



# Initial Environment Examination

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Project Number: 35290-033  
July 2017

## IND: North Eastern Region Capital Cities Development Investment Program (NERCCDIP) - T2 (Mizoram)

Subproject: Aizawl Water Supply and Sewerage

Submitted by:

State Investment Program Management and Implementation Unit (SIPMIU),  
Government of Mizoram

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*RUC*  
SIPMIU: AIZAWL

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No. W-11020/7/2017-PD/SIPMIU(NERCCDIP)/40

Dated Aizawl, 12<sup>th</sup> June, 2017

To,

The Country Director  
Indian Resident Mission (INRM)  
Asian Development Bank,  
4 San Martin Marg, Chanakyapuri  
New Delhi 110021



Subject: Submission of updated Initial Environmental Examination (IEE) Tranche - 2  
Aizawl Water Supply and Sewerage Sub-project, April 2017

Sir,

With reference to the subject cited above, I have the honour to submit herewith  
**'Updated Initial Environmental Examination (IEE) Tranche-2 Aizawl Water Supply  
and Sewerage Sub-project, April 2017'** after revision and changes made as required.

Yours faithfully,

*Valbuena*  
Dis (VALBUENA) / 12/06  
Program Director,  
SIPMIU (NERCCDIP)

Memo.No. W-11020/7/2017-PD/SIPMIU(NERCCDIP)/40 Dated Aizawl, 12<sup>th</sup> June, 2017

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Program Director,  
SIPMIU (NERCCDIP)

# **INITIAL ENVIRONMENTAL EXAMINATION**

**APRIL 2017 (UPDATED)**

India: North-Eastern Region Capital Cities  
Development Investment Program (Tranche-2)–  
Aizawl Water Supply and Sewerage Subproject

Prepared by the State Investment Program Management and Implementation Unit (SIPMIU), Urban Development Department for the Asian Development Bank. This is an updated version of the revised IEE posted in March 2015 available on <https://www.adb.org/sites/default/files/project-document/158768/35290-033-iee-10.pdf>

## ABBREVIATIONS

ADB	—	Asian Development Bank
AMC	—	Aizawl Municipal Council
CBO	—	Community Based Organization
CLC	—	City Level Committee
CPHEEO	—	Central Public Health and Environmental Engineering Organization
CTE	—	Consent to Establish
CTO	—	Consent to Operate
DSMC	—	Design, Supervision and Management Consultancy
EAC	—	Expert Appraisal Committee
EARF	—	Environment Assessment and Review Framework
EIA	—	Environmental Impact Assessment
EMP	—	Environment Management Plan
GAPA	—	Greater Aizawl Planning Area
GRC	—	Grievance Redress Committee
H&S	—	Health and Safety
IEE	—	Initial Environment Examination
IPCC	—	Investment Program Coordination Cell
Lpcd	—	Liters per capita per day
MFF	—	Multitranchise Financing Facility
MoEFCC	—	Ministry of Environment, Forest and Climate Change
MoUD	—	Ministry of Urban Development
MSW	—	Municipal Solid Waste
NAAQS	—	National Ambient Air Quality Standards
NEA	—	National level Executing Agency
NER	—	North Eastern Region
NERCCDIP	—	North Eastern Region Capital Cities Development Investment Program
NGO	—	Non Governmental Organization
NSC	—	National level Steering Committee
O&M	—	Operation and Maintenance
PMIU	—	Project Management and Implementation Unit
PSP	—	Private Sector Participation
ROW	—	Right of Way
SEA	—	State-level Executing Agency
SEIAA	—	State Environment Impact Assessment Authority
SIPMIU	—	State Investment Programme Management Implementing Unit
SPS	—	Safeguard policy Statement
TOR	—	Terms Of Reference
UD&PAD	—	Urban Development and Poverty Alleviation Department
UDD	—	Urban Development Department
ULB	—	Urban Local Body
LCC	—	Local Council Chairman

## **WEIGHTS AND MEASURES**

dbA		decibels
ha		hectare
km	–	kilometer
km <sup>2</sup>		square kilometer
l		liter
m	–	meter
m <sup>2</sup>		square meter
M <sup>3</sup>		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 will be implemented over a six year period beginning in 2010, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the Asian Development Bank (ADB).
2. The Ministry of Urban Development (MoUD) is the national Executing Agency. A State-level Investment Program Management and Implementation Units (SIPMIU) in each state is responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. The SIPMIU is being assisted by: design, management and supervision consultants (DMSC), who are designing the infrastructure, managing the tendering of contracts, and will supervise construction.
3. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB's Safeguard Policy Statement (SPS) (2009). This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, loans involving financial intermediaries, and private sector loans.
4. This Initial Environmental Examination (IEE) has been prepared for the Aizawl Water Supply and Sewerage Subproject as part of NERCCDIP-Tranche 2 during 2013 and which updated on march 2015.. The approved disclosed IEE is further updated for change in location of pipeline and as per detailed design. The proposed improvement in the water supply system will involve: (i) construction of 3 ground level reinforced cement concrete zonal tanks; (ii) electrical and mechanical works testing, equipment installation and commissioning of two booster pumps in Chandmari and Tlangnuam; (iii) Extension of main feeder pipe lines (23.44 km), rehabilitation of existing secondary and tertiary network (51.70 km), extension to distribution system (32.16 Km) and road restoration; (iv) Installation of Bulk (85 nos.) and Consumer Water Meter (20,000 households) (Establishment of Water Meter Installation and UFW Reduction Program).; and (v) power substation and transmission line (132 Kilovolt-amperes (kVA) to provide uninterrupted power),. The proposed improvement in the sewerage system will involve: (i) sewerage network consisting of 46 km including manholes and ventilation shafts and all associated earthworks and utility shifting; (ii) procurement of 5 numbers of septic tank cleaning equipment; (iii) construction of 10 community toilets; (iv) construction of a sewage treatment plant (STP) of 10 MLD; and (v) construction of approach road to the STP (320 m)
5. 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.
6. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure. No impacts were identified as being due to the subproject design or location. An EMP is proposed as part of this IEE which includes (i) mitigation measures for significant environmental impacts during implementation, (ii) environmental monitoring program, and the responsible entities for mitigation, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) grievance redress mechanism. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. A number of impacts and their significance have already been reduced by amending the designs.
7. During the construction phase, impacts mainly arise from the need to excavate large areas which can result to increase in dust and noise levels, disturbance to residents and

businesses along the delivery routes, and traffic. These are common impacts of construction in built-up areas, and there are well developed methods for their mitigation.

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

9. The main impacts of operating the improved water supply and sewerage system will be beneficial to the citizens of Aizawl because they will be provided with equitable distribution and supply of water. Improvement in sewerage system will also be beneficial to the citizens of Aizawl because they will be provided with improved hygienic conditions. In addition, the natural resources will also be protected from pollution because a system for collection, conveyance, treatment, and disposal for wastewater will be provided.

10. The stakeholders were involved in developing the IEE through face-to-face discussions on site and public 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-recognized non-government organization 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.

11. Therefore, 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. 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, Shillong and Gangtok through investments in urban infrastructure sectors. The urban infrastructure and services improvement is proposed in the following sectors (i) water supply, (ii) sewerage and sanitation, and (iii) solid waste management. The expected impact of NERCCDIP is increased economic growth potential, reduced poverty, and reduced imbalances between the NER and the rest of the country. The expected outcomes of the Investment Program will be an improved urban environment and better living conditions for the 1.65 million people expected to be living in the NERCCDIP cities by 2018. To this end, NERCCDIP will (i) improve and expand urban infrastructure and services in the cities including in slums, and (ii) strengthen urban institutional, management, and the financing capacity of the institutions, including the urban local bodies. Based on considerations of economic justification, absorptive capacity and sustainability of the implementing agencies, sub-projects have been identified in each city in the priority infrastructure sectors.

2. Though NERCCDIP aims to improve the environmental condition of urban areas, the proposed improvements of infrastructure facilities may exert certain adverse impacts on the natural environment. While developing urban infrastructure facilities, impacts during the construction stage are expected to be more severe than impacts during the operation phase, though for a short duration. Exceptions being some facilities such as solid waste landfills and sewage treatment plants, which may also exert adverse impacts during the operation phase, if due care is not taken.

3. NERCCDIP is being implemented over a six year period since 2010, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the ADB. The Ministry of Urban Development (MOUD) is the national Executing Agency. A State-level Investment Program Management and Implementation Units (SIPMIU) in each state are responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. The SIPMIU is being assisted by: design, management and supervision consultants (DMSC), who are designing the infrastructure, managing the tendering of contracts, and will supervise construction.

4. 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 Safeguards Policy Statement (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. The Initial Environmental Examination (IEE) has been prepared for the Aizawl Water Supply and Sewerage Subproject as part of NERCCDIP-Tranche 2. Location (particularly pipeline) has been changed for few components. Accordingly IEE is now revised as per present scope and location. The updated IEE covers improvement in the water supply system: (i) construction of 3 ground level reinforced cement concrete zonal tanks; (ii) electrical and mechanical works testing, equipment installation and commissioning of two booster pumps in Chandmari and Tlangnuam; (iii) Extension of main feeder pipe lines (23.44 km), rehabilitation of existing secondary and tertiary network (51.70 km), extension to distribution system (32.16 Km) and road restoration; (iv) Installation of Bulk (85 nos.) and Consumer Water Meter (20,000 households) (Establishment of Water Meter Installation and UFW Reduction Program); and (v) power substation and transmission line (132 Kilovolt-amperes (kVA) to provide uninterrupted power). The proposed improvement in the sewerage system will involve: (i) sewerage network consisting of 46 km including manholes and ventilation shafts and all associated earthworks and utility shifting; (ii) procurement of 5 numbers of septic tank cleaning equipment; (iii) construction of 10 community toilets; (iv) construction of a sewage treatment plant (STP) of 10 MLD; and (v) construction of approach road to the STP (320 m).

5. This IEE report covers the general environmental profile of Aizawl and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the subproject's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) is also proposed as part of this report which includes mitigation measures for significant environmental impacts during implementation of the Project, environmental monitoring program, and the responsible entities for mitigation and monitoring.

## **B. Extent of the IEE Study**

6. This IEE report was prepared on the basis of detailed screening and analysis of all environmental parameters, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation per ADB's SPS, 2009 and Government of India Environmental Impact Assessment (EIA) Notification of 2006.

### **1. ADB Policy**

7. 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.

8. **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.

9. **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.

10. **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.

## **2. National Law**

### **a. EIA Notification (2006)**

11. 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 categorized as A or B depending on the scale of the project and the nature of its impacts.

12. 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 a comprehensive Terms of Reference (TOR) for the EIA study, which are finalized within 60 days. Upon 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.

13. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares the 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.

14. The only type of infrastructure provided by the NERCCDIP that is specified in the EIA Notification is solid waste management. SEIAA in Mizoram has not yet been constituted therefore the Environmental Clearance has been obtained from the MOEF in New Delhi. However, for this subproject Environmental Clearance is not required.

### **b. Water (Prevention and Control of Pollution) Act (1974)**

15. Any component of urban infrastructure project having potential to generate sewage or trade effluent will come under the purview of the Water (Prevention and Control of Pollution) Act, 1974. Such projects have to obtain Consent to Establish (CTE) under Section 25 of the Act from the State Pollution Control Board before starting implementation and Consent to Operate (CTO) before commissioning. The annual renewal of the CTO is based on the performance of the facility and its compliance with the discharge standards. The Water Act also requires the occupier of such subprojects to take measures for abating the possible pollution of receiving water bodies.

