

Draft Initial Environmental Examination

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India: North-Eastern Region Capital Cities Development Investment Program (Tranche 3) – Agartala Water Supply

Prepared by State Investment Program Management and Implementation Unit (SIPMIU)
Urban Development Department, Govt. of Tripura

For the Government of Tripura
North-eastern Region Capital Cities Development Investment Program (NERCCDIP)

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.

Asian Development Bank

ABBREVIATIONS

ADB	— Asian Development Bank
AMC	— Agartala Municipal Council
BOQ	— Bill of quantity
CBO	— Community-based organization
CDP	— City Development Plan
CFE	— Consent for Establishment
CFO	— Consent for Operation
CGWB	— Central Ground Water Board
CLC	— City Level Committee
CPHEEO	— Central Public Health and Environmental Engineering Organization
DSMC	— Design Supervision and Management Consultant
DTW	— Deep Tube Well
DWS	— Drinking Water and Sanitation
EAC	— Expert Appraisal Committee
EARF	— Environmental Assessment Resettlement Framework
EARP	— Environment Assessment Review Procedure
EIA	— Environmental Impact Assessment
EMP	— Environmental Management Plan
EMS	— Environmental Monitoring Specialist
EPA	— Environmental Protection Agency
FFA	— Framework Financing Agreement
GAPA	— Greater Agartala Planning Area
GLSR	— Ground level Storage Reservoir
GRC	— Grievance Redress Committee
GWTP	— Ground Water Treatment Plant
H and S	— Health and safety
IEE	— Initial Environmental Examination
INR	— Indian Rupee
IRP	— Iron Removal Plant
JNNURM	— Jawaharlal Nehru National Urban Renewal Mission
KL	--- Kilo liters
LPCD	— Liters per capita per day
MFF	— Multitranchise financing facility
MLD	— Million liters per day
MOEF	— Ministry of Environment and Forests
NAAQS	— National Ambient Air Quality Standards
NER	— North Eastern Region
NERCCDIP	— North Eastern Region Capital Cities Development Investment Program
NGO	— Nongovernmental organization
NRW	— Non-revenue water
O and M	— Operation and maintenance
OHSA	— Occupational Health and Safety Administration
OHSR	— Overhead storage reservoirs
OMC	— Operations and Maintenance Contractors
PFR	— Periodic Financing Request
PHED	— Public Health Engineering Department
PWD	— Public Works Department

ROW	—	Right of way
SEIAA	—	State Environment Impact Assessment Authority
SIPMIU	—	State-level Investment Program Management and Implementation Units
SPS	—	Safeguard Policy Statement
SR	—	Service Reservoir
TA	—	Technical Assistance
TDS	—	Total dissolved solids
TOR	—	Terms of reference
UDD	—	Urban Development Department
UFW	—	Un-accounted For Water
ULB	—	Urban local body

WEIGHTS AND MEASURES

dbA		decibels
ha		Hectare
KL		Kilo liter
km	—	kilometer
km ²		square kilometer
l		liter
m	—	meter
m ²		square meter
m ³		cubic meter
MT		metric tons
MTD		metric tons per day

NOTES

- (i) In this report, "\$" refers to US dollars.
- (ii) "INR" and "Rs" refer to Indian rupees.

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EXECUTIVE SUMMARY

1. The North Eastern Region Capital Cities Development Investment Program (NERCCDIP) envisages achieving sustainable urban development in the Project Cities of Agartala, Aizawl, Kohima, Gangtok and Shillong through investments in urban infrastructure sectors. NERCCDIP is being implemented over a six year period beginning in 2010, and is being funded by a loan via the Multitranchise Financing Facility (MFF) of the Asian Development Bank (ADB). Tranche 1 was approved in July 2009 and the second tranche (Tranche 2) was approved in December 2011. The executing agency (EA) is the Government of Tripura (GoT) Urban Development Department (UDD) and the implementing agency is the State-level Investment Program Management and Implementation Units (SIPMIU).

2. 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 SPS (2009). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

3. This draft Initial Environmental Examination (IEE) has been prepared for Agartala Water Supply Subproject for funding under NERCCDIP Tranche 3 following the EARF and meeting the requirements of ADB SPS, 2009. The components of the subproject include: (i) providing and laying of 177 km distribution pipelines in the Central Zone of Agartala, (ii) procurement of domestic water meters and installation, (iii) construction of new jackwell including rehabilitation of the existing water treatment plant (WTP) at College Tillah, (iv) construction of new ground level service reservoir including rehabilitation of the intake and existing WTP at Bardowali, and (v) installation of 12 deep tube wells along with pumping machineries including replacement of existing tube wells. An Environmental Management Plan (EMP) is proposed as part of this report 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 grievance redress mechanism.

4. Detailed design began in the middle of 2013 and completed in September 2014. After award of contract concerned contractor will finalize the field design and accordingly IEE will be revised. Construction will begin in mid-2015, and will take around eighteen months. All civil works will be completed by the end of 2016.

5. The subproject locations are located in the built-up area of Agartala City. The subproject locations are plain to generally undulating but are not located in areas prone to water-logging, salinasation, and flash flood. There are no protected areas, wetlands, mangroves, or estuarines in or near the subproject locations. Trees, vegetation (mostly shrubs and grasses), and animals are those commonly found in urban areas. The subproject locations are not located in or near any historically-, culturally-, archaeologically- or architecturally-significant or tourists area.

6. Potential negative impacts were identified in relation to design, construction, and operation of the infrastructure. A number of impacts and their significance have been reduced by amending the designs and considering the environmental criteria for subproject selection specified in the EARF thus no impacts were identified as being due to the project design or location. During the construction phase, impacts mainly arise from the need to dispose of moderate quantities of waste soil and construction wastes, disturbance of residents, businesses, and traffic and workers health and safety. These are common impacts of

construction in urban areas, and there are well developed methods for their mitigation. Once the system is operating, most facilities (deep tube wells and pipelines) will operate with routine maintenance, which should not affect the environment. Potential impacts due to operation of the WTP include competing uses due to water abstraction, solid waste such as sludge and residuals that may be generated during operations and maintenance activities, filter backwash that may contain suspended solids and organics from the raw water, high levels of dissolved solids, heavy metals, etc. and risks to workers due to use of chemicals for coagulation, disinfection, and water conditioning. The subproject will include development of O&M manuals which includes occupational health and safety. Therefore anticipated environmental impacts are mainly related to the construction period which can be minimized by the mitigating measures and environmentally-sound engineering and construction practices. O&M impacts can be avoided by ensuring operators are qualified and experienced, complying with national and state regulations, and implementing mitigation measures per O&M manual.

7. An impact of improved water supply system is increased generation of domestic wastewater. Agartala will its current collection and treatment of septage thru another subproject to be financed by NERCCDIP Tranche 3. Therefore this subproject will have positive impacts to the citizens of Agartala as they will be provided with a constant supply of water resulting to improved quality of life.

8. The stakeholders were involved in developing the IEE through face-to-face discussions and public meetings organized by SIPMIU. Views expressed were incorporated into the IEE and the subproject planning and development. Relevant information will be disclosed to stakeholders in language and form understandable to them and to a wider audience via ADB website. The consultation process will be continued and expanded during subproject implementation to ensure that stakeholders are fully engaged in the project, have the opportunity to participate in its development and implementation, and made aware of the project grievance redress mechanism.

9. The EMP includes mitigation measures intended to protect the environment, workers and community and will form part of the civil works contract. Its implementation will be assured by an environmental monitoring program. SIPMIU, with the assistance of design, supervision and monitoring consultants (DSMC) will monitor and measure the progress of EMP implementation thru observations on- and off-site, document checks and interviews with workers and beneficiaries. Indicative EMP implementation cost includes budget to cover updating the IEE, preparing and submitting semi-annual reports, consultations and disclosure, application for environmental clearance/s, NOCs, CFEs, and CFOs and monitoring of EMP implementation. The cost of mitigation measures and surveys during construction stage will be incorporated into the contractor's costs. SIPMIU will communicate with ADB regarding environmental safeguard issues. EMP implementation reporting to ADB will be done on a semi-annual basis.

10. Therefore the subproject is unlikely to cause significant adverse impacts as the potential environmental impacts associated with design, construction, and operation can be mitigated to standard levels without difficulty. 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.

I. INTRODUCTION

A. Purpose of the Report

1. The North Eastern Region Capital Cities Development Investment Program (NERCCDIP) envisages achieving sustainable urban development in the Project Cities of Agartala, Aizawl, Kohima, Gangtok and Shillong through investments in urban infrastructure sectors. NERCCDIP is being implemented over a six year period beginning in 2010, and is being funded by a loan via the Multitranchise Financing Facility (MFF) of the Asian Development Bank (ADB). Tranche 1 was approved in July 2009 and the second tranche (Tranche 2) was approved in December 2011. The executing agency (EA) is the Government of Tripura (GoT) Urban Development Department (UDD) and the implementing agency is the State-level Investment Program Management and Implementation Units (SIPMIU).

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B. Policy and Legal Framework

1. ADB Policy

4. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for Environmental Assessment are described in ADB SPS 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.

5. **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.

6. **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.

7. **Public Disclosure.** 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) For environmental category A projects, draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and
- (iii) Environmental Monitoring Reports submitted by SIPMIU during project implementation upon receipt.

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

2. National Law

9. The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorised as A or B depending on the scale of the project and the nature of its impacts.

10. **Categories A** projects require Environmental Clearance from the National Ministry of Environment and Forests (MOEF). The proponent is required to provide preliminary details of the project in the form of a Notification, after which an Expert Appraisal Committee (EAC) of the MOEF prepares comprehensive Terms of Reference (TOR) for the EIA study, which are finalized within 60 days. On completion of the study and review of the report by the EAC, MOEF considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.

11. **Category B** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorises the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the Environmental Clearance based on the EAC recommendation. The Notification also provides that any project or activity classified as category B will be treated as category A if it is located in

whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

12. The only type of infrastructure provided by the NERCCDIP that is specified in the EIA Notification is solid waste management. Environment Clearance is not required for the said subproject.

3. Others

13. As per Tripura State Pollution Control Board (TSPCB) before renovation of water treatment plants Consent for Establishment (CFE) will be required. Also Consent for Operation (CFO) will be necessary prior to operation of the water treatment plants.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

14. **Type.** This is an urban water supply subproject intended to improve the current situation of Agartala in terms of improved water supply system. This is one of a series of subprojects designed by NERCCDP that are intended to raise the standards of the municipal infrastructure and services of Agartala and the other urban centres to those expected of modern Asian towns.

15. **Category.** Environmental examination indicates the proposed subproject falls within ADB's environmental Category B projects. The subproject components will only have small-scale, localized impacts on the environment, and can be mitigated. Under ADB procedures such projects require an IEE to identify and mitigate the impacts.

16. **Need.** The present water generation in Agartala city is estimated to be around 45.6 million liters per day (MLD) against the required demand of 70 MLD. It is projected that between 2001 and 2041 the population of Greater Agartala Planning Area (GAPA)¹ will go up by more than two fold from an estimated 3.8 Lakhs to 8.22 Lakhs. It is estimated that by 2041, 16% of the population in the state will be residing in the GAPA alone. Thus the existing system needs to be augmented/upgraded/expanded to meet the present and projected needs in consonance with the increased demand. As per estimation in respect to population growth, net and gross water demand in the year 2041 will be 112.45 MLD and 129.31 MLD respectively².

17. Apart from the increase in quantitative output, an overall improvement of the quality of water is also desired, since the water sourced from deep tube wells in Agartala has significantly high proportion of iron (It has been observed that water supplied from deep tube wells have iron content much higher than the permissible limit of 0.3 mg/litre). Treatment of ground water through installation of iron removal plants has not been very effective due to operational inadequacies. As such water quality remains poor and treatment process needs to be improved. Accordingly under Tranche 2 Ground Water Treatment Plant have been constructed. Also under

¹ Greater Agartala Planning Area or GAPA is defined as encompassing an area of approximately 92 square kilometres (km²) constituting the present Agartala Municipal Council (with an area of 62 km²) and fringe villages comprising of Singarbil, Narsingarh and Gandhigram CT in the north and Ananda Nagar, Dukli, Madhupur, Madhuban and Charipara in the south. The GAPA is mainly divided into three planning zones by Haora and Katakhal River, the north zone, central zone, and south zone.

² The net water demand is assessed considering 135 liters per capita per day (LPCD) for residential population and 35 LPCD for floating population, which is 5% of the residential population. Gross water demand includes 15% unaccounted for water.

Tranche 2 water distribution network at south zone, water storage reservoirs both south & central zones have been considered.

18. Under Tranche 2 Water Supply Subproject, specifically for the (i) construction of 7 groundwater treatment plants (GWTPs); (ii) construction of 14 new overhead service reservoirs (SRs); (iii) laying of approximately 70.0 km new rising mains; (iv) laying of approx. 432.0 km gravity distribution main at central and south part of Agartala including replacement of worn-out mains; (v) providing 40,000 nos. household connection. Even after that there is a requirement for further augmentation of water supply system of Agartala for future needs.

19. As per present condition under Tranche 3 additional works are required in aspect to:

- (i) Improvement of water Supply Distribution Network in Central Zone and Procurement and installation of Domestic Water Meters.
- (ii) Rehabilitation and Augmentation of the Existing Water Treatment Plants at College Tillah and Bardowali.
- (iii) Installation of New Deep Tube wells including replacement of existing tube wells to increase water availability.

20. Hence sub-project has been undertaken to improve water quality by renovation of surface water treatment units, enhancement of exploitation of ground water and distribution networking for central zone.

B. Location and Implementation Schedule

21. The subproject is located in Agartala City of Tripura District, in the west part of Tripura in north-eastern India. The proposed infrastructures will be located in and around the city. The subproject will cover the central zone (area measuring 13.084 km²) and southern zone (area measuring 22.826 km²) under the Agartala Municipal Council (AMC). The total subproject area is 35.910 km².

22. Detailed design began in the middle of 2013 and completed in September 2014. Construction will begin in mid-2015, and will take around eighteen months. All civil works will be completed by the end of 2016.

C. Description of the Subproject

1. Existing Water Supply and Service Delivery

23. **Source.** Water supply requirement in Agartala is presently met from both surface and ground water source. Surface water is from Haora River while groundwater is extracted through deep tube wells. The total production capacity and assessed capacity of water supply is given in **Table 1**.

Table 1: Details of Existing Water Supply Sources in Agartala

SI	Source of Supply	Installed Capacity	Assessed Production
1	College Tillah (surface water)	13.5 MLD	13.6 MLD
2	Burdowali (surface water)	18.0 MLD	14.0 MLD
3	Tube wells (37 tube wells)	52.0 MLD	12.0 MLD
Total Assessed Generation		83.5 MLD	39.6 MLD

24. The water demand for the Base year (of 2011), intermediate year (2031), and Design year (of 2041) including the present day availability of water for the project area (comprising of Central and South Zone of Agartala) is shown below:

Table 2: Requirement of Water to be availed from Ground Water Sources

Year	Water Demand	³ Available Extraction from Haora	Extraction from Deep Tube wells
Base Year 2011	44.24 Mld	31.50 Mld	12.74 Mld
Intermediate Year 2031	62.51 MID	31.50 Mld	31.01 Mld
Design Year 2041	87.00 Mld	31.50 Mld	55.50 Mld

25. As already indicated, there are presently 37 Nos. of Deep Tube wells within the Project Area. The estimated availability from these Deep Tube wells is presently assessed to be approximately 10 Mld - 14.0 Mld. The water demand continues to increase in the coming years. As such there is a need to bridge the gap between the available and required water demand through installation of new deep tube wells.

26. There are two intakes on the river Haora. The older intake at College Tillah (commissioned in 1970) has an installed capacity of 1.5 MGD (6.8 MLD), later plant augmented to 3 MGD (14 MLD) while the new intake (commissioned in 2000) at Burdowali has an installed capacity of 4 MGD (18 MLD). The two plants supply water to most parts of Central Agartala. During lean season the flow in the Haora river is reduced substantially from 0.4 cubic meters per second (m^3/s) compared to its flow during monsoon season (more than 200 m^3/s).

27. Agartala area has substantial groundwater reserve. The approximate depth of the deep tube wells is around 150 to 200 meters (m) with an installed production capacity ranging from 2,500 to 20,000 gallons per hour i.e. 11.4 to 90.9 KL/hr. Supply to the entire northern zone and almost the entire southern zone is through deep tube wells.

28. **Treatment – Surface Water.** Both the treatment plants have similar treatment units consisting of: (i) cascade aerator; (ii) chemical dosing; (iii) clariflocculator; (iv) rapid gravity filter; (v) chlorinator. Mixing of chemical is effected through a flash mixer in Burdowali WTP. In College Tillah, mixing is effected through baffles within the channel between the cascade aerator and clariflocculator.

29. The College Tillah Water Treatment Plant (WTP) has been operating satisfactorily. However, the Burdowali WTP does not operate at its rated capacity due to the shortage of storage capacity. Quality of water from these WTPs is monitored regularly and is within the desirable limits set by Bureau of Indian Standards (BIS). However, both WTPs need to be rehabilitated to reduce the increased operational and maintenance costs on account of breakdown of machineries and for smooth functioning.

30. **Treatment – Groundwater.** Groundwater in Agartala contains significantly high iron content, necessitating the need for iron removal treatment. Available reports indicate that the iron content for deeper aquifers vary between 3 to 5 milligrams per liter (mg/l) and at times up to 7 mg/l from which most of the deep tube wells extract the water. In Central Agartala, only 6 of

³ Assuming both the College Tillah (Installed Capacity: 3 MGD, 14 MLD) and Bardowali Water Treatment Plant (Installed Capacity: 4 MGD, 18 MLD) are operated at 100% capacity

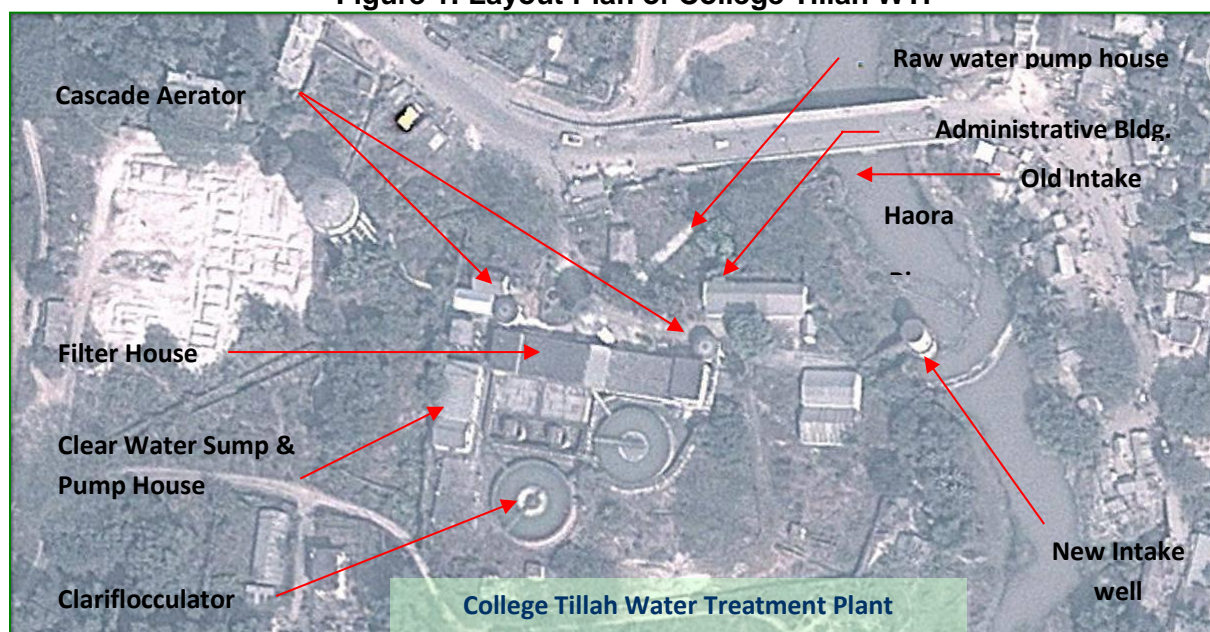
the 9 tube wells have iron removal treatment plants (5 of these have conventional system⁴ – which is spray aeration followed by filtration and 1 is a packaged type plant). In South Agartala, only 13 out of the 25 tube wells have iron removal treatment plants (9 of these are packaged type and the rest have conventional system).

31. The conventional treatment units consist of aeration (achieved through spray aeration) and subsequent filtration of the water through a bed of charcoal. Occasional chlorine dosing is done to expedite settling. The conventional treatment process is unable to reduce the iron content within the desired limits. The packaged treatment plants have been installed more in the recent times. The packaged treatment plants require effective monitoring for clogging of the filter media. Most of the packaged type iron removal plants do not function effectively due to lack of regular maintenance and are occasionally bypassed.

32. **Treatment Surface water at College Tillah WTP:** College Tillah Water Treatment Plant was commissioned way back in 1970, with a capacity of 1.5 MGD (6.8 MLD). Subsequently the Treatment plant was augmented to 3 MGD (14 MLD). Schematic layout of College Tillah Water Treatment Plant on Haora river is shown below:

⁴ The conventional treatment units consist of aeration (achieved through spray aeration) and subsequent filtration of the water through a bed of charcoal.

Figure 1: Layout Plan of College Tillah WTP



33. The intake arrangement at College Tillah consists of:
- (i) A jack well (Older Intake) with a raw water pump house, housing centrifugal pumps for allowing direct pumping arrangement from the Haora River. The number of pumps in the raw water pump house for the Old Intake is: 4 (2 Working + 2 Standby), with a rated Discharge of: 1.00 Lakh Gallons/Hr. Head: 30m. (These are all new centrifugal pumps, which have been recently installed), and a
 - (ii) (New) intake well housing vertical pump sets with 2 vertical turbine pumps (1 Working + 1 Standby). Rated Discharge: 1.00 Lakh Gallons/Hr. Head: 10m.
34. The existing Jackwell is of brick and presently in an extremely poor condition (liable to collapse at any point of time). Means of rehabilitation are not worthy and as such a new well adjacent to the existing one need to be sunk.
35. Treatment Units: The treatment plant comprises of the following treatment units:
- (i) Cascade Aerator
 - (ii) Clariflocculator
 - (iii) Rapid Gravity Filter
 - (iv) Chlorinator
36. There are no flash mixers or similar units, and much of the mixing of chemicals is affected through baffles within the existing channel between Cascade aerator and Clariflocculator. A pre-sedimentation tank provided to reduce the suspended solids count is no longer in use. Due to use of high concentration of liquid chlorine, which is infused as pre-chlorination, the concrete in the raw water channel to clariflocculator is heavily corroded. The raw water channels of concrete need to be repaired.
37. **Issues:** College Tillah WTP: Some of the issues that need immediate and urgent attention at College Tillah WTP are:
- (i) Chlorination unit and chemical dosing / feeding system, which is non-functional.

- (ii) Due to the high silt / iron content of the river and also chemical dosing, most component parts (viz., Clariflocculator arm, gear box, scraper assembly, flocculator paddles, turbine blades in rapid mix unit etc.) are in extremely poor condition.
- (iii) Clariflocculator is leaking at places and needs to be rehabilitated.
- (iv) Due to the high iron content, filters have to be backwashed short intervals. However due to lack of periodical backwashing / maintenance, the backwashing arrangement and filters beds need to be overhauled.
- (v) Suitable measures to reduce the effects due high silt content on raw water pumps and motors.

