Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.</li> </ul>		√	Not applicable.
<ul style="list-style-type: none"> <li>▪ Health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?</li> </ul>		√	Not applicable
<ul style="list-style-type: none"> <li>▪ Dislocation or involuntary resettlement of people</li> </ul>		√	Displacement of communities is not required in this subproject. However during construction of the pipe-laying, small-scale displacement will be required which will be temporary in nature. A Resettlement Plan (RP) has been developed to mitigate these temporary impacts.
<ul style="list-style-type: none"> <li>▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>		√	Not applicable. The subproject will not affect indigenous peoples or other vulnerable group. The subproject will be beneficial to women and children as water will be available in their home. This will improve the current condition of getting and carrying water in hilly terrains.
<ul style="list-style-type: none"> <li>▪ Noise and dust from construction activities?</li> </ul>	√		The noise and the dust emissions will be insignificant as per the nature of the work. Adequate mitigation measures will be taken to further minimize it.
<ul style="list-style-type: none"> <li>▪ Increased road traffic due to interference of construction activities?</li> </ul>	√		Construction will be managed as to allow traffic to maintain through access. There is no expected considerable increased in road traffic due to construction activities. Consultation with traffic police authority will be undertaken and traffic management plant will be implemented
<ul style="list-style-type: none"> <li>▪ Continuing soil erosion/silt runoff from construction operations?</li> </ul>	√		As the part of the subproject area is hilly and the terrain is rocky, run-off during construction will be more but erosion will be less. However, impacts are temporary and short in duration. The EMP will ensure measures are included to mitigate the impacts. Construction contractors will be required to include channelization where it is required.
<ul style="list-style-type: none"> <li>▪ Delivery of unsafe water due to poor O&amp;M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?</li> </ul>		√	The O&M Manual includes schedule for regular maintenance and appropriate chemical dosing.
<ul style="list-style-type: none"> <li>▪ Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?</li> </ul>		√	Not Anticipated. Water quality will be regularly monitored by the State Public Health and Engineering Department
<ul style="list-style-type: none"> <li>▪ Accidental leakage of chlorine gas?</li> </ul>		√	Not applicable.

Screening questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>Excessive abstraction of water affecting downstream water users?</li> </ul>		√	Not applicable.
<ul style="list-style-type: none"> <li>Competing uses of water?</li> </ul>		√	Not anticipated.
<ul style="list-style-type: none"> <li>Increased sewage flow due to increased water supply</li> </ul>	√		A slight increase in sewage flow is anticipated due to increase in water supply. However, the additional volume of water finding its way into sewage shall be beneficial, as it shall dilute the actual concentration of contaminants. AUIP includes improvement of the sewerage system.
<ul style="list-style-type: none"> <li>Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant</li> </ul>	√		Not applicable
<ul style="list-style-type: none"> <li>Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>		√	Construction and laying of reservoirs and transmission mains are not a big construction. Hardly 30-40 labourers will be work during construction, therefore temporary burden to social infrastructure is insignificant In case of setting up of labour camp permission will be obtained from Municipal Council. Water supply and sanitation arrangement will be made as per hygienic norms
<ul style="list-style-type: none"> <li>Social conflicts if workers from other regions or countries are hired?</li> </ul>		√	Preference will be given to the local workers in order to minimize the chances of such conflicts.
<ul style="list-style-type: none"> <li>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?</li> </ul>		√	No explosive will be used. Fuel and chemicals will be stored as per storage and import of hazardous chemical rules 1989 and safety norms
<ul style="list-style-type: none"> <li>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?</li> </ul>		√	No such impact is anticipated, in case of the proposed sub-project, as the structural elements of the sub-project are away from community habitations. In case of pipe laying for water transmission community safety will be considered as per EMP

### A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/ Assam Urban Infrastructure Investment Program

Sector: Urban Development

Subsector: Water Supply

Division/Department: Guwahati Development Department & Urban Development Department

Screening Questions		Score	Remarks <sup>15</sup>
<b>Location and Design of project</b>	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
<b>Materials and Maintenance</b>	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
<b>Performance of project outputs</b>	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

**Result of Initial Screening (Low, Medium, High): Low Risk**

<sup>15</sup> If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

## APPENDIX 3 Sample Traffic Management Plan (TMP)

### A. Principles

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties
- (v) Avoid hazards in addressing issues that may delay the project.

### B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

- (i) Make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance.
- (ii) Inhibit traffic movement as little as possible.
- (iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
- (iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
- (v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
- (vi) Train all persons that select, place, and maintain temporary traffic control devices.
- (vii) Keep the public well informed.
- (viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

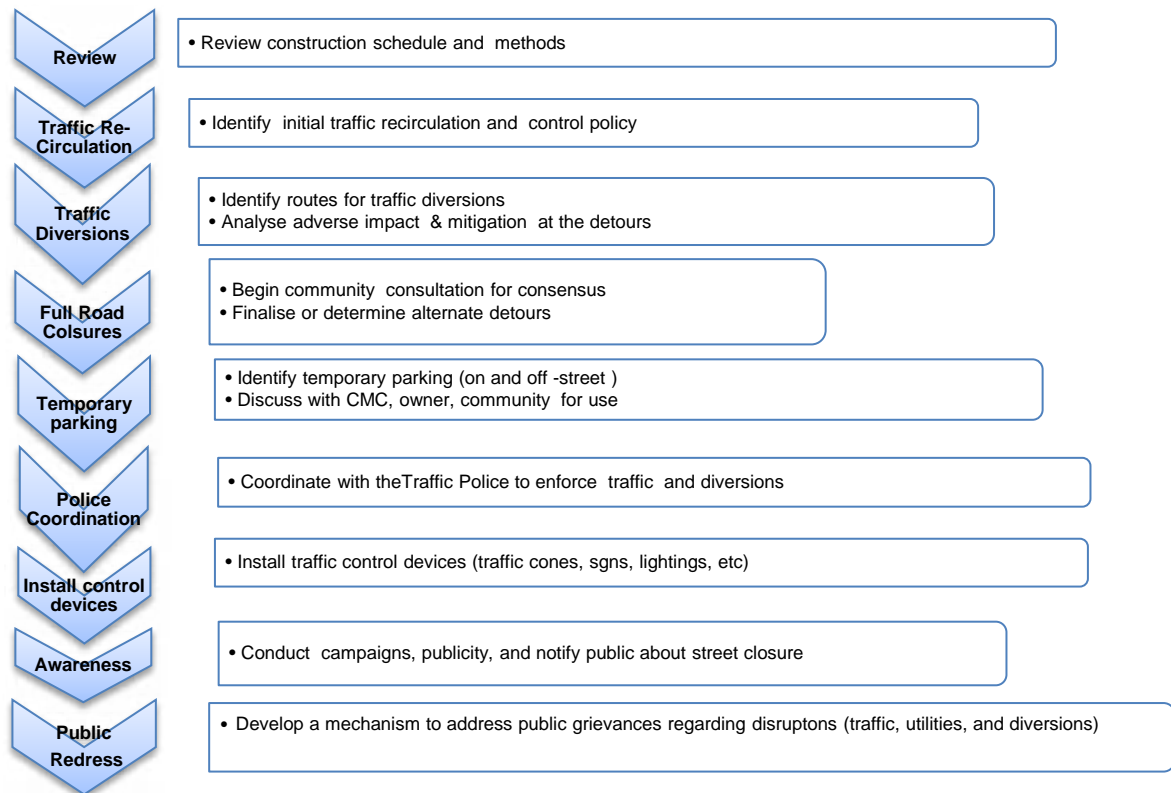
### C. Analyze the impact due to street closure, if required