16. Actions required for this subproject specifically for the construction of the STP (Table 1 of the Environmental Assessment Framework [EARF]) includes obtaining from the State Pollution Control Board Consent for Establishment (CFE) before construction.

### **c. Air (Prevention and Control of Pollution) Act (1981)**

17. The sub-projects having potential to emit air pollutants into the atmosphere have to obtain [CTE under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981] from State Pollution Control Board before starting implementation and CTO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution. If stone crushers, generators and other air pollution sources are to be established as part of the subproject, they will fall under the purview of the Air Act.

### **d. Forest Legislation**

18. Forest legislation in India dates back to the enactment of the Indian Forest Act, 1927. This Act empowers the State Government to declare “any forest land or waste-land, which is the property of Government or over which the Government has proprietary rights or to the whole or any part of the forest-product of which the Government is entitled”, a reserved forest or protected forest. The State Government may assign to any village-community the rights of Government over a reserved forest – those are called village-forests. The Act also allows Government control over forest and lands not being the property of Government.

19. Acts like clearing or break up of any land for cultivation or for any other purpose, damage to vegetation/trees and quarrying or removing any forest produce from reserved forest is prohibited. All these are also applicable to village-forests. For protected forests, with the provision of the Act, the State Government makes rules to regulate activities like: cutting of trees and removal of forest produce; clearing or breaking up of land for cultivation or any other purpose; and for protection and management of any portion of protected forest.

20. GoI Forest (Conservation) Act, 1980 (amended in 1988) restricts the deforestation of forests for use of non-forest purposes. According to the Act, State Government requires prior approval of GoI for the use of forest land for non-forest purposes (means the breaking up or clearing of any forest land) or for assigning least to any private person or agency not controlled by government. The Forest (Conservation) Rules, 2003 issued under this Act, provide specific procedures to be followed for conversion of forest land for non-forest purposes.

21. Conversion of forest lands that are part of National Parks/Sanctuaries and Tiger Reserve areas (notified under Indian Wildlife (Protection) Act, 1972) is not permitted. In exceptional case, the State Government requires consent of the Indian Board of Wildlife for obtaining approval of the State Legislature for de-notification of the area as a sanctuary.

22. Cutting of trees in non-forest land, irrespective of land ownership, also requires permission from the Mizoram Forest and Environment Department (MFED). Afforestation to the extent of two trees per each tree felled is mandatory.

23. The following Consents, NOCs & Authorization are obtained for water supply & Sewerage Sub – Projects and attach as appendix , which summarized in the **Table 1**.

**Table 1: Status of Authorization, Consents & NOCs for the Project**

Sr. No	Authorization, Consents & NOCs	Issued by	Date of Issue	Remarks
1	Tree felling permission for STP	Principal Chief Conservator of Forest Mizoram	23.04.2014 by letter no- B. 14017\ 16\ 95 – PCCF(G)\ 271	Tree felling work completed , a copy of NOC is attached as appendix 5
2	Consent for Establishment of STP	Member Secretary Mizoram state pollution Board	23.8.2012 by letter no – H. 88088 \ poltn \ 9\ (153) \ 2011 – MPCB – 27 – 31 Renewed further on every year. Last on 24.08.2016 and which valid upto 23.08.2017 .	The construction work for STP is in progress and a copy of Consent for establishment is attached as appendix 6
3	NOC for construction of Community Sepatge at College Veng, kulikawn	Office of Local Council, office of Dyp. Medical	Letters dated 17 .10. 2013, 27.11.2013 and	A copy of NOCs are attached as appendix 4

Sr. No	Authorization, Consents & NOCs	Issued by	Date of Issue	Remarks
	hospital and Aizwal city bus owner associations	Superintendent Kulikawn Hospital and Aizwal city bus owner associations	25. 01. 2014	
4	NOC from PWD Govt. of Mizoram for STP Approach Road	Office of the Executive Engineer : PWD: Aizwal Road , North Division	9.12. 2014 by letter no – T – 11013 \ 19 \ 09 \ ARN \ APL \ SD – I \ 216	Copy of NOC is attached as appendix 7
5	NOC from Forest dept. for laying of sewage pipeline after modification of alignment	Deputy Conservator of Forest, MoEFCC, Govt. of Aizawl	B14020/ 1/2010-FTS dated 4.4.2017	Internal correspondence letter attached as appendix 8

## II. DESCRIPTION OF THE PROJECT

### A. Type, Category and Need

24. **Type.** This is a water supply and sewerage subproject intended to improve the current situation in Aizawl in terms of improving the water supply and distribution system, and improving the collection, conveyance, treatment and disposal of sewerage.

25. **Category.** Environmental examination indicates the proposed subproject falls within ADB's environmental Category B projects. The Project 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, and to determine whether further study or a more detailed EIA may be required.

26. **Need.** The subproject is needed because the present water supply and sewerage system in Aizawl is inadequate for the needs of the growing population. The present water supply system is under severe wear and tear, energy cost to deliver water from source to users is very high, distribution is intermittent and limited to only a few, and system losses is estimated to a high of 50%. Currently, there is no sewerage system in Aizawl resulting to unhygienic conditions and pollution of surface and groundwater.

### B. Location and Implementation Schedule

27. The subproject will cover the Greater Aizawl Planning Area (GAPA)<sup>1</sup> which covers a total land area of 128.9 square kilometres (km<sup>2</sup>). GAPA includes Aizawl city and 80 adjacent village councils. All subproject components will be located on government-owned land and existing right-of-way (ROW). The STP will be constructed in 2 hectares (ha) vacant government land (acquired from private ownership) in Bethlehem Vengthlang, 2 km from Aizawl city.

### C. Description of the Subproject

#### 1. Existing Water Supply System

28. **Management.** Aizawl Municipal Council (AMC) was recently established in part to manage municipal services. However, the Mizoram Public Health Engineering Department (PHED) has been mandated to manage the water supply in Aizawl.

29. **Source.** The water supply source is the Tlawng River, located about 12 km away from the city. The lift involved in pumping from the source to the topmost balancing storage reservoir is more than 1 km hence energy cost involved is very high and forms a major part of

<sup>1</sup> Greater Aizawl Planning Area

the operating and maintenance expenditure. Though new source development is not targeted at present as it will be a separate endeavour to select a new source which will involve less operating expenditure.

30. **Distribution.** The Greater Aizawl Water Supply Project was formulated in 1983 and was executed from 1983 to 1988. It aimed at a production of 10.8 million liters per day (MLD) for a population of 70,000 (at an overall supply level of 135 lpcd excluding 15% losses). By the time the project was completed, the population had already exceeded the designed capacity.

31. The objective of enhanced water production through Phase II Part I has not been achieved so far and the present water supply production still stands at 10.8 MLD. The present production is far too short of the present, though completion of Phase II Part I (12 MLD) works was in the end of 2007. The Phase-II (Part-2) of 12 MLD works is still ongoing. Even if Phase II Part II is completed, there is still a gap to emerge soon after its completion, unless steps are taken now to identify and develop new water sources for augmentation immediately.

32. There are problems with the distribution of the water supply in the city. Due to very uneven terrain on hilly area and very high heads involved in the system (150 m to 300 m) consumers can be supplied water only to the extent of few hours in a week. Zoning has been done in the system and the total storage created in the system is about 27% and is satisfactory.

33. Most of the distribution lines are metallic<sup>2</sup> and as far as the consumer lines are concerned they are 20 millimeters (mm) diameter and above. As the system is getting older, the leakages and losses in the system are increasing and anticipated losses have been assessed to the tune of 50%.

34. There is an equally important need to upgrade the present distribution system and rehabilitation pumping machineries of Greater Aizawl Water Supply Scheme Phase-I. Mizoram PHED has taken initiatives and prepared Detailed Project Report for rehabilitation of pumping machineries and equipments of Phase-I and is now ongoing with the Central Assistance under JNNURM. The system of supply through main reservoir – zonal reservoirs – supply tanks has to be changed. There are high frictional losses in the consumer's long service lines, which are a cause of low pressures. There are high leakage losses through these very service lines as well as supply tanks. On one hand, these high losses are resulting in lesser supply at the consumer end, while on the other hand precious water lifted to more than a km height is lost without use. What is required is that the distribution system has to be fed directly from the zonal reservoirs and distribution lines need to be extended without proper design in every lane, to cover all the households due to demand basis. The distribution system cannot function with dead ends and has to be converted in to loops, which are to be fed from the reservoir of proper elevation so as to achieve minimum of 12 m terminal head at the last end of distribution network by way of pressure zoning. Besides, distribution networks need to be extended to areas which are not presently covered by present supply network.

35. **Storage.** Storages are adequate as per norms but the system has to face very large falls and hence the storage runs down in a very short time. To control the water forcing the lower areas, valves are controlled. This exerts heavy pressures in the system and leakages increase. Velocities are very high in the system and hence, on controlling the valves return surges do occur.

36. **Metering.** Meters also go out of order due to system pressures. Repairing of the system in the very congested areas takes time and the supply is affected. Pipe lines are laid on the stringent slopes and curves. In case of higher diameter pipes, the joints in the pressurized condition leak. Connections from the system are taken in the form of bunched "T"s

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<sup>2</sup> Galvanized iron (GI) pipes have been used for more than 20 years for house connections and for the distribution network. They are likely to be rusted.

from the main pipeline. This leads to the situation of giving number of connections from the same point.

## **2. Existing Sewerage System Condition**

37. **Management.** Mizoram PHED is also mandated to manage the sewerage system in Aizawl.

38. **Sewerage Zones.** Based on the topography and watershed characteristics, GAPA is divided in four sewerage zones. The core area lies in Zone 1<sup>3</sup>. Zones 3 and 4 are sparsely populated thus not suitable for piped sewerage system at this stage.

39. **Collection, Conveyance, and Treatment.** There is no system for collection, conveyance, and treatment of wastewater in any of the locality of GAPA.

40. About 90% of households have toilets, and most of these are either bucket or cistern flush. However, as many as 5% to 10% of households depend upon pit latrines or open places for their toilet needs. Presently, latrines are connected to septic tank or pits. Sullage from septic tank and other wastewater flows in soak pits or in open drain and find its way from higher ridges to lower ridges. Septic tanks are cleaned during night time by private truck tankers but disposed off at open spaces in and around the city. Thus, most of the surface drains carry sewage during the dry season; and sewage and rainwater during wet seasons.

41. Surface run off is very high and polluted water flows from higher ridges to lower ridges. Thus, people living in lower ridges are severely affected. Some of the wastewater is draining to the Tlawng River, specifically upstream of pick up point for the city's water supply.

42. Aizawl has frequent landslips, the incidence of which becomes higher during and after rainy season. Percolation of water through the loose strata has been identified as one of the major causes of landslips. The existence of a large number of soak pits for disposal of household wastewater is another major cause as this wastewater seeps through soil layers, thereby triggering the landslips. In the absence of sewerage system, people have no option other than to resort to septic tank and soak pits disposal. With the increase in the quantity of water supply, there will be an increase in the quantity of wastewater and hence higher probability of landslides.