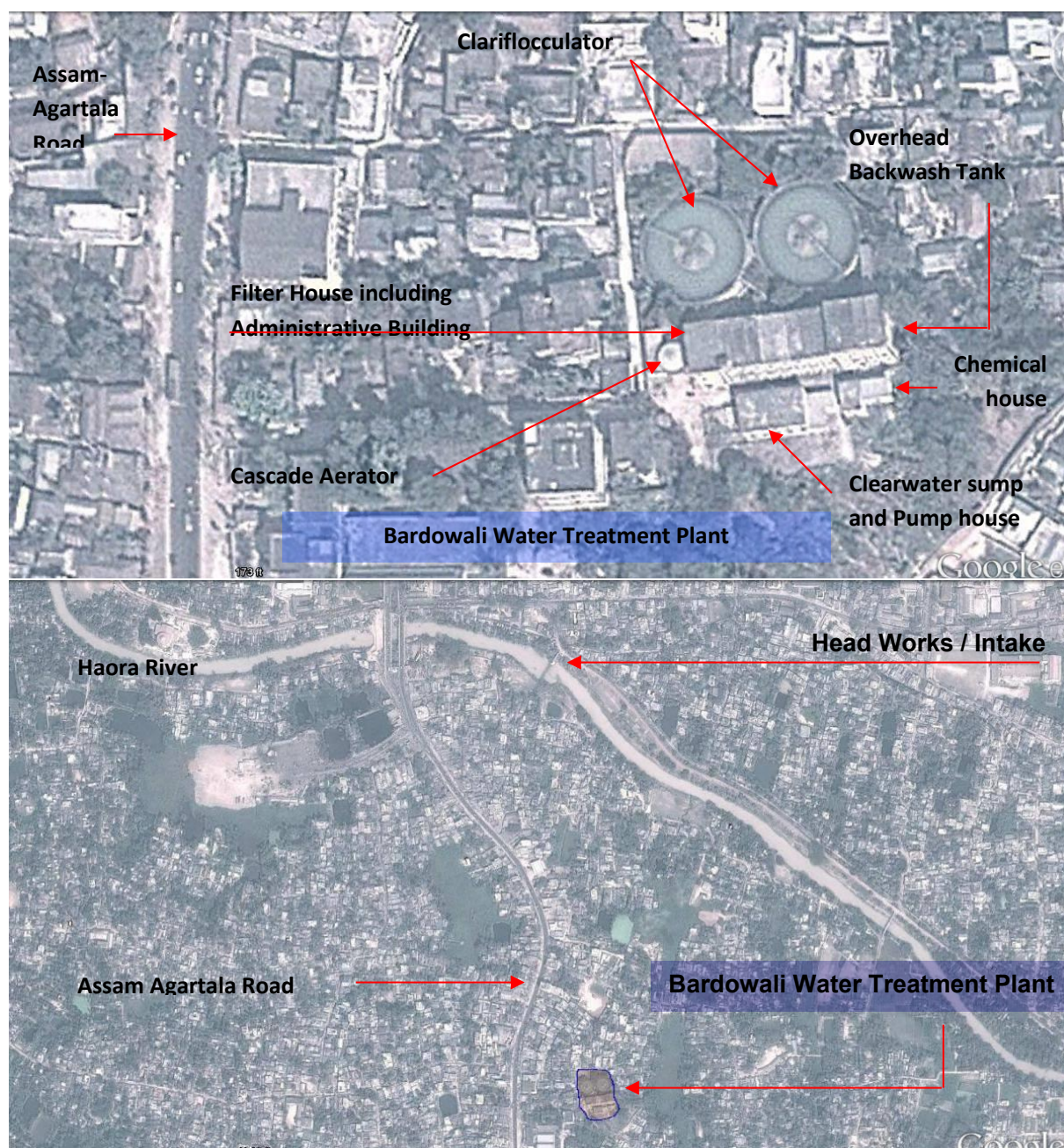
38. **Treatment Surface water at Bardowali WTP:** The 4 MGD (18 MLD) Water Treatment Plant was commissioned in 2000 to meet the water requirements of core areas of Central and South zone of Agartala. Layout of the Bardowali Treatment plant and its locational setting to Agartala city is shown **Figure 2**.

39. Head works consist of an Intake well housing vertical pump sets. No. of pumps in the Intake well is: 3 (2 Working + 1 Standby). Discharge: 1.35 lakh Gallons/Hr. Head: 10m.

40. **Issues:** The issues at Bardowali WTP are similar to that of College Tillah, since the raw water source is the same. Some of the other points that need immediate and urgent attention are:

- (i) Lack of adequate storage capacity: Considering 2 hours detention time for storage of the treated water, the required storage capacity considering 23 hrs working, works out to be $= 2 \times 18/23 = 1.6$ Million Litres $\cong 3.5$ Lakh Gallons. The present storage capacity is only 1.5 Lakh Gallons. As such, the additional storage capacity that will be required is (3.5-1.5) Lakh Gallons i.e. 2.0 Lakh Gallons. Due to the inadequate storage, the utilization of the Treatment plant presently stands at only 14 MLD.
- (ii) Protection of WTP in the form of boundary wall: The existing Treatment plant is not bounded on all sides and as a result of which there is increased movement of unauthorized trespassers. The periphery needs to be secured with boundary wall and fencing.
- (iii) Leakage from Roof top tank.
- (iv) Reduced efficacy of the filters, due to the high iron content, and irregular backwashing arrangement. The existing filter beds need to be replaced with new filter bed materials.
- (v) Non-functional Chlorination unit and chemical dosing / feeding system.
- (vi) Due to the high silt / iron content of the river and also chemical dosing, most component parts (viz., Clariflocculator arm, gear box, scraper assembly, flocculator paddles, turbine blades in rapid mix unit etc.) need to be replaced.
- (vii) Due to the high silt content, considerable expenses are borne on the pumps and motors, As such preventive steps to mitigate the effects due to high silt content on raw water pumps and motors are considered separately.

Figure 2: Layout plan of Bardowali WTP



41. **Storage of Water.** The storage capacity for zonal reservoirs in Agartala is approximately 7,240 KL and is considerably less compared to the gross production capacity (storage capacity is only 10% as compared to the required 25 to 35%). There are 7 overhead service reservoirs (OHSR) and 2 ground level service reservoirs (GLSR) in Agartala. The OHSRs and GLSRs are made from a combination of reinforced cement concrete and steel. The steel reservoirs are quite old and some of these may need to be re-habilitated or replaced immediately.

42. **Distribution system.** Water in central Agartala is predominantly supplied to the distribution system through the SRs. Supply from all the tube wells (9 in Central Agartala and

25 in South Agartala) is by direct pumping. Supply period from tube wells is limited to 4 to 8 hours depending on the demand and the command area. Supply to the various localities is done periodically over this duration and as such, each locality receives supply for a period of 1 to 3 hours each day. Non-operation of one tube well in a particular locality, due to mechanical failure or otherwise results in acute shortage of water in the area.

43. The distribution system is old (around 35 to 40 years back). Due to widening of the roads, the pipelines run along the carriageway width of the road which makes it difficult to attend to repairs in case of leakages. The construction of roads and drains has resulted in the road level being raised and the existing water pipes now lay buried deep at a depth of 2 to 2.5 m below the road surface. The delay to detect and to attend to repairs of leaky pipes/connections results in continued losses.

44. The pipe material in the existing distribution network is generally ductile iron (DI) or cast iron (CI). In certain localities polyvinyl chloride (PVC) pipes have also been used. Due to the high iron content in the water obtained from tube-wells, the pipes get clogged with iron deposits.

45. Existing Command Areas: There are 6 existing water zones in the Central Zone which are presently being served from existing service reservoirs. 4 of the reservoirs are fed from the WTP at College Tilla and 2 of the reservoirs are served from WTP at Bardowali. The existing reservoirs are at:

- (i) Ashram Chowmuhani
- (ii) Science Building
- (iii) Gandhi School
- (iv) Palace Compound, all served from College Tilla – WTP
- (v) Sishu Vihar and
- (vi) Durga Chowmuhani, served from Bardowali – WTP

46. For most parts of existing Distribution system in the Central core area, the water supply distribution pipes were laid way back in 1971 and in the early 80's. Since, then most of the roads have widened and also overlaid with new bituminous layers. Consequent upon the changes, most of the existing pipes now lay either along the width of the carriageway (i.e. about 80%-85% are laid earlier now in or near mid-way of the road) or below considerable depth rendering difficulties in day-to-day operation including day-to-day maintenance and repairs of the water supply system.

47. Also, most of the existing pipes have outlived their durable life (The age of network is over 30-35 years). There are significant leakages to attend too, as well. The existing Water Supply Distribution network for Central zone is shown in layout drawing annexed with the report.

48. Environment Audit report for Water Treatment Plants which are considered under the project is attached as **Appendix 1**.

49. Environment Audit has been conducted for two water treatment plants under the project. Both the treatment plants are not functioning properly. Environment concern mainly related to poor sludge management and unsatisfactory disinfection process. Moreover required environment compliance particularly "Consent Management", stipulation of Pollution Control Board has not been taken care. Manpower analyses indicate that there is requirement of inclusion of Chemist and safety person at WTP. Also it is noted that O & M cost for running of the plants will increase almost 2 times after rehabilitation of WTPs. Compliance requirement for WTP as per Audit Report is shown in Table.

Table 3: Compliance Requirement for WTP

Sr. No.	Present status – Non compliance	Compliance Requirement under the project
1	Poor sludge management - Sludge in form of slurry directly discharge into river Howrah at the downstream point of intake well.	Following provision in rehabilitated WTP: Before discharge of sludge in river settling at sludge pond including proper recirculation of backwash. Settled sludge needs to be removed at least once/ twice in a year for use/ disposal.
2	Unsatisfactory disinfection process - Electro chlorinator non-functioning. Moreover direct use of high dose of liquid chlorine during pre-chlorination process, clariflocculator is get corroded	Rehabilitation of electro-chlorinator in the project After renovation of plant chlorine salt like hypochlorite will be used in electro- chlorinator.
3	For both treatment plants have improper storage of Chlorine and Alum, both are hazardous chemicals. Storage of bleaching powder as disinfectant is temporary	Proper storage of hazardous chemicals for treatment considered under the project
4	Consent Management – presently no consent to operate for WTP	As per Tripura State Pollution Control Board (TSPCB), before renovation of water treatment plants Consent for Establishment (CFE) will be required. Also Consent for Operation (CFO) will be necessary prior to operation of the water treatment plants.
5	Insufficient manpower – no chemist & safety person in WTP	Placement of manpower as per compliance requirement

2. Subproject Components

50. The subproject under Tranche 3 covers (i) Providing and laying of 177 km distribution pipelines in the Central Zone of Agartala, (ii) Procurement of domestic water meters and installation, (iii) Construction of new Jackwell including rehabilitation of the Existing Treatment Plant at College Tillah, (iv) Construction of new Ground level reservoir including rehabilitation of the Intake and Existing Treatment Plant at Bardowali, and (v) Installation of 12 Nos. Deep Tube wells along with pumping machineries including replacement of existing tube wells to augment water production for Agartala.

51. **Laying of Gravity Distribution Mains.** Distribution of water at different areas including replacement of pipes to reduce leakages. Four new service reservoirs have been proposed in the Central zone. These are located at:

- (i) Pragati School
- (ii) Harijan Colony
- (iii) Dashami Ghat and
- (iv) Rampur

52. These areas / water sub-zones are presently served from Deep Tube wells by direct boosting. The pipe diameters vary from 400 mm to 90 mm. Different Pipe materials have been used in the existing system, which varies from DI to HDPE. The pipes supplying water by direct boosting are corroded and heavily encrusted with iron oxide resulting in reduced carrying capacity of the pipes. Since, the proposed system will provide potable water (and is planned for revenue generation), it has been suggested by DWS that all existing pipes supplying water by

direct boosting from the Deep Tube wells (which are likely to be encrusted with iron) will not be used for the proposed system.

53. The estimated length of the pipeline to be retained in Central Zone is 8 Km. The total length of Road network in Central Zone is estimated at 160 Km (As per Survey Data). In road stretches where width of road is more than 10m, pipelines have been proposed on either side of the roads. The total length of pipe line to be laid 177 Km out of which the network in un-piped area will be 44 km. In view of congestion and highly trafficated city road, it is proposed that out of 177 km of pipe line, 51 km will be executed through Trenchless Technology (T.T.) method and rest by conventional cutting and filling method. The roads in the commercial zone and busy trafficated zone have been chosen for the T.T. method of laying pipe line.

54. Proposals for Improvement of College Tillah WTP

55. Jackwell & Raw water pump house

- (i) Construction of a new Jackwell complete with mechanical appurtenances like screen and sluice gate, including dismantling the existing suction piping arrangement of the existing centrifugal pump sets feeding raw water to the WTP.
- (ii) Re-orienting the suction piping arrangement for suction arrangement of the existing centrifugal pump sets to the new jackwell
- (iii) Supply and installation of foot valves for each suction pipe of the existing centrifugal pump sets
- (iv) Provision of vacuum priming arrangement complete with supply and installation of vacuum pumps, piping arrangement for the centrifugal pump sets
- (v) Supply and installation of automatic voltage regulator for each of the drive of the centrifugal pump sets
- (vi) Supply and installation of the automatic power factor correction capacitor panel with capacitors

56. Intake arrangement at new intake

- (i) Supply and Installation of 3 nos. vertical turbine pumps of capacity 135000 GPH complete with drive motor including supply of 2 sets of spare bowl assembly of vertical pump
- (ii) Provision of fresh water lubrication for the vertical pumps including overhead storage tank, piping arrangement and centrifugal pumps for fresh water lubrication and cooling of thrust bearing of vertical pumps and
- (iii) Supply and installation of desilting pump with pipeline
- (iv) Supply and installation of the sluice gate and screen at the entry point to the existing new intake well
- (v) Supply and installation of automatic voltage regulator for each of the drive of the vertical pump sets
- (vi) Supply and installation of the automatic power factor correction capacitor panel with capacitors.
- (vii) Supply of portable dewatering pump with flexible pipe line.

57. Treatment plant

- (i) Supply and installation of alum and lime feeding mechanism complete with pipeline and instrumentation
- (ii) Supply and installation of rapid mixers at the entry channel of clariflocculator
- (iii) Supply and installation of central hub, peripheral drive arrangement complete with reduction gear arrangement for the clariflocculator unit.

- (iv) Installation of drive arrangement complete with extension shaft and paddles for the flocculation unit of the clariflocculator unit.
- (v) Installation of rubber squeezes for the scraper unit of the clariflocculator unit.
- (vi) Implantation of the filter media, supply, & installation of the sluice valves of the rapid filter arrangement.
- (vii) Supply and installation of new drain piping arrangement including valves for the backwash drainage arrangement of the rapid filter.
- (viii) Supply and installation of instrumentation for the measurement of flow from the rapid filter units.
- (ix) Supply and installation of Electro chlorinator

58. Clear water pump house

- (i) Civil works for modification of the existing pre-treatment sedimentation tank to a clear treated water storage reservoir
- (ii) Supply and installation of automatic voltage regulator for each of the drive of the centrifugal pump sets
- (iii) Supply and installation of the automatic power factor correction capacitor panel with capacitors
- (iv) Provision of clamp - on type ultrasonic type flow meter.

59. Suggested proposals for Improvement of Bardowali WTP

60. Intake well

- (i) Replacement of the 3 nos. vertical turbine pumps of (capacity 135000 GPH) complete with drive motor and supply of 2 sets of spare bowl assembly
- (ii) Provision of fresh water lubrication for the vertical pumps including overhead storage tank, piping arrangement and centrifugal pumps for fresh water lubrication and cooling of the trust bearing of the pump sets.
- (iii) Supply and installation of de-silting pump with pipeline
- (iv) Supply and installation of the sluice gates and screen at the entry point to the existing intake well
- (v) Supply of portable dewatering pump with flexible pipe line.
- (vi) Supply and installation of automatic voltage regulator for each of the drive of the vertical pump sets
- (vii) Supply and installation of the automatic power factor correction capacitor panel with capacitors.

61. Treatment plant

- (i) Replacement of the entire chemical feeding mechanism
- (ii) Replacement of rapid chemical mixing mechanism.
- (iii) Installation of central hub, peripheral drive arrangement complete with reduction gear arrangement for the clariflocculator unit
- (iv) Installation of drive arrangement complete with extension shaft and paddles for the flocculation unit of the clariflocculator unit
- (v) Installation of rubber squeezes for the scraper unit of the clariflocculator unit
- (vi) Replacement of backwash and drainage arrangement including improvement of rapid filter mechanism
- (vii) Improvement of the backwash arrangement of the rapid filter mechanism by way of introduction of receiver for compressed air storage

- (viii) Installation of receiver of adequate capacity including piping arrangement, valves and related instrumentation for the compressed air system (air scouring) for the backwash arrangement of the rapid filter
- (ix) Repairs to roof / wall by water proofing compound / grouting.
- (x) Installation of electro-chlorinator unit

62. Clear water pump

- (i) Introduction of automatic voltage regulator for each of the vertical pump sets
- (ii) Introduction of automatic power factor correction capacitor panel with capacitors
- (iii) Replacement of 2 sets of vertical pump sets (Capacity : 100000GPH) with drive arrangement complete with Motor control centre, piping, valves, chain pulley block with geared travelling trolley, instrumentation, cabling, earthing and illumination and allied electrical works.
- (iv) Construction of a clear water reservoir adequate to store the additional water subsequent to realization of the additional 4MLD of treated water
- (v) Treatment plant area is proposed to be secured by boundary wall with wire fencing atop along the eastern and southern periphery of the Treatment Plant.
- (vi) Provision of clamp - on type ultrasonic type flow meter

63. Installation of deep tube well. Significant quantity of the present water that is available to the City of Agartala is through Deep Tube wells. The 2 existing Water Treatment Plants contribute an estimated 27.5 MLD of Water (13.5 Mld from College Tillah and 14.0 MLD from ⁵Bardowali) out of the total demand, estimated at 58 - 60 MLD, at present (For the North, Central and South Zone of Agartala). Considering the depleted water level in Haora, particularly in the lean season further extraction from the River is not feasible.

64. Ground Water Availability and Status of Development. As per the Central Ground Water Board (CGWB), the ground water resource is estimated at 781.75 Hecta meter and ground water draft as 443.7 Hecta meter (ham). Ground water resources available for future development are estimated at 338.05 ham. The CGWB recommends "The stage of ground water development is to be around 56.7% and the area of Agartala under safe category".

65. As such, to ensure sufficient availability of water in the near future, installation of Deep Tube wells will be necessary to cater to the immediate and projected water requirement.

66. Proposal for New Deep Tube wells. Existing Deep Tube wells, which have already been installed (Replacement Deep Tube wells) under Tranche1. The details of the need based requirement of deep tube wells, new and to be renovated under Tranche 3 is given below.

⁵ Installed Capacity of Bardowali WTP is 18Mld

Table 3: Existing TW and New Requirement of TW in Central and South Zone of Agartala City

Sr. No.	Supply To: Identified GWTP (Under Tranche 2)	Proposal under Tranche-3		DTW's Proposed under Tranche-3
		<i>Existing DTW to be replaced</i>	<i>New Tube wells proposed and location (Capacity)</i>	
1	GWTP – 01: PHE Complex, Opp. Pragati School	Existing DTW at Palace compound to be replaced (68 KI/Hr)	▪ Municipality Market, Durga Chowmuhani (68 KI/Hr)	(1 +1)= 2 Nos.
2	GWTP – 02: Area near Bhagat Singh Colony Rampur	Existing DTW at Rampur, Joypur, Balurchar and Pratapgarh at GWTP site to be replaced.(All 68 KI/Hr)	▪ Near west of proposed Treatment Plant (68 KI/Hr) ▪ 1 no. North of Treatment Plant (68 KI/Hr)	(4+2) = 6 Nos.
Total New Deep Tube-well for Central Zone				8 Nos.
3	GWTP – 03; Land near Sarbadharma Ashram	Existing DTW of Panchamukh to be replaced (68 KI/Hr)	▪ 1 New Deep tube well at Camper bazaar (68 KI/Hr)	(1 +1)= 2 Nos.
4	GWTP – 04: PHE Stores, Dukli	Existing DTW at Pranabananda (68 KI/Hr) to be replaced.	No New Deep Tube-wells proposed	1 No.
Total New Deep Tube-well for South Zone-I [Bardowali]				3 Nos.
5	GWTP – 07: , Near Aralia-II DTW	Existing DTW at Champamura to be replaced with New DTW (45 KI/Hr)	No New Deep Tube-wells proposed	1 No.
Total New Deep Tube-well for South Zone-II [Jogendranagar]				1 No.
Under Tranche 3				Total 12 Nos.

67. **Installation of Domestic Meter & household connections.** The extent of Non-revenue water in Agartala as per the Service Level Benchmark, prepared by the AMC, is estimated at over 55%, though the data remains unsubstantiated, due to the lack of flow measurements and metering. Based on available data the total number of authorized connections and households in Central Zone and South Zone of Agartala, it is around 36,000 household connections would be regularized and accounted for under the present programme it expected that more demand of connections will be at the time of commission of water supply, for the so far uncovered area that is total of 40, 000 taken.

68. Assuming an increase in WS connections due to improved services @ 2% over the implementation period, the estimated number of Domestic Household connection would be around 41,200 by 2016

69. **Appendix 2** shows the proposed work components under Tranche 3 in location map.

70. **Table 4** summarizes Agartala **Tranche 3** water supply subproject components.

Table 4: Agartala Water Supply Subproject Components- Tranche 3

Component	Location	Function	Description	Remarks
Laying of Gravity Distribution System	In Central zone of Agartala city. Service area, Pragati School (i) Harijan Colony (ii) Dashami Ghat and (iii) Rampur	Distribution of water in Central zone of Agartala at different areas including replacement of pipes to reduce leaking	Laying of Gravity based distribution mains will be provided to improve the existing water supply system. The pipe diameters vary from 400 mm to 90 mm. Different Pipe materials have been used in the existing system, which varies from DI to HDPE Total approx. length- 177 km	New and Replacement
New Deep Tube wells along with pumping machineries including replacement of existing tube wells to augment water production	New deep tube well at Municipality Market at Durga Chowmuhani, 1 No. New Tube well near west of proposed Water Treatment Plant and 1 No. North of GWTP at Bhagat Singh colony and Campar bazar Replacement of existing DTW at Palace compound, Rampur, Joypur, Balurchar, Pratapgar, Panchmukh, Pranabananda and Champamura	Augment water production to satisfy future requirement	Installation of an estimated 12 Nos. Deep Tube wells along with pumping machineries including replacement of existing tube wells to augment water production	New and Renovation
Construction of new Jackwell including rehabilitation of the Existing Treatment Plant at College Tilla	College Tilla Water Treatment Plant	Improvement on Haora River raw water treatment	Works related to, Jackwell & Raw water pump house. Intake arrangement like supply and Installation of 3 nos. vertical turbine pumps, installation of desilting pump with pipeline Renovation of Treatment plant including installation of Electro chlorinator Civil works for modification of the existing pre-treatment sedimentation tank to a clear treated water storage reservoir, and other works for clear water pump house	Renovation work
Construction of new Ground level reservoir including	Existing Treatment Plant at Bardowali	Improvement of Haora River raw water treatment	Works related to, Intake well- Replacement of the 3 nos. vertical	Renovation work

Component	Location	Function	Description	Remarks
rehabilitation of the Existing Treatment Plant at Bardowali			turbine pumps, installation of desilting pump with pipeline etc. Renovation of Treatment system- Replacement of the entire chemical feeding mechanism, rapid chemical mixing mechanism. Renovation of pump house - Replacement of 2 sets of vertical pump sets, construction of a clear water reservoir adequate to store the additional water subsequent to realization of the additional 4MLD of treated water	
Installation of water meters	Different part of Agartala city	Measure flow in existing pipelines to assess demand	Providing water meters Requirement of meter in central zone is 40000 nos.	New
Providing Household connections	In Central zone of Agartala city	Supply of water to household	An estimated 25,000 household connections are proposed (new and replacement) are to be provided in this investment programme. Majority of the household connections will be domestic type (15mm) with some commercial connections (20mm and 25mm).	New and Replacement
Cutting and Restoration of road	Different part of Agartala city	Restoration of road after pipe laying	New and replacement pipelines shall be laid along the edge of the road. Existing bituminous roads which will be dug for laying of pipelines will be re-laid with bituminous courses confirming with the existing pavement conditions. Wherever shoulder space is available, the pipeline will be laid along the shoulder width.	New

Note: DTW = deep tube well; GWTP = ground water treatment plant; PHE= Public Health Engineering

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Administrative Boundaries

71. Agartala is the capital of Tripura, the third smallest Indian state considered as the gateway to the North-Eastern India. The AMC was established in 1871 with an area of only 3 km². Presently the extended limit of AMC covers an area of 62 km² comprising of 35 wards.

72. The Greater Agartala Planning Area (GAPA) is spread over an area of 92.0 km². It comprises AMC and eight other villages with population of more than 4 lakhs. **Figure 3** shows the AMC wards and GAPA zonal map. Considering the natural geographical division created by the Haora and Katakhal Rivers, the GAPA has been demarcated to distinguish the three (3) zones: the north zone, central zone and south zone.

- (i) North Zone: The area is located, north of Katakhal River. This zone comprises mainly the northern extension of the present AMC area (Wards 1 to 8) and peripheral villages, Narsingarh, Singarbil, and Gandhigram CT.
- (ii) Central Zone: The area bounded by Haora River embankment on the south and Katakhal River on the north. This zone mainly comprises the erstwhile AMC area and the newly extended areas (Wards 9 to 16 and Wards 18 to 22).
- (iii) South Zone: This area is located at the south of Haora River. This zone includes the southern part of the extended AMC (Wards 23 to 35) and the adjoining areas of Ananda nagar, Dukli, Madhupur, Madhuban and Charipara.