3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- (i) approval from the PIU, local administration to use the local streets as detours;
- (ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (iv) determining if additional traffic control or temporary improvements are needed along the detour route;
- (v) considering how access will be provided to the worksite;
- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

4. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the Detour Street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

### Figure: Policy Steps for the TMP



#### D. Public awareness and notifications

5. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The SIPMIU/DSMC will also conduct an awareness campaign to educate the public about the following issues:

- (i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- (ii) defensive driving behaviour along the work zones; and
- (iii) reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the

project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) explain why the brochure was prepared, along with a brief description of the project;
- (ii) advise the public to expect the unexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- (vi) indicate the office hours of relevant offices.

**E. Vehicle Maintenance and Safety**

10. A vehicle maintenance and safety program shall be implemented by the construction contractor. The contractor should ensure that all the vehicles are in proper running condition and it comply with roadworthy and meet certification standards of Assam Govt./ Gol. All vehicles to be used shall be in perfect condition meeting pollution standards of Assam Govt./ Gol. The vehicle operator requires a pre state of shift checklist. Additional safety precautions will include the requirement for:

- Driver will follow the special code of conduct and road safety rules of Government of India
- Drivers to ensure that all loads are covered and secured drivers to ensure operation equipment can't leak materials hauled
- Vehicles will be cleaned and maintained in designed places.

**F. Install traffic control devices at the work zones and traffic diversion routes**

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

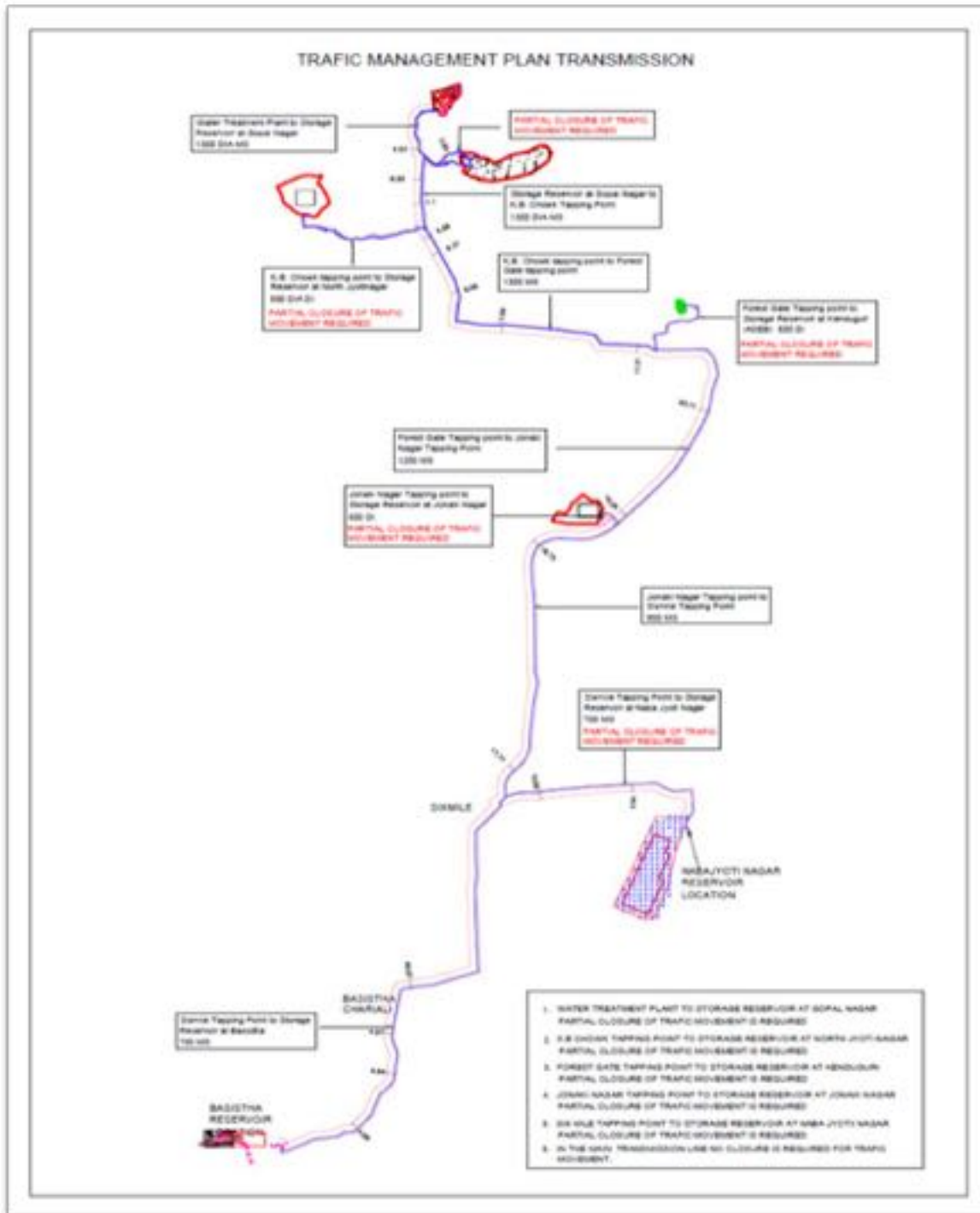
11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary "STOP" and "GO").

12. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

13. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

14 In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

15. The SIPMIU/DSMC and contractor will coordinate with the local administration and traffic police regarding the traffic signs, detour, and any other matters related to traffic. The contractor will prepare the traffic management plan in detail and submit it along with the EMP for the final approval.