## **3. Subproject Components**

43. The proposed improvement in the water supply system will involve: (i) construction of 3 ground level reinforced cement concrete zonal tanks; (ii) electrical and mechanical works testing, equipment installation and commissioning of two booster pumps in Chandmari and Tlangnuam; (iii) Extension of main feeder pipe lines (23.44 km), rehabilitation of existing secondary and tertiary network (51.70 km), extension to distribution system (32.16 Km) and road restoration; (iv) Installation of Bulk (85 nos.) and Consumer Water Meter (20,000 households) (Establishment of Water Meter Installation and UFW Reduction Program); and (v) power substation and transmission line {132 Kilovolt-amperes (kVA) to provide uninterrupted power}. The proposed improvement in the sewerage system will involve: (i) sewerage network consisting of 46 km including manholes and ventilation shafts and all associated earthworks and utility shifting; (ii) procurement of 5 numbers of septic tank cleaning equipment; (iii) construction of 10 community toilets; (iv) construction of a sewage treatment plant (STP) of 10 MLD; and (v) construction of approach road to the STP (320 m).

44. The objective of the improvement in water supply system is to provide equitable distribution over the city area. By commissioning the new treatment plant (funded under the Greater Aizawl Water Supply Project Phase-II) the quantity of water will be adequate for the demand in the near future. Still the problem will be of the distribution of water on the uneven slopes of the town. Thus, the subproject will:

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<sup>3</sup> It is proposed that out of 3,227 ha Zone 1 area, approximately 650 ha area will be provided with wastewater collection conveyance and treatment system under Tranche-2.

- (i) Provide for the facility of the rehabilitating of the existing distribution and feeder mains. If required they will be replaced;
- (ii) reduce unaccounted-for-water;
- (iii) ensure uninterrupted power for the pumping of water from the head works and treatment plant;
- (iv) provide metering of the house connections;
- (v) get rid of T junctions;
- (vi) avoid ad hoc billing and actual billing of rational quantity of water; and
- (vii) Increase coverage and revenue by extending the system to the maximum possible extent.

45. The objective of the improved sewerage system is to provide hygienic and environmentally-safe living conditions for citizens of core area. The subproject will:

- (i) provide sewerage system for 67% of core area population or 30 % population of entire city;
- (ii) prevent ground water pollution;
- (iii) control landslides;
- (iv) provide environmentally-safe disposal for wastewater; and
- (v) protect the city's water supply source

46. As mentioned earlier this IEE report is updated again due to some change in sewerage pipeline alignment. Justification of change and overall benefit is discussed below.

47. **Justification of change:** The requirement of change in alignment of the current alignment and design has arisen in Bethlehem Vengthlang area, i.e., Zone IV of Aizawl Sewerage Network. To lay the sewer line from MH1954/19 to MH1954/29, an excavation of approximately 6.00 m depth for 300mm diameter pipe and C-Type manhole (i.e 1.5m internal diameter) has to be made on an earthen road of narrow width. Site conditions do not permit this kind of excavation as it can be catastrophic to the nearby residents on both hill side and valley side of the road.

48. This line carries the entire flow of Zone IV of the sewerage network. As the sewerage network of Aizawl is designed for gravity flow and hilly terrain of Aizawl with irregular undulations, this was considered as the only path in the initial design. Also, there is no available land or possibility of constructing an Intermediate Pumping Station (IPS) at MH 1954/19 location as it is a residential area; and even if an IPS could be constructed at this location it can cause tremendous nuisance to the residents in the vicinity and impossible to get NOC.

49. **Changes proposed:** In order to avoid the above said situation, the available choices were considered such as construction of a new STP for this zone, Omission of Zone IV of sewerage network and Alignment change of this stretch with an intermediate pumping station. The choices were presented during the 'Progress of NERCCDIP Implementation in Aizawl' meeting by Program Director, SIPMIU, Aizawl to Director (UD), MoUD, GoI on 17<sup>th</sup> February 2017 at New Delhi. An extract from MoM – "The PD was advised not to curtail the scope but to seek variation from ADB which MoUD would support".

50. The changes proposed in the alignment are such –

- a) the line from MH 1954/29 to 1594/19 will be reversed with diameter of 150mm.
- b) the remaining line of this stretch MH 1954/30 to STP will remain the same.
- c) Additional line at nala with a new IPS is proposed as shown in the map.



51. **Benefit:** The benefits from change in alignment are –
- It will not decrease the initial anticipated users as the original alignment is not cancelled but only the flow direction and pipe size is changed, nor will it increase the number of users as the new introduced line traverses through nala with no residents in the vicinity.
  - Deep excavations will be avoided consequently avoiding risk for the residents as well as for workers.
  - Scope of works will not be reduced thus ensuring services to public as initially planned and promised.
52. **Length:** Additional pipe length to be constructed in nala –
- 150mm dia – 189.844m
  - 300mm dia – 294.069m
  - 350mm dia – 1566.193 meter
53. Part of the new alignment will be passes through Forest Training School Accordingly permission has been taken from Mizoram Environment , Forest and Climate Change Department of Mizoram.. Internal correspondence is attached as **Appendix 8. Appendix 9** shows proposed new sewage alignment photo
54. **Figure 1** shows location Map of Sewerage Network Layout s, **Figure 2** shows satellite image of sewage network, **Figure 3** shows Satellite image depicting location of proposed STP site and original proposed approach, second proposal and final proposed approach road, and **Figure 4** Shows Proposed change alignment of sewage pipeline with IPS.,
55. **Figure 5** shows Location Map of Water Supply Network Layouts, **Figure 6** shows Satellite image depicting three proposed reservoir locations, **Figure 7** shows Satellite image showing proposed feeder mains alignments, and **Figure 8** shows Satellite image depicting proposed Toilet Locations
56. **Figure 9** shows Google Image of Proposed Electrical Transmission Line Alignment with Tower
57. Details of the subproject components are provided in **Table 2**. The descriptions shown in the table are based on the present proposals, which are expected to be substantially correct, although certain details may change as development of the subproject progresses.

**Table 2: Aizawl Water Supply and Sewerage Subproject Components**

Component	Location	Function	Description	Remarks
<b>(i) Improvement in Water Supply System</b>				
1. Substation and transmission line (132 Kilovolt-amperes (KVA) to Provide uninterrupted power)	Dihmunzawl	Provide uninterrupted power	132 Kilovolt-amperes (KVA) substation and	After final alignment 19 transmission tower of different size as per tower type varying from 67.24 sqm minimum to 112.36 sqm maximum is required. 16 locations belonging to 14 private landowners had been purchased as per the rate finalized under the Valuation Committee. Rest 3 locations are

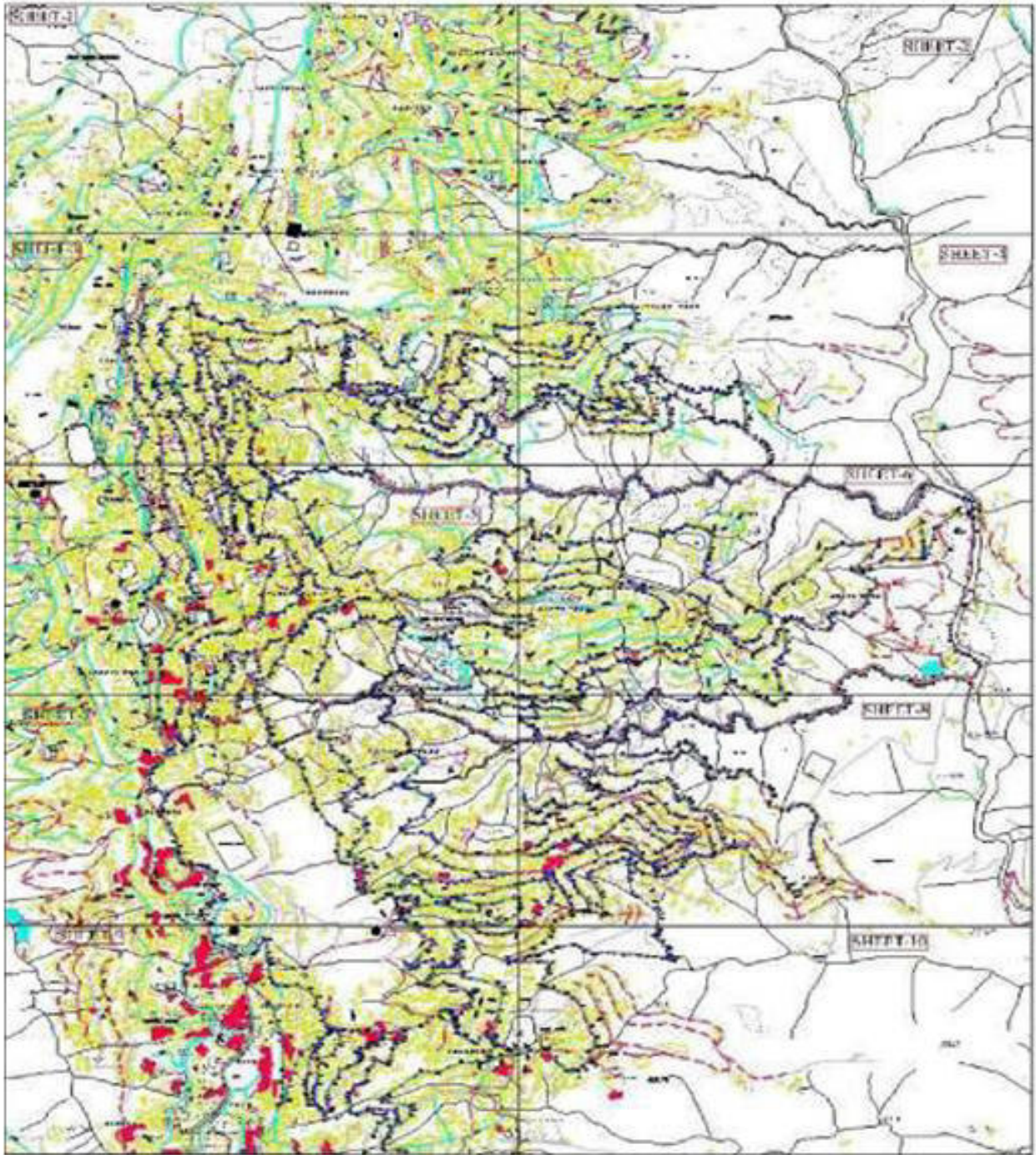
Component	Location	Function	Description	Remarks
				<p>govt land. Land for the string area (cable) where transmission line will go overhead, compensation to landowners will not be required after modification of the alignment in consultations with all landowners. All locations are still unused vacant land covered with wild shrubs and plants. Therefore compensation due to restriction of land use below the transmission line will not arise after modification of the cable alignment as per consultations with all landowners.</p> <p>In case of tree felling NOC needs to be obtained from Forest Dept.</p>
2. Installation of 2 new booster pump sets (Replace worn-out pumps)	Existing booster stations at Chandmari and Tlangnuam	Replace worn-out pumps.	Electrical and mechanical works testing, equipment provision, installation of pumps, commissioning, and provision of record drawings. Additional scope for extension of existing pump house at Tlangnuam.	No new land is required. Works will be confined on existing pump house. Extension of existing pump house within PHED land. There will be no environmental or social impact.
3. Extension of main feeder pipe lines (23.44 km), rehabilitation of existing secondary and tertiary network (51.70 km), extension to distribution system (32.16 Km) and road restoration.	Existing ROWs	Rehabilitate and expand distribution network	Rehabilitation & Extension of Water Supply Feeder mains & distribution networks consisting of 107.3 km and road restoration for	No new land is required.