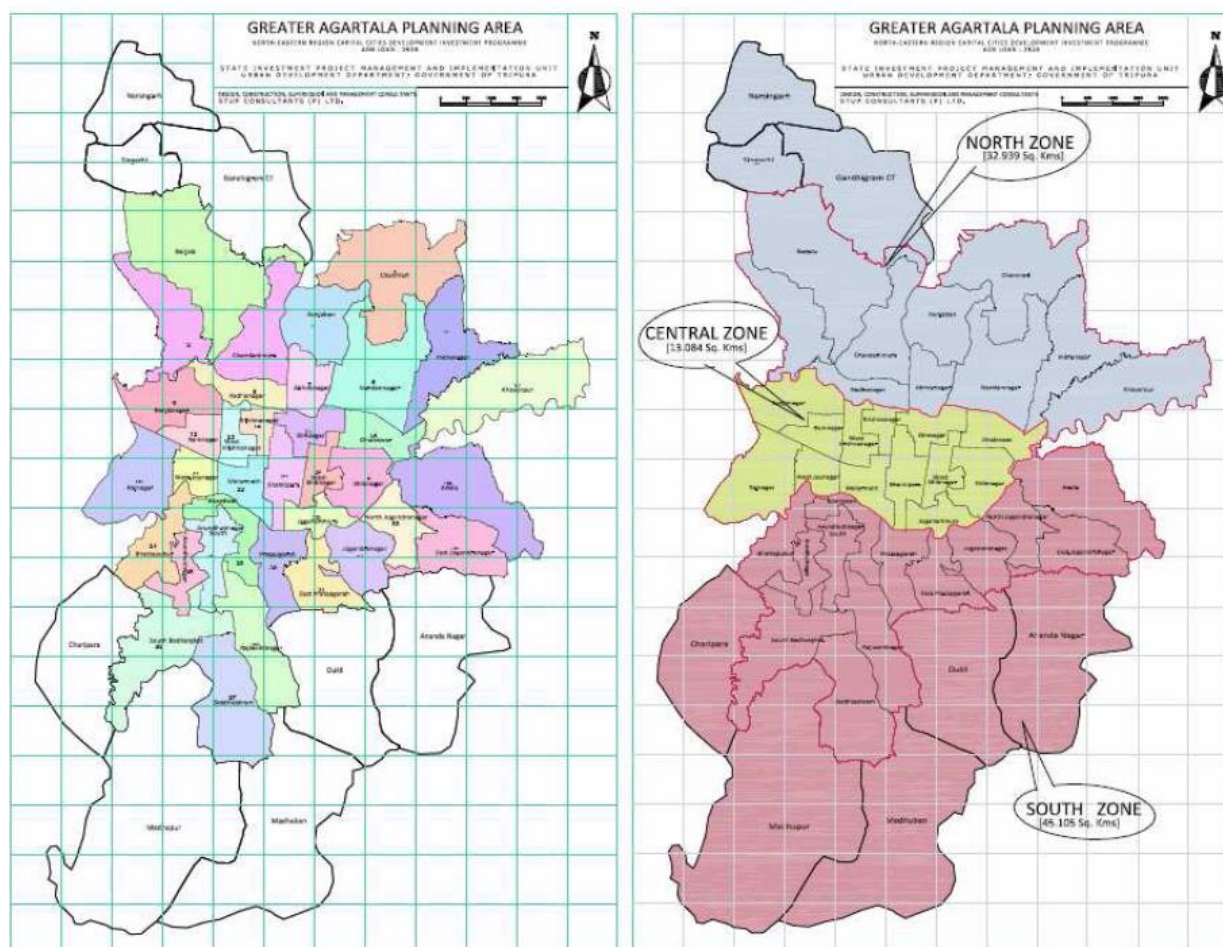
73. Considering similar geographical divisions, the subproject area has been defined to be the area comprising of the central zone (area measuring 13.084 km²) and south zone (area measuring 22.826 km²). The total subproject area is 35.910 km².

2. Topography, Drainage, and Natural Hazards

74. **Topography.** The major part of the City (Central Agartala) has a flat terrain. However, the North and South Zones have a rolling terrain with average altitude varying from a high of 25 to 30 m to a low of 8 m. Greater Agartala is a combination of plain and undulated areas. The central zone is a flat land bounded by the rivers Haora in the south and Katakhal in the north. An important characteristic of the central part of the city is that it is located at a lower level than other areas giving it the appearance of a saucer. Due to its saucer shape, the low lying areas are vulnerable to inundation during monsoons.

75. **Drainage.** The drainage system of Greater Agartala is dominated by two major rivers (Haora and Katakhal), which drains the core area of the city. These two rivers flow westward into Bangladesh. In terms of catchment area, Haora River is the seventh largest in the Tripura and is the only source of surface water for Greater Agartala. In addition to these two rivers, there are other rivers like Bangeshwar Gang, Debta Gang, Nagichara, Kalapani Charra and its tributaries within Greater Agartala. The Akhaura canal system running along the Akhaura road serves mainly the central area. All rivers are rain-fed and ephemeral in nature and their flow is directly related to rainfall.

Figure 3: Ward Map of AMC and Zone Map of Greater Agartala Planning Area



76. **Natural Hazards.** North-eastern region of India extending to the Himalayan arc in the north and Burmese arc to the east is among the most seismically active regions of the world. The whole of Tripura State falls under seismic zone V, and is highly vulnerable to earthquakes. The sites covered by the subproject are not located in areas prone to water-logging, salinasation, and flash flood.

3. Geology, Mineral Resources, and Soils

77. **Geology.** The geology of GAPA is represented by the repetitive succession of sedimentary rock like sandstone, shale and clay from bottom to top, belonging to Surma group, Tipam group and Dupitila group. The valley is dominated by thick sandstones horizons with thin intervening shale/clay horizons. The sedimentary rocks are deformed and folded. The sandstones are highly porous underlain by impermeable shales or clay and are favourable for ground water retention.

78. **Mineral Resources.** The most important minerals in Tripura are glass sand, lignite, clay, and limestone. The most important of all the minerals that are associated with the state is natural gas and oil. There are good sources of white sand on the bank of the water body called Bijainadi close to the place called old Agartala. Some other reserves are found in the western and eastern parts of Champamura.

79. **Soils.** The plains of Haora River are alluvial in nature consisting of sand, silt and clay. The soil in Agartala is in general of poor to medium quality. It is characterized by a top soil underlain by a soft to medium/stiff, silty clay/clayey silt layer, which follows a moderately dense to very dense silty sand layer. Bearing capacity of soil is poor and usually is of the range of 4 – 6 tons per m² Central Agartala and most parts of south Agartala.

4. Climate

80. The climate of Agartala is of tropical monsoon type. The average annual rainfall is around 2,200 mm. The ambient temperature varies from 4.2 °C to 37.6 °C on the average. The winter period is from November to early March, summer is from March to May, and monsoon is from June to September. Winds, which are of moderate velocity, are from the south-to-south – east direction for most of the time. Average velocity of wind varies from 4 km to 9 km per hour.

5. Air Quality

81. There is no fixed ambient air quality monitoring stations under the Tripura State Pollution Control Board. There are no major air-polluting industries in Agartala and traffic/vehicular emission is the only significant source of pollutant, so air quality is likely to be well within the National Ambient Air Quality Standards (NAAQS).

82. During the year 2013 ambient air quality monitoring has been carried out under North-Eastern Region Capital Cities Development Investment Program at different locations of Agartala. The results of the monitoring are shown in **Table 5**.

Table 5: Ambient air Quality Monitoring for Agartala

Location	Date of sampling	Parameters (in microgram/cum)					
		PM 2.5	PM 10	NOx	SO ₂	CO	Pb
Area near AMC zonal office (ward 35)	13.11.2013	12.51	52.60	13.56	ND	ND	ND
	19.11.2013	14.7	51.9	9.5	ND	ND	ND
Camper Bazar- Deendayal Ashram	14.11.2013	9.10	42.73	10.17	ND	ND	ND
Near Aralia-II Deep TW	15.11.2013	6.26	33.24	ND	ND	ND	ND
Pratapgarh - Sadhu Tilla	16.11.2013	14.20	47.32	11.67	ND	ND	ND
Near Pragati School	18.11.2013	17.22	51.60	12.08	ND	ND	ND
Near Kali bari Sadhu Tilla	20.11.2013	21.2	57.6	12.4	ND	ND	ND
Near Sishu Vidya Mandir Nursery School (Aralia)	21.11.2013	27.8	73.6	14.6	ND	ND	ND
Near West Champamura School (Champamura)	22.11.2013	24.5	68.2	10.7	ND	ND	ND
Near Vidhyasagar School (Bankumari bazaar)	23.11.2013	20.6	63.4	11.2	ND	ND	ND
Near Vivekananda School (Bardowali)	25.11.2013	17.2	68.3	11.4	ND	ND	ND
Near SD Mission (Sarbadharma Ashram)	26.11.2013	19.1	72.6	14.2	ND	ND	ND
Near Cold Store (Dasaratdeb Stadium)	27.11.2013	15.8	65.3	10.6	ND	ND	ND
Near Badharghat School (Dukli)	28.11.2013	20.4	67.2	12.7	ND	ND	ND
Near AMC Sector Office (Ward No. 27)	29.11.2013	14.5	60.6	10.3	ND	ND	ND
Standard		60.0	100.0	80.0	80.0	4.0 (1 hr. limit)	1.0

(Source: Monitoring data as a part of NERCCDIP, Agartala, 2013)

83. Monitoring results indicate that concentration of air quality parameters are within the standard.

6. Surface Water

84. The State of Tripura is well endowed with surface water resources. As many as ten major rivers are reported to generate an annual flow of 793 million m³ of water. All rivers are rain-fed and ephemeral in nature. All major rivers originate from hill ranges and show a typical drainage pattern called *trellis*, except a few instances of dendrite pattern.

85. **Haora River.** The Haora River originates from Baramura range and flows westerly via Agartala to Bangladesh. The total length of the river is 53 km. The quality of raw and treated water from Haora River is measured by the Drinking Water and Sanitation Department (DWS Dept.). Results of water quality analysis conducted in 18 June 2010 is shown in **Table 6** below. The physico-chemical analysis of the water of Haora River shows that iron levels (raw water) are more than the prescribed standard. All other parameters are within the prescribed limits. After Agartala, Haora River flows to Bangladesh, where it is used mainly for irrigation purposes.

Table 6: Surface Water Quality of Haora River – Raw & Treated (Date of Sampling: 18 June 2010)

Parameters	Raw Water	Treated water	Desired Limit (Drinking water BIS 2012)	Permissible Limit (Drinking water BIS 10500: 2012)
Temperature (°C)	31.0	-	-	-
Physical appearance	U	U	U	U
Colour in Hazen unit	<5	<5	5	25.0
Turbidity in NTU	0.2	0.2	5	10.0
Taste & Odour	A	A	A	A
pH - value	7.2	7.0	6.5 – 8.5	No relaxation
Total Alkalinity in mg/l as CaCO ₃	72.0	56.0	200.0	600.0
Total Hardness in mg/l as CaCO ₃	56.0	50.0	300.0	600.0
Total Iron in mg/l as Fe	2.986	0.034	0.3	1.0
Chloride in mg/l as Cl	12.0	13.0	250.0	1000.0
Total Solid in mg/l	-	71.5	5000.0	No guideline
Total dissolved solid in mg/l	82.55	BDL	500.0	2000.0
Total suspended solid in mg/l	-	71.5	25.0	100.0
Residual Chlorine as Cl in mg/l	-	0.2	0.2	No relaxation
Nitrate in mg/l as NO ₃	2.984	BDL	45.0	100.0
Arsenic in mg/l as As	BDL	BDL	0.05	No relaxation
Sulphate in mg/l as SO ₃	36.48	34.16	200.0	400.0
Calcium in mg/l as Ca	18.2	11.2	75.0	200.0
Magnesium in mg/l as Mg	1.3	5.3	30.0	150.0
Electrical Conductivity in µs	127.0	110.0	-	-
Total Fluoride in mg/l as F	0.256	0.056	1.0	1,5
Total Acidity in mg/l	4.0	6.0	<12	<12
Free Carbon dioxide in mg/l	5.0	3.0	-	-
Dissolved oxygen in mg/l	6.8	7.2	≥6.0	≥6.0

Note: BDL = below detection limit; mg/L = milligram per liter; U = unobjectionable; A = agreeable; Desired Limit = Bureau of Indian Standard (BIS) for Drinking Water (undesirable effects expected when exceeded); Permissible Limit = BIS for Drinking Water in absence of alternate source (beyond permissible limit is not allowed).

BIS: Bureau of Indian Standard

Source: Drinking Water and Sanitation Department, Government of Tripura.

86. Later in 2011 extent of pollution of Haora River was studied by the Tripura State Pollution Control Board. Results are shown in Table below. Results indicate that Haora River water is contaminated with discharge sewerage within city limit. Level of coliform count and BOD are high and above the standard.

Table 7: Haora River water quality at different locations

Parameters	Locations			Standard Value (Surface River Water)
	Point of origin of Haora River	Near Chandrapur Agartala	Near Bangladesh Boarder	
Temperature ($^{\circ}\text{C}$)	28.5	30.0	30.5	-
Total dissolved solid in mg/l	156	174	220	500
Total suspended solid in mg/l	26	46	180	
pH - value	7.65	7.34	8.10	6.5 -8.5
Colour in Hazen unit	2.5	10.2	12.6	10
Turbidity in NTU	5	26	38	-
Total Alkalinity in mg/l as CaCO_3	69.34	120.0	143.02	-
Dissolved oxygen mg/l	7.2	6.24	5.6	6.0
Biochemical Oxygen Demand mg/l	1.9	3.5	8.6	3.0
Chemical Oxygen Demand mg/l	8.0	22.0	39.0	-
Total Coliform (MPN/100 ml)	110	540	1800	500
Phosphates mg/l	0.010	0.020	0.065	-
Total Hardness in mg/l as CaCO_3	59.55	84.36	178.65	300
Calcium in mg/l as Ca	15.91	23.86	35.79	80.10
Magnesium in mg/l as Mg	4.8	6.02	21.63	24.28
Chloride in mg/l as Cl	7.2	9.6	24	250
Nitrate in mg/l as NO_3	0.02	0.025	0.060	20
Nitrite in mg/l	0.01	0.035	0.040	-
Ammoniacal Nitrogen mg/l	Nil	0.016	0.025	1.2

(Source: Pollution Control Board) http://agartalacity.tripura.gov.in/PDF/Septage_Mangement.pdf

87. Recently DWS Dept. carried out monitoring for Haora River raw water and treated water. Results are depicted in Table below. Results indicate that treated water is suitable for drinking except high concentration of residual chlorine.

Table 8: Raw & Treated water quality of Haora River (2014)

Parameters	Raw Water	Treated water from Present WTP	Desired Limit (Drinking water BIS 2012)	Permissible Limit (Drinking water BIS 2012)
Physical appearance	Turbid	Unobjectionable	Unobjectionable	
Colour in Hazen unit	-	<5	5	25.0
Turbidity in NTU	261	1.02	5	10.0
Taste & Odour	Unobjectionable	Unobjectionable	A	A
pH - value	7.24	7.0	6.5 – 8.5	No relaxation
Total Alkalinity in mg/l as CaCO_3	80.0	58.0	200.0	600.0
Total Hardness in mg/l as CaCO_3	62.0	56.0	300.0	600.0
Total Iron in mg/l as Fe	2.874	0.033	0.3	1.0
Chloride in mg/l as Cl	10.0	11.0	250.0	1000.0

Parameters	Raw Water	Treated water from Present WTP	Desired Limit (Drinking water BIS 2012)	Permissible Limit (Drinking water BIS 2012)
Residual Chlorine as Cl in mg/l	-	0.5	0.2	No relaxation
Nitrate in mg/l as NO ₃	-	0.392	45.0	100.0
Arsenic in mg/l as As	-	BDL	0.05	No relaxation
Sulphate in mg/l as SO ₃	-	38.91	200.0	400.0

(Source: DWS Data on River Haora, date of sampling 27.05.2014)

7. Groundwater

88. Surveys carried out by the Central Ground Water Board (CGWB) reveal that the aquifer system in the Agartala possesses good potential. The depth of the water table in both pre-monsoon and post-monsoon seasons range between 2 to 6 m with net seasonal fluctuations ranging between 1 to 2 m. In Greater Agartala, the depth of water level for shallow aquifer was observed to be in the range of 1 to 5 meter below ground level (mbgl), while the depth to water level in the deeper aquifers was observed between 1 to 7 mbgl. The pattern of pre-monsoon water table contours in Agartala reveals that the master slope of the ground water is towards West.

89. Hydrological surveys revealed that the valleys of Tripura have three to four major aquifers within 259 m in depth. Data from the CGWB⁷ shows annual replenishable groundwater resource is 2.19 billion cubic meters (BCM) and the net annual groundwater availability is 1.97 BCM. It also shows that 0.17 BCM is drafted annually thus the groundwater is not over exploited and not critical.

90. Records of groundwater quality monitoring from DWSD (**Table 9**) show raw groundwater quality, which supply directly to households in Agartala. The quality does not conform to the set norms of the BIS. It has been noted that iron levels in all the deep tube wells are above the desired and permissible limits. In few locations, levels of turbidity, colour, fluoride, and dissolved oxygen are above the permissible limits.

Table 9: Deep Tube Wells Ground Water Quality (Date of Sampling: 10th February 2009)

Parameters	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	Desired Limit	Permissible Limit
Temperature (°C)	23	23	23	23	23	23	23	23	23	-	-
Physical appearance	O	U	U	U	O	U	U	U	U	U	U
Colour in Hazen unit	>25	<10	<10	<5	>50	<5	<10	<5	<5	5	25.0
Turbidity in NTU	32.1	8.9	6.1	1.3	76.0	2.6	4.8	3.7	1.1	5	10.0
Taste & Odour	A	A	A	A	A	A	A	A	A	A	
pH- value	6.49	6.35	6.74	6.31	7.05	6.34	6.28	6.47	6.15	6.5 –	No

⁷ Data accessed from CGWB website (<http://cgwb.gov.in>) on 23-February-2011.

Parameters	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	Desired Limit	Permissible Limit
										8.5	relaxation
Total Alkalinity in mg/l as CaCO ₃	92.0	84.0	86.0	88.0	72.0	90.0	76.0	84.0	72.0	200.0	600.0
Total Hardness in mg/l as CaCO ₃	62.0	56.0	58.0	50.0	44.0	42.0	58.0	20.0	44.0	300.0	600.0
Total Iron in mg/l as Fe	4.24	5.12	4.88	4.46	5.86	4.32	4.38	4.47	4.15	0.3	1.0
Chloride in mg/l as Cl	13.0	13.0	13.5	8.5	9.0	8.5	9.2	9.5	18.0	250.0	1000.0
Total Solid in mg/l	89.9	81.4	80.1	86.0	64.6	78.7	63.8	78.1	81.4	5000.0	No guideline
Total dissolved solid in mg/l	89.7	81.3	79.9	85.8	64.3	78.6	63.7	78.0	81.3	500.0	2000.0
Total suspended solid in mg/l	0.16	0.15	0.16	0.25	0.28	0.10	0.15	0.10	0.15	25.0	100.0
Residual Chlorine as Cl in mg/l	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	Not Found	0.2	-
Nitrate in mg/l as NO ₃	3.06	0.77	0.66	0.15	3.12	0.58	0.78	1.34	0.65	45.0	100.0
Arsenic in mg/l as As	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05	No relaxation
Sulphate in mg/l as SO ₃	12.2	0.74	1.11	BDL	25.56	2.96	2.56	2.96	0.56	200.0	400.0
Calcium in mg/l as Ca	12.0	4.0	11.2	8.0	8.8	6.4	5.6	6.4	3.2	75.0	200.0
Magnesium in mg/l as Mg	7.7	11.1	7.2	7.2	5.3	6.3	7.29	0.97	8.7	30.0	150.0
Electrical Conductivity in μ s	138	125	123	132	99	121	98.0	120	106	-	-
Total Fluoride in mg/l as F	0.04	BDL	0.081	0.28	BDL	0.16	BDL	0.08	BDL	1.0	1.5
Total Acidity in mg/l	32.0	32.0	18.0	64.0	12.0	60.0	40.0	46.0	66.0	<12	<12
Free Carbon	58.0	82.0	20.9	180.0	22.0	86.0	48.0	124.0	90.0	-	-

Parameters	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	Desired Limit	Permissible Limit
dioxide in mg/l											
Dissolved oxygen in mg/l	6.2	5.8	9.0	3.8	9.1	5.1	5.8	5.5	5.3	≥6.0	≥6.0

Note: BDL = below detection limit; mg/L = milligrams per liter; O = objectionable; U = unobjectionable; A = agreeable

Source: Drinking Water and Sanitation Department, Government of Tripura

Locations: GW-1: Deep Tube Well (DTW) at West Pratapgarh – Raw water; GW-2: DTW at Srinagar- Raw water; GW-3: DTW at Sripally – Raw water; GW-4: DTW at Beltali – Raw water; GW-5: DTW at Gajaria – Raw water; GW-6: DTW at Bairagitila – Raw water; GW -7: DTW at Siddhiashram (Pranavananda School)- Raw water; GW-8 : DTW at Subhashpally – Raw water; GW-9: DTW at Panchamukh – Raw water

91. New deep tube well water qualities have been tested by DWS Dept. at two locations. Results indicate that in both the samples concentration of iron is very high and much above the desirable and permissible limits for drinking water. Hence treatment (removal of iron) is required before supply.

Table 10: Recent data ground water quality from new deep tube well

Parameters	New DTW at Jogendranagar Ward No 32	New DTW at Pratapgarh- I Ward No 31	Desired Limit (Drinking water BIS 2012)	Permissible Limit (Drinking water BIS 2012)
Date of sampling	13.08.2013	26.09.2013		
Temperature (°C)	29	27.7	-	-
Physical appearance	Unobjectionable	Unobjectionable	U	U
Colour in Hazen unit	>25	>25	5	25.0
Turbidity in NTU	124.0	26.0	5	10.0
Taste & Odour	Agreeable	Agreeable	A	
pH- value	6.54	6.67	6.5 – 8.5	No relaxation
Total Alkalinity in mg/l as CaCO ₃	64.0	90.0	200.0	600.0
Total Hardness in mg/l as CaCO ₃	46.0	52.0	300.0	600.0
Total Iron in mg/l as Fe	6.092	4.166	0.3	1.0
Chloride in mg/l as Cl	10.0	6.5	250.0	1000.0
Total Solid in mg/l	-	-	5000.0	No guideline
Total dissolved solid in mg/l	81.9	91.0	500.0	2000.0
Total suspended solid in mg/l	-	-	25.0	100.0
Residual Chlorine as Cl in mg/l	Not Found	Not Found	0.2	-
Nitrate in mg/l as NO ₃	1.326	1.096	45.0	100.0
Arsenic in mg/l as As	BDL	BDL	0.05	No relaxation
Sulphate in mg/l as SO ₃	24.0	30.08	200.0	400.0
Calcium in mg/l as Ca	8.0	11.2	75.0	200.0
Magnesium in mg/l as Mg	6.31	5.83	30.0	150.0
Electrical Conductivity in µs	126	140	-	-
Total Fluoride in mg/l	1.342	0.198	1.0	1.5

Parameters	New DTW at Jogendranagar Ward No 32	New DTW at Pratapgarh- I Ward No 31	Desired Limit (Drinking water BIS 2012)	Permissible Limit (Drinking water BIS 2012)
Date of sampling	13.08.2013	26.09.2013		
as F				
Total Acidity in mg/l	-	-	<12	<12
Free Carbon dioxide in mg/l	Escaped	Escaped	-	-
Dissolved oxygen in mg/l	7.8	7.6	≥6.0	≥6.0

Source: DWS (PWD), Agartala, Tripura, 2013}

B. Biological Resources

92. There are no protected areas, wetlands, mangroves, or estuarines in or within the subproject location.

93. The “Shipahijala Wild Life Sanctuary” situated in Bishalgarh Development Block, is located at a distance of 28 km from Agartala city. The sanctuary covers an area of 18.53 sq. km, and possesses rich diversity of wild life particularly birds (migratory birds during winter seasons) and primates. The subproject components are not expected to have any effect on the Sanctuary.

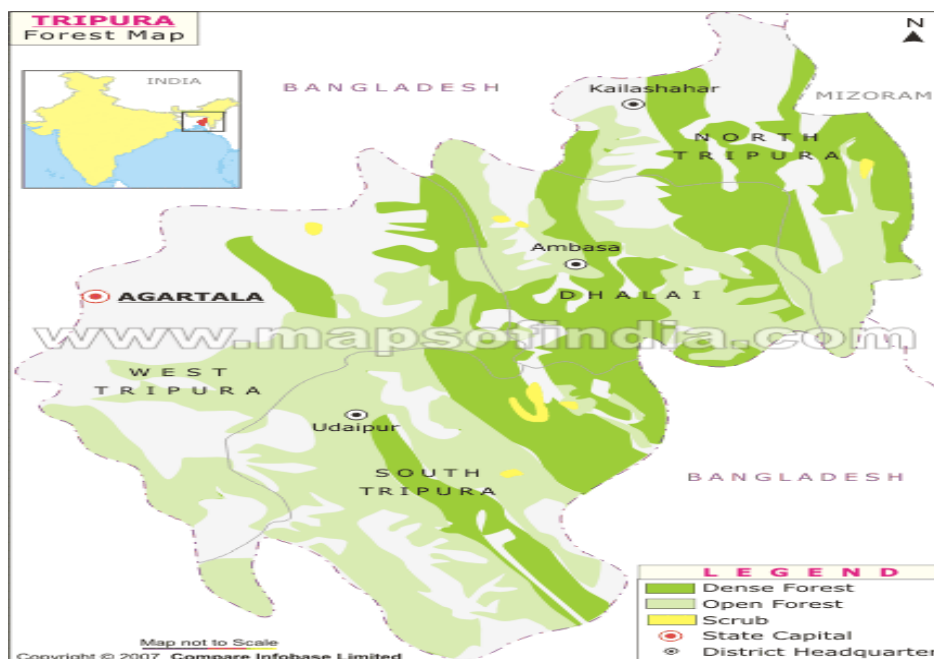
94. Forest map of Tripura shown in **Figure 4**. It shows that there is no forest area nearby the city. Only few open scrub land is noted.