**Semi-Annual Environmental Reporting Format**

**I. INTRODUCTION**

- Overall project description and objectives
- Description of subprojects
- Environmental category of the sub-projects
- Details of site personnel and/or consultants responsible for environmental monitoring
- Overall project and sub-project progress and status

No.	Sub-Project Name	Status of Sub-Project				List of Works	Progress of Works
		Design	Pre-Construction	Construction	Operational Phase		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Compliance status with National/ State/ Local statutory environmental requirements

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

Compliance status with environmental loan covenants

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

**II. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN**

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.



- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:

- (i) What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries?
- (ii) If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
- (iii) Adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
- (iv) Are there designated areas for concrete works, and re-fuelling?
- (v) Are there spill kits on site and if there are site procedures for handling emergencies;
- (vi) Is there any chemical stored on site and what is the storage condition?
- (vii) Is there any dewatering activities if yes, where is the water being discharged;
- (viii) How are the stockpiles being managed?
- (ix) How is solid and liquid waste being handled on site?
- (x) Review of the complaint management system;
- (xi) Checking if there are any activities being under taken out of working hours and how that is being managed.

**Summary Monitoring Table –Water supply subproject**

**A. Pre-construction Stage**

<b>Field</b>	<b>Mitigation Measures</b>	<b>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</b>	<b>Method of Monitoring</b>	<b>Location of Monitoring</b>	<b>Date of Monitoring Conducted</b>	<b>Name and Designation of Person Who Conducted the Monitoring</b>
Utilities	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.					
Structure stability in seismic zone V	Design and analysis as per the Peak Ground Acceleration (PGA) and the seismic acceleration response curve and other factors like Response Reduction Factor (RRF) and Importance Factor (IF) as per the Indian Standard code					
Water Supply	(i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration); and					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	(ii) In coordination with GMC, provide alternative potable water to affected households and businesses for the duration of the shut-down if any					
Traffic Management	(i) Prepare a traffic management plan during preconstruction phase.					
Social and Cultural Resources	(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 construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.					
Construction work camps, hot mix plants,	(i) Prioritize areas within or nearest possible vacant space					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
stockpile areas, storage areas, and disposal areas.	<p>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; and</p> <p>(iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community.</p>					
Sources of Materials	<p>(i) Prioritize sites already permitted by the Mining Department;</p> <p>(ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of PMU/PIU and</p> <p>(iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PMU/PIU.</p>					

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

**B. Construction Stage**

<b>Field</b>	<b>Mitigation Measures</b>	<b>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</b>	<b>Method of Monitoring</b>	<b>Location of Monitoring</b>	<b>Date of Monitoring Conducted</b>	<b>Name and Designation of Person Who Conducted the Monitoring</b>
Sources of Materials	(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 additional quarries will be required after construction has started, obtain written approval from PMU/PIU; and (iv) Submit to DSC on a monthly basis documentation of sources of materials.					
Air Quality	(i) Consult with PMU/PIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	(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.					
Traffic Management	(i) Implement a traffic management plan during preconstruction phase.					
Surface water quality	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PMU/PIU/DSC on designated disposal areas; (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Dispose any wastes generated by construction activities in designated sites; and (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).					
Noise Levels	(i) Plan activities in consultation with PMU/PIU/DSC 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 construction equipment by using vehicle silencers,					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	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.					
Ecological resources – Terrestrial	(i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation, (iii) Require to plant three (3) native trees for every one (1) that is removed; and (iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.					
Existing Infrastructure and Facilities	(i) Obtain from PMU/PIU/DSC the list of					



Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>affected utilities and operators if any;</p> <p>(ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service</p>					
Landscape and Aesthetics	<p>(i) Storage areas will be properly fenced off.</p> <p>(ii) Prepare and implement Waste Management List;</p> <p>(iii) Avoid stockpiling of excess excavated soils;</p> <p>(iv) Coordinate with GMC for beneficial uses of excess excavated soils of about 91889 cum or immediately dispose/ use to designated areas;</p> <p>(v) Recover used oil and lubricants and reuse or remove from the sites;</p> <p>(vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(vii) Remove all wreckage, rubbish;</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	(viii) Retain mature trees on and around the site where possible; (ix) Cluster construction activities on site on a specific area to avoid "sprawl"; (x) Unwanted material and litter will be removed on frequent basis; and (xi) Request PMU/PIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.					
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					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>congestion;</p> <p>(iv) Keep the site free from all unnecessary obstructions;</p> <p>(v) Drive vehicles in a considerate manner;</p> <p>(vi) Coordinate with 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 construction works and contact numbers for concerns/complaints.</p> <p>(viii) Provide planks across trenches in front of businesses, and ensure works are completed quickly to avoid disruption, and</p> <p>(ix) Avoid full street closure</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
Socio-Economic Income.	<ul style="list-style-type: none"> <li>– (i) Leave spaces for access between mounds of soil;</li> <li>(ii) Provide walkways and metal sheets where required for people;</li> <li>(iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;</li> <li>(iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and</li> <li>(v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</li> </ul>					
Employment Generation	<ul style="list-style-type: none"> <li>(i) The use of labor intensive construction measures will be used where appropriate;</li> <li>(ii) Employ local (unskilled) labor if possible;</li> <li>(iii) Training of labor to benefit individuals beyond</li> </ul>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	completion of the subproject; and (iv) Recruitment of labors will take place offsite.					
Occupational Health and Safety	<p>(i) Develop and implement site-specific Health and Safety (H&amp;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 like helmet, gumboot, safety belt, gloves, nose musk and ear plugs; (c) H&amp;S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Ensure that qualified first- aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the project site;</p> <p>(iii) Provide medical insurance coverage for</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>workers;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(v) Provide supplies of potable drinking water at working sites;</p> <p>(vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and</p> <p>(vii) Provide H&amp;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</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>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 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</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	be enforced actively.					
Core Labour Standard (CLS)- safety and compliance	Monitoring compliance with national labor laws and regulations, provided that these national laws are consistent with CLS. PMU will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on: (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste; and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.					



Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
Community Health and Safety.	<p>(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with PMU/PIU/DSC in identifying high-risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of manufacturer- approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p> <p>(iv) Provide road signs and flag persons to warn.</p> <p>(v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours. potentially cause soil contamination;</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:</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>reuse, recycling and disposal to designated areas;</p> <p>(viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and</p> <p>(ix) Request PMU/PIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>					
Office, Work Camps & storage	<p>(i) Consult with PIU/ DSC before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees/labours;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the</p>					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	<p>storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(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 (such as buildings, shelters, and latrines) which are no longer required; and</p> <p>(ix) Request DSC/ PIU to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>					
Social and Cultural Resources	<p>(i) Strictly follow the protocol for chance finds in any excavation work;</p> <p>(ii) Request PMU/PIU/DSC or any authorized person</p>					

<b>Field</b>	<b>Mitigation Measures</b>	<b>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</b>	<b>Method of Monitoring</b>	<b>Location of Monitoring</b>	<b>Date of Monitoring Conducted</b>	<b>Name and Designation of Person Who Conducted the Monitoring</b>
	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/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.					

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

**C. Defects Liability Stage**

<b>Field</b>	<b>Mitigation Measures</b>	<b>Parameters Monitored (As a minimum those identified in the IEE should be monitored)</b>	<b>Method of Monitoring</b>	<b>Location of Monitoring</b>	<b>Date of Monitoring Conducted</b>	<b>Name and Designation of Person Who Conducted the Monitoring</b>
General	(i) Refill and re-compact trenches soil and backfilled sand will be removed to expose the					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
	leaking junction or pipe; (ii) Conduct work during non- monsoon period; and (iii) Cover or wet excavated material to prevent dusts.					
Socio cultural Resources	(i) Consult the city authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; (ii) Complete work in sensitive areas quickly; (iii) 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.					

Field	Mitigation Measures	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name and Designation of Person Who Conducted the Monitoring
Land uses	Regular maintenance and monitoring of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.					
Health & safety	<ul style="list-style-type: none"> <li>Undertake regular monitoring and maintenance of water supply infrastructure.</li> </ul>					

**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

**III. Training Orientation program details – Date, Venue, Participants, Subjects**

#### IV. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

Brief description on the approach and methodology used for environmental monitoring of each subproject

- Monitoring of environmental IMPACTS on PROJECT SURROUNDINGS (ambient air, water quality and noise levels)
- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be 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 (Monitoring Results)		
			PM10 µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>2</sub> µg/m <sup>3</sup>

##### Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters (Government Standards)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	Turbidity in NTU	TP mg/L

##### Noise Quality Results

Site No.	Date of Testing	Site Location	LAeq (dBA) (Government Standard)	
			Day Time	Night Time

#### V. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

## **VI. APPENDIXES**

Photos

Summary of consultations

Copies of environmental clearances and permits

Sample of environmental site inspection report

Others



## APPENDIX 5: RECORDS OF PUBLIC CONSULTATION

### Project: Construction of water reservoirs and laying of water transmission mains under Guwahati Water Supply Project

#### Issues discussed

- ✓ Awareness and extent of the project and development components
- ✓ Benefits of Project for the economic and social Upliftment of Community
- ✓ Labour availability in the Project area or requirement of outside labour involvement
- ✓ Local disturbances due to Project Construction Work
- ✓ Necessity of tree felling etc. at project sites
- ✓ Water logging and drainage problem if any
- ✓ Drinking water problem
- ✓ Forest and sensitive area nearby the project site
- ✓ Movement of wild animal if any
- ✓ Other problems, encountered, if any

#### Consultation 1

**Area: Panjabari (In the command area of Nabajyoti nagar)** - Public consultation was conducted at Hindi Saraswati LP School.

**Date & Time:** 17<sup>th</sup> November, 2013. From 03.00 pm to 04.30 pm.

Sr. No.	Issues	Perception	Action taken
1	Awareness and extent of the project and development components	Local people are not much aware on components of the project. In 30% cases they have some idea	Awareness program at different project locations related to project components is essential
2	Perceptions and view of the local community on the project—is the project relevant or not?	The people in the project areas agreed on the relevance of the project. They shared that sufficient & quality water is required throughout the day	
3	In what way they may associate with the project	At the construction phase some people can work as laborers, after completion, water supply to nearby areas shall be improved	
4	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The project area is Govt. land for which permission has been granted. There is no wildlife or sensitive/ unique environmental components in the project area. The project area is surrounded by residences.	
5	Presence of historical/ cultural/ religious sites nearby	There is no historical / religious site nearby. The regional cultural center "Kalakhetra" is located in the region but this is not going to be effected.	
6	Unfavourable climatic condition	The pick summer is hot and humid and not suitable for continuous work at open area.	
7	Occurrence of flood	No such case is reported. During monsoon, temporary water logging occurs for a very short duration	Drainage project will be designed considering the issue
8	What is the nature of drainage/ solid waste problem in the community	No such problem reported.	

	at present? What is the view of the people on improving it?		
9	Drainage problem facing	No such problem being reported	
10	Present drinking water problem – quantity and quality	In 70% cases local complained on non availability of water, Presence of iron is not reported by 90% of total habitation. In 50% cases people have own arrangement (tube well or dug well) within their premises	
11	Present solid waste collection and disposal problem	As per local people – done properly by AMC.	
12	Availability of labour during construction time	Some local people may work as labor during construction phase.	
13	Access road to project Site	Yes existing bitumen road is noted	
14	Perception of locals On tree felling and afforestation	Few trees may be cut	If required compensatory plantation will be done as per Govt. rule
15	Dust and noise pollution and disturbances during construction work	Request for arresting of dust and protection of habitation from noise pollution	Mitigation measures will be applied as per EMP
16	Setting up worker camp site within the village/ project locality	Project area does not have sufficient space for workers camp.	
17	Safety of residents during construction phase and plying of vehicle for construction activities	Local requested for safety arrangement particularly where excavation is being planned near main city road.	