Component	Location	Function	Description	Remarks
			the same.	
4. Construction of 3 nos. Ground Service Reservoirs	Mualpui S.Hlimen, Tanhril	Storage of water prior to distribution	3 ground level reinforced concrete zonal tanks including fixing of Inlet, outlet and other pipes, its' commissioning and testing, land cost, site clearance etc.	No new land acquisition All three locations are in PHE Land.
5. Provision of non-revenue water reduction measures Installation of Bulk(85 nos.) and Consumer Water Meter (20,000 households) (Establishment of Water Meter Installation and UFW Reduction Program)	Throuhout the Aizawl city		Purchase, installation of bulk and domestic water meters and unaccounted-for-water reduction program	No physical interaction with the environment
6. Provision for the IEC component	GAPA	to increase capacity and awareness level on water conservation and sanitation		No physical interaction with the environment
<b>(ii) Improvement in Sewerage System</b>				
1. Laying of primary and secondary network	Along existing road stretches and along hillsides where conveyance through gravity is possible.	Collection and conveyance of wastewater	Sewerage network consisting of 46 Km including manholes and ventilation shafts and all associated earthworks; and utility shifting	No new land acquisition
2. Construction of new toilet blocks	For those localities where the households do not have space to construct toilets within their premises	Provision of low cost sanitation facilities to communities lacking basic access to sanitation facilities.	• 10 units	3 locations have been changed from the original proposed location
3. Construction of sewage treatment plant (STP)	Bethlehem Vengthlang (about 2 km from the city)	Treatment of wastewater	Technology to be used is Sequencing Batch Reactors (SBR).	To be acquired by the government from a private owner.  Dried sludge will be used for agricultural purposes.

Component	Location	Function	Description	Remarks
				Treated water will be discharged in a small river (Chite Lui). This river ultimately joins the Tuirial Lui flowing towards north.
4. Land development and construction of approach road	Bethlehem Vengthlang (about 2 km from the city)	Approach road to STP	Location is new from the original proposed road.	A new location is identified starting from the existing Bethlehem Vengthlang road near the bridge and passing through the hill-slope adjacent to the STP site. This new alignment roughly parallel to the river will lie at a distance of about 50meters at the farthest and about 20 meters at the nearest points from the river.
5. Construction of Intermediate pumping station (IPS)	Within Forest Training School premises	Pumping of sewage to STP	IPS have 4 pumps 34 lps each. Sump of 4 m dia	

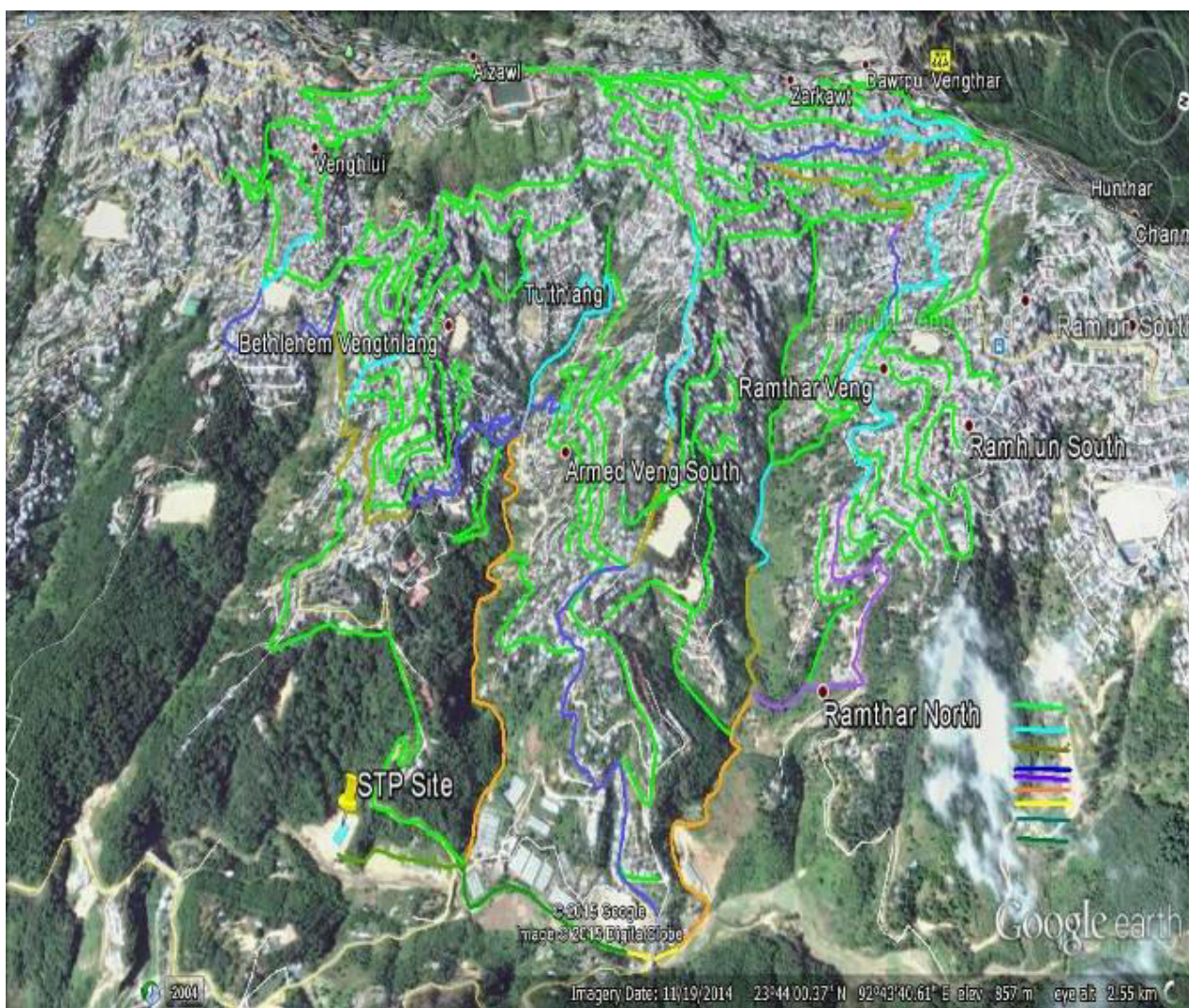


**Subproject Location:**



**Figure 1: Location Map of Sewerage Network Layout s (Dark Pointed)**





**Figure 2: Settelite Image of sewerage Network**



**Figure 3: Satellite image depicting location of proposed STP site and original proposed approach, second proposal and final proposed approach road**

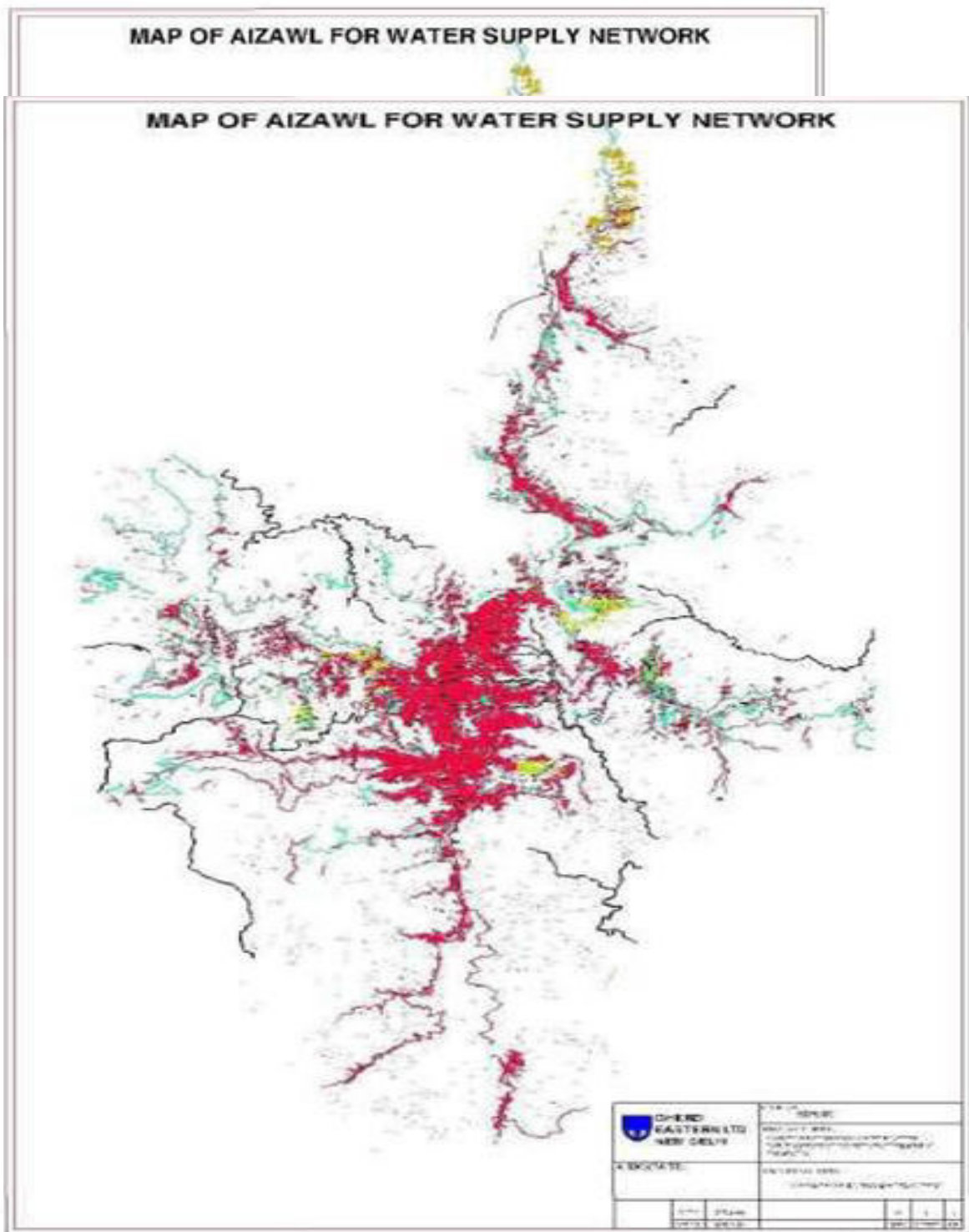


**Legend:** Green line indicates old alignment. For new line: Orange indicates realigned flow covering the same users, red indicates new line going through nullah and blue line indicates new line going through forest training school premises.