95. **Flora.** There are no designated forest areas or sanctuaries within the GAPA boundaries. The Tripura State Biodiversity Action Plan has identified pockets of rich biodiversity as conservation hotspots. None of the identified hotspots are located within the GAPA boundaries. While a number of endangered primate species are found within Tripura state, none of them are reported within the GAPA.

96. A phyto diversity survey and analysis was carried out at the subproject locations in GAPA using the Shannon-Wiener Diversity Index, and evenness with the Evenness index. The indices show that the diversity in terms of flora is not significant, and the indices reveal that all locations fall short of that a primary forest. The trees are mostly timber yielding. While there exist some species in locations away from the inhabited areas, that are important, they are not unique. In none of the project locations, rare/endangered tree/plant species have been identified that need to be taken up for conservation or special protection in the project. However, it is included in the mitigation measures to minimize loss and clearance of vegetation shall be complied with to ensure loss of vegetation.

97. **Fauna.** The subproject locations are plain agricultural and residential/commercial lands. Therefore existence of wild fauna is not reported. Only domestic animals such as pigs, dogs, cows, buffalos, cats and goats are present in the subproject areas.

Figure 4: Forest Map of Tripura



C. Economic

1. Land Use

98. Total area of GAPA is 9,200 hectares (ha), out of which 3,125 ha are classified as developed area (residential, commercial, industrial, government and semi-government, recreation-park, public facilities, and circulation). The remaining 6,075 ha are water bodies, plantations, defence area, vacant land and agricultural area. Majority of the subproject locations are in the developed area of the city.

2. Commerce, Industry and Agriculture

99. Tripura's gross state domestic product for 2004 is estimated at \$2.1 billion in current prices. The economy of Tripura is agrarian. More than 50 per cent of its population depends on agriculture for livelihood and contribution of agriculture and allied activities.

100. Tripura is characterised by low income, overwhelming percentage of population below the poverty line, income leakage, and unemployment. The state is predominantly rural in character (85.29%). Average land holding size is 0.97 hectare. 90% of the cultivators are either small or marginal.

101. **Trade and Commerce.** There are two small industrial estates, with a total number of 36 industrial units and with a total capital investment of INR 56.575 million. Other than the 2 industrial estates, there are 17 other significant industries in Agartala. These industries, as per records, are not in the category of large and medium industries.

102. Wholesale trade in the city is functioning mostly in the Gole Market area and spreads haphazardly mixing with the retail trade. There are 9 markets maintained by AMC within erstwhile Municipal limits, of which, Battala and Maharaj Ganja Bazaar are the main service and distribution centres of Greater Agartala.

103. **Agriculture.** Agriculture and allied activities is the mainstay of the people of Tripura and provides employment to about 64% of the population. There is a preponderance of food crop cultivation over cash crop cultivation in Tripura. At present about 62% of the net sown area is under food crop cultivation. Paddy is the principal crop, followed by oilseed, pulses, potato and sugarcane. Tea and rubber are the important cash crops of the State. Handicraft, particularly hand-woven cotton fabric, wood carvings and bamboo products, are also important. The subproject areas are not located in agricultural lands.

3. Infrastructure

104. **Water Supply.** The people of Agartala get their water from piped water supply systems operated by the Public Health Engineering Department (PHED), private and community wells and the two rivers that run through the city. Although about 70% of the population of the area is served by central water supplies, water is available for only a few hours a day in most parts of the city. PHED's water supply systems have two main sources, comprising the Haora River and groundwater. Distribution of water is partly through distribution reservoirs and partly through direct pumping. Major parts of the distribution system pipelines are obstructed by iron deposits. The water supply system is unmetered. The major problems with the water supply system are under utilization of the capacity of the two treatment plants, under production from the ground water sources, ineffective treatment for iron removal, absence of proper disinfection and a substantial amount of unaccounted for water (UFW), presently about 35% of production.

105. **Sewerage and Sanitation.** Agartala city is not covered by an underground sewerage system at present. Although about 90% of households have cistern or pour flush latrines, about 10% use pit latrines. Open defecation is widespread among lower income group people especially those living along rivers and drains and in rural areas. The ground water table being very high there is a high risk of contamination of wells.

106. **Drainage.** Although GAPA has numerous storm water drains and two major rivers flowing through it, the city suffers from recurrent flood problems. During normal rainfall of about 3 to 4 hours, the central part of Agartala gets flooded. Although there is adequate fall in most parts of the city to support a gravity drainage system, some parts of the city are on low-lying land and drainage problem is more evident. The most severe problems arise when a combination of tidal conditions in the Brahmaputra basin and high rainfall cause the waters in the Haora and Katakhal Rivers to be higher than the city. Several pumps have been provided to lift the water out of the city during these seasons. Most of the main drains are masonry-lined, but the feeder drains are earth-lined and in a poor condition with silt and vegetation choking them.

107. **Industrial Effluents.** Industries within the city area have no separate treatment facility. The industries are required to treat their own effluents before disposal and are not allowed by the Agartala Municipal Council (AMC) to connect to the local drainage network.

108. **Solid Waste.** An estimated 200 tons/day of solid waste is generated within the city. Only 50% of the waste generated is collected and transported. The waste dumped haphazardly along roads, drains and open areas leading to unhygienic conditions. The collected waste is dumped at Hapania, situated in village Madhupur about a kilometer away from the Dr. Ambedkar hospital.

109. **Transportation.** The Assam – Agartala – Sabroom Road (NH-44) connects Agartala with Silchar, Guwahati and other towns of Assam. The total length of roads in the city is approximately 390 km with a road density of about 4.2 km per km². The road system is planned,

well defined and geometrical in the central core area, following a gridiron pattern. In the outer areas, it is more haphazard and ill planned. The mixed traffic and encroachments along roads like the Motor Stand to Subhash Market road, Hariganga Basak Road up to the Post Office Chowmanjhi etc., leads to high levels of congestion in the city especially in the central business district area. The presence of cycle rickshaws adds to the congestion.

D. Social and Cultural Resources

110. **Demography.** The total estimated population of AMC limits as per 2011 census is 399,668. Population density of GAPA increased to 41% person per hectare in the year 2001 in compared to 38% in 1991. There are two major racial groups, namely the Indo-Aryans represented by the Bengalis and the Indo-mongoloid represented by communities like the Tripuris, the Reangs, the Noatis, the Kukis, the Halams, the Chakma, the Mogh and the Lushai. The percentage of Scheduled Tribe population to the total city population is estimated to be around 4%. The scheduled tribe populations living in the city is well integrated with the mainstream and is gainfully employed. The literacy rate in Agartala is the highest among the localities of Tripura.

111. **Health and Educational Facilities.** There are good educational facilities in Tripura state, which serve both Agartala urban people and inhabitants of surrounding villages and towns in the hinterland. There are about 21 colleges in Agartala comprising Medical college, Degree college, Nursing college, Polytechnic college and Open university. Percentage of literacy according to 2011 census is 93.88, higher than the national literacy rate.

112. There are also 9 nos. nursing home and hospital at Agartala. One Government Medical College is also located at Agartala.

113. **History, Culture, and Tourism.** The city has a historical back ground. The ancient capital of the princely State 'Swadhin Tripura' was at Rangamati (Udaipur, South Tripura) by the bank of the river Gomti and in 1760 A.D., It was shifted by the Maharaja Krishna Manikya to the site of old Agartala by the bank of river Haora and was named 'Haveli'. The Capital city of Agartala was founded in 1838 AD by Maharaja Krishna Kishore Manikya (1830-49 A.D.).

114. Agartala is a city of many tourist attractions. These include palaces, temples, wildlife sanctuaries and many others. The most popular tourist place in Agartala is the Tripura Sundari Temple, popularly known as Matabari that is located at a distance of 55 Km from the city. Other places of interest are, the Ujjayanta Palace, located within the city, Neer Mahal located 53 km from the city, Unnakoti- a pilgrimage center with rock carvings and murals. The tourism industry in Agartala city is growing at a fast pace. The specific subproject locations are not located within any historically-, culturally-, archaeologically- or architecturally-significant or tourists area.

IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

115. 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) the sites for deep tube wells, gravity distribution mains, existing WTP & intake locations (under renovation); (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 Agartala area outside of the delineated primary impact area; and (ii) entire West Tripura district in terms of over-all environmental improvement.

116. 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 found in **Appendix 3**. All the proposed subproject components will interact physically with the environment.

117. 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) being located in the built-up area of Agartala city, will not cause direct impact on biodiversity values. The subproject will be in properties held by the local government and access to the subproject locations is thru public rights-of-way and existing roads hence, land acquisition and encroachment on private property will not occur.

A. Pre-construction – Location and Design

118. **Design of the Proposed Components.** The Central Public Health and Environment Engineering Organization (CPHEEO) manual suggests a design period of 15/30 years⁸ in general while designing the system for water supply components. Since, the packages are proposed to be implemented sequentially; theoretically, each of the system components should have a different design year.

119. However, in order to maintain unanimity in the design period and design population, it is proposed to consider 2041 as the design year for all the system components. Accordingly, 2011 shall be the base year and 2031 the intermediate year to cross check the designs pertaining to intermediate demand as also for designing pumps, motors and others. The rate of supply has been taken as 135 lpcd for 100% population.

120. Agartala area has substantial groundwater reserve. The approximate depth of the deep tube wells is around 150 to 200 meters (m) with an installed production capacity ranging from 2,500 to 20,000 gallons per hour i.e. 11.4 to 90.9 KL/hr. Supply to the entire northern zone and almost the entire southern zone is through deep tube wells. As per the Central Ground Water Board (CGWB), the ground water resource is estimated at 781.75 Hecta meter and ground water draft as 443.7 Hecta meter (ham). Ground water resources available for future development are estimated at 338.05 ham. The CGWB recommends “The stage of ground water development is to be around 56.7% and the area of Agartala under safe category”. Hence water source at Agartala is sustainable. As such, to ensure sufficient availability of water in the near future, installation of Deep Tube wells will be necessary to cater to the immediate and projected water requirement.

121. With increase in additional production of water and its use more sewage water will be generated. There is no sewage treatment system within the project area. Hence treatment of raw sewage water and septage management is very much necessary along with development of the city.

⁸ As per CPHEEO, pumps, motors, storage reservoirs are to be designed for a life of 15 years.

122. As per DWS Dept. the excess sewage to be generated due to increase in the level of water supply will be taken care of by the existing household level on-site sanitation system. The excess sullage will be going to the existing wastewater and drainage disposal system which is being augmented under 13th. Finance commission of Govt. of India. This proposed augmentation is expected to be completed by 2016. At present the individual houses is provided with individual septic tanks and public toilets are constructed and maintained by city Municipal Corporation. For septage management a proposal under Govt.'s consideration for implementation under ADB's financial assistance.

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

124. 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 livelihoods due to the development of the proposed site.

125. 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 Agartala 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.

126. **Encroachment into private properties, forestland and cutting of trees and damage to vegetation.** Construction works in the Agartala city area, distribution pipe lines are 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.

127. No private land acquisition is required for construction of intake structure allied components, deep tube well construction.

128. No forest area is involved in the project. Forest Clearance from the Tripura Environment and Forest Department will be not required. As per preliminary design tree cutting is not required for the project. In case of tree felling in future permission will be taken up from forest dept.

129. **Location of deep tube wells and pipelines.** Environmental screening of the site has been done for the specific project areas and pipe laying area. All the lands are under Executing agency. No sensitive environmental features in and around the subproject locations are recorded.

130. The city has been subdivided in 6 distribution zones. The designs considered the demands for the year 2011, 2031, and 2041 and available production for the zones. The requirements of distribution pipe line and augmentation work have been planned considering the future projection.

131. **Utilities.** Telephone lines, electric poles and wires, water lines within the proposed subproject locations may require to be shifted in few cases. To mitigate the adverse impacts due to relocation of the utilities, DSMC will (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.

132. **Water Supply.** A different but no less significant impact is the effect on people and communities if water supplies are closed down for extended periods when work is conducted on the network. This would be inconvenient in the short term, and there could be health risks if the water supply was unavailable for several successive days or longer. It will therefore be important to take the necessary measures to avoid such a situation. This will require SIPMIU to:

- (i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration);
- (ii) In coordination with DWS, provide alternative potable water to affected households and businesses for the duration of the shut-down; and
- (iii) Liaise with affected persons to inform them of any cessation in advance, and to ensure that they are provided with an alternative supply.

133. **Social and Cultural Resources.** Tripura is an area of large numbers of temples (some of them are historic) and other religious sites, so there is a risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. For this subproject, excavation will occur in open area, so it could be that there is a medium risk of such impacts. Nevertheless, DSMC/SIPMIU will:

- (iv) Consult Agartala Municipal Corporation (AMC) to obtain an expert assessment of the archaeological potential of the site;
- (v) Consider alternatives if the site is found to be of high risk;
- (vi) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available; and
- (vii) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved.

134. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the subproject locations. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals on water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings.

135. **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 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 Urban Local Body. 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 AMC.

B. Construction

1. Screening of No Significant Impacts

136. The construction work is expected not to cause major negative impacts, mainly because:

- (i) Most of the activities will be on the built-up areas of Agartala city thus could be constructed without causing impacts to biodiversity;
- (ii) All the sites are located on an government-owned land which is not occupied or used for any other purpose;
- (iii) Overall construction program will be relatively short and is expected to be completed in 18 months with activities to be conducted by small teams and specified location so most impacts will be localized and short in duration; and
- (iv) Most of the predicted impacts associated with the construction process are produced because the process is invasive, such as involving excavation. However the routine nature of the impacts means that most can be easily mitigated and the impacts are clearly a result of the construction process rather than the design or location, as impacts will not occur if excavation or other ground disturbance is not involved.

137. As a result, there are several aspects of the environment which are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 11**. These environmental factors are screened out presently but will be assessed again before starting of the construction activities.

Table 11: Fields in which construction is not expected to have significant impacts

Field	Rationale
Topography, Drainage, and Natural Hazards	Activities are not large enough to affect these features.
Geology, Geomorphology, Mineral Resources, and Soils	Activities are not large enough to affect these features. No mineral resources in the subproject location.
Climate	Activities are not large enough to affect this feature.
Air Quality	Short-term production of dust is the only effect on atmosphere
Geohydrology and Groundwater	Activities will not be large enough to affect these features
Protected Areas	No protected areas nearby the Agartala city and project locations
Flora and Fauna	No rare or endangered species.
Land Use	No change in major land use.
Socio-economic	Subproject site is located partly in private land so there is some need to acquire land from private owners.

Field	Rationale
Commerce, Industry, and Agriculture	Activities are not large enough to affect these features
Population	Activities are not large enough to affect this feature.
Health and education facilities	Activities are not large enough to affect this feature.
Historical, Archaeological, Paleontological, or Architectural sites	No scheduled or unscheduled historical, archaeological, paleontological, or architectural sites

2. Construction method

138. The construction of Tube Well will be done by vertical boring to required depth and by lowering the TW assembly in the bore thus made. The procedure and methodology will be the similar to that done for Tranche 1.

139. Renovation of Water treatment Plants will be done as per scope of work. All construction waste will be dispose after taking permission from the DWS Dept.

140. Distribution mains will be buried in trenches adjacent to roads un-used RoWs. In some areas occupied by drains or edges of shops and houses, trenches may be dug into the edge of the road to avoid damage to utilities and properties.

141. Trenches will be dug using a backhoe/manual, supplemented by manual digging where necessary. Excavated soil will be placed alongside, and the pipes (brought to site on trucks and stored on unused land nearby) will be placed in the trench by hand or using ropes for the Ductile Iron (DI) pipes. Pipes will be joined by hand, after which filling will be done with the excavated soil manually up to the ground level and compacted by a vibrating compressor. Where trenches are dug into an existing roadway, the bitumen or concrete surface will be broken by hand-held pneumatic drills, after which the trench will be excavated by backhoe, and the appropriate surface will be reapplied on completion.

142. Pipes are normally placed by approx. 1 m below the existing ground level/road level and a clearance of 200 mm is left between the pipe and each side of the trench to allow backfilling. Trenches will be smaller for the distribution main (minimum of 1m deep and 0.7 m wide). Old pipes will be replaced by new one after taken out old pipe by digging.

143. New pipes and connections to the distribution main will be provided to house connections, and these will run to individual dwellings in small hand-dug trenches, or on the surface. New consumer meters will be located outside houses, attached to a wall or set onto the ground. In slum areas water will be provided via community taps from where people will collect their water.

3. Anticipated Impacts and Mitigation Measures

144. Although construction of the subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Agartala city where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; (ii) refilled and compacted after pipes are installed; (iii) if trenching done on roads, repaired to pre-construction conditions and (iv) any

excavation done near sensitive area like school, religious places and house will be protected as per standard norms⁹.

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

- (i) The material sources permitted by government;
- (ii) Verify suitability of all material sources and obtain approval of State Investment Program Management & Implementation Unit (SIPMIU); and
- (iii) Submit to DSMC on a monthly basis documentation of sources of materials.

146. **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:

- (i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
- (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (iii) Avoiding the need to stockpile on site;
- (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.

147. **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 stream or River water. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

- (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 SIPMIU/DSMC on designated disposal areas;
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water 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).

148. **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,

⁹ Occupational Health and Safety of employees working only in factories and mines have been specifically covered in GOI laws. However, the Constitution of India has provisions to ensure that the health and well-being of all employees are protected and the State has the duty to ensure protection. For this subproject, the mitigation measures were based on the World Bank Environmental, Health, and Safety (EHS) Guidelines.

and people. Impact is negative, short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with SIPMIU/DSMC 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, 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.

149. **Generation of Spoil and disposal.** In case of disposal of the earth within the river turbidity will be increased.

150. The following measures should be taken up:

- (i) Not to dispose any construction materials in river/stream which may pollute the river water and aquatic fauna
- (ii) Spoil Disposal Management Plan (SDMP) will be prepared and implemented to minimize the potential effects of sediment plumes on aquatic habitats. Sample spoil management plan is attached as **Appendix 4**.
- (iii) Details of the proposed Water Quality Monitoring Program will be included in the environment management plan

151. **Existing Infrastructure and Facilities.** Excavation works can damage existing infrastructure located alongside roads, in particular water supply pipes. It will be particularly important to avoid damaging existing water pipes. It is therefore important that construction contractors will be required to:

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

152. **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:

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

153. **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.

154. **Accessibility.** Hauling of construction materials and operation of equipment on-site can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

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

155. Sample Traffic Management Plan is attached as **Appendix 5**.

156. **Socio-Economic – Income.** The subproject components will be located in Government land. Construction works will impede the access of residents to specific site in limited cases. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

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

157. **Socio-Economic – Employment.** Manpower will be required during the 18-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:

- (i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and
- (ii) Secure construction materials from local market.

158. **Occupational Health 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:

- (i) Designate a safeguard focal person and undertake safeguards orientation by SIPMIU/ DSMC
- (ii) Develop and implement site-specific Health and Safety (H and 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 and S Training¹⁰ for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (iii) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;
 - (iv) Provide specific guidance for suitable PPE for every on-site work assignment.
 - (v) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
 - (vi) Provide medical insurance coverage for workers;
 - (vii) Secure all installations from unauthorized intrusion and accident risks;
 - (viii) Provide supplies of potable drinking water;
 - (ix) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
 - (x) Provide H and 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;
 - (xi) 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;
 - (xii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
 - (xiii) Ensure moving equipment is outfitted with audible back-up alarms;
 - (xiv) 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
 - (xv) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

159. Maintaining Core Labour Standard. The Contractor and SIPMIU are responsible for ensuring that international CLS¹¹ –as reflected in national labor laws and regulations are adhered to. SIPMIU 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. SIPMIU 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)

¹⁰ 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.

¹¹ 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.

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.

160. 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 minimum. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan routes to avoid times of peak-pedestrian activities.
- (ii) Liaise with SIPMIU/DSMC in identifying risk areas on route cards/maps.
- (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- (iv) Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road.
- (v) Provide protective fencing around open trenches, and cover any open trench with metal planks during non-construction hours

161. 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. The construction contractor will be required to:

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

162. Social and Cultural Resources. For this subproject, excavation will occur at specific isolated location and along the roads, so it could be that there is a moderate risk of such impacts. Nevertheless, the construction contractor will be required to:

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

C. Operation and Maintenance

1. Screening out areas of no significant impact

163. Because a water supply system should operate without the need for major repair and maintenance, there are several environmental sectors which should be unaffected once the system begins to function. These are identified in **Table 12** below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

Table 12: Fields in which Operation and Maintenance of the Water Supply Component is not Expected to have Significant Impacts

Field	Rationale
Climate	No impact expected
Wildlife, forests, rare species, protected areas	There are no wildlife, forests, rare species, and protected areas.
Coastal resources	Agartala is not located in a coastal area.
Industries	The water supplied by the new system will not be for industrial use

2. Operation and Maintenance of the Improved Water Supply System

164. O and M of the water supply system will be the responsibility of DWS. A small number of people will be employed to operate and maintain the tube well, WTP and pipelines. DWS will employ local contractors to conduct repairs, and contractors should be required to operate the same kinds of Health and Safety procedures as used in the construction phase to protect workers and the public.

165. The system have a design life of 30 years, during which shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the pumps and other equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

166. 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; pipe will be removed and replaced if necessary.

3. Anticipated Environmental Impacts and Mitigation Measures

167. **General.** The work will follow the same procedures during the construction stage. DWS needs to require its O and M contractor to:

- (i) Maintenance of WTPs should be done as per supplier repairing guideline,
- (ii) Prior to discharge, ensure compliance of filter back wash water to Indian (Central Pollution Control Board) Effluent Discharge standard.
- (iii) Conduct work during non-monsoon period; and
- (iv) Cover construction material like cement to prevent dusts.

168. O & M Manual of Bore wells, Distribution network and Treatment plants will be prepared at advance stage of construction before commissioning of system.

169. If trenches are will be dug to locate and repair leaks or remove and replace lengths of pipe or illegal connections, the work will follow the same procedures during the construction stage. DWS needs to require its O and M contractor to:

- (i) Refill and re-compact 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.

170. **Sludge Handling.** During operation of water treatment plant large volume of physical and chemical sludge will be generated.

171. There will be 3 sludge/waste producing units like Pre-settling tank, Clariflocculator and Filter back wash. A part of existing settling tank/pond is proposed to be used as sludge settling/disposal tank from Pre-settling tank, for renovated WTP. Sludge cake, produced from both WTP, is proposed to dump/stack in the areas within WTP campus. In case of excess will be disposed at low laying area after taking permission from concerned authority.

172. Environmental issues associated with the WTPs include: (i) solid waste; (ii) wastewater; (iii) hazardous chemicals; (iv) air emissions; and (v) ecological impacts.

173. **Solid Waste.** Solid waste residuals which may be generated by the WTPs include process residuals, used filtration membranes, spent media and miscellaneous wastes. Process residuals primarily consist of settled suspended solids from source water and chemicals added in the treatment process, such as lime and coagulants. Pre-sedimentation, coagulation (e.g. with aluminium hydroxide [alum] or ferric hydroxide), and iron will produce sludge. Composition of the sludge depends on the treatment process and the characteristics of the source water, lime, and other organic compounds, microorganisms, etc. DWS needs to require its O and M contractor to:

- (i) Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes;
- (ii) Dispose of ferric and alum sludge by land application, if allowed and if such application can be shown through modelling and sampling to have no adverse impacts on groundwater or surface water (e.g. from nutrient runoff); and
- (iii) Potential impact on soil, groundwater, and surface water, in the context of protection, conservation and long term sustainability of water and land resources, should be assessed when land is used as part of any waste or wastewater treatment system.

174. **Wastewater.** Wastewater from water treatment projects include filter backwash. These waste streams may contain suspended solids and organics from the raw water, dissolved solids, high or low pH, heavy metals, etc. DWS needs to require its O and M contractor to:

- (i) Land application of wastes with high dissolved solids concentrations is generally preferred over discharge to surface water subject to an evaluation of potential impact on soil, groundwater, and surface water resulting from such application;
- (ii) Recycle filter backwash into the process if possible; and
- (iii) Treat and dispose of reject streams, consistent with CPHEEO requirements.

175. **Appendix 6** shows the Indian standard for discharge of effluent in environment.

176. **Hazardous Chemicals.** Water treatment may involve the use of chemicals for coagulation, disinfection and water conditioning. For WTP that will use chlorine gas, DWS needs to require its O and M contractor to:

- (i) Store chlorine gas cylinder in cool, dry, and dark conditions for no more than one month, and use equipment constructed of corrosion-resistant materials;
- (ii) Minimize the amount of chlorination chemicals stored on site while maintaining a sufficient inventory to cover intermittent disruptions in supply;
- (iii) Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; and
- (iv) Develop and implement a plan for responding to accidental releases.