**NAME AND POSITION OF PERSONS CONSULTED:**

- |                                |                               |
|--------------------------------|-------------------------------|
| 1) Sri Aswani Kr. Barah        | 17) Md. Ataur Rahamsn         |
| 2) Sri Bablu Hussian Borbhuyan | 18) Sri Jojen Roy             |
| 3) Sri Nayan Rajbonsi          | 19) Sri Nabab Ali             |
| 4) Sri Rintu Das               | 20) Sri Samsul Haque          |
| 5) Sri Upen Das                | 21) Sri Fulsan Ali            |
| 6) Smti Yangam Doley           | 22) Sri Ayub Ali              |
| 7) Sri Mahim Das               | 23) Sri Rajan Ali             |
| 8) Smti Champa Gogoi           | 24) Sri Anil Ali              |
| 9) Smti Matu Basumatary        | 25) Sri H. Adhikari           |
| 10) Smti Beauti Mahanta        | 26) Sri Banjeet Burman        |
| 11) Sri Milan Doley            | 27) Sri Kiran Kutum           |
| 12) Sri Pabitra Pegu           | 28) Sri Dharmeswar Bhuyan     |
| 13) Sri Amir Ali               | 29) Md. Saifur Rahaman        |
| 14) Sri Saibul Islam           | 30) Sri Umesh Patir           |
| 15) Sri Sanjib Das             | 31) Sri Anwar Hussian         |
| 16) Sri Nareswer Das           | 32) Sri Krishna Prasad Sarma. |

## Consultation 2

**Area: Kenduguri area, Bijuli Nagar Unnyan Samity(near ASEB Narengi)**

**Date & Time:** 01.09.2014, From 11.30 am to 12.30 pm.

<b>Sr. No.</b>	<b>Key Issues/Demands</b>	<b>Perception of community</b>	<b>Action to be Taken</b>
1	Awareness of the project – including coverage area	Local people are not aware of the components of the project. It is understood that 20% of the people have some idea.	Awareness program at different locations related to the project components is essential. Summary of the project was explained.
2	In what way they may associate with the project	At construction phase some people can work as laborers and after completion water supply to the nearby areas shall be improved.	
3	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The reservoir site is in ASEB land. Presence of any wildlife is not reported.	
4	Presence of historical/ cultural/ religious sites nearby	There is no such historical /cultural site nearby.	
5	Unfavourable climatic condition	In the pick summer and in the rainy season it is humid and hot. Not suitable for continuous work.	
6	Occurrence of flood	No such case is reported in the reservoir area since it is higher elevation however in downhill areas temporary water logging is reported during high rainy season.	
7	Drainage problem facing	No such case reported.	
8	Present drinking water problem – quantity and quality	There is scarcity of drinking water. The local residents use makeshift well water or purchase water for other household purposes. Presence iron is not reported in well water.	
9	Present solid waste collection and disposal problem	As per the local people it is disposed in municipality garbage bin.	
10	Availability of labour during construction time	As discussed during the consultation, some local labours may be available during construction.	
11	Access road to project Site	There is metallic bituminous and non-bituminous road in the area.	
12	Perception of locals On tree felling and afforestation	Generally the locals are against the tree felling but for reservoir site felling of few trees involved.	Required compensation will be given and required plantation will be done as per Govt. rule
13	Dust and noise pollution and disturbances during construction work	Request for arresting dust and protection from noise pollution for habitation.	Mitigation measures will be applied as per EMP.

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
14	Setting up worker camp site within the village/ project locality	Project area have a space for setting labour camp. Local people will allow to set up labour camp.	
15	Safety of residents during construction phase and plying of vehicle for construction activities	Local people requested for safety measures when excavation and construction work will be going on and also for traffic management.	Arrangements as per EMP will be applied.

#### NAME AND POSITION OF PERSONS CONSULTED:

- |                           |                            |                           |
|---------------------------|----------------------------|---------------------------|
| 1) Sri Ganeswar Talukdar  | 35) Sri Pan deka           | 69) Sri B.Barua           |
| 2) Sri Bipin Chandra das  | 36) Smti Dalimi Deka       | 70) Smti Maliti           |
| 3) Sri Karabi Das         | 37) Smti Phuleawari Barua  | 71) Smti Sewali Devi      |
| 4) Sri Dhaneswar Boro     | 38) Smti Niru Gogoi        | 72) Smti Uma Pandit       |
| 5) Sri Ashad Ali          | 39) Sri Mrinal Burman      | 73) Sri Rin Gogoi         |
| 6) Sri Deben Chandra Deka | 40) Smti Minati Kalita     | 74) Smti Manju Baisya     |
| 7) Sri Gopal Barman       | 41) Sri Kandrapa Kalita    | 75) Smti Binita Deka      |
| 8) Sri Mohan Singh        | 42) Sri Harakanta Deka     | 76) Smti Sangita          |
| 9) Smti Sumita Devi       | 43) Sri Raman Kalita       | 77) Sri Kratic Kakati     |
| 10) Sri Bhabesh Das       | 44) Sri Umakanta Pandit    | 78) Sri Monoranjan Kakati |
| 11) Smti Dipika Das       | 45) Sri R.Sarma Devi       | 79) Smti Sumitra Kalita   |
| 12) Sri Uperdar Paswan    | 46) Smti Kalyani Baishya   | 80) Sri Islamuddin Laskar |
| 13) Smti Kalyani Devi     | 47) Sri Tilak Baishya      |                           |
| 14) Smti Mausami Bhuyan   | 48) Smti Manika Bashya     |                           |
| 15) Smti Runumi Bhuyan    | 49) Smti Sikha Moni Kalita |                           |
| 16) Sri Ratan Kr.Deka     | 50) Smti Purnima Bhagawati |                           |
| 17) Sri Naren Rajbonsi    | 51) Smti Kankana Sutradhar |                           |
| 18) Smti Bijuli Deka      | 52) Sri Ritu Parna Kalita  |                           |
| 19) Sri Mohesh Nath       | 53) Smti Dalimi Deka       |                           |
| 20) Smti mina Das         | 54) Sri Mohon Singh        |                           |
| 21) Smti Karabi Das       | 55) smti Chintamoni Devi   |                           |
| 22) Smti Kanika Boro      | 56) Smti Ramabati Thakur   |                           |
| 23) Sri Kalpana Basya     | 57) Smti Aparna Kakati     |                           |
| 24) Smti Sangita Basya    | 58) Smti Pramila Haloi     |                           |
| 25) Sri Basanta Basya     | 59) Sri Bhawan Thakur      |                           |
| 26) Sri Ratan Ch.Deka     | 60) Smti Binita Deka       |                           |
| 27) Sri Ranju Deka        | 61) Smti Sabita Nath       |                           |
| 28) Smti Rita Kalita      | 62) Smyi Rinkumoni Deka    |                           |
| 29) Sri Bhagawan Haloi    | 63) Smti Kusum Medhi       |                           |
| 30) Sri Ratneswar Basya   | 64) Smti Niru Nath         |                           |
| 31) Smti Gitu Rajbansi    | 65) Sri Kamal Bora         |                           |
| 32) Sri Upen Das          | 66) Sri K.Nath             |                           |
| 33) Smti Jhulan Garg      | 67) Sri Narayan Sarma      |                           |
| 34) Sri Lalit Barua       | 68) Sri Bikram Deka        |                           |

N.B. All persons are the residents of Kenduguri and nearby areas and near to the project site.