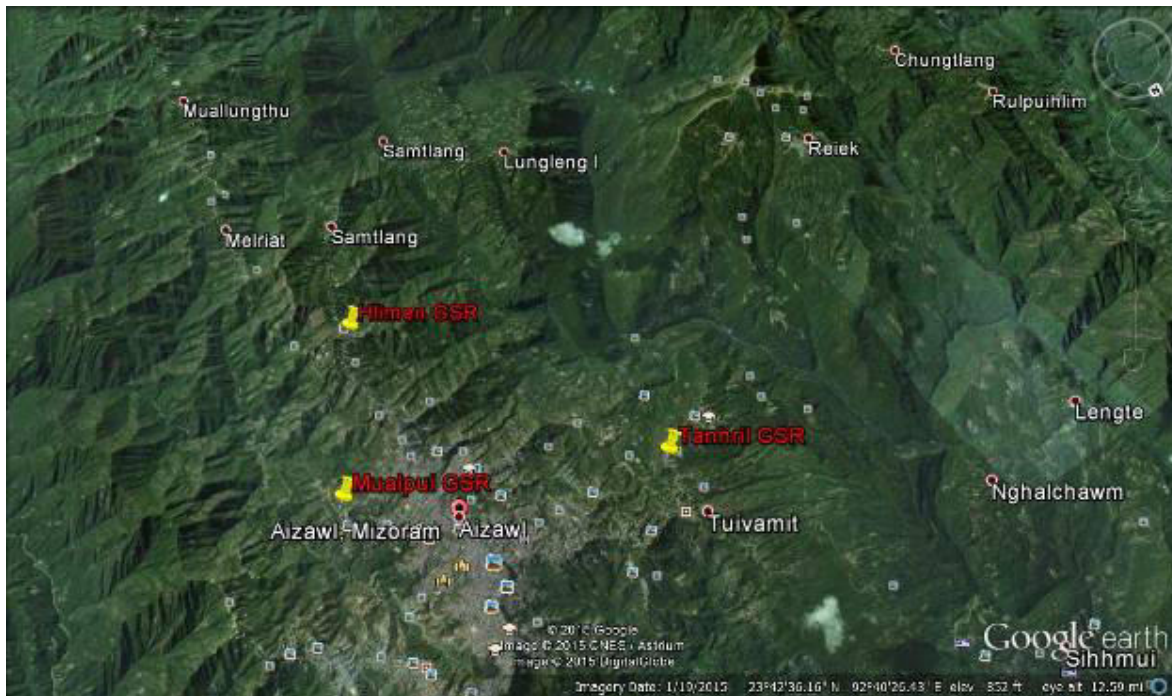


**Figure 4: Shows Proposed change alignment of sewage pipeline with proposed IPS**

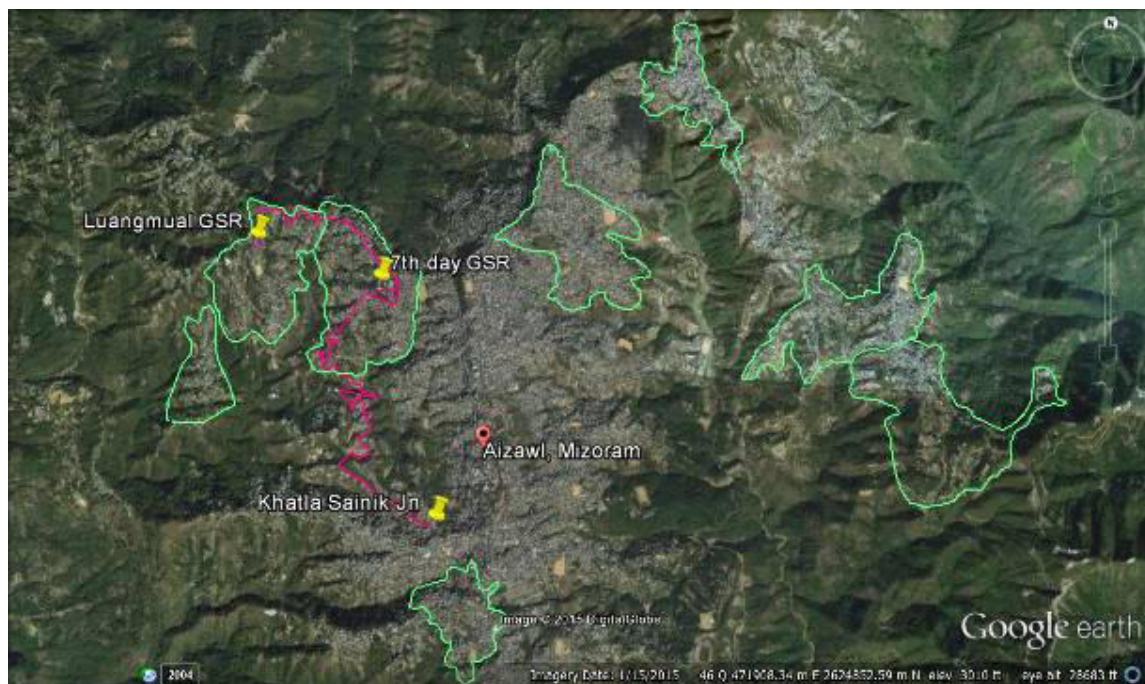




**Figure 5: Location Map of Water Supply Network Layout s (Dark Pointed)**



**Figure 6: Satellite image depicting three proposed reservoir locations**



**Note:** Feeder main alignment is depicted as red line and boundary of area covered by distribution network is shown in green.

**Figure 7: Satellite image showing proposed feeder mains alignments**



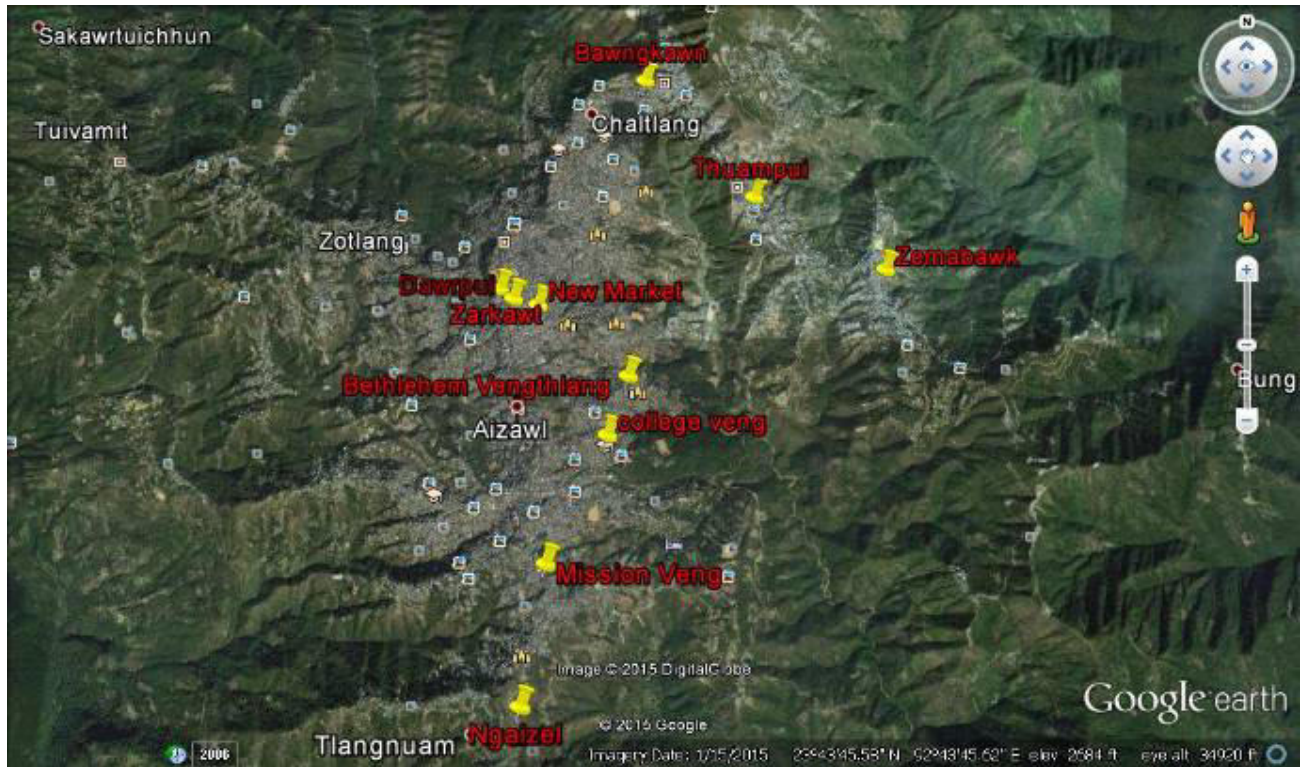


Figure 8: Satellite image depicting proposed Toilet Locations

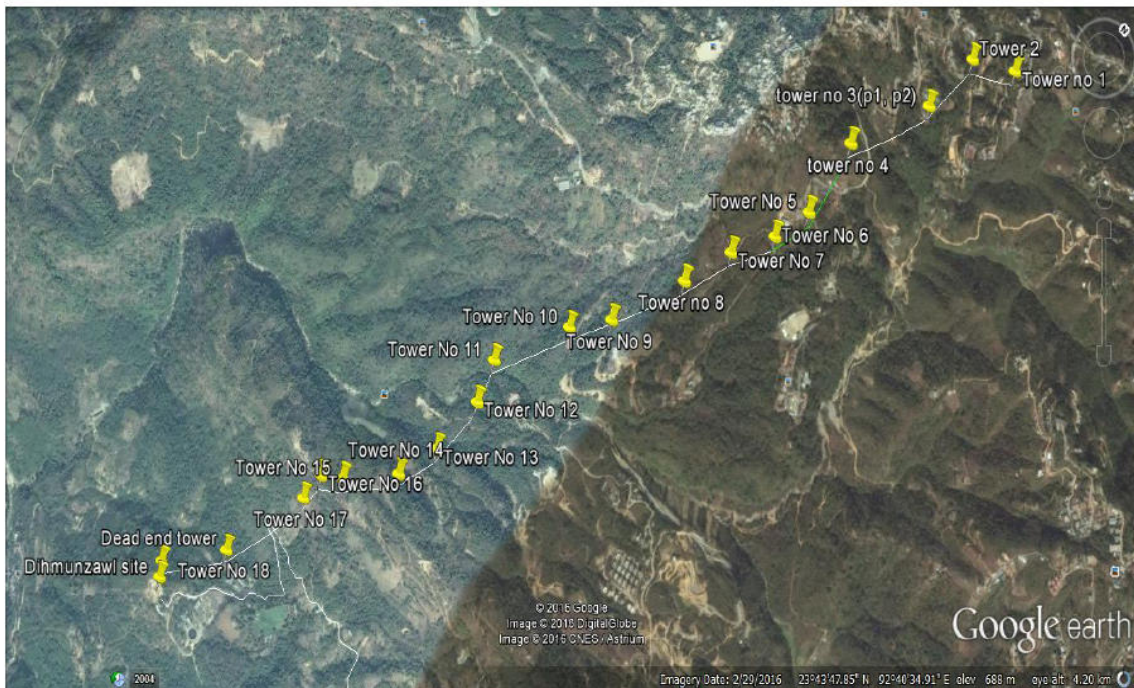


Figure 9: Google Image of Proposed Electrical Transmission Line Alignment with Tower

### III. DESCRIPTION OF THE ENVIRONMENT

#### A. Physical Resources

##### 1. Location and Administrative Boundaries

58. Aizawl, the capital of Mizoram lies between 92°30'-92°60' E - longitude and 21°58'-24°85' N latitude. The city of Aizawl is located on one prominent north-south extending ridgeline, situated between 700 m to nearly 1288 m from the Mean Sea Level. Aizawl is linked with rest of India through the National Highway 54 (NH 54). The nearest air linkage is at Lengpui, 32 km from the city.

59. **Location – STP Site.** The proposed STP site covers an area of about 7.8 ha. It is located near Bethlehem Vengthlang and is 2 km distance from Aizawl city.

##### 2. Topography, Drainage, and Natural Hazards

60. **Topography.** Mizoram is a land of rolling hills, rivers and lakes with mainly clayey loam soil mixed with broke angular shale of varying size. The Mizo Hills, which dominate the state's topography, rise to more than 6,560 ft near the Myanmar border. There are as many as 21 major hills, ranges or peaks of different heights run through the length and breadth of the state with the highest peak 'Phawngpui (Blue Mountain) towering 2,065 meters above the sea level. The terrain has, perhaps, the most variegated topography among all hilly areas in this part of the country. The hills are extremely rugged and leaving some plains scattered occasionally here and there. The region, in general, exhibits first - order topography of folded Miocene Strata. The compact and relatively - older rocks constitute these ridges and the younger strata make up the valleys. Elements of second - order topography are seen towards east of longitude 93°30' East.