177. **Air Emissions.** Air emissions from water treatment operations may include gaseous or volatile chemicals used for disinfection processes (e.g., chlorine). Measures related to hazardous chemicals discussed above will mitigate risks of chlorine release.

178. **Ecological Resources.** There are no significant ecological resources in or around the city as well as project location, so any repairs or maintenance work can be conducted without ecological impacts.

179. Drinking Water Sanitation (DWS) dept. Govt. of Tripura has a plan to develop green belt within WTP campus by their own budget after completion of renovation work. No extra land from outside will be required.

180. **Economic Development.** There are no major anticipated economic development impacts during O and M of the facilities. Nevertheless DWS needs to require its O and M contractor to:

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

181. The provision of an improved and expanded water supply system is not expected to have direct economic benefits for business or industry, as connections will only be provided to domestic users. However businesses will almost certainly benefit from the expected improvement in the health and well-being of their workforce as this should result in fewer days lost through illness, and overall increased productivity.

182. **Social and Cultural Resources.** Although there is a medium risk of excavation in the city discovering material of historical or archaeological importance, there will be no need to take precautions to protect such material when areas are excavated to repair.

183. Repair works could cause some temporary disruption of activities at locations of social and cultural importance such as schools, hospitals, temples, tourist sites etc., so the same precautions as employed during the construction period should be adopted. DWS needs to require its O and M contractor to:

- (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 these 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.

184. The citizens of the Agartala city will be the major beneficiaries of the improved water supply, as they will be provided with a constant supply of better quality water, piped into their homes. In addition to improved environmental conditions, the subproject will improve the overall health condition of the town as diseases of poor sanitation (such as diarrhoea and dysentery) will be reduced.

185. **Appendix 7** depicts Indian Standards for Drinking Water - Specification (Bureau of Indian Standard, BIS 10500: 2012). The standard indicates desirable and permissible limit of drinking water under Indian condition.

V. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

186. The primary stakeholders are:

- (i) Residents, shopkeepers and businesspeople who live and work alongside the roads in which improvements will be provided and near sites where facilities will be built;
- (ii) Custodians and users of socially and culturally important buildings in affected areas;
- (iii) State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts; and
- (iv) State and local tourism authorities.

187. The secondary stakeholders are:

- (i) Urban Development Department (UDD) as the Executing Agency;
- (ii) Other government institutions whose remit includes areas or issues affected by the subproject (state and local planning authorities such as PWD, AMC);
- (iii) Non-government organizations (NGOs) and community-based organizations (CBOs) working in the affected communities;
- (iv) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- (v) The beneficiary community in general; and
- (vi) ADB, GoI, and Ministry of Finance.

B. Consultations and Disclosures Conducted

188. Discussion was held with the local people during site visit. Issues discussed are:

- (i) Awareness and extent of the project and development components;
- (ii) Benefits of the subproject for the economic and social upliftment of community;
- (iii) Labour availability in the subproject locations or requirement of outside labour involvement;
- (iv) Local disturbances due to construction works;

- (v) Necessity of tree felling etc. at subproject location;
- (vi) Water logging and drainage problem if any;
- (vii) Drinking water problem;
- (viii) Forest and sensitive area nearby the subproject locations and
- (ix) Movement of wild animals nearby the subproject sites.

189. Public consultations and group discussion meetings were conducted by DSMC on 17th July 2014 and during 8-11th August 2014. The objectives were to appraise the stakeholders about the program's environmental and social impacts and present safeguards to mitigate any potential significant impacts. Records of public consultations and group meeting are attached as **Appendix 8**. The major issues raised are related to water availability – quality & quantity, possible dust and noise problems during construction phase. Other comments include construction vehicles creating some disturbances to the local people daily activities, necessity of proper safety arrangements. The issues and comments have been considered and incorporated in the design of the subproject and mitigation measures for the potential environmental impacts raised during the public consultations.

190. 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:

- (i) Proposed water supply project should ensure enough supply of drinking water;
- (ii) Efforts should be made by the government to maintain the drinking water supply round the clock ;
- (iii) Livelihood affected households should be given adequate assistance in the mode of cash compensation;
- (iv) Local people should be employed by the contractor during construction work;
- (v) Adequate safety measures should be taken during construction work;
- (vi) Proper arrangements should be made for access to houses and shops during construction throughout the construction period.

191. English version of the Environmental Assessment and Review Framework (EARF) has been placed in the offices of AMC, DWS and SIPMIU. Begalee (local language) versions of the EARF and this IEE will be provided during workshops to ensure stakeholders understood the objectives, policy, principles, and procedures.

C. Future Consultation and Disclosure

192. UDD extended and expanded the consultation and disclosure process significantly during implementation of NERCCDIP. They temporarily appointed NGO to handle this key aspect of the programme. The NGO continuously (i) conducts a wide range of community development activities in relation to all subprojects in the city; and (ii) ensures the needs and concerns of stakeholders are registered and are addressed in subproject design.

- (i) **Consultation during detailed design:**
 - a. Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary; and
 - b. Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

- (ii) **Consultation during construction:**
 - a. Public meetings with affected communities to discuss and plan work programmers and allow issues to be raised and addressed once construction has started
 - b. 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.
- (iii) **Project disclosure:**
 - a. 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;
 - b. 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;
 - c. Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and
 - d. Providing a mechanism through which comments can be made.

193. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon receipt; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports, upon receipt.

VI. GRIEVANCE REDRESS MECHANISM

194. Grievances of affected persons will first be brought to the attention of the SIPMIU. Grievances not redressed by the SIPMIU will be brought to the Independent Grievance Redress Committee (IGRC) set up to monitor project implementation in Agartala. The IGRC is chaired by the Secretary, Urban Development Department¹² with representatives from the ULB, state government agencies, community-based organizations (CBOs) and NGOs. The GRC will determine the merit of each grievance, and resolve grievances within 10 days of receiving the complaint. Grievance not redressed by the IGRC will be referred to the appropriate courts of law. The DSMC will keep records of all grievances received including: contact details of complainant, date that the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, and final outcome. The grievance redress process is shown in **Figure 5**.

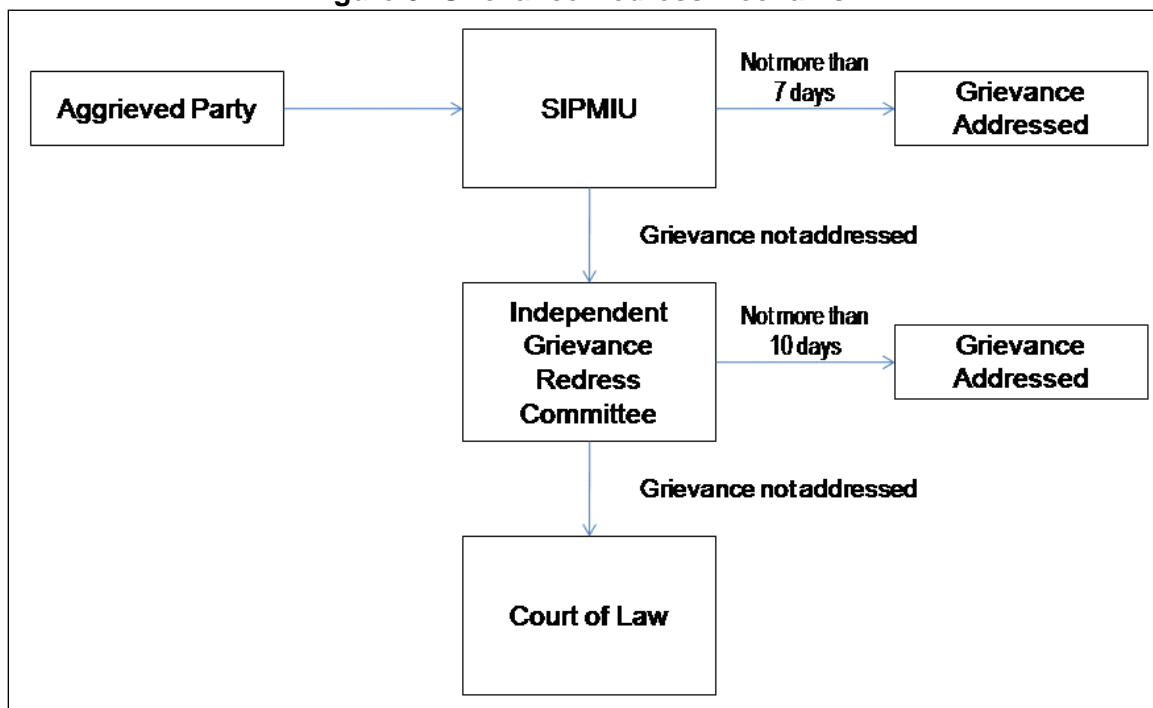
195. All costs involved in resolving the complaints will be borne by the SIPMIU. The GRCs will continue to function throughout the project duration.

196. **Appendix 9** shows Grievance Redress notification at Website and process shown in local language.

¹² The Secretary, Urban Development Department with Chief Engineer Public Works Department, PWD (Road and Bridge, R & B), Chief Engineer PWD (DWS, Drinking water & Sanitation) and Chairman cum Managing Director, will chair the Independent Grievance Redress Committee (IGRC). The Project Director would be the Secretary of the Committee. The IGRC will be fully empowered to take decisions in all matters related to the Project, which will include financial and administrative approvals.

197. **Appendix 10** shows The Grievance Registration/Suggestion Form in English and local language.

Figure 5: Grievance Redress Mechanism



VII. ENVIRONMENTAL MANAGEMENT PLAN

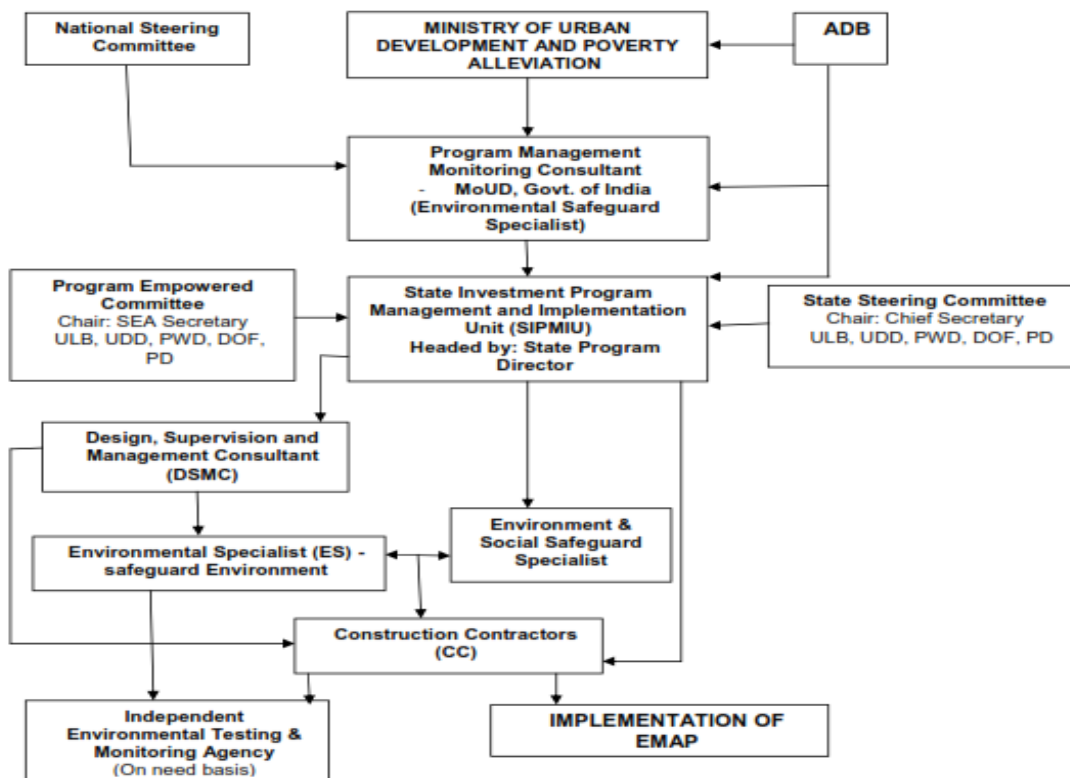
A. Institutional Arrangements

198. The main agencies involved in managing and implementing the subproject are:
- (i) The national-level Executing Agency (NEA) for the Investment Program is MOUD;
 - (ii) Investment Program Coordination Cell (IPCC) as Program Management Monitoring Consultant (PMMC) is established in MOUD. PMMC is responsible for overall management of the Investment Program in the city and they include social/environmental safeguard specialists whose tasks include monitoring Program implementation and reviewing and screening the subprojects submitted by State in accordance with subproject selection criteria, including the environmental provisions;
 - (iii) National level Steering Committee (NSC) set up by GOI to monitor the use of funds under MFF and overall implementation performance of the Investment Program;
 - (iv) State-level Executing Agency (SEA) is responsible for executing the part of the loan falling under the State Government;
 - (v) State Investment Program Management and Implementation Unit (SIPMIU) established in SEA and headed by a Program Director (PD). SIPMIU will oversee the Program's environment and resettlement planning. This includes the preparation of all documentation needed for decision-making, contracting, and supervision of work and providing progress-monitoring information to the PD;

- (vi) The SIPMIU have one Environment & Social Safeguard Specialist. The Environment and social Safeguard Specialist of SIPMIU shall be responsible for implementing the environmental safeguard provisions in the project including (i) ensuring environmental criteria for subproject selection in the EARP are followed, (ii) ensuring mitigation requirements are in contractor bidding documents, and (iii) liaising with various Central and State government agencies on compliance matters. The SIPMIU will appoint and manage Construction Contractors (CC) to build elements of the infrastructure who are required to submit Environmental Implementation Plans (EIPs) for SIPMIU approval;
- (vii) The SIPMIU is assisted by the DSMC, who is responsible for design the infrastructure, manage tendering of contracts, and supervise the construction process;
- (viii) An Environmental Specialist (ES) in the DSMC is responsible for addressing the environmental issues in the project components during design and implementation. The ES will ensure all mitigation requirements are in contractor bidding documents and EIPs, and will supervise the effective implementation of environmental provisions during construction. In addition, the ES will assist the SIPMIU on the procurement needs and other project implementation aspects and shall play a central role in ensuring capacity building on environmental management of the SIPMIU, Contractor and Line Departments through capacity development support and training.

199. **Figure 6** shows institutional responsibility for implementation of environmental safeguard at different level.

Figure 6: Institutional Responsibility- NERCCDIP



AMC = Agartala Municipal Corporation, DOF = Department of Forest, PHED = Public Health Engineering Department, PWD = Public Work Department, SEA = State Executing Agency- Urban Development Dept. Govt. of Tripura, ULB = Urban Local Body.

1. Responsible for carrying out mitigation measures

200. During construction stage, implementation of mitigation measures is the construction contractor's responsibility while during operation stage, DWS will be responsible for the conduct of maintenance or repair works.

2. Responsible for carrying out monitoring measures

201. During construction, Environmental Specialist (ES) of DSMC and Environment & Social Safeguard Specialist of SIPMIU will monitor the construction contractor's environmental performance.

202. During the operation stage, monitoring will be the responsibility of DWS.

3. Responsible for reporting

203. Construction contractor will submit monthly environment compliance report to DSMC. DSMC will submit quarterly monitoring and implementation reports to SIPMIU, who will take follow-up actions, SIPMIU will submit monitoring reports to the PD who will then submit to ADB. DSMC along with SIPMIU will prepare semi-annual environment monitoring report for ADB. The semi-annual report is to focus on the progress of implementation of the EMP and EARP and issues encountered and measures adopted, follow-up actions required, if any, as well as the status of Program compliance with subproject selection criteria, and relevant loan covenants. PMMC will seek clearance for submission and disclosure of the annual environmental monitoring report to ADB.

204. Environment monitoring report format checklist for Tranche 1 and Tranche 2 is attached as **Appendix 11**. Sample semi-annual report format of Tranche 3 is attached as **Appendix 12**.

B. Environmental Mitigation Plan

205. **Table 13 to 15** shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

C. Environmental Monitoring Program

206. **Table 16 to 18** shows the proposed environmental monitoring program for this subproject. It includes all relevant environmental parameters, location, responsibility of mitigation and monitoring, method of monitoring and frequency of monitoring. Monitoring activities during the detailed engineering design stage will form part of the baseline conditions of the subproject location and will be used as the reference for acceptance of restoration works by the construction contractors.

Table 13: Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan

Field/Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area particularly at water distribution pipeline locations	<p>(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</p> <p>(ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.</p>	DSMC	<p>(i) List of affected utilities and operators;</p> <p>(ii) Bid document to include requirement for a contingency plan for service interruptions</p>
Water Supply	Health risk due to closure of water supply through WTP at College Tilla and Bardowali	<p>(i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration);</p> <p>(ii) In coordination with DWS, provide alternative potable water to affected households and businesses for the duration of the shut-down; and</p> <p>(iii) Liaise with affected persons to inform them of any cessation in advance, and to ensure that they are provided with an alternative supply.</p> <p>(iv) O& M Manual, which will be prepared before commissioning of system ,</p>	SIPMIU	(i) Schedule of closure; (ii) delivery of potable water to affected people by DWS

Field/Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		- health & safety guidelines to followed		
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	(i) Consult Archaeological Survey of India (ASI) or concerned dept. of Tripura Govt. 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 recognised and measures are taken to ensure they are protected and conserved.	SIPMIU & DSMC	Chance Finds Protocol
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors along distribution pipeline laying area	(i) Prioritize areas within or nearest possible vacant space in the subproject location; (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; (iii) Do not consider core residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water	SIPMIU and DSMC to determine locations prior to award of construction contracts.	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.

Field/Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		body which will inconvenience the community.		
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.	(i) Prioritize sites already permitted by the Mining Department; (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 SIPMIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from SIPMIU.	SIPMIU and DSMC 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.

CPHEEO = Central Public Health and Environmental Engineering Organization, DSMC = Design Supervision Management Consultant, EIA = Environmental Impact Assessment, O&M = operation and maintenance, SIPMIU = State-level Investment Program Management and Implementation Units, DWS= Drinking Water and Sanitation.

Table 14: Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan

Field/ Issues	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 SIPMIU; (iii) If additional quarries will be required after construction has started, obtain written approval from SIPMIU; and; (iv) Submit to DSMC on a monthly basis documentation of sources of materials.	Construction Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery 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)	(i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; and (iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.	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- PM10 & PM2.5) and suspended particulate matter (SPM); (v) Vehicular emissions such as sulphur dioxide (SO ₂), nitrous oxides (NO _x), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt	(i) Avoid stockpiling of	Construction Contractor	(i) Areas for stockpiles,

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water (River water) quality.	<p>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 SIPMIU/DSMC on designated disposal areas;</p> <p>(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;</p> <p>(v) Dispose any wastes generated by construction activities in designated sites; and</p> <p>(vi) Conduct surface quality inspection particularly for River water according to the Environmental Management Plan (EMP).</p>		<p>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: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.</p>
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with SIPMIU/DSMC so that activities with the greatest potential to generate noise are conducted during	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of silencers in noise-producing equipment and sound barriers;</p>

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and</p> <p>(iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</p>		(iii) Equivalent day and night time noise levels
Ecological resources – Terrestrial	Felling of the trees (if any) – affect terrestrial ecological balance	<p>(i) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(ii) If tree-removal will be required, obtain tree-cutting permit from Municipal Corporation,</p> <p>(iii) Require to plant three (3) native trees for every one (1) that is removed; and</p> <p>(iv) Prohibit employees from poaching wildlife, bird hunting, and cutting of trees for firewood.</p>	Construction Contractor	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from SIPMIU/DSMC the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service	Construction Contractor	Existing Utilities Contingency Plan
Landscape and Aesthetics	Solid wastes as well as excess construction materials	(i) Prepare and implement Waste Management Plan; (ii) Avoid stockpiling of excess excavated soils; (iii) Coordinate with AMC/PWD for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish; and (vii) Request SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	Construction Contractor	(i) Waste Management Plan; (ii) Complaints from sensitive receptors; (iii) SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.
Accessibility	Traffic problems and	(i) Plan transportation	Construction Contractor	(i) Traffic Management

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	conflicts near project locations and haul road	<p>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 Agartala Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and</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>Plan;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Number of signages placed at subproject location.</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</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Number of walkways, signages, and metal</p>

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		required for people; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		sheets placed at subproject location.
Socio-Economic Employment	- Generation of contractual employment and increase in local revenue	(i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and (ii) Secure construction materials from local market.	Construction Contractor	(i) Employment records; (ii) records of sources of materials
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Develop and implement site-specific Health and Safety (H and 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	Construction Contractor	(i) Site-specific Health and Safety (H and 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

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>helmet, gumboot, safety belt, gloves, nose mask and ear plugs; (c) H and 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 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;</p> <p>(vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) Provide H and 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</p>		<p>where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) record of H and S orientation trainings</p> <p>(viii) personal protective equipment;</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/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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 greater than 85 dBA for a duration of more than 8 hours per day without</p>		

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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. (SIPMIU 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 material and waste transportation	(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with SIPMIU/DSMC in identifying high-risk areas	Construction Contractor	(i) Traffic Management Plan; (ii) Complaints from sensitive receptors

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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>		
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 SIPMIU/DSMC 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</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for employees; and</p> <p>(iii) SIPMIU/DSMC report in writing that the camp has been vacated and restored to pre-project conditions</p>

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request SIPMIU/DSMC 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 SIPMIU/DSMC 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 SIPMIU/DSMC if a find is suspected, and take any action they require ensuring its removal or protection in situ.	Construction Contractor	Records of chance finds

DSMC = Design Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, SIPMIU = State-level Investment Program Management and Implementation Units, SPM = suspended particulate matter, AMC= Agartala Municipal Council, PWD= Public Works Department, DWS= Drinking Water and Sanitation

Table 15: Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Occupational Health and Safety	Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous debris	(i) Ensure persons employed will be provided with suitable equipment; and (ii) Ensure all removed material will be deposited in the municipal waste storage bins.	PWD (DWS) and O and M Contractors	(i) Records of training; (ii) H and S Plan approved by UDD
General	General impact	(i) Refill and re-compact 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.	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors
Solid Wastes	Environmental pollution - Potential impact on soil, groundwater, and surface water nearby the disposal site	(i) Minimize the quantity of solids generated by the water treatment process, (ii) Dispose of lime sludge by land application, (iii) limiting application rates of sludge to minimize the potential for mobilization of metals into plant tissue and groundwater, (iv) Dispose of ferric and alum sludge by controlled land application not near water body, (v) Assessment of	PWD (DWS) and O and M Contractors	(i) Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water nearby

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		soil, ground water and surface water nearby solid waste disposal		
Wastewater	Discharge into water causing water pollution	(i) Land application of wastes with high dissolved solids concentrations (ii) Recycle filter backwash into the process (iii) Treat and dispose of reject streams as per CPHEEO norm and O & M Manual	PWD (DWS) and O and M Contractors	(i) Complaints from sensitive receptors (ii) Field checking (iii) Testing of soil, surface and ground water
Hazardous Chemicals	Release to nature causing air, water and soil pollution	(i)Store of chlorine gas in cool, dry, and dark conditions for no more than one month, (ii)Use equipment constructed of corrosion-resistant materials, (iii)Minimize the amount of chlorination chemicals stored on site, (iv)Develop and implement a prevention program that includes identification of potential hazards, written operating procedures, training, maintenance, and accident investigation procedures; (v)Develop emergency plan for responding to accidental releases (vi) O& M Manual, which will be prepared before commissioning of system , - health & safety guidelines	PWD (DWS) and O and M Contractors	(i) Complaints from sensitive receptors (ii) Site checking (iii) Checking of awareness and emergency training document

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		to followed		
Air Emissions	Air pollution from gaseous or volatile chemicals used for disinfection processes	Proper storage and scientific utilization of chemicals utilized in treatment process Collection of air samples as per CTO	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors
Economic Development	Impediments to residents and businesses	(i) Inform all residents and businesses about the nature and duration of any work well in advance so that they can make preparations if necessary; (ii) Conduct these works to provide wooden walkways across trenches for pedestrians and metal sheets where vehicle access is required; and (iii) Consult the local police regarding any such work so that it can be planned to avoid traffic disruption as far as possible, and road diversions can be organised if necessary.	PWD (DWS) and O and M Contractors	Complaints from 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	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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.		
Land Uses	<ul style="list-style-type: none"> • With augmentation of water supply system, the presently water scarce areas can be put to their utmost possible use. • The proposed project is expected to facilitate an integrated development approach to the area thereby improving the overall quality of life. • The proposed development is expected to bring about positive economic benefits in the medium- to long-term. • Local businesses and educational facilities, etc. are likely to benefit from the subproject. 	Regular maintenance of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors
Health and Safety	<ul style="list-style-type: none"> • Improvement of water supply system is expected to significantly enhance the quantity and quality 	<ul style="list-style-type: none"> • Undertake regular monitoring and maintenance of water supply infrastructure. • Carry out water quality 	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors

Field/ Issues	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	of the supplied water. • Reduction in leakages will ensure adequate supply of potable drinking water minimizing contamination risks with corresponding reduction in health risks to the citizens.	monitoring as per CTO		

H&S = health and safety, O&M = operation and maintenance, PWD (DWS) = Public Works Department (Drinking water and sanitation)

Table 16: Pre-construction Environmental Monitoring Program

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Baseline Environmental Condition – Ambient Air Quality	Subproject location	Contractor	Establish baseline values of (i) respirable particulate matter (RPM) and (ii) CO, SO ₂ & NO _x	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	SIPMIU
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	SIPMIU
Utilities	As per site requirement	DSMC	(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	Once	SIPMIU

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
					interruptions included in bid documents		
Water Supply Cessation	As per site requirement	DWS	(i) schedule of closure; (ii) delivery of DWS 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 DWS for supply of potable water to 100% affected people	Once	SIPMIU, DSMC
Social and Cultural Heritage	As per site requirement	SIPMIU and DSMC	Chance Finds Protocol	Checking of records	Chance Finds Protocol provided to construction contractors prior to commencement of activities	Once	SIPMIU
Construction work camps, stockpile areas, storage areas, and disposal areas.	As per site requirement	SIPMIU and DSMC to determine locations prior to award of construction contracts.	List of selected location for construction work camps, 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	SIPMIU

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	As per site requirement	SIPMIU and DSMC 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 additional quarry sites if necessary.	Once	SIPMIU

DSMC = Design Supervision Management Consultant, O&M = operation and maintenance, SIPMIU = State-level Investment Program Management and Implementation Units.