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 cooperation is expected from the local residents. During construction time there is necessity to apply mitigation measures as per the Environment Management Plan.

### Consultation 3

**Area: Gopalnagar**

**Date & Time:** 1st. September, 2013. From 10.30 pm to 11.30pm.

<b>Sr. No.</b>	<b>Issues</b>	<b>Perception</b>	<b>Action taken</b>
1	Awareness and extent of the project and development components	Local people are not aware of the components of the project. It is understood that 20% of the people have some idea.	Awareness program at different project locations related to project components is essential
2	Perceptions and view of the local community on the project—is the project relevant or not?	The people in the project areas agreed on the relevance of the project. They shared that sufficient & quality water needs to be available throughout the day	
3	In what way they may associate with the project	At the construction phase some people can work as laborers	
4	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	No forest land nearby	
5	Presence of historical/ cultural/ religious sites nearby	There is one Siva temple by the side of approach road but this is not going to be effected	
6	Unfavourable climatic condition	In the pick summer and in the rainy season it is humid and hot. Not suitable for continuous work.	
7	Occurrence of flood	No such case is reported	Drainage project will be designed considering the issue
8	What is the nature of drainage/ solid waste problem in the community at present? What is the view of the people on improving it?	No such problem	
9	Drainage problem facing	No such case reported even during monsoon.	
10	Present drinking water problem – quantity and quality	There is scarcity of drinking water. There is small drinking water supply scheme catering to the needs of only around 450 people which is also not assured. Presence of iron in water is not reported.	
11	Present solid waste collection and disposal problem	As per the local people it is disposed in municipal garbage bin	
12	Availability of labour during construction time	Some local people may work as labor during construction phase.	
13	Access road to project Site	There is nonmetallic and non-bituminous road.	
14	Perception of locals On tree felling and afforestation	Generally not required. Forest department has already given permission to cut trees.	Required compensation will be given and required plantation will be done as per Govt. Rule
15	Dust and noise pollution and disturbances during construction work	Request for arresting of dust and protection of habitation from noise pollution	Mitigation measures will be applied as per EMP
16	Setting up worker camp site	Project area has sufficient space for	

	within the village/ project locality	setting labour camp. Local people will allow to set up labour camp.	
17	Safety of residents during construction phase and plying of vehicle for construction activities	Local people requested for safety measures when excavation and construction work will be going on and also for traffic management.	

**NAME AND POSITION OF PERSONS CONSULTED:** All persons are the residents of Gopalnagar Siva Mandir Path

- 1) Sri Rajat Chandra Das.
- 2) Sri B.K.Sarma.
- 3) Sri M.Kakati
- 4) Sri Girish Ch. Sarma.
- 5) Sri Anil Bora.
- 6) Sri Anil Kalita.
- 7) Sri Kamal Talukdar.
- 8) Sri Deshbandhu Nath.
- 9) Sri Khagendra Nath Das.
- 10) Sri Girish Chandra Dutta.
- 11) Sri Binoy Das.
- 12) Sri Pradip Deka.
- 13) Sri Biren Nath.
- 14) Sri Raj Kumar Niak.
- 15) Sri Mintu Das.
- 17) SriGautam Bharali.

#### **Consultation : 4**

**Area: Basistha area, Bijoipur,Barpathar,Arunodo Gaon**

**Date & Time:** 06.04.2015, From 10.30 am to 12.30 pm

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
1	Awareness of the project – including coverage area	Local people are not aware of the components of the project. It is understood that 20% of the people have some idea.	Awareness program at different locations related to the project components is essential.
2	In what way they may associate with the project	At construction phase some people can work as labourers and after completion water supply to the nearby areas shall be improved.	
3	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The reservoir site does not fall under forest area	
4	Presence of historical/ cultural/ religious sites nearby	There is main Basistha Temple in the area but this is not going to be effected.	
5	Unfavourable climatic condition	In the pick summer and in the rainy season it is humid and hot. Not suitable for continuous work.	
6	Occurrence of flood	No such case is reported in the reservoir area since it is higher elevation however in downhill	

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
		areas water logging is reported.	
7	Drainage problem facing	No such case reported.	
8	Present drinking water problem – quantity and quality	There is scarcity of drinking water. The local residents use makeshift well, tube well Govt. supply (for small duration) water for other household purposes.. Presence iron is reported in tube well water.	
9	Present solid waste collection and disposal problem	As per the local people it is disposed in municipality garbage bin	
10	Availability of labour during construction time	As discussed during the consultation, some local labours may be available during construction.	
11	Access road to project Site	There is metallic bituminas and non-bituminous road in the area.	
12	Perception of locals On tree felling and afforestation	Generally the locals are against the tree felling but for distribution net work and in the reservoir site no felling of trees involved.	Required compensation will be given and required plantation will be done as per Govt.rule.
13	Dust and noise pollution and disturbances during construction work	Request for arresting dust and protection from noise pollution for habitation.	Mitigation measures will be applied as per EMP.
14	Setting up worker camp site within the village/ project locality	Project area does not has sufficient space for setting labour camp. However local people will allow to set up labour camp if alternative arrangement is made.	
15	Safety of residents during construction phase and plying of vehicle for construction activities	Local people requested for safety measures when excavation and construction work will be going on and also for traffic management.	Arrangements as per EMP will be applied.

**NAME AND POSITION OF PERSONS CONSULTED:**

- 35) Smti. Gangarani Das
- 36) Sri Jaswant Singh
- 37) Sri Pinku Saharia
- 38) Smti Dapali Mudoj
- 39) Sri Bishnu Das
- 40) Sri Rituraj Sarma
- 41) Smti Rekha Debnath
- 42) Smti Usha Roy
- 43) Sri Nakul Debnath
- 44) Smti Monika Khatoniar
- 45) Sri Gonesh Das
- 46) Sri Julu Khatoniar
- 47) Sri Ramen Medhi
- 48) Sri Brojen Das
- 49) Smti Aloka Medhi
- 50) Sri Chandra Das
- 51) Sri Parama Patgiri
- 52) Sri Gonesh Kalita
- 53) Sri Babul Das

- 54) Sri Parasmani Das
- 55) Smti Nirupama Saikia
- 56) Smti Sabitri Devi
- 57) Smti Monika Deka
- 58) Smti Nomita Knowar
- 59) Smti Golapi Talukdar
- 60) Sri Dipak Kalita
- 61) Sri Dhiraj Saikia.
- 62) SriJiben Ghose Dastidar Rahman

N.B. All persons are the residents of of Bijoipur Basistha, Borpathar, Arundhuti gaon and Basistha mandir path and nearby areas and near to the project site. The reservoir site does not have residences.