61. **Topography – STP Site.** Aizawl is situated in hilly environment hence availability of flat area is very rare. The site is situated in hilly terrain in a valley with elevation ranging from 260 m to 368 m. The proposed site, although situated in hilly terrain, maintains adequate area of wider contours which will require relatively little grading work.

##### 62. Approach Road to STP

(i) **Alternative 1:** Original alignment proposed for approach road to STP (*starting from steel bridge, World Bank Road and passing through forest land*) required change in location as the Forest Department emphasised damage to natural forest since many different important species will be damaged and that if road is constructed there will be many encroachers in future, therefore could not issue permission for which identification of new location was initiated. The location also being rocky terrain with steep slopes will require a lot of excavation which may cause future instability on the hill slope. Keeping all these in view and that the forest department objected in giving the land, hence requirement arised to identify other alternate route.

(ii) **Alternative 2:** New location identified from Bethlehem Vengthlang road alongside River Chite. The land belongs to the same owner of STP. Landowner also wanted to utilise the road after completion, and the road would protect his land from the eroding effects of the river during monsoon. It was with this reason that he agreed to give the required stretch of land without selling. Landowner desires to give the land to the government with an agreement that he can have an access to his land from the said proposed new road. An agreement was prepared in local language which was signed between Land owner and SIPMIU.

(iii) **Alternative 3:** However, this proposed alignment of approach road (alternative 2) lies parallel and close to the existing Chite River, the ADB mission on its visit to Aizawl project raised concerns regarding the safety of construction, a major part of which would be earthfill embankment, and the disturbance that would be caused to the course of a natural stream.

With this reason, a new road alignment is sought again for approaching the STP site. A new location is identified starting from the existing Bethlehem Vengthlang road near the bridge and passing through the hill-slope adjacent to the STP site. This new alignment roughly parallel to the river will lie at a distance of about 50meters at the farthest and about 20 meters at the nearest points from the river.

63. **Drainage.** Being situated on a hilly terrain with more than 20% slopes, most of the rainwater flows down as surface run off. The natural drainage system of the city includes: (i) eastern drainage system; and (ii) western drainage system. Two rivers surround the city along its sides, namely Tuirial River on the eastern side and Tlawng River on the western side. The storm water and the wastewater from the Aizawl city ultimately get drained out into these two river systems. The eastern portion of the city is drained mainly by Chite-lui (covers more than two third of the eastern portion) and Tuirial rivers. The river Tlawng, flowing from South to North, carries water from the western part of the city.

64. **Drainage – STP Site.** The natural drains of the site are towards Chite Lui river. None of these drains are used as drinking water source.

65. **Natural Hazards.** The Capital City Aizawl falls under Seismic Zone -V. It is referred to as the Very High Damage Risk Zone. The Indian states Kashmir, Punjab, the western and central Himalayas, the North-East Indian region and the Rann of Kutch fall in this zone. Generally, the areas having trap or basaltic rock are prone to earthquakes. The present valleys and ravines are the result of the underlying faults and structural patterns, giving origin to different types of drainage patterns. Faulting has resulted in creation of steep curves, highly dissected ranges with deep ravines, spurs, etc., vulnerable to comprehensive erosion. The rocks are fractured and hence susceptible to failure during monsoon resulting in landslides.

66. Subsidence is another problem encountered in Aizawl. Land subsidence and soil fissuring are generally considered as phenomena connected to groundwater extraction or consolidation of strata in sedimentary basins, the subsidence case of Aizawl appears to be a result of fluvial action. This is particularly because all the subsidence cases occur during and just after the rainfall. The percolated water which comes out as return flow also carries the finer fraction of soil, which adversely affects the shear strength parameter. Removal of finer fraction can also lead to formation of piping in the subsurface and result in sudden subsidence. Presence of dissolved material in the subsurface can also lead to subsidence if the area remains under action of water for a relatively long period.

### 3. Geology and Soils

67. **Geology.** Mizoram constitutes the sedimentary basin complex of Assam Shelf and Assam-Arakan. The Assam-Arakan sedimentary basin is a shelf-slope-basinal system. The shelf part of the basin spreads over the Brahmaputra valley. The basinal part (geosynclinal) is occupied by the Naga Schuppen belt and the Cachar, Tripura, Mizoram and Manipur fold belts. The Assam-Arakan fold belt extends southward to the Cachar-Mizo fold zone. West of this zone, lies the frontal belt of Tripura with mostly closed folds which gradually become tighter towards east in Mizoram. The common rocks found are sandstone, limestone, shale, silt stone and slates. The rock system is weak and unstable, prone to frequent seismic influence. The geo-morphological formations consist of steep hill slopes and deep valleys oriented on the topographic surface in a linear fashion.

68. **Soils.** The soil formation of Aizawl, in general, is of loose sedimentary type, with high porosity and permeability. This results in the city being highly susceptible to erosion and rain induced landslides, leading to severe damages to property and lives every year. Soils vary from sandy loam and clayey loam to clay, generally mature but leached owing to steep gradient and heavy rainfall. The soils are porous with poor water holding capacity, deficient in potash, phosphorous, nitrogen and even humus due to the traditional practice of shifting cultivation called 'jhuming'. The pH shows acidic to neutral reaction due to excessive leaching (Environment & Forest Department Report 2003). Shifting cultivation principally practiced in

Mizoram affects soil productivity through increase of soil acidity, lowering of surface moisture and intensifying erosion losses of soil and nutrients through runoff.

#### **4. Climate**

69. The climate of Mizoram is neither very hot nor very cold, but moderate throughout the year. The whole state falls under the direct influence of south-west monsoon and receives an adequate amount of rainfall. The fluctuation in temperature is not much and the highest temperature is observed during May to July and starts decreasing with the onset of monsoon. This fall of temperature continues with the span of monsoon and becomes more evident with the retreating monsoon. The temperature becomes minimum in December and January. In summer the temperature ranges between 18° C to 32° C. During winter season, the minimum and maximum temperature ranges between 8°C to 32°C. During the last two decades, a substantial increase in average temperature has been observed, which may be due to global warming. Relative humidity in the dry season is 60% to 70% and in the monsoon period is about 90%. During southwest monsoon, February to April is comparatively dry when humidity is between 60% to 70%.

#### **5. Air Quality**

70. There are no major air-polluting industries in Aizawl 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).

71. **Air Quality – STP Site.** As there are no major air pollution potential sources, the air quality of the disposal site is generally good.

#### **6. Noise Level**

72. The observed noise levels in the project area of Aizawl were measured over 24 hrs using a handheld noise meter. The results indicate that noise levels are higher than the threshold limits.

73. **Noise Level – STP Site.** The sub-project site is in an undeveloped area without any industry or commercial activity hence the noise level is within GoI Ambient Noise standards.

#### **7. Surface Water**

74. The analysis of water quality of rivers within Greater Aizawl, namely the Chite Lui and Lawibual rivers indicate that the water quality parameters are within the prescribed standard values. Low values of turbidity, total dissolved solids, non-existence of oil & grease and high value of dissolved oxygen clearly indicate that the water quality of the rivers is fairly good. However, coliform is present in higher concentrations.

75. **Surface Water – STP Site.** There are natural drains within the proposed STP site for carrying surface run off. All these natural drains meet at a point downstream to the Chite Lui river. The small stream also receives water from different streams draining water from surrounding hill areas.

#### **7. Groundwater**

76. Due to the hilly terrain with slopes more than 20%, most of the rainwater flows out as surface run off. Hence, the scope of groundwater storage is limited and is depending upon the secondary porosity and structural control in the higher elevated aquifers. The groundwater stored in these aquifers emanates in the form of springs that act as a source of water supply for the people especially in the rural areas. The ground water exploration done by the Central Ground Water Board (CGWB) indicates that there is considerable potential for exploration of ground water within a depth range of 200 m with a potential yield ranging from 120 liters to 330 liters per minute for draw down of 13 m to 20 m. While the quality of ground water, is

found to be potable from the hydro-chemical point of view, the hydro-geological conditions in Aizawl are not favorable for ground water recharge and storage.<sup>4</sup>

77. **Groundwater – STP Site.** Ground water level is more than 20 meter and it is expected to be good quality due to absence of any pollution sources and depth of the groundwater table.

## **B. Ecological Resources**

78. Though there are sizeable areas covered by large varieties of vegetation and small grasses, within Aizawl, there are no major tracts of designated reserved forests within the Greater Aizawl planning area boundaries.

79. The forest type of Aizawl is represented by tropical semi-evergreen forest. A phyto diversity survey was carried out at some of the project locations in the Greater Aizawl Planning Area (GAPA) using the Shannon-Wiener Diversity Index, and evenness with the Evenness index. The indices were employed to get a comprehensive, easily comparable, and quantitative estimate of the diversity and degree of evenness (i.e., uniformity) of the plant community. The indices show that there are no priority sites within GAPA. Dampa Sanctuary (Protected Area) is situated near the Bangladesh boundary and is very far from the GAPA.

80. **Ecological Resources – STP Site.** Vegetation exists adjacent of the project site but no major trees have been observed within and around the site. There are no critical habitats adjacent to or within the vicinity of the proposed site.

## **C. Economic Development**

### **1. Land Use**

81. The Aizawl development planning area covers an area of 128.98 sq km of which 21.58% of the total area is developed whereas 78.42% of the total area is not suitable for developing due to excessive slopes and instability due to landslides. 1.98% of the total area is under cantonment/defense area.

### **2. Local Economy – Commerce, Industry and Agriculture**

82. In recent years, Aizawl has seen growth in its industrial sector and is becoming one of the most important industrial centers of Mizoram. Out of the total registered industrial units of the entire state of Mizoram as many as 1,134 or 51.43% are concentrated in Aizawl city. Industrial growth and development in Aizawl is mainly in seen in small scale sectors.

83. Since 1972, mining and quarrying for building materials has been started within Aizawl city. As per the information from geology and mining wing on July 2001, there are more than 29 quarries without any legal support. The method of extraction is mainly through drilling, blasting, etc., which is leading to slope instability. The unused materials are disposed off alongside the quarries and slopes causing environmental problems.

### **3. Infrastructure**

84. **Water Supply.** Water supply in Aizawl is in a state of crisis. Most people are dependent upon the piped water supply system, which presently provides water for only an hour or so a week. People have installed rainwater catchment and storage systems and sometimes are able to get water from springs or the ground. However, average consumption during the rainy season is not more than 80 lpcd and it is much less, perhaps as little as 50 lpcd or 60 lpcd, during the dry season. The River Tlawng is the major source of water for Aizawl. Water supply from this source involves a high static lift of 1,017 meters, from the riverbed level at 146 meters to the main storage reservoir at 1,163 meters, making it one of the most expensive water supply systems in India.

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<sup>4</sup> Report on Dynamic ground water resources of Mizoram, March 2004. Central Ground Water Board, NE Region, Guwahati.



85. **Sewerage and Sanitation.** At present, the city possesses no sewerage system. All the house sullage (kitchen and bath room waste water) drains into nearby streams along the hill slopes, whereas human excreta from households are disposed off either in septic tank / soak pit or directly discharge into the natural drains.