Table 17: Construction Environmental Monitoring Program

Field of Mitigation Measures	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 DSMC	DSMC
Air Quality	Construction sites and areas	Construction Contractor	(i) Location of stockpiles; (ii) complaints from	(i) Checking of records; (ii) visual	(i) Stockpiles on designated areas only;	Monthly for checking records	DSMC in coordination with Pollution Control

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	designated for stockpiling of materials		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 emissions such as sulphur dioxide (SO ₂), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)	inspection of sites	(ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (v) GOI Vehicular Emission Standards for SO ₂ , NOx, CO and HC.		Board
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	visual inspection	(i) Designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) GOI Standards for Water Discharges to Inland Waters and Land for	Monthly	DSMC in coordination with Pollution Control Board

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.		Irrigation		
Noise Levels	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels	(i) Checking of records; (ii) visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	Monthly	DSMC in coordination with Pollution Control Board
Ecological resources – Terrestrial and aquatic	Construction sites	Construction Contractor	Record related of tree felling and aquatic floral and faunal impact if any	(i) Checking of records; (ii) visual inspection	(i) Complaints from sensitive receptors; (ii) checking of conservation management plan for tree species	Quarterly	DSMC
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	DSMC
Landscape and Aesthetics	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste	Construction Contractor	(i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) SIPMIU/DSMC to report in writing that the necessary environmental restoration work	(i) Checking of records; (ii) visual inspection	(i) No accumulation of solid wastes on-site; (ii) implementation of Waste Management Plan; (iii) complaints from sensitive receptors satisfactorily	Monthly	DSMC

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	materials; (iii) work camps		has been adequately performed before acceptance of work.		addressed.		
Accessibility	(i) Construction sites; (ii) traffic haul road	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject location.	Visual inspection	(i) Implementation of Traffic Management Plan, if required; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	Monthly	DSMC
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	DSMC
Socio-Economic employment	construction sites	Construction Contractor	(i) Employment records; (ii) records of sources of materials	Checking of records	Number of employees from Agartala equal or greater than 50% of total workforce	Quarterly	DSMC
Occupational Health and Safety	construction sites	Construction Contractor	(i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical	(i) Checking of records; (ii) visual inspection	(i) Implementation of H and S plan; (ii) number of work-related accidents; (iii) % usage of personal protective	Quarterly	DSMC

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			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 and S orientation trainings (viii) personal protective equipment; (ix) % of moving 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.		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		
Core Labour Standard	Construction sites	Construction Contractor	Monitoring compliance with	(i) Checking of records;	Implementation of Core Labour	Quarterly	DSMC, SIPMIU

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			national labor laws and regulations provided that these national laws are consistent with CLS. (SIPMIU 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	(ii) visual inspection	Standard		

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			local communities surrounding the project sites.				
Community Health and Safety	Construction sites	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors	Visual inspection	(i) Implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DSMC
Office, Work Camps and storage areas	Work camps, Office And storage areas	Construction Contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) SIPMIU/DSMC report in writing that the camp has been vacated and restored to pre-project conditions	Visual inspection	(i) Designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	Quarterly	DSMC
Chance Finds	Construction sites	Construction Contractor	Records of chance finds	Checking of records	Implementation of Chance Finds Protocol	As needed	DSMC

BOD = biological oxygen demand, DSMC = Design Supervision Management Consultant, H&S = health and safety, RPM = respirable particulate matter, GOI= Government of India, SIPMIU = State-level Investment Program Management and Implementation Units SPM = suspended particulate matter.

Table 18: Operation and Maintenance Environmental Monitoring Program

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Occupational Health and Safety	subproject location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	(i) Records of training; (ii) H and S Plan approved by PWD (DWS)	Complaints from sensitive receptors satisfactorily addressed	As needed	SIPMIU
General Maintenance work	subproject location	PWD (DWS) and O and M	Complaints from sensitive	Checking of records	Complaints from sensitive receptors	As needed	SIPMIU

Field of Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
		Contractors	receptors		satisfactorily addressed		
Community Health and Safety	subproject location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Checking of records	complaints from sensitive receptors satisfactorily addressed	As needed	SIPMIU
Accessibility	subproject location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	SIPMIU
Water Quality	All treatment plant location	PWD (DWS) and O and M Contractors	Drinking water and surface water quality as per BIS specification	Sample collection and laboratory analyses	GOI Drinking Water Standards	As needed	SIPMIU
Solid Wastes	Near treatment plant Disposal location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Sample collection and laboratory analyses	Complaints from sensitive receptors satisfactorily addressed	Quarterly	SIPMIU
Hazardous Wastes	Treatment plant	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	(i) Site checking (ii) Checking of document	Complaints from sensitive receptors satisfactorily addressed. Awareness and emergency training document	Quarterly	SIPMIU
Air Emissions	Treatment plant location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Air sample collection and laboratory testing	GOI air quality standard	Quarterly	SIPMIU
Land Uses	subproject location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU
Health and Safety	subproject location	PWD (DWS) and O and M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PMU/PIU

CPCB = Central Pollution Control Board; DWS = Drinking Water and Sanitation Department; O&M = Operation and Maintenance; PWD = Public Works Department, SIPMIU = State-level Investment Program Management and Implementation Units

D. Environmental Management Costs

207. Most of the mitigation measures require the Construction Contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the construction contractors or DSMC are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of UDD will be provided as part of their management of the project, so this also does not need to be duplicated here.

208. The remaining actions in the EMP are the various environmental monitoring activities to be conducted by the Environmental Monitoring Specialist. These have not been budgeted elsewhere, and their costs are shown in **Table 19**. The figures show that the total cost of environmental management and monitoring for the subproject as a whole (covering operation & design phase) is **INR 1.42 million**.

Table 19: Environmental Management and Monitoring Costs (INR)

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	Applicable	Applicable	-
Public consultations and information disclosure	Information disclosure and consultations during preconstruction and construction phase.	As required	Lump sum	50,000	Concerned Contractor during project implementation will do public consultation Information disclosure in website by SIPMIU – project budget
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.	As required	Lump sum	2,00,000	Concerned Contractor
Traffic management	Safety Signboards, delineators, traffic regulation equipment, flagman, temporary diversions, etc.	Wherever required throughout subproject corridor	Contractor's liability	Not applicable	Covered in engineering cost
Baseline Monitoring	Site preparation and preliminary activities				
Air	Once before start of construction works Covering all working sites	15 samples	8,000 per sample	1,20,000	Covered under engineering design and cost -Concerned Contractor
Noise	Once before start of	15 samples	2,000 per	30,000	Covered under

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
	construction works Covering all working sites		sample		engineering design and cost -Concerned Contractor
Water quality	Near water bodies/ Haora river intake	4	10,000 per sample	40,000	Covered under engineering design and cost –Concerned Contractor
Construction Monitoring					
Air	Quarterly at 10 locations near project sites for at least 1 year	40 samples	8,000 sample per	3,20,000	Covered under engineering design and cost –Concerned Contractor
Noise	Quarterly at 10 locations near project sites for at least 1 year	40 samples	2,000 sample per	80,000	Covered under engineering design and cost –Concerned Contractor
Water quality	Quarterly of specially River/ any surface water turbidity during repairing work/ construction	16 samples	10000 sample per	160,000	Covered under engineering design and cost –Concerned Contractor
Defect Liability Period (No. of sites will be finalized as per Consent to Operate condition)					
Air	Twice at 5 locations near project sites for 1 year	10 samples	8,000 sample per	80,000	Covered under engineering design and cost –Concerned Contractor
Noise	Twice at 10 locations near project sites for 1 year	20 samples	2,000 sample per	40,000	Covered under engineering design and cost –Concerned Contractor
Water quality	From WTP – raw and treated	10 samples	10000 sample per	100,000	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	2,00,000	As per requirement - SIPMIU
TOTAL (INR) Rupees fourteen lakh twenty thousand only					14,20,000
TOTAL (US\$)					23279

VIII. FINDINGS AND RECOMMENDATIONS

209. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Agartala Water Supply Subproject. Potential negative impacts were identified in relation to both construction and operation of the improved infrastructure, but no impacts were identified as being due to either the project design or location. Mitigation measures have been developed in generic way 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 outline designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

210. Regardless of these and various other actions taken during the IEE process and in developing the project, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of trenching and other excavation; because the distribution network is located in city where there are densely populated areas and sites of historical and tourism interest; so there is a medium risk that ground disturbance may uncover important remains. Because of these factors the most significant impacts are on the physical environment, the human environment, tourism, and the cultural heritage.

211. During the construction phase, impacts mainly arise from the need to dispose of moderate quantities of waste soil; and from the 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.

212. One field in which impacts are much less routine is archaeology, and here a series of specific measures have been developed to avoid damaging important remains if any present at project location.

213. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

214. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Leaks in the distribution network 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. It will also be conducted in areas that have already been excavated, so there will be no need to protect archaeological or historic material.

215. The main impacts of the operating water supply system will be beneficial as the citizens of Agartala city will be provided with a constant supply of water, which will serve a greater proportion of the population, including slum-dwellers. This will improve the quality of life of people as well as benefiting both individual and public health as the improvements in hygiene should reduce the incidence of disease associated with poor sanitation. This should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

216. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the SIPMIU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population.

217. Finally, stakeholders were involved in developing the IEE through face-to-face discussions and on site meeting held in the city, after which views expressed were incorporated into the IEE and the planning and development of the project. 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, when a nationally-recognised NGO will be appointed to handle this key element to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

IX. CONCLUSIONS

218. 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.

219. 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) or GoI EIA Notification (2006).

APPENDIX 1: ENVIRONMENT AUDIT – WATER TREATMENT PLANT

A. Executive Summary

Environment Audit has been conducted for two water treatment plants under the project. Both the treatment plants are not functioning properly. Environment concern mainly related to poor sludge management and unsatisfactory disinfection process. Moreover required environment compliance particularly “Consent Management”, stipulation of Pollution Control Board has not been taken care. Manpower analyses indicate that there is requirement of inclusion of Chemist and safety person at WTP. Also it is noted that O & M cost for running of the plants will increase almost 2 times after rehabilitation of WTPs.

B. Facilities Description

The two water treatment plants have been taken up for renovation under the project.

Present statuses of Water Treatment Plants are,

Water Treatment Plant at College Tillah: College Tillah Water Treatment Plant was commissioned way back in 1970, with a capacity of 1.5 MGD (6.8 MLD). Subsequently the Treatment plant was augmented to 3 MGD (14 MLD).

The intake arrangement at College Tillah consists of:

- (i) A jack well (Older Intake) with a raw water pump house, housing centrifugal pumps for allowing direct pumping arrangement from the Howrah River, and
- (ii) (New) intake well housing vertical pump sets

The existing Jackwell is of brick and presently in an extremely poor condition (liable to collapse at any point of time). Means of rehabilitation are not worthy and as such a new well adjacent to the existing one need to be sunk.

Treatment Units: The treatment plant comprises of the following treatment units: Cascade Aerator, Clariflocculator, Rapid Gravity Filter and Chlorinator.

There are no flash mixers or similar units, and much of the mixing of chemicals is affected through baffles within the existing channel between Cascade aerator and Clariflocculator. A pre-sedimentation tank provided to reduce the suspended solids count is no longer in use. Due to use of high concentration of liquid chlorine, which is infused as pre-chlorination, the concrete in the raw water channel to clariflocculator is heavily corroded. The raw water channels of concrete need to be repaired. The environmental concern is poor disinfection of treated water since chlorinator not working properly. Same time due to direct use of high dose of liquid chlorine during pre-chlorination process, clariflocculator is get corroded.

Moreover, as per declaration of Executive Engineer (Ref. letter attached as **Annex 1** of this Audit report); there is no sludge collection system at WTP. Sludge in form of slurry directly discharge into river Howrah at the downstream point of intake well.

Water Treatment Plant at Bardowali

The 4 MGD (18 MLD) Water Treatment Plant was commissioned in 2000 to meet the water requirements of core areas of Central and South zone of Agartala.

Head works consist of an Intake well (within River Howrah) housing vertical pump sets.

Water Treatment process is same as that of College Tilla.

Environment problem as mentioned above for College Tilla WTP is same for Bardowali WTP.

C. Regulatory Setting

Environmental regulations, state and national levels are,

Environmental Regulations

Applicability of Acts/Guidelines	Compliance Criteria
The EIA notification, 2006 (and its subsequent amendments in 2009) provides for categorization of projects into category A and B, based on extent of impact	The sub project is not covered in the ambit of the EIA notification as this is not covered either under Category A or Category B of the notification. As a result, the categorization, and the subsequent environmental assessment and clearance requirements, either from the state or the central Government is not triggered. Environmental Clearance is not required for the proposed sub project
Wild Life (Protection) Act 1972, Amendment Act, 1993 and 2002 and Wildlife (Protection) Rules, 1995	The wildlife protection act is not applicable for the proposed project work
The Indian Forest Act, 1927; Forest (Conservation) Act, 1980, amended 1988; Forest (Conservation) Rules, 1981 amended 1992 and 2003	No forest land is involved. Not applicable
Ancient Monuments and Archaeological Sites and Remains Rules, 1959, provide guidance for carrying out activities, including conservation, construction and reuse in and around the protected monuments.	There is no requirement of clearance from ASI, Govt. of India or State. Not applicable
Water (Prevention and control of pollution) Act, 1974, as amended Air (prevention and control of pollution) Act, 1981, as amended and Noise Pollution (Regulation and Control) Rules, 2000, as amended.	Consent to Establish (CTE) and Consent to Operate (CTO) from the Tripura State Pollution Control Board for renovation of WTP and for setting up of hot mix plants, wet mix plants, stone crushers and diesel generators. To be obtained prior to construction.

In Summary: As per Govt. of India Regulation no environment clearance is required for renovation of Water Treatment Plant. But as per Tripura State Pollution Control Board (TSPCB), before renovation of water treatment plants Consent for Establishment (CFE) will be required. Also Consent for Operation (CFO) will be necessary prior to operation of the water treatment plants. At present there is no Consent to Operate for water treatment plant. Since the project will be funded under ADB loan and as per state regulation environment compliance is necessary.

D. Audit and Site Investigation Procedure

Audit has been conducted through site visit, collection of information and discussion with Executive Engineer DWS Division Agartala, Asst. Engineer DWS, Junior Engineer (Mechanical and Electrical) at College Tilla and Bardowali WTP. Present problem related to management of plant and environment issues have been noted down.

Before distribution water quality of treated water is generally checked at least 3 times for College Tilla water treatment plant and 5 times for Bardowali water treatment plant. Sample water quality testing result is attached as **Appendix 2** of the Audit Report.

E. Findings and Areas of Concern

Areas of concern for both the treatment plant pointed below,

College Tilla WTP: Some of the issues that need immediate and urgent attention at College Tilla WTP are:

- (i) Chlorination unit and chemical dosing / feeding system, which is non-functional – disinfection process unsatisfactory
- (ii) Due to the high silt / iron content of the river and also chemical dosing, most component parts (viz., Clariflocculator arm, gear box, scraper assembly, flocculator paddles, turbine blades in rapid mix unit etc.) are in extremely poor condition.
- (iii) Clariflocculator is leaking at places
- (iv) Due to the high iron content, filters have to be backwashed at short intervals. However due to lack of periodical backwashing / maintenance, the backwashing arrangement and filters beds need to be overhauled.
- (v) Suitable measures to reduce the effects due high silt content on raw water pumps and motors. Which resulting mechanical failure.

The issues at **Bardowali WTP** are similar to that of College Tilla, since the raw water source is the same. Some of the other points that need immediate and urgent attention are:

- (i) Lack of adequate storage capacity: Considering 2 hours detention time for storage of the treated water, the required storage capacity considering 23 hrs working, works out to be 1.6 Million Litres \cong 3.5 Lakh Gallons. The present storage capacity is only 1.5 Lakh Gallons. As such, the additional storage capacity that will be required is (3.5-1.5) Lakh Gallons i.e. 2.0 Lakh Gallons. Due to the inadequate storage, the utilization of the Treatment plant presently stands at only 14 MLD.
- (ii) Protection of WTP in the form of boundary wall: The existing Treatment plant is not bounded on all sides
- (iii) Leakage from Roof top tank.
- (iv) Reduced efficacy of the filters, due to the high iron content, and irregular backwashing arrangement.
- (v) Non-functional Chlorination unit and chemical dosing / feeding system. Disinfection of water is absent
- (vi) Due to the high silt / iron content of the river and also chemical dosing, most component parts (viz., Clariflocculator arm, gear box, scraper assembly, flocculator paddles, turbine blades in rapid mix unit etc.) need to be replaced.
- (vii) Due to the high silt content, considerable expenses are borne on the pumps and motors, As such preventive steps to mitigate the effects due to high silt content on raw water pumps and motors are considered separately.

In summary, at Bardowali problems related to, (i) Back wash tank and (ii) Damage of civil structure and (iii) Poor functioning of mechanical and electrical equipment.

One of the environment concerns for both treatment plants is improper storage of Chlorine and Alum, both are hazardous chemicals. Normal storage of Alum at College Tilla and Burdowali are 80 MT and 200 MT respectively. It is recorded that at a time storage of chlorine in form of Bleaching powder is about 3.0 MT, which is not risky.

As per plant in-charge, since electro chlorinator became non-functioning, storage of bleaching powder as disinfectant is temporary. After renovation of plant chlorine salt like hypochlorite will be used in electro-chlorinator.

However water quality testing result as attached in **Annex 2** indicates that supply water quality conform the prescribed national standard.

It is noted that manpower distribution in both the plants are follows,

At Bardowali WTP

J. Engg:	= 2 nos. (1 Electrical & 1 Mechanical)
Chemical House Labour	= 5 nos.
Maintenance Staff	= Electrical = 3 nos, Mech = 4 nos.
Laboratory Staff	= 2 nos. (Research Asst.)
Pump operator & Helper	= 14 nos.
Group 'D' Staff	= 2 nos.

At College Tilla WTP

J. Engg:	= 2 nos. (Electrical & Mechanical)
Pump operator	= 12 nos.
Helper	= 17 nos.
Fitter	= 3 nos.
Electrician	= 4 nos.

It is noted that there is no Chemist available in College Tilla WTP and at the same time only Research Asst. present at Bardowali WTP. There is requirement of inclusion of Chemist at WTP for proper analyses and interpretation of results as well as controlling of chemical use. There is no plant safety person within

WTP. Presence of health and safety Engineer will be required for controlling of all environment and health related problem including proper sludge management.

F. Corrective Action Plan, Costs and Schedule (CAP)

As per proposed project scope proposal have been finalized for the both College Tilla WTP and Bardowali WTP.

Proposals for Improvement of College Tilla WTP

- (i) **Jackwell & Raw water pump house**
 - a. Construction of a new Jackwell complete with mechanical appurtenances like screen and sluice gate, including dismantling the existing suction piping arrangement of the existing centrifugal pump sets feeding raw water to the WTP.
 - b. Re-orienting the suction piping arrangement for suction arrangement of the existing centrifugal pump sets to the new jackwell
 - c. Complete rehabilitation of mechanical and electrical components of intake Jackwell
- (ii) **Intake arrangement at new intake**
 - a. Supply and Installation of 3 nos. vertical turbine pumps
 - b. Provision of fresh water lubrication for the vertical pumps including overhead storage tank
 - c. Supply and installation of desilting pump with pipeline
 - d. Rehabilitation of pumping system – mechanical and electrical components
- (iii) **Treatment plant**
 - a. Supply and installation of alum and lime feeding mechanism complete with pipeline and instrumentation
 - b. Supply and installation of rapid mixers at the entry channel of clariflocculator, central hub, and peripheral drive arrangement complete with reduction gear arrangement for the clariflocculator unit.
 - c. Installation of drive arrangement complete with extension shaft and paddles for the flocculation unit of the clariflocculator unit.
 - d. Implantation of the filter media, supply, & installation of the sluice valves of the rapid filter arrangement.
 - e. Supply and installation of new drain piping arrangement including valves for the backwash drainage arrangement of the rapid filter.
 - f. Supply and installation of Electro chlorinator
- (iv) **Clear water pump house**
 - a. Civil works for modification of the existing pre-treatment sedimentation tank to a clear treated water storage reservoir
 - b. Others mechanical and electrical equipment

Proposals for Improvement of Bardowali WTP

- (i) **Intake well**
 - a. Replacement of the 3 nos. vertical turbine pumps
 - b. Supply and installation of de-silting pump with pipeline
 - c. Rehabilitation of mechanical and electrical components
- (ii) **Treatment plant**
 - a. Replacement of the entire chemical feeding mechanism
 - b. Replacement of rapid chemical mixing mechanism.
 - c. Installation of central hub, peripheral drive arrangement complete with reduction gear arrangement for the clariflocculator unit
 - d. Replacement of backwash and drainage arrangement including improvement of rapid filter mechanism

- e. Improvement of the backwash arrangement of the rapid filter mechanism by way of introduction of receiver for compressed air storage
 - f. Repairs to roof / wall by water proofing compound / grouting.
 - g. Installation of electro-chlorinator unit
- (iii) **Clear water pump**
- a. Replacement of 2 sets of vertical pump sets with drive arrangement complete with Motor control centre, piping, valves, chain pulley block with geared travelling trolley, instrumentation, cabling, earthing and illumination and allied electrical works.
 - b. Construction of a clear water reservoir adequate to store the additional water subsequent to realization of the additional 4MLD of treated water
 - c. Treatment plant area is proposed to be secured by boundary wall with wire fencing atop along the eastern and southern periphery of the Treatment Plant.
 - d. Provision of clamp - on type ultrasonic type flow meter

In both the cases before discharge of sludge in river settling at sludge pond including proper recirculation of backwash is necessary. Settled sludge needs to be removed at least once/ twice in a year for use/ disposal.

Table below indicates corrective action, capital and O & M cost (existing & proposed)

Present problem	Corrective action	Capital cost	Present annual Operation and Maintenance cost	Proposed annual Operation and Maintenance cost
College Tilla WTP- (i) Bridge of Clarifloulator (ii) Alum mixing chamber (iii) Low lift intake well (iv) All channels + supporting RCC (v) Plaster fall structure (vi) Electro chlorinator repair	<ul style="list-style-type: none"> Jackwell & Raw water pump house repair and augmentation Intake arrangement at new intake Water treatment plant rehabilitation Clear water pump house – mechanical and electrical job Sludge management 	424.0 Lakh	195.0 Lakh	368.0 Lakh
Bardowali WTP- (i) Back wash tank (ii) All Mechanical Equipment (iii) Damaged Civil structure of WTP	<ul style="list-style-type: none"> Rehabilitation -mechanical and electrical for intake Water treatment plant rehabilitation Clear water pump augmentation and clear water reservoir Sludge management 	547.0 Lakh	287.0 Lakh	492.00 Lakh

It is noted that proposed operation & maintenance cost is about 1.8 times of present operation & maintenance cost.

Implementation arrangement for the work as mentioned above, as follows,

Sr. No.	Phase of Work	Expansion and rehabilitation of WTP
1	Issuance of Bid	February 2015
2	Submission of Bid	March 2015
3	Completion of Bid Evaluation	April 2015
4	Award of Contract	May 2014
5	Completion of Works	November 2016

Annex 1 of Audit Report

NO.F.12-24/EE/DWS/AGT-I/...2701-06
 GOVERNMENT OF TRIPURA
 OFFICE OF THE EXECUTIVE ENGINEER
 DRINKING WATER AND SANITATION DIVISION
 AGARTALA-I:TRIPURA(WEST)

Date...27-01-15

To
 The Additional Programme Director,
 SIPMIU,
 Directorate of Urban Development,
 Gorkhabasti, P.N complex,
 Agartala, Tripura (W).