Summary of outcome: Local people are very much interested in the proposed project. They requested to complete the project as early as possible. All type of cooperation is expected from the local residents. During construction time there is necessity to apply mitigation measures as per the Environment Management Plan.

### **Consultation: 5**

**Area: Basistha Mandir**

**Date & Time:** 22<sup>nd</sup>, March, 2014. From 03.10 pm to 04.10pm.

<b>Sr. No.</b>	<b>Key Issues/Demands</b>	<b>Perception of community</b>	<b>Action to be Taken</b>
1	Awareness of the project – including coverage area	Local people are not aware of the components of the project. It is understood that 10% of the people have some idea.	Awareness program at different locations related to the project components is essential.
2	In what way they may associate with the project	At construction phase some people can work as labourers and after completion water supply to the nearby areas shall be improved	
3	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The project site is not in forest area	
4	Presence of historical/ cultural/ religious sites nearby	There is main Basistha Temple is away from the site and this is not going to be effected.	
5	Unfavourable climatic condition	In the pick summer and in the rainy season it is humid and hot. Not suitable for continuous work.	
6	Occurrence of flood	No such case is reported. The reservoir site is in the higher elevation. The surface run off in the downhill areas goes down the rivulets near by the temple. .	
7	Drainage problem facing	No such case reported even during monsoon	



Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
8	Present drinking water problem – quantity and quality	There is scarcity of drinking water in the area There is a small water supply scheme which supplies intermittently to about 100 households. Few people use well water and purchased water for daily needs. Presence iron is reported	
9	Present solid waste collection and disposal problem	As per the local people it is disposed in municipality garbage bin .	
10	Availability of labour during construction time	As discussed during the consultation, some local labours may be available during construction.	
11	Access road to project Site	There is metallic and bituminous road in the area	
12	Perception of locals On tree felling and afforestation	Generally not required as Forest department has been requested for land for reservoir. Local people are interested in planting trees for the project.	Required compensation will be given and required plantation will be done as per Govt.rule if tree is cut.
13	Dust and noise pollution and disturbances during construction work	Request for arresting dust and protection from noise pollution for habitation.	Mitigation measures will be applied as per EMP.
14	Setting up worker camp site within the village/ project locality	Project area has sufficient space for setting labour camp. Local people will allow to set up labour camp.	
15	Safety of residents during construction phase and plying of vehicle for construction activities	Local people requested for safety measures when excavation and construction work will be going on and also for traffic management.	Arrangements as per EMP will be applied.

**NAME AND POSITION OF PERSONS CONSULTED:**

- 1)Smti. Laksmi Das.
- 2)Smti Marami Nath.
- 3)Smti. Jali Das.
- 4)Smti .Damayanti Nath.
- 5)Smti.Mina Rai.
- 6)Smti. Monika Medhi.
- 7)Sri. Bubul Das.
- 8)Sri. Mantu Sarma.
- 9)Sri.Damador Kalita.
- 10)Sri.Pabitra Baishya
- 11)Sri.Jayanta Dev.
- 12)Sri .Binod Sarma.
- 13)Sri Gonesh Chowdhury.
- 14)Sri.Jitendra Baishya.
- 15)Sri.Deepak Das
- 17) Smti.Anima Nath.

N.B. All persons are the residents of Basistha Mandir and adjoining 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 sort of cooperation is expected from the local residents. During construction time there is necessity to apply mitigation measures as per the Environment Management Plan.

### **Consultation 6**

**Area: North jyotinagar (Deepjyoti Sangha)**

**Date & Time:** 2<sup>nd</sup>, March , 2014. From 11.00 am to 12.30pm.

<b>Sr. No.</b>	<b>Key Issues/Demands</b>	<b>Perception of community</b>	<b>Action to be Taken</b>
1	Awareness of the project – including coverage area	Local people are not aware of the components of the project. It is understood that 20% of the people have some idea.	Awareness program at different locations related to the project components is essential.
2	In what way they may associate with the project	At construction phase some people can work as labourers and after completion water supply to the nearby areas shall be improved.	
3	Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project area	There is no forest area near by the project site.	
4	Presence of historical/ cultural/religious sites nearby	There is no presence of historical/cultural sites nearby. Temple like Manasa mandir, Siva mandir, constructed by local people are there.	
5	Unfavourable climatic condition	In the pick summer and in the rainy season it is humid and hot. Not suitable for continuous work.	
6	Occurrence of flood	No such case is reported. The reservoir site is in the hilltop. The surface run off some times create water logging in the downhill areas for some period of time.	
7	Drainage problem facing	No such case reported even during monsoon other than temporary water logging in the downhill areas.	
8	Present drinking water problem – quantity and quality	There is scarcity of drinking water in the area. Most of the people purchase water for their daily needs. A few people have deep tube well. Presence iron is reported	
9	Present solid waste collection and disposal problem	As per the local people it is disposed in municipality garbage bin	

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
10	Availability of labour during construction time	As discussed during the consultation, some local labours may be available during construction.	
11	Access road to project Site	There is metallic and non-bituminous road in the area	
12	Perception of locals On tree felling and afforestation	Generally not required as Forest department has already given permission to cut trees. Local people are interested in planting trees for the project.	Required compensation will be given and required plantation will be done as per Govt. rule.
13	Dust and noise pollution and disturbances during construction work	Request for arresting dust and protection from noise pollution for habitation.	Mitigation measures will be applied as per EMP.
14	Setting up worker camp site within the village/ project locality	Project area has sufficient space for setting labour camp. Local people will allow to set up labour camp.	
15	Safety of residents during construction phase and plying of vehicle for construction activities	Local people requested for safety measures when excavation and construction work will be going on and also for traffic management.	Arrangements as per EMP will be applied.

**NAME AND POSITION OF PERSONS CONSULTED:**

- |                           |                          |
|---------------------------|--------------------------|
| 1) Sri Nandalal Das       | 11) Sri Dipak Choudhury. |
| 2) Sri Kailash Ch. Sarma  | 12) Sri Ranjit Gogoi     |
| 3) Sri Jogen Thakuria     | 13) Smti. Pallabi Devi.  |
| 4) Sri Binod Sarma        | 14) Smti. Bina Kote.     |
| 5) Sri Parag Medhi.       | 15) Smti Phula Kalita    |
| 6) Sri Bhupen Sarma       | 16) Sri Mukul Ch. Das.   |
| 7) Sri Brojen Das         | 17) Smti. Dipali Baruah  |
| 8) Sri Ashis Kr. Bhuyan   | 18) Smti Padumi Malakar. |
| 9) Sri. G. Rabha          | 19) Smti Reena Talukdar. |
| 10) Sri. Kamal Lochan Das |                          |

N.B. All persons are the residents of North Jyotinagar.