86. **Roads and Transportation.** The road network is characterized by the presence of NH 54 running from east to west connecting Sairang/Silchar in the West and Lunglei in the East. One major district road is running from north to south and other roads branching out from this main road. Due to topographical constraints, almost all roads are narrow and the intersections and junctions in the city are 'V' shaped. At most of the intersections, there is absence/poor-turning facilities. The road sections that have poor geometric alignment and steep gradient include (i) Armed Veng to Bawngkawn, (ii) Republic Kawipui to Treasury Square, (iii) Salem Veng to Damveng, (iv) Secretariat complex to Tuikhuatlang, (v) D. Hnunlana to Industry Mualpeng, (vi) Mission Vengthlang to Synod Book-room, and (vii) Bethlehem to Bungkawn.

87. **Drainage.** Though Aizawl has numerous drains criss-crossing the city, the drainage situation has come to a deplorable state with choked, over flowing drains, acting as disposal point for solid waste and sewage. The poor drainage conditions coupled with loose sedimentary soils and unregulated construction activities for developmental purposes have lead to a substantial incidence of landslides.

88. **Health Facilities.** The city has 7 major hospitals out of which, 2 hospitals are run by the Presbyterian and Seventh Day Adventist Church and one is a private hospital. Also, there are about 23 dispensaries and sub-health centers scattered all over the city.

89. **Slum Up gradation.** There are no notified slums in the city. However, several areas especially on the fringes of the city, at lower elevations where wastes are concentrated, have extremely poor living conditions. These areas have poor accessibility and therefore, are also critically short of basic infrastructure. The State Government is in the process of identifying such areas in the city and notifying them as slums. It is of utmost priority that such areas be notified as slums and then phased improvement measures can be taken up.

90. **Education Facilities.** Being the state capital, it has all levels of education facilities such as one university campus along with 11 colleges and considerable number of higher secondary schools, high schools, middle schools and primary schools. The city also has one veterinary college, one polytechnic institute, one industrial training institute and two-law colleges.

#### **D. Social and Cultural Resources**

91. **Demography.** The GAPA has a total population of 229,714 as per 2001 census. Around 52% of the urban population of the state lives in the city. The sex ratio in the city has increased from 926 females per 1,000 males in 1991, to 964 females per 1,000 males in 2001, the national average being only 933. With respect to literacy rate, Aizawl has attained a literacy rate of 100%, which is more than the national average (64.8%) and state average (88.49%). Within the city, only 15.9% of the population have education up to graduation and beyond. The work force participation rate for Aizawl has shown a decline from 48.9% in 1991 to 45.6% in 2001. Workers engaged in various activities reflect the predominance of tertiary sector, with 48.7% of the population in salaried services.

92. Ninety eight percent of the population in Aizawl belongs to the scheduled tribes (STs). The main indigenous groups are the Lushais, Chakmas, Ralte, Paite, Baite, Pawi Dhilen, Lakher, Hmar, and Piang. Lushai group of tribals accounts for more than 98% of the city tribals. Though they speak their tribal dialect among themselves, they also speak English in general, while interacting with others. Most tribes are Christian (84%). Though categorized as tribes, they are into modern means of production and consumption.



93. **History, Culture, and Tourism.** There are several beautiful Churches in and around the city. There is no heritage building nor is there any property related to cultural activities in the surroundings of the proposed STP site.

94. **Indigenous People.** In the entire state of Mizoram, the tribes constitute the mainstream society. The dominant tribe are Mizo, integrated by one language “Mizo” which is common to all other tribes such as Kuki, Hmar, Lakher, Mara etc. Aizawl city being the capital of Mizoram has an urban outlook whereby people are involved in all sorts of urbanized practice in terms of livelihood. Therefore the people living in the city do not exhibit any primitive or distinct characteristics of that are considered to be indigenous people

#### IV. ANTICIPATED IMPACTS AND MITIGATION MEASURES

95. 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 locations for laying of pipes, STP and toilet sites; (ii) main routes/intersections which will be traversed by construction vehicles; and (ii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) entire Aizawl area outside of the delineated primary impact area; and (ii) entire Mizoram State in terms of over-all environmental improvement.

96. The ADB Rapid Environmental Assessment Checklists for Water Supply and Sewerage in [http://www.adb.org/documents/guidelines/environmental\\_assessment/eaguidelines002.asp](http://www.adb.org/documents/guidelines/environmental_assessment/eaguidelines002.asp) were used to screen the subproject for environmental impacts and to determine the scope of the IEE investigation. The completed Checklist is found in **Appendix 1 (Water Supply) and (Sewerage Treatment)**. All the proposed subproject components, except for the replacement of pumps and installation of house meters, will interact physically with the environment.

97. 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; and (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, will not cause direct impact on biodiversity values. The subproject will be in properties owned and/or acquired by the local government and access to the subproject locations is through public ROW and existing roads hence, land acquisition and encroachment on private property will not occur.

##### A. Pre-construction – Location and Design

98. **Location.** These Impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site.

99. **Location of Sewerage Components.** Proposed STP site is located in unused, vacant roadside land. Acquisition of a private land (1.08 ha) has been acquired for construction of STP<sup>5</sup> and this has been included in the subproject’s Resettlement Plan. The present site has been considered because it is located in an area of: (i) at least 500 m from any inhabited areas; (ii) no risk of flooding or other hazards that might impair the functioning of the plant; (iii) no risk of chance finds; (iv) no waterway that is a source of water for domestic or municipal supply; and (v) available right-of-way (ROW) for the sewer network.

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<sup>5</sup> Availability of environmentally-suitable lands for an STP is very limited in Aizawl due to topographic limitations and close proximity to sensitive receptors.

100. **STP Approach Road.** Original alignment proposed for approach road to STP (*starting from steel bridge, World Bank Road and passing through forest land*) required change in location as the Forest Department emphasised damage to natural forest, future instability of the hill slope, etc., and therefore could not issue permission for which identification of new location was initiated.

101. Examination of the location reveals that original proposed STP approach road seems unsuitable not only due to forest area, but the topography being rocky terrain and steep gradient and the construction will require excavation and rock blasting which may result future instability of the location. Hence identification of alternate New proposed location (alternative 3, alternative 2 already explained above) identified is a private land. The proposed new location (Alternative 3) is a vacant private land starting from the existing Bethlehem Vengthlang road near the bridge and passing through the hill-slope adjacent to the STP site. This new alignment roughly parallel to the river will lie at a distance of about 50meters at the farthest and about 20 meters at the nearest points from the river. There will be one impact caused to existing temporary shed around the location which will be relocated as per the resettlement plan. Besides one structure no other impact is anticipated. The construction work will have no major impacts. Since the area does not have any settlement closeby/public utilities/natural reserve etc that can be affected. Hence the location is regarded feasible for construction.

102. **Tree Cutting permission from Forest Department:** Permission for tree cutting has been applied to The Chief Conservator of Forest, Environment and Forest Department on the 26<sup>th</sup> March 2014. Follow up with the Environment and Forest Department has been taken up. The copy of the letter of application to the Chief Conservator of Forest is enclosed herewith as **Appendix 5**. The DFO Office Forest Department had already verified the location. The permission file has been put up to the Chief Conservator for issue of permission.

103. The land for STP approach road is the same owner for STP site land. The acquisition is in process. Several consultations with the landowner reveal his interest to sell the strip of land. The land is not in any use except for the temporary shed occupied by landowner's sister and family. The landowner informed that his sister and family will be provided another plot in around the area. The resettlement of the required relocation shed will be carried out as per the entitlement matrix. Landowner's sister's husband Mr. Kumar Thapa had been consulted for the same. The temporary shed had also been estimated. The details of consultations and acquisition process are referred in the revised RP.



Figure 10: Google Image of STP Approach Road with all Three Alternatives



**Figure 11: Cross – Sectional View of STP Approach Road**

104. **Community Toilets.** Out of 10 nos. 3 is replaced from the original location. The request from local council in case of Sikulpuikawn, weak soil bearing capacity in case of Hunthar and proposed existing slab being weak in case of Electric Veng which is not feasible for construction. New sites have been identified which are all within govt land. No impact is

envisaged in all this three locations. NOC from the concerned locations is attached in **Appendix 4.**

105. **Design of the proposed components.** The subproject has been designed for 30 years life. It is proposed that the subproject be commissioned by the year 2017(approx) and the plan horizon year will be 2041. The design was based on a population forecast and demand calculations for the mid-period, year 2026.

106. **Sludge Management.** Excess sludge from Cyclic-Tech Basins (based on Sequencing Batch Reactor Method) will be withdrawn through the surplus activated sludge pumps and will be collected in the sludge sump. The sludge will be pumped to the solid bowl centrifuge for dewatering. Poly-electrolytes will be dosed online prior to the centrifuge to further remove liquid from the sludge. The wet cake (dewatered sludged) will be collected, air-dried, and disposed off as agricultural soil conditioner. The removed fluid, called centrate, will be reintroduced into the wastewater process. Since industrial effluents are not permitted into domestic sewage, the sludge cakes are expected to be free from toxic hazardous metals and will contain mainly nitrogen and phosphorous. Although there are no Indian standards on quality of sludge utilized for agricultural practices, regular chemical testing of the dried sludge cake will be required before any utilization.

107. **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.

108. **Social and Cultural Resources.** 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 or existing infrastructure, so it could be that there is a medium risk of such impacts. Nevertheless, DSMC/SIPMIU will:

- (i) consult PHED to obtain an expert assessment of the archaeological potential of the site;
- (ii) consider alternatives if the site is found to be of high risk;
- (iii) 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
- (iv) 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.

109. **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 near the forest, water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings.

110. **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 will 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 ULB. 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 PHED.

## **B. Construction**

### **1. Screening of No Significant Impacts**

111. 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 Aizawl city and/or existing RoWs thus could be constructed without causing impacts to biodiversity;
- (ii) most of the sites are located on 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 12 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.

112. 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 2**. These environmental factors are screened out presently but will be assessed again before starting the construction activities.

**Table 2: Field in which Construction is expected not to have Significant Impacts**

<b>Field</b>	<b>Rationale</b>
Topography, Soils, and Geology	Activities are not large enough to affect these features.
Climate	Activities are not large enough to affect this feature.
Air Quality	Short-term production of dust is the only effect on atmosphere
Groundwater	Activities will not be large enough to affect these features
Ecological Resources - Protected Areas	Construction-related transport activities (hauling of materials and disposal of wastes) will not affect the forested area nearby.
Flora and Fauna	No rare or endangered species in the STP site.
Economic Development	Activities are not large enough to permanently affect this feature.
Land Use	No change in land use.
Socio-economic	Subproject site is located entirely on government-owned land so there is no need to acquire land from private owners except for STP land and some temporary impacts which is included in the updated RP
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.
Religious sites	No religious sites within the two subproject sites.
Historical, Archaeological, Paleontological, or Architectural sites	No scheduled or unscheduled historical, archaeological, paleontological, or architectural sites

### **2. Construction Method**

113. **STP.** Although the site is not fairly large, the STP construction will be straightforward involving mainly simple excavation. The reactor ponds will be dug by backhoe diggers and bulldozers, and soil will be transferred into trucks for offsite disposal. Clay will then be applied to the floor and sloping sides of each pond and after watering will be covered with low density poly-ethylene (LDPE) sheeting and concreting in some parts. A thin layer of cement mortar is then added, and concrete tiles are embedded into the surface by hand, with more cement grouting applied to seal joints between tiles.