Sub:- Disposal of waste from Surface Water Treatment Plant at Collegetilla and Bordowali.

Ref:- Your letter No.16(2)-ADB(SIPMIU-TRIP)/CIVIL-WORKS/2014/941-43 dt.27-01-2015.

Sir,

Kindly refer to the above, I would like to bring your kind notice that there are provisions for the disposal from Surface Water Treatment Plant at Collegetilla and Bordowali. We are discharging sludge from both the Treatment Plants through separate channels / pipe in the downstream side of intake well.

This is for favour of your kind information please

Yours faithfully,

[Signature]
 28/1/15
 Executive Engineer,
 DWS Division Agartala-I.
 Agartala, Tripura(W)

Copy to :-

- 1) The Addl. Chief Engineer, PWD (DWS) for favour of his kind information.
- 2) The Superintending Engineer, DWS Circle for favour of his kind information.
- 3) The Project Director, SIPMIU, UD Department for favour of his kind information.
- 4-5) The Assistant Engineer, DWS Sub-Division No-I. Collegetilla / II, Millonsangha for information.

[Signature]
 28/1/15
 Executive Engineer,
 DWS Division Agartala-I.
 Agartala, Tripura(W)

[Signature]

Annex 2 of Audit Report

GOVERNMENT OF TRIPURA
4MGD WATER TREATMENT PLANT
UNDER DWS SUB-DIVISION NO.II MILIANSANGHA
BARDOWALI, AGARTALA.

REPORT ON PHYSICAL & CHEMICAL ANALYSIS OF WATER SAMPLE

Source of sample:-Raw water of River Howrah.

Date of collection:-27.05.14

Date of testing :- 27.05.14

Sl.No	Description of test	Result	Remarks
1.	Physical appearance	Turbid	
2.	Turbidity in NTU	261	
3.	Taste & Odour	Unobjectionable	
4.	pH value	7.24	
5.	Total Alkalinity in mg/l as CaCO ₃	80.0	
6.	Total Hardness in mg/l as CaCO ₃	62.0	
7.	Total Iron in mg/l as Fe	2.874	
8.	Chloride in mg/l as Cl	10.0	

GOVERNMENT OF TRIPURA
4MGD WATER TREATMENT PLANT
UNDER DWS SUB-DIVISION NO.II,MILANSANGHA
 BARDOWALI, AGARTALA. Dated, Agartala, the
REPORT ON PHYSICAL & CHEMICAL ANALYSIS OF WATER SAMPLE

Source of sample:-CLEAR WATER OF RIVER HOWRAH

Date of collection:-27.05.14

Date of testing:- 27.05.14

Sl.No	Description of test	Result	Desired limit	Permissible limit	Remarks
1.	Physical appearance	Unobjectionable	Unobjectionable	-	
2.	Colour in Hazen unit	<5	05	25	
3.	Turbidity in NTU	1.02	05	10	
4.	Taste & Odour	Unobjectionable	Unobjectionable	Unobjectionable	
5.	pH value	7.0	6.5 to 8.5	No relaxation	
6.	Total Alkalinity in mg/l as CaCO ₃	58.0	200	600	
7.	Total Hardness in mg/l as CaCO ₃	56.0	300	600	
8.	Total Iron in mg/l as Fe	0.033	0.3	1.0	
9.	Chloride in mg/l as Cl	11.0	250	1000	
10.	Residual Chlorine in mg/l as Cl	0.5	<0.3	0.3	
11.	Nitrate in mg/l as NO ₃ -N	0.392	45	100	
12.	Arsenic in mg/l as As	BDL	0.05	No relaxation	
13.	Sulphate in mg/l as SO ₄	38.91	200	400	

GOVERNMENT OF TRIPURA
3 MGD WATER TREATMENT PLANT
UNDER DWS DIVISION AGARTALA - 1
COLLEGETILLAH, AGARTALA

REPORT ON PHYSICAL & CHEMICAL ANALYSIS OF WATER SAMPLE

Source of Sample:- RAW WATER OF RIVER HOWRAH.

Date of Collection:- 25/2/2015

Date of Testing:- 25/2/2015

SL NO	Description of Test	Result	Remarks
1	Physical appearance	<i>Slight Turbid</i>	
2	Turbidity in NTU	<i>160</i>	
3	Taste & Odour	<i>Unobjectionable</i>	
4	pH value	<i>7.2</i>	
5	Total Alkalinity in mg/l as CaCO ₃	<i>48</i>	
6	Total Hardness in mg/l as CaCO ₃	<i>42</i>	
7	Total iron in mg/l as Fe	<i>1.44</i>	
8	Chloride in mg/l as Cl.	<i>13</i>	

[Signature] 26/2/2014
In-charge,
DWS West District Laboratory,
Collegatilla, Agartala.
Tripura (88).

GOVERNMENT OF TRIPURA
3MGD WATER TREATMENT PLANT
UNDER DWS SUB-DIVISION College Tillah
College Tillah, AGARTALA. Dated, Agartala, the

REPORT ON PHYSICAL & CHEMICAL ANALYSIS OF WATER SAMPLE

Source of sample:-CLEAR WATER OF RIVER HOWRAH

Date of collection:- 25/2/2015

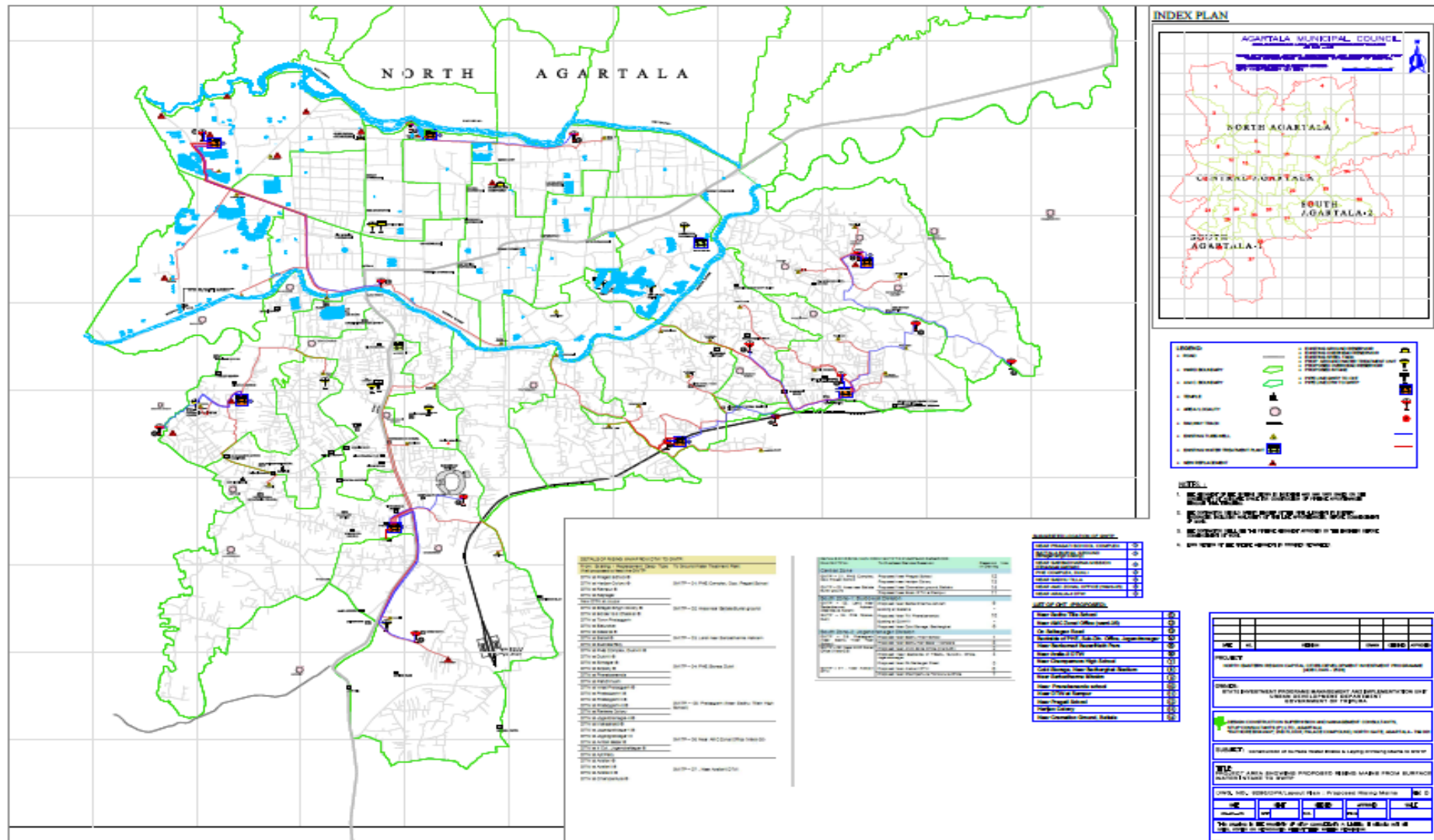
Date of testing:- 25/2/2015

Sl.No	Description of test	Result	Desired limit	Permissible limit	Remarks
1.	Physical appearance	Clear	Un Objectionable	—	
2.	Colour in Hazen unit	* NIL	05	25	
3.	Turbidity in NTU	1.13	05	10	
4.	Taste & Odour	* NIL	Un Objectionable	Un Objectionable	
5.	pH value	7.0	6.5 - 8.5	No relaxation	
6.	Total Alkalinity in mg/l as CaCO ₃	75	200	600	
7.	Total Hardness in mg/l as CaCO ₃	38	300	600	
8.	Total Iron in mg/l as Fe	0.074	0.3	1.00	
9.	Chloride in mg/l as Cl	12	250	1000	
10.	Residual Chlorine in mg/l as Cl	0.75	> 0.3	0.3	
11.	Nitrate in mg/l as NO ₃ -N	0.311	45	100	
12.	Arsenic in mg/l as As	* NIL	0.05	No relaxation	
13.	Sulphate in mg/l as SO ₄	—	—	—	

* NIL - Un Objectionable

Signature 26/2/2015
In-charge,
DWS West District Laboratory,
College Tillah, Agartala.
Tripura (W)

APPENDIX 2: PROPOSED WORK COMPONENTS UNDER TRANCHE 3- SHOWN IN MAP



APPENDIX 3: ADB Rapid Environmental Assessment Checklist (WATER SUPPLY- AGARTALA, TRIPURA)

Screening questions	Yes	No	Remarks
A. Project siting			
Is the project area...			
• Densely populated?		✓	Agartala is not densely populated. There are no heavy development activities in the subproject area. The area is predominantly residential and commercial.
• Heavy with development activities?		✓	
• Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		✓	
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
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?		✓	Not anticipated. There are no industries and agricultural activities upstream of sources. Areas upstream of the sources are undisturbed.
• Impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Not applicable. There are no historical/cultural monuments/areas within or adjacent to subproject sites.
• Hazard of land subsidence caused by excessive ground water pumping?		✓	Not anticipated. Per data from Central Ground Water Board (CGWB), Agartala has net annual groundwater availability of 1.97 billion cubic meters and stage of groundwater development is low (9%). No impact on groundwater due to installation of 12 DTWs.
• Social conflicts arising from displacement of communities?		✓	No displacements required. Subproject sites are government-owned. Temporary impacts to businesses may occur during pipelaying works and are to be addressed through specific measures in the EMP. Any involuntary resettlement impacts identified will be addressed in the Resettlement Plan (RP).
• Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	Not anticipated. No additional abstraction from surface source. Groundwater availability will not be affected per data from CGWB.
• Unsatisfactory raw water supply (e.g. Excessive pathogens or mineral constituents)?		✓	Periodic monitoring and analysis conducted by Agartala Drinking Water and Sanitation Department (DWSD) and SIPMIU on raw water from the sources indicate water quality parameters are within prescribed limits.
• Delivery of unsafe water to distribution system?		✓	Subproject includes rehabilitation of existing and construction of distribution network. Any distributed water will be treated and ensured to comply with the National Drinking Water Quality Standards.
• Inadequate protection of intake works or wells, leading to pollution of water supply?		✓	Subproject includes fencing and other protection work for water intakes.
• Over pumping of ground water, leading to salinization and ground subsidence?		✓	Salinization due to salt bearing strata is not a problem in Agartala. To avoid ground

Screening questions	Yes	No	Remarks
			subsidence and over-exploitation, CGWB is undertaking enactment of Ground Water Bill to regulate and control the development of ground water. In view of very low development of ground water (9%), Tripura State Government will introduce the Bill when the stage of development approaches 70%. Subproject will replace/install flow and water depth instrumentation on all ground water DTWs for extraction monitoring.
• Excessive algal growth in storage reservoir?		✓	Storage reservoirs are only for treated water. The water is chlorinated and the reservoirs covered to prevent algal growth.
• Increase in production of sewage beyond capabilities of community facilities?		✓	NERCCDIP Project 3 will improve the existing collection and treatment systems by providing additional cesspool equipment and construction septage treatment facility.
• Inadequate disposal of sludge from water treatment plants?		✓	WTP sludge to be disposed in Agartala municipal SLF.
• Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	Not applicable. Buffer zones included in designs of WTPs and DTWs.
• Impairments associated with transmission lines and access roads?		✓	Not anticipated. Road closures are not required during pipelaying works. A section-wise approach will limit impairments to traffic and businesses during construction. The EMP ensures measures are included to mitigate the impacts.
• Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		✓	Not anticipated. WTP designs include dedicated areas for chemical storage. Workers will be trained on proper chemical handling and emergency response procedures.
• Health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		✓	Not anticipated. During construction, workers will be required to undergo health and safety induction course prior to mobilization to construction sites. During O&M, workers will be trained on proper chemical handling and emergency response procedures.
• Dislocation or involuntary resettlement of people?		✓	No involuntary resettlement impacts envisioned. Lands for the subproject are government-owned. Any involuntary resettlement impacts identified will be addressed in the RP.
• Disproportionate impacts on the poor, women and children, indigenous peoples or other vulnerable groups?		✓	Not anticipated. The contractor will be encouraged to hire local workers from the local labor force.
• Noise and dust from construction activities?	✓		Anticipated during construction activities. Temporary increase in noise level and dusts may be caused by excavation equipment, and the transportation of equipment, materials, and people. The impacts are negative but short-term and site-specific within a relatively small area. and reversible through mitigation measures. Good construction practices will mitigate noise and dust, and will be specified in the EMP.
• Increased road traffic due to interference of construction activities?	✓		Anticipated during construction activities. The impacts are negative but short-term and site-specific within a relatively small area and reversible through mitigation measures. Traffic

Screening questions	Yes	No	Remarks
			management will be specified in the EMP.
<ul style="list-style-type: none"> Continuing soil erosion/silt runoff from construction operations? 	✓		Due to excavation and run-off from stockpiled materials. The impacts are negative but short-term and site-specific within a relatively small area and reversible through mitigation measures. Good construction practices will mitigate soil erosion and silt runoff and will be specified in the EMP.
<ul style="list-style-type: none"> Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems? 		✓	The project will include development of O&M manuals to ensure facilities are kept in working condition, including maintenance of filters and monitoring of disinfection/chlorination system. Any distributed water must comply with the National Drinking Water Quality Standards.
<ul style="list-style-type: none"> Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals? 		✓	The project will include development of O&M manuals to ensure facilities are kept in working condition, including checking and maintenance of distribution network. Any distributed water must comply with the National Drinking Water Quality Standards.
<ul style="list-style-type: none"> Accidental leakage of chlorine gas? 		✓	Not applicable. Chlorine gas will not be used.
<ul style="list-style-type: none"> Excessive abstraction of water affecting downstream water users? 		✓	Not anticipated. No additional abstraction from surface source. Groundwater availability will not be affected per data from CGWB.
<ul style="list-style-type: none"> Competing uses of water? 		✓	
<ul style="list-style-type: none"> Increased sewage flow due to increased water supply 	✓		NERCCDIP Project 3 will improve the existing septage collection and treatment systems by providing additional cesspool equipment and construction of septage treatment facility.
<ul style="list-style-type: none"> Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant 	✓		Sludge from WTPs and STP will be disposed in the municipal SLF.
<ul style="list-style-type: none"> Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)? 		✓	Improved management systems through capacity building and institutional development will ensure reduced burden on services and infrastructure.
<ul style="list-style-type: none"> Social conflicts if workers from other regions or countries are hired? 		✓	Priority in employment will be given to local residents.
<ul style="list-style-type: none"> Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction? 		✓	Not applicable. Construction will not involve use of explosives and chemicals.
<ul style="list-style-type: none"> Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning? 		✓	Work areas will be clearly demarcated with signage and safety barriers, and access will be controlled. Only workers and project concerned members will be allowed to visit the operational sites.

Screening Questions		Score	Remarks ¹³
Location and Design of project	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,	0	All pipes will be constructed below ground, no components will be sited in

¹³ 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.

	storms, landslides? 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	flood plains etc. Proposed investments will not pass through major cross drainages and river. Pipes are designed to handle peak flow demands.
Materials and Maintenance	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	No significant effect
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	0	No significant effect
Performance of project outputs	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	No significant effect

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

APPENDIX 4: STANDARDS- EFFLUENT AND DRINKING WATER
General Standards for Discharge of Environmental Pollutants: Effluents

SL.no	Parameter	Standards			
		Inland surface water	Public sewers	Land of irrigation	Marine/coastal areas
		(a)	(b)	(c)	(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids mg/l. max.	100	600	200	(a) For process waste water 100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a) Floatable solids, max. 3mm. (b) Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 5 ⁰ C above the receiving water temperature			shall not exceed 5 ⁰ C above the receiving water temperature
6.	Oil and grease, mg./l. max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH ₃) mg/l. max	100			100
10.	Free ammonia (as NH ₃), mg/l.max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27 ⁰ C), mg/l. max.	30	350	100	100
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2

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

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

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

APPENDIX 5: INDIAN STANDARDS FOR DRINKING WATER - SPECIFICATION (BUREAU OF INDIAN STANDARD, BIS 10500: 2012)

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

APPENDIX 6: SAMPLE OUTLINE OF SPOIL MANAGEMENT PLAN (SMP)

1.0 Purpose and application:

SMP is to describe how the project will manage the spoil generated and reuse related to design and construction works. This is an integral part of EMP. The objective of SMP is to reuse of spoil from works in accordance with the spoil management hierarchy outlined in this document.

2.0 Objectives of SMP

The objectives of SMP are:

- (i) To minimize spoil generation where possible
- (ii) Maximize beneficial reuse of spoil from construction works in accordance with spoil management hierarchy
- (iii) Manage onsite spoil handling to minimize environmental impacts on resident and other receivers
- (iv) Minimize any further site contamination of land, water, soil
- (v) Manage the transportation of spoil with consideration of traffic impacts and transport related emissions

3.0 Structure of SMP:

Section 1: Introduction of SMP

Section 2: Legal and other requirements

Section 3: Roles and responsibilities

Section 4: Identification and assessment of spoil aspects and impacts

Section 5: Spoil volumes, characteristics and minimization

Section 6: Spoil reuses opportunities, identification and assessment

Section 7: On site spoil management approach

Section 8: Spoil transportation methodology

Section 9: Monitoring, Reporting, Review, and Improvements

4.0 Aspects and Potential Impacts

The key aspects of potential impacts in relation to SMP are listed in table below

Aspects	Potential Impacts
Air Quality	Potential for high winds generating airborne dust from the stock piles
Sedimentation	Potential for sediment laden site runoff from spoil stockpiles and potential for spillage of spoil from truck on roads
Surface and Groundwater	Contamination of water (surface and ground water)
Noise	Associated with spoil handling and haulage and storage
Traffic	Impacts associated with spoil haulage
Land Use	Potential for spoil to be transported to a receivable site that doesn't have permission for storage/disposal
Design specifications	Limitations on opportunities to minimize spoil generation
Sustainability	Limited sites for storage, reuse opportunities

5.0 Spoil volumes, characteristics and minimization

5.1 Spoil volume calculations: Estimate the volumes of spoils produced from each of the construction sites.

5.2 Characterization of spoil: Based on the type of spoil; characterization is done (sand stone, mud mix materials, reusable materials)

5.3 Adopt Spoil Reduce, Reuse Opportunities

An overview of the assessment methodology to be used is mentioned below.

- (i) Consideration of likely spoil characteristics
- (ii) Identification of possible reuse sites
- (iii) Screening of possible reuse opportunities

5.4 Identification of possible safe disposal sites for spoil: Those spoils which can't be reuse shall be properly disposed in designated areas, such disposal areas should be identified in project locations. Such disposal areas should be safe from environmental aspects and there should be any legal and resettlement related issues. Such areas need to be identified and prior cliental approval should be obtained to use it as spoil disposal area. The local administration must be consulted and if required permission should be obtained from them.

5.5 Storage and stock piling

5.6 Transportation and haulage route

6.0 Based on the above, the contractor will prepare a SMP as an integral part of EMP and submit it to the DSC for their review and approval.

APPENDIX 7: 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.

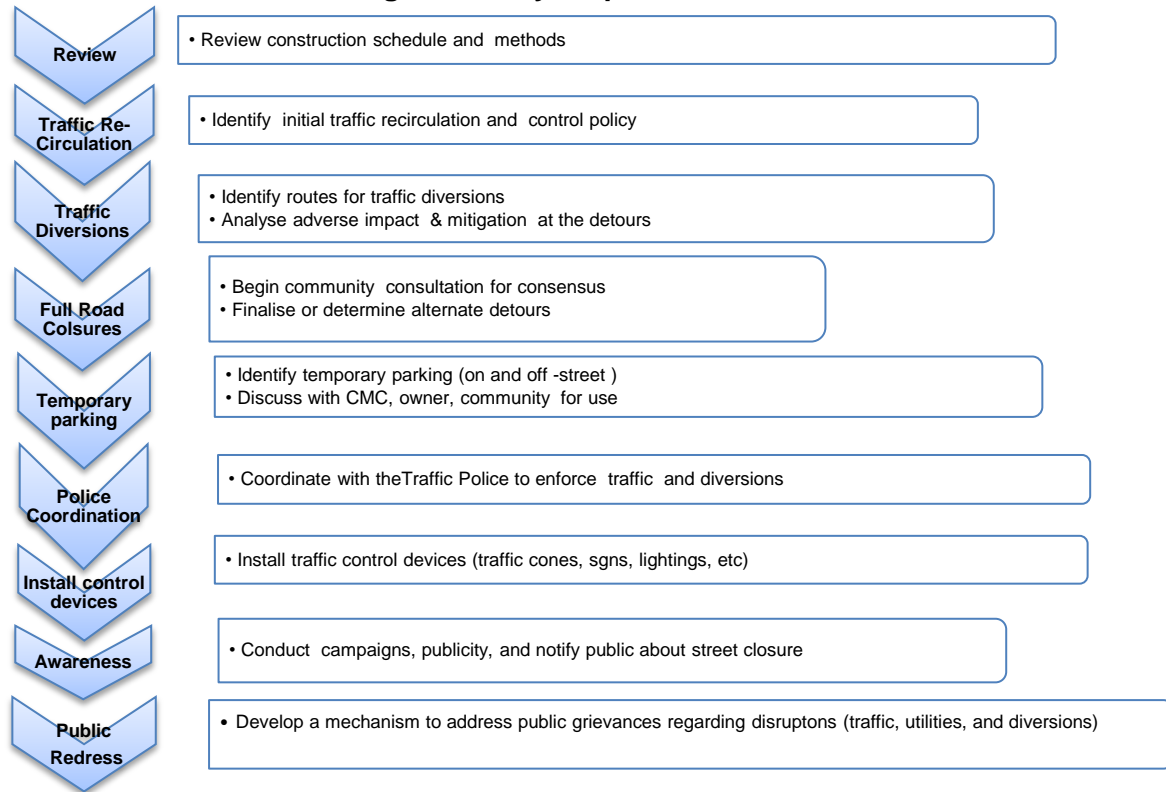
C. Analyze the impact due to street closure, if required

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 Tripura Govt. / Gol. All vehicles to be used shall be in perfect condition meeting pollution standards of Tripura Govt. / Gol. The vehicle operator requires a pre state of shift checklist. Additional safety precautions will include the requirement for:

- (i) Driver will follow the special code of conduct and road safety rules of Government of India
- (ii) Drivers to ensure that all loads are covered and secured drivers to ensure operation equipment can't leak materials hauled
- (iii) 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:

- (i) Signs
- (ii) Pavement Markings

- (iii) Channelizing Devices
- (iv) Arrow Panels
- (v) 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.