Summary of outcome: Local people are very much interested in the proposed project. They requested to complete the project as early as possible. All sort of cooperation is expected from the local residents. During construction time there is necessity to apply mitigation measures as per the Environment Management Plan.

**Consultation 7**

**Area :** Kailash Nagar (Near Nabajyoti and Alokjyoti Nagar)

**Date & Time :** 31st November, 2013. From 3.30pm to 5.0pm

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
1	Awareness of the project – including	Local people are not much aware on components of the project. In 30% cases	Awareness program at different project locations

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
	coverage area	they have some idea	related to project components is essential
2	In what way they may associate with the project	At the construction phase some people can work as laborers, after completion, water supply to nearby areas shall be improved	
3	Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area	The project area is Govt. land for which permission has been granted. There is no wild life or sensitive/ unique environmental components in the project area.	
4	Presence of historical/ cultural/ religious sites nearby	There is no historical / cultural or religious site nearby.	
5	Unfavourable climatic condition	The pick summer is hot and humid and not suitable for continuous work at open area.	
6	Occurrence of flood	No such case is reported During monsoon water runs down the hill slope and passes through the downhill in to the drain by the road side.	Drainage project will be designed considering the issue
7	Drainage problem facing	No any	
8	Present drinking water problem – quantity and quality	In 70% cases local complained on non availability of water, Presence of iron is not reported by 90% of habitation. In 50% cases people have own arrangement (tube well or dug well) within their premises even carry water from outside	
9	Present solid waste collection and disposal problem	As per local people solid wastes are disposed in municipal dust bin which is cleared by Guwahati Municipality.	
10	Availability of labour during construction time	Yes, labours are available in the nearby areas.	
11	Access road to project Site	Non bituminous road is existing in some of the cases. However access road is to be constructed.	
12	Perception of locals On tree felling and afforestation	Generally not required in most of the cases.	If required compensatory plantation will be done as per Govt. rule
13	Dust and noise pollution and disturbances during construction work	Request for arresting of dust and protection of habitation from noise pollution	Mitigation measures will be applied as per EMP
14	Setting up worker camp site within the project locality	Project area appears not having sufficient space for workers camp. Local people will allow to set up labour camp if necessary.	
15	Safety of residents during construction phase and plying of vehicle for	Local requested for safety arrangement particularly where excavation is being planned near main city road.	Mitigation plan will be applied

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
	construction activities		

**NAME AND POSITION OF PERSONS CONSULTED:**

- |                         |                         |                             |
|-------------------------|-------------------------|-----------------------------|
| 1)Smti Birohi Kathar.   | 23)Smti Sabita Roy      | 45)Sri Ajit Gogoi           |
| 2)Smti Rumi Pachoni     | 24)Smti Pratima Rahman  | 46) Sri Sri Bidyadhar Anand |
| 3)Smti Kurachi Devi     | 25)Sri Rami Sinha       | 47)Smti Jahanara Khatun     |
| 4)Smti Renuka Choudhury | 26)Sri Mono Roy         | 48)Sri Kajiron              |
| 5)Smti Anima Choudhury  | 27)Smti Minu Goala      | 49)Smti Parbati Burman      |
| 6)Smti Dalimi Boro      | 28)Smti Sabita Burman   | 50)Smti Arpana Kalita       |
| 7)Smti Jonali Boro      | 29)Smti Parbati Burman  | 51)Sri Kalaswer Kalita      |
| 8)Smti Rina Pegu        | 30)Sri Kanda Burman     | 52)Sri Dilip Thapa          |
| 9)Smti Dalimi Boro      | 31)Sri Bhagya Mandal    | 53)Sri Dipak Thapa          |
| 10)Smti Mamoni Basya    | 32)Sri Sri Kisore Thapa | 54)SriDipak Gurung          |
| 11) Sabita Dangoria     | 33)Smti Kapila Thapa    | 55)Sri Boloram Sarma        |
| 12)Smti Madhumita Das   | 34)Sri Dipak Gurung     | 56)Md.Fatar Ali             |
| 13)Smti Maya Sonar      | 35)Sri Simanta Saini    | 57)Smti Saraswati           |
| 14)Smti Smitra Tharu    | 36)Smti Anawara Begum   | 58)Miss Mamani Begum        |
| 15)Smti Ranu            | 37)Smti Runujun Begum   | 59)Smti Lalita Pradhan      |
| 16)Smti Nilima Sarma    | 38)Sri Gopi Thapa       | 60)Sri Mubarak Hussian      |
| 17)Smti Anima Das       | 39)Smti Gita Roy        | 61)Smti Kusum Kalita        |
| 18)Sri Hira Das         | 40)Sri Sadhan sarkar    | 62)Smti Achiron Begum       |
| 19)Smti Premoda Das     | 41)Sri Monoj Rajbonshi  | 63) Smti Anju Baisya        |
| 20)SmtiGitingali Das    | 42)Sri Ranjan Thapa     | 64) Sm NiRoda Boro          |
| 21)Smti Monomoti Burman | 44)Sri Monoj Kr.Rai     |                             |
| 22)Smti Tunu Deka       |                         |                             |

Summary of outcome: Local people are very much interested on the proposed project. They requested to complete the project at earliest. All sort of cooperation is expected from local habitation. During construction time there is a necessity to apply mitigation measures as per Environment Management Plan

Public Consultation at different locations



## APPENDIX 6: Sample Grievance Registration Form

(To be available in Hindi, Assamese and English or local language, if any)

The **Assam Urban Infrastructure Investment Program (AUIIP)** 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.

<b>Date</b>		<b>Place of registration</b>			
<b>Contact Information/Personal Details</b>					
<b>Name</b>		<b>Gender</b>	<b>Male</b>	<b>Female</b>	<b>Age</b>
<b>Home Address</b>					
<b>Village / Town</b>					
<b>District</b>					
<b>Phone no.</b>					
<b>E-mail</b>					
<b>Complaint/Suggestion/Comment/Question Please provide the details (who, what, where and how) of your grievance below:</b>					
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

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

### GRIVENCES RECORD AND ACTION TAKEN

Sr. No.	Date	Name and Contact No. of Complainer	Type of Complain	Place	Status of Redress	Remarks