(i) **STP Approach Road (New Location).** The construction of road in the new location (alternative 3) will have no anticipated future impact as encountered in the first two alternatives. The strip of land has gentle slope, and though the construction of road will involve cutting and filling, desired slope can be maintained to avoid future landslide. The location does not have any settlement closely/public utilities/natural reserve etc. that can be affected. Hence the location is regarded feasible for construction. The only temporary structure encountered on the RoW has been taken care for shifting to another location after consultation with the landowner and the as per all activities mentioned in the Resettlement Plan.

(ii) **Pavement:** Topography Survey was conducted and accordingly design of the approach road was prepared. The road construction consisting of cuts and fills for constructing a total length of 350m and 6m width. The RoW will be 6m including 1.125m shoulder on both sides. 200 mm thick GSB, WBM 150 mm thick, premix 20 mm thick and seal coat 6 mm is provided. The valley side will be retained with provision for crossed drainage by pipe culvert.

(iii) **Consultation:** Consultation was carried out to houses dwelling nearby area informing the project work and the construction of the approach road explaining the design. One house will be affected. The owner have been identified and relocation will be as per resettlement plan. Consultation with nearby dwellers has no objection or comments regarding the design proposed road (alternative 3). Further, socio economic findings reveals that most of the houses are daily wager and are interested to work in the ongoing construction work advantage being near to their houses. The contractors agreed to employ once the work commences. However, noise and dust pollution generated will be minimized as procedure included in the approved EMP.(iii) **Pavement:** Topography Survey was conducted and accordingly design of the approach road was prepared. The road construction consisting of cuts and fills for constructing a total length of 350m and 6m width. The RoW will be 6m including 1.125m shoulder on both sides. 200 mm thick GSB, WBM 150 mm thick, premix 20 mm thick and seal coat 6 mm is provided. The valley side will be retained with provision for crossed drainage by pipe culvert.

(iv) **Pipe Culvert:** To cross drain surface runoff from the road, hume pipe culvert is provided. This will ensure that there is no water logging problem. The outlet of the pipe culvert will be channelized with open drain towards the river to control erosion over the dry land.

(v) **Tree cutting:** 98 numbers of wild trees (with the local nomenclature) have been identified jointly with the land owner at the location. The owner agrees cutting down all affected trees. However, the Forest Department consent has been applied and is awaited. For every tree fell, the ratio of 1:2 (1 cut:2 planted) will be adopted. As far as possible, the new plantations will be taken up along the side of new approach road. Tree cutting permission has been applied. The location had been already inspected by the concerned DFO office. The permission is awaited.

(vi) **Spoil management:** the road construction consisting of cuts and fills for constructing a total length of 350m and 6m width. It is estimated that the debris generated from earth cut will be less than the quantity required for filling. Hence there will be no excess spoil to manage. The deficit quantity for filling will be used from the STP site development work.

114. **Community Toilets:** Out of the original proposed 10 locations 3 Nos. requires to be replaced to new locations. Reason for replacing from the original locations and feasibility of new site identified is shown under the following table no.3:

Table No.3: Replaced 3 Nos. Community Toilet Blocks				
S/N	Original Location	Reason Replacing for	New Location	Suitability of New Location
i)	Sikulpuikawn	Construction work will create closure to approach step going to college and Govt. Boys M.E school during entire construction period. The local council of the area requested SIPMIU to shift to other location. Letter from Local Council is attached in the updated RP.	Replaced location is at Ngaizel which is a vacant Govt. land given to city bus owners association for their terminal.	The proposed new site is in bus stand. The area is close by petrol pump, workshops, sumo stand etc. It is also nearby Stopping point for trucks and district buses. Hence, an ideal location for toilet.
ii)	Electric Veng	The proposed location was to construct on the existing slab building of P&E Dept. Careful study shows that the existing foundation will not bear the load of the design toilet.	Replaced location is at Kulikawn area within Govt. hospital premises.	The location is a Govt. land free from any encroachment/squatters. Location is within hospital area and thus will serve a good purpose for visitors and public passerby. NOC from the Health Department obtained and stated in the updated RP.
iii)	Hunthar	The proposed location is towards the outlet of culvert. After two monsoons erosion had made the soil vulnerable and hence the soil bearing capacity has become weak for the construction.	College Veng junction. ( <i>College Veng is name of locality in the city</i> )	The location is Govt vacant land free from any encroachers/squatters. The location is at the periphery of College veng playground. Consent from local authority obtained and stated in the updated RP.

115. **For the pipe-laying** and outfall, most pipes will be buried in trenches towards the hillside of the roads, mostly in the unused area within the ROW. The trunk main and secondary network will be located along hill side main roads, where there is generally more than enough free space to accommodate the pipeline. However, in parts of the tertiary network where roads are narrow, this area is occupied by drains, so trenches may have to be dug into by dismantling drains and restored it towards the hill toe.

116. **Additional Scope for Extension of Booster Pump House at Tlangnuam.** The extension work is within PHED land. No impact is envisaged from the surroundings. Area does



not require land development or dismantling. Small volume of earth spoils will be generated from the foundation excavation which will be re-used for back filling and leveling.

117. Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the pipes (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. After the pipes are joined, loose soil will be shoveled back into the trench, and the surface layer will be compacted by hand-operated compressor.

118. Pipes are normally covered by 1.2 m of soil, and a clearance of 100 mm is left between the pipe and each side of the trench to allow backfilling. Trenches will therefore be quite large, a maximum of 2.3 m deep and 1.2 m wide for the trunk main, and a minimum of 1.5 m deep and 0.4 m wide for the secondary/ tertiary network.

119. At intervals, small chambers (about 1 to 2 m<sup>3</sup>) will be created to allow inspection and clearance of blockages and sediment during operation. These will be excavated by backhoe and hardcore and concrete (mixed on site) will be tipped in to form the base. Brick sides will then be added by masons by hand, and the top will be sealed at ground level by a metal manhole cover.

120. As noted above, some of the narrower roads are constructed of concrete and have no available space because of the presence of drains, or shop- and house-fronts encroaching into the ROW. In these places it may be necessary to break open the surface of the road using hand-held pneumatic drills, after which the trench and pipeline will be constructed as described above. On completion, a concrete layer will be re-applied to the surface to repair the road.

### **3. Anticipated Impacts and Mitigation Measures**

121. 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 Aizawl 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) any excavation done near sensitive area like school, religious places and house will be protected as per standard norms<sup>6</sup>. Busy street and bazaar area will require night work. For night work Contractor will ensure lights not focusing on houses, low noise generator. Proper sinages and barricades. Prior noticed before construction work of a particular stretch to residences/shops etc.

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

- (i) Use quarry sites and 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.

123. **Air Quality.** It is most certain that work will be conducted during the dry season, so there is potential for creating dust from the excavation of dry soil, backfilling, transportation to disposal, and from the import and storage of sand/gravel for bedding. Emissions from

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<sup>6</sup> Occupational health&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.

construction vehicles, equipment, and machinery used for excavation and construction will also 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) Excavate the SRs foundations at the same time as the access roads (if needed) are built so that dug material is used immediately, avoiding the need to stockpile on site;
- (iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (iv) Bring materials (aggregates) as and when required;
- (v) Use tarpaulins to cover sand and other loose material when transported by vehicles;
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; and
- (vii) Clean wheels and undercarriage of vehicles prior to leaving construction site.

124. **Surface Water Quality.** Due to hilly topography and high intensity rainfall, there is likely large scale erosion from construction areas. This may lead to silting and blockage of drains and water bodies. 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).

125. **Noise Levels.** The rock cutting and trenching activities will certainly generate noise and vibrations. The sensitive receptors are the general population in these areas. Noise will be for a short term (about 2-3 days at each location) thus 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) Provide prior information to the local public about the work schedule;
- (iii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;

- (iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;
- (v) 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
- (vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

126. **Landscape and Aesthetics.** The construction work is likely to generate significant quantities of waste soil and debris. This activity will generate wood, metal and concrete debris. Indiscriminate disposal of the soil and waste may affect the local environment at the disposal location. 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) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers;
- (iv) Coordinate with PHED for beneficial uses of excess excavated soils or immediately dispose to designated areas;
- (v) Recover wood, metal, used oil, and lubricants and reuse or remove from the sites;
- (vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (vii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (viii) Request SIPMIU/DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

127. **Accessibility.** Transport infrastructure will be affected as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate pipes alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan pipeline work in consultation with the traffic police;
- (ii) Conduct work during light traffic;
- (iii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
- (iv) Provide for immediate consolidation of backfilling material to desired compaction to avoid future settlement risk - this will allow immediate road restoration and therefore will minimize disturbance to the traffic movement;
- (v) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line;
- (vi) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;

- (vii) In case of closure of main roads, provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes;
- (viii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.

128. **Socio-Economic – Income.** Excavation will obstruct access to residences/commercial building. Disruption of access to commercial establishments may affect livelihood. Since many of the roads are narrow, construction activities may also obstruct traffic. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

- (i) Leave space for access between mounds of excavated soil;
- (ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required;
- (iii) Consult affected businesspeople to inform them in advance when work will occur;
- (iv) Address livelihood issues; implement the Resettlement Plan (RP) to address these issues;
- (v) Provide prior public information about the work schedule in particular locality and the traffic diversions/changes in any – information shall disseminated through local papers and cable television services;
- (vi) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and
- (vii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

129. **Socio-Economic – Employment.** Manpower will be required during the 12 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.

130. **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) Develop and implement site-specific Health and safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S Training<sup>7</sup> for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

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<sup>7</sup> Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of

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

131. **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.

132. **Quarry Sites and Borrow Pits.** Extraction of clay, soils, stones, aggregates, and loose materials other than stones can cause disruption of natural land contours and vegetation resulting in accelerated erosion, landslides, disturbance in natural drainage patterns, sedimentation/siltation of surface waters, and water pollution. Extraction of rocks and materials from river beds can result in endangerment of bridges and continuous degradation of the river

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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.

regime. Potential impacts are negative and can be long-term and irreversible thus the construction contractor will be required to:

- (i) Verify suitability of all material sources and obtain approval of DSMC;
- (ii) Prioritize government-approved quarries and borrow pits;
- (iii) Obtain approval of DSMC if new quarries and borrow sites are necessary;
- (iv) Obtain approval of DSMC if extracting rocks, gravel, and sand from small rivers or streams is necessary. The extraction points shall be spread out along the length of the river to minimize disruption in river flow and to prevent instability to embankments. Local residents and water users shall be consulted to ensure that irrigation intakes, bunds, and local fishing are not adversely impacted; and
- (v) Request DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

133. **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.

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

- (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 if deemed necessary by local authorities;
- (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**

135. 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. The STP is located outside the town in an uninhabited and unused area while the toilet blocks will be placed in fixed and relatively small areas within the city. Thus there are several fields that are not expected to have significant impacts during the operation and maintenance stage of the subproject (**Table 4**).

**Table 4: Fields in which Operation and Maintenance is Not Expected to have Significant Impacts**

Field	Rationale
Location and administrative boundaries	No impact expected
Topography, soil, and geology	O&M activities are not large enough to affect these features.
Climate	O&M activities are not large enough to affect these features.
Air Quality	O&M activities are not large enough to affect these features.
Groundwater	O&M activities are not large enough to affect these features.
Ecological Resources	O&M activities are not large enough to affect these features.
Land Use	O&M activities are not large enough to affect these features.
Local Economy – Industries, Trade, and Commerce	O&M activities are not large enough to affect these features.
Population	O&M activities are not large enough to affect these features.
History, Culture and Tourism	O&M activities are not large enough to affect these features.

## **2. Mode of Operation**

136. **Management.** Mizoram PHED will be responsible for management and implementation of the water supply and sewerage system