APPENDIX 8: RECORDS OF PUBLIC CONSULTATION

Issues discussed

- (i) Awareness and extent of the project and development components
- (ii) Benefits of Project for the economic and social Upliftment of Community
- (iii) Labour availability in the Project area or requirement of outside labour involvement
- (iv) Local disturbances due to Project Construction Work
- (v) Necessity of tree felling etc. at project sites
- (vi) Water logging and drainage problem if any
- (vii) Drinking water problem
- (viii) Forest and sensitive area nearby the project site
- (ix) Other problems, encountered, if any

Area: Bodhjunga Chowmuhani, Battala, Durga Chowmuhani, Paradise Chowmuhani, Near City center

Date & Time: 17th July 2014 and during 8-11th August 2014

Table: Issues of the Public Consultation- Design phase

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
1	Awareness of the project – including coverage area	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	In what way they may associate with the project	At the construction phase some people can work as labourers, 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	There is no forest area nearby the project location	
4	Presence of historical/ cultural/ religious sites nearby	Temples are present nearby the proposed tube well and distribution pipeline sites. Local people requested not to impact on those sites	
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 stagnation is reported in case of continuous rain	Drainage project already under implementation
7	Drainage problem facing	No any	
8	Present drinking water problem – quantity and quality	In 80% cases local complained on non-availability of water, Presence of iron is reported by 90% of habitation. In 50% cases people have own arrangement (tube well) within their building premises	
9	Present solid waste collection and disposal problem	As per local people – done properly by AMC	
10	Availability of labour during construction time	Yes, labours are easily available in the nearby villages	
11	Access road to project Site	Yes existing bitumen road in most of the cases	
12	Perception of locals On	Generally not required in most of the cases.	If required compensatory

Sr. No.	Key Issues/Demands	Perception of community	Action to be Taken
	tree felling and afforestation		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 village/ project locality	Project area is having sufficient space for workers 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 requested for safety arrangement particularly where excavation is being planned near main city road.	

NAME AND POSITION OF PERSONS CONSULTED:

1. Jadab Paul (Businessman, Bodhjung Chowmuhani
2. Mrs. Rupali Majumdar (Local resident) Bodhjung Chowmuhani
3. Pradip Debbarma (Labour) Bodhjung Chowmuhani
4. Kamal Sarkar (Labour) Bodhjung Chowmuhani
5. Tapan Karmakar (Businessman). Battala
6. Ashoke Kr, Roy (Employee, ONGC), Battala
7. Bhakta Rupini (Employee), Battala
8. Suman Saha (Shop Owner), Durga Chowmuhani
9. Raju Dey (Student), Durga Chowmuhani
10. Prasanta Paul (Employee), Durga Chowmuhani
11. Partha Dey (Businessman), Durga Chowmuhani
12. Paresh Malakar (Employee), Paradise Chowmuhani
13. Utpal Sarkar (Employee), Paradise Chowmuhani
14. Rajib Roy (Businessman), Paradise Chowmuhani
15. Somnath Roy (Ward Committee member), Near city center
16. Arindam Das Gupta (Employee), Near city center
17. Priyotosh Saha (Buisness man), Near city center
18. Rakesh Shil (Local resident), Near city center



Bodhjung Chowmuhani (Central Zone)



Battala (Central Zone)



Durga Chowmuhani (Central Zone)



Paradise Chowmuhani (Central Zone)

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.

Group Meeting I

One public consultation was held at Madhya Banamalipur, near Bodhjunga Girls' school. The area is inhabited by mostly tribal persons. The meeting was conducted in the house of Mrs Kanakprabha Deb Barman. The respondent was Mr Ranjan Deb Barman who is in Railways service.

The question was asked regarding water supply condition in that area. The points were as follows:

- (i) The supply is inadequate.
- (ii) Iron content is high.
- (iii) Sometimes water is smelly.
- (iv) Due to insufficiency of water the family has to purchase water regularly.
- (v) Though they have to procure water from outside they pay water tax regularly.



Group Meeting II

Another public consultation was held at Krishnagar Pragati Road, near Pragati School. It is near the treatment plant, where work is ongoing. The meeting was conducted in the house of Mrs. Dipika Deb Barman. The respondent was Mrs Deb Barman who is a housewife. The question was asked regarding water supply condition in that area. The points were as follows:

- (i) The supply is scarce.
- (ii) They collect water from other's house.
- (iii) Iron content is high.
- (iv) Sometimes water is smelly and black.
- (v) Even they found insects in water.



Group Meeting III

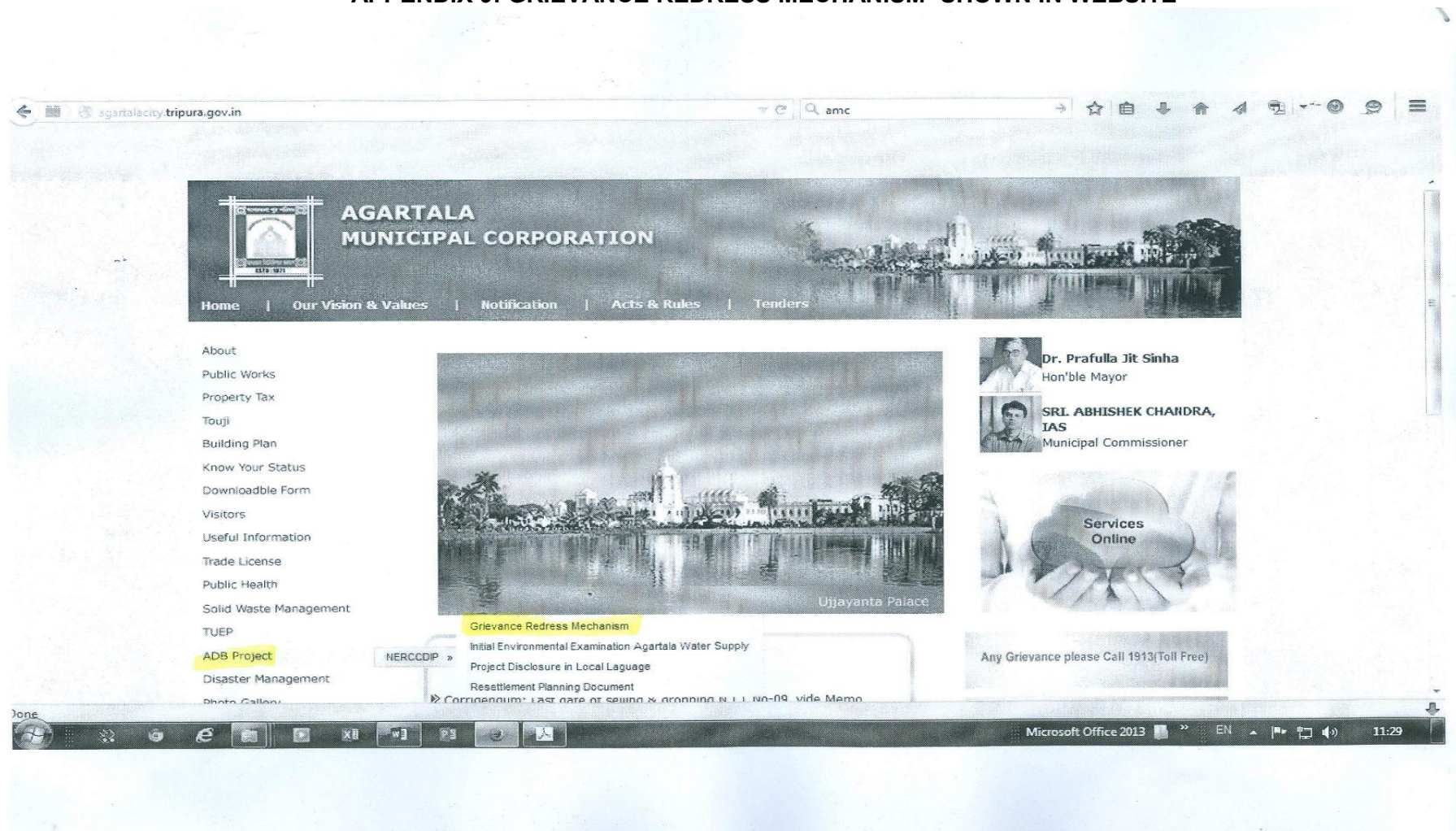
The third public consultation was held at Ramnagar No 5. The meeting was conducted in the house of Mrs Madhuri Bhowmik. The respondent was Mrs Bhowmik who is a housewife. The question was asked regarding water supply condition in that area. The points were as follows:

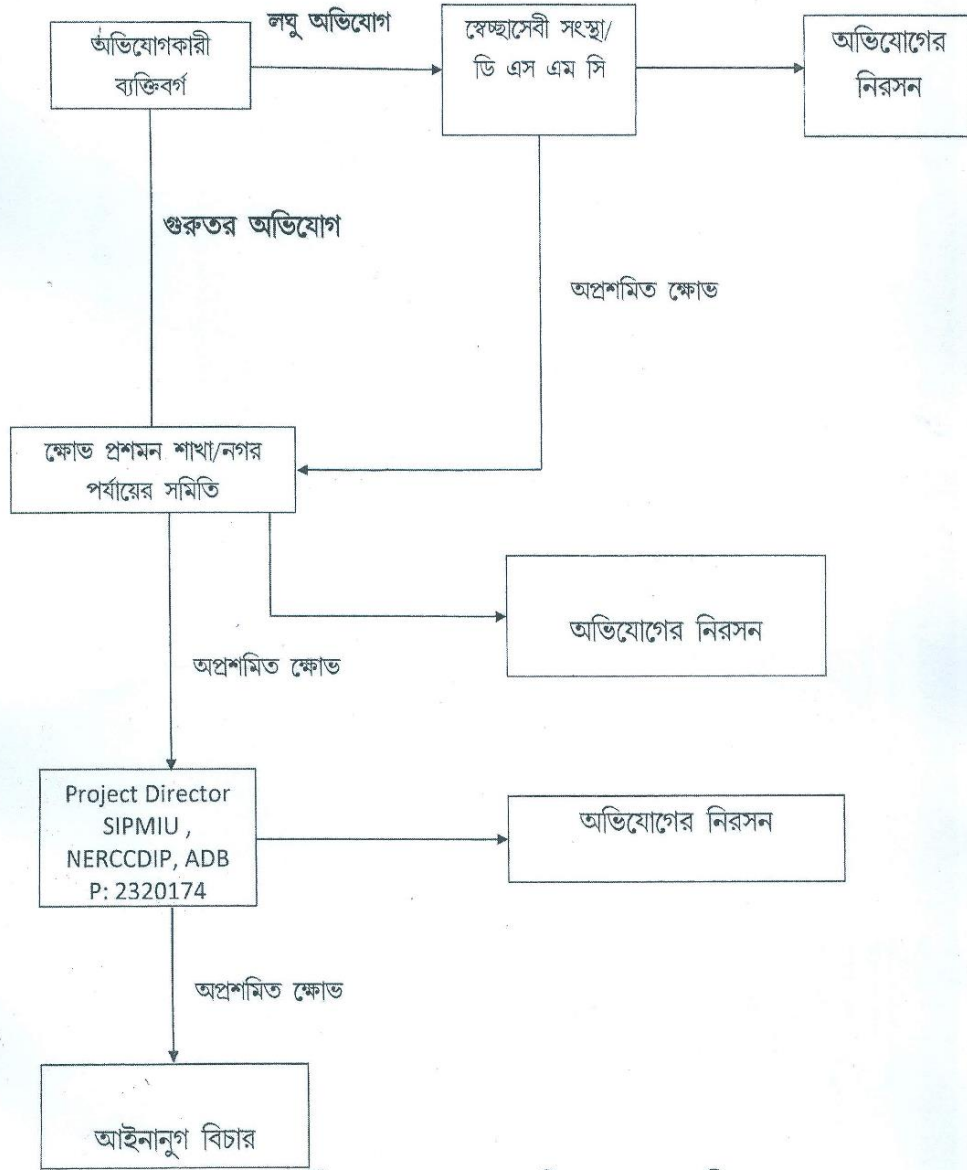
- (i) The supply is not enough.
- (ii) Iron content is high.
- (iii) Sometimes they found insects in water.
- (iv) In spite of newly installed pipeline they do not get water on time and suffer.

From the above three discussions it was clear they were not aware of the ongoing water supply project. Quality water availability is not sufficient.

More awareness campaigns are required to inform the ongoing water supply works

APPENDIX 9: GRIEVANCE REDRESS MECHANISM- SHOWN IN WEBSITE





চিত্র নং-১ ক্ষোভ নিরসনের পদ্ধতি।

Project Director
SIPMIU, NERCCDIP, ADB

**APPENDIX 10: SAMPLE GRIEVANCE REGISTRATION FORM
(TO BE AVAILABLE IN HINDI, ENGLISH OR LOCAL LANGUAGE, IF ANY)**

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

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

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

FOR OFFICIAL USE ONLY

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

GRIEVANCES RECORD AND ACTION TAKEN

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

LOCAL LANGUAGE

এন, ই, আর, সি, সি, ডি, আই, পি প্রকল্প বাস্তবায়ন সংক্রান্ত অভিযোগ, পরামর্শ, প্রশ্ন এবং মন্তব্য স্বাগত জানায়। আমরা শোষণ এবং প্রতিক্রিয়ার জন্য আপনার সাথে যোগাযোগ পেতে সক্ষম তাদের নাম এবং যোগাযোগের তথ্য প্রদান অভিযোগ ব্যক্তিদের উত্সাহিত করি।

আপনি আপনার ব্যক্তিগত বিবরণ অন্তর্ভুক্ত করতে কিন্তু যে তথ্য গোপন থাকা চাই উচিত, আপনার নামের উপরে / টাইপ * (গোপনীয়) * লিখে আমাদের অবহিত করুন।

আপনাকে ধন্যবাদ।

তারিখ		নিবন্ধন স্থান			
যোগাযোগ তথ্য / ব্যক্তিগত তথ্য					
নাম		লিঙ্গ	পুরুষ / মহিলা	বয়স	
বাড়ির ঠিকানা					
গ্রাম / শহর					
জেলা					
ফোন নম্বর					
ইমেল					
অভিযোগ / পরামর্শ / মন্তব্য / প্রশ্ন (কে, কি, কোথায় এবং কিভাবে) নীচের আপনার অভিযোগের বিবরণ প্রদান করুন:					
সংযুক্তি / নোট / চিঠি হিসাবে অন্তর্ভুক্ত করা হয়, এখানে টিক করুন:					
কিভাবে আপনি আপনার মন্তব্য / অভিযোগ প্রতিক্রিয়া বা আপডেটের জন্য আপনি পৌঁছাতে চান?					

শুধুমাত্র সরকারী ব্যবহারের জন্য

(অফিসিয়াল নিবন্ধনের অভিযোগ নাম): দ্বারা নিবন্ধিত	
- তারপর মোড:	
<ul style="list-style-type: none"> ▪ উল্লেখ্য / পত্র ▪ ইমেল ▪ মৌখিক / টেলিফোনে 	
পর্যালোচনা: (নাম / অফিসিয়াল (গুলি) পর্যালোচনা অভিযোগ পজিশন)	
গৃহীত পদক্ষেপ:	
যতই কর্ম প্রকাশ নেওয়া:	<ul style="list-style-type: none"> ▪ হ্যাঁ ▪ না
প্রকাশ মাধ্যম:	

অভিযোগ তালিকা ও গৃহীত পদক্ষেপ

ক্রমিক সংখ্যা	তারিখ	অভিযোগকারীর নাম এবং যোগাযোগের বিশদ	অভিযোগের প্রকার	স্থান	প্রতিকারের অবস্থান	মন্তব্য

APPENDIX 11: MONITORING CHECKLIST FOR TRANCHE 1 & 2**TRANCHE 1 MONITORING CHECKLIST**

Project: Water Supply – Package No: Progress: Physical progress :						
Sr. No.	Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Responsible for Monitoring	Compliance Status/ Explanation
Pre-Construction Design phase						
1	Site preparation work completed including necessary clearance					
Construction						
2	Establishment of temporary camps with sanitary and solid waste management arrangement					
3	Removal of overburden and excavated material from working site and use / preservation of the same – as per mitigation measures					
4	Water sprinkling at construction site for arresting dust (if any during dry period)					
5	Materials carrying vehicle are covered					
6	All vehicles and equipment mobilized to construction site and producing emission, have Pollution Control Board certification					
7	At sensitive locations enclosures provided around generator set or other noise producing machinery					
8	Regular maintenance of noise producing equipment done					
9	Arrangement of drainage of waste water and arresting solid waste from waste water generated at construction site					
10	Arrangement of pit for storage of muck					
11	Felling of trees done (if necessary) with mitigation measures i.e. planting of three trees for each tree fell.					
12	Pollution of water bodies at construction site					
13	Disposal of construction debris if any as per mitigation measures					
14	Ensure use of Personal Protective Equipment like helmet, gumboot, gloves,					

Project: Water Supply – Package No: Progress: Physical progress :						
Sr. No.	Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Responsible for Monitoring	Compliance Status/ Explanation
	and earplugs at work place Arrangement of First Aid Box at working site					
15	Provide Health and Safety training to all personnel and implement H&S plan					
16	Plan truck routes (for carrying construction materials including pipes) to avoid narrow or congested roads and tourist sites					
17	Consideration of public safety - as per prescribed mitigation measures					
18	Employ at least 50% of workforce from communities near sites					
19	Continuous monitoring on implementation of mitigation measures					

Tranche 2- Monitoring checklist

Project: Water Supply- Package No: Progress: Physical progress:						
Sr. No.	Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Responsible for Monitoring	Compliance Status/ Explanation
Pre-Construction Design phase						
1	Site preparation work completed including necessary clearance					
Construction						
2	Establishment of temporary camps with sanitary and solid waste management arrangement					
3	Removal of overburden and excavated material from working site and use / preservation of the same – as per mitigation measures					
4	Water sprinkling at construction site for arresting dust (if any during dry period)					
5	Materials carrying vehicle are covered- Reducing dust hazard					
6	All vehicles and equipment mobilized to construction site and producing emission, have Pollution Control Board certification					
7	At sensitive locations enclosures provided					

Project: Water Supply- Package No: Progress: Physical progress:						
Sr. No.	Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Responsible for Monitoring	Compliance Status/ Explanation
	around generator set or other noise producing machinery					
8	Regular maintenance of noise producing equipment done					
9	Arrangement of drainage of waste water and arresting solid waste from waste water generated at construction site					
10	Felling of trees done (if necessary) with mitigation measures i.e. planting of three trees for each tree fell.					
11	Pollution of water bodies at construction site					
12	Disposal of construction debris if any as per mitigation measures					
13	Ensure use of Personal Protective Equipment like helmet, gumboot, gloves, and earplugs at work place Arrangement of First Aid Box at working site					
14	Provide Health and Safety training to all personnel and implement H&S plan					
15	Plan truck routes (for carrying construction materials including pipes) to avoid narrow or congested roads and tourist sites					
16	Consideration of public safety - as per prescribed mitigation measures					
17	Employ at least 50% of workforce from communities near sites					
18	Continuous monitoring on implementation of mitigation measures					

APPENDIX 12: SEMI-ANNUAL ENVIRONMENTAL REPORTING FORMAT

I. INTRODUCTION

- (i) Overall project description and objectives
- (ii) Description of subprojects
- (iii) Environmental category of the sub-projects
- (iv) Details of site personnel and/or consultants responsible for environmental monitoring
- (v) 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

- (i) Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.
- (ii) 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:
 - a. What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries?
 - b. If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
 - c. 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;
 - d. Are there designated areas for concrete works, and re-fuelling?
 - e. Are there spill kits on site and if there are site procedures for handling emergencies;
 - f. Is there any chemical stored on site and what is the storage condition?
 - g. Is there any dewatering activities if yes, where is the water being discharged;
 - h. How are the stockpiles being managed?
 - i. How is solid and liquid waste being handled on site?
 - j. Review of the complaint management system;
 - k. 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

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
Utilities/Tree cutting	(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. (iii) Collection of tree cutting permission with assistance SIPMIU/DSMC					
Water Supply	(i) Plan the construction program to keep the cessation of water supplies to the minimum possible (in both area and duration); (ii) Design consideration as per CPHEEO Manual on water supply and treatment; and (iii) In coordination with AMC, provide alternative potable water to affected households and businesses for the duration of the shut-down if any					
Traffic Management	(i) Prepare a short traffic management schedule during preconstruction phase.					
Social and Cultural	(i) Consult Archaeological					

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
Resources	<p>Survey of India (ASI) or concerned department in Agartala 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>					
Construction work camps, hot mix plants, stock pile areas, storage areas, and disposal areas.	<p>(i) Prioritize areas within or nearest possible vacant space in the subproject location;</p> <p>(ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation and drinking water supply systems;</p> <p>(iii) Do not consider residential areas;</p> <p>(iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and</p> <p>(v) Avoid setting up of labour camp near river</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
Sources of Materials	(i) Prioritize sites already permitted by the Mining Department; (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 SIPMIU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from SIPMIU					

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

B. Construction Stage

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
Sources of Materials	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment SIPMIU; (iii) If additional quarries will be required after construction has started, obtain written approval from					

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
	SIPMIU; and (iv) Submit to DSMC on a monthly basis documentation of sources of materials.					
Air Quality	(i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of pipes, soils, gravel, and other construction materials; (ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; and (iv) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly. (v) Carry out air quality monitoring					
Traffic Management	(i) Implement a traffic management schedule during preconstruction phase.					
Surface water quality	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or					

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
	plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with SIPMIU/DSMC on designated disposal areas; (iii) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (iv) Dispose any wastes generated by construction activities in designated sites; and (v) Conduct visual surface quality inspection					
Noise Levels	(i) Plan activities in consultation with SIPMIU/DSMC 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, fitting jackhammers with					

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
	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 (if any) 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 SIPMIU/DSMC the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service					
Landscape and Aesthetics	(i) Storage areas will be properly fenced off.					

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) Prepare and implement Waste Management List; (iii) Avoid stockpiling of excess excavated soils; (iv) Coordinate with AMC for beneficial uses of excess excavated soils (v) Recover used oil and lubricants and reuse or remove from the sites; (vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vii) Remove all wreckage, rubbish; (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 SIPMIU/DSMC 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					

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
	not use narrow local roads, except in the immediate vicinity of delivery sites; (ii) Schedule transport and hauling activities during non-peak hours; (iii) Locate entry and exit points in areas where there is low potential for traffic congestion; (iv) Keep the site free from all unnecessary obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with Agartala Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints; and (viii) Provide planks across trenches in front of businesses, and ensure works are completed quickly to avoid disruption					
Socio-Economic–Income.	(i) Leave spaces for access between mounds of soil;					

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) Provide walkways and metal sheets where required for people; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.					
Employment Generation	(i) The use of labor intensive construction measures will be used where appropriate; (ii) Employ local (unskilled) labor if possible; (iii) Training of labor to benefit individuals beyond completion of the subproject; (iv) The training of unskilled or previously unemployed persons will add to the skills base of the area; and (v) Recruitment of labor will take place offsite.					
Occupational Health and Safety	(i) Develop and implement site-specific Health and Safety (H&S) Plan which will					

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>include measures such as:</p> <ul style="list-style-type: none"> (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment like helmet, gumboot, gloves, nose mask and ear plugs; (c) H&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; <p>(ii) Designate a safeguard focal person and undertake safeguards orientation by PMU/PIU;</p> <p>(iii) Ensure H&S plan is easily understandable to workers and laborers. Keep in mind that this plan will be used on-site and workers/laborers may not always understand highly technical terms;</p> <p>(iv) Strict compliance of H&S plan and requirements of wearing personal protective equipment (PPE) during work hours;</p> <p>(v) Provide specific guidance for suitable PPE for every on-site work assignment</p> <p>(vi) Ensure that qualified first- aid can be provided at</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>all times. Equipped first-aid stations shall be easily accessible throughout the project site;</p> <p>(vii) Provide medical insurance coverage for workers;</p> <p>(viii) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(ix) Provide supplies of potable drinking water at working sites;</p> <p>(x) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; and</p> <p>(xi) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p> <p>(xii) 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>(xiii) Ensure the visibility of workers through their use 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>high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(xiv) Ensure moving equipment is outfitted with audible back- up alarms;</p> <p>(xv) 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>(xvi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p>					
Community Health and Safety.	<p>(i) Plan routes to avoid times of peak-pedestrian activities.</p> <p>(ii) Liaise with SIPMIU/DSMC in identifying high-risk areas on route cards/maps.</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>(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;</p> <p>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(vii) Develop and implement a traffic management plan; and</p> <p>(viii) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>					
Camp sites	(i) Consult SIPMIU/DSMC					

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>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;</p> <p>(iv) Prohibit employees from cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil 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 (ix) Request SIPMIU/DSMC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</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
Social and Cultural Resources	(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request SIPMIU/DSMC 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 SIPMIU/DSMC 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

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
General maintenance	(i) Refill and re-compact trenches soil and backfilled sand will be removed to expose the leaking junction or pipe; (ii) Conduct work during non-monsoon period; 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
	(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.					
Land uses	Regular maintenance of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.					
Health & safety	Undertake regular monitoring and maintenance of water supply infrastructure.					

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

- (i) Monitoring of environmental IMPACTS on PROJECT SURROUNDINGS (ambient air, water quality and noise levels)
- (ii) Brief discussion on the basis for monitoring
- (iii) Indicate type and location of environmental parameters to be monitored
- (iv) Indicate the method of monitoring and equipment to be used
- (v) 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 ³	SO ₂ µg/m ³	NO ₂ µg/m ³

Water Quality Results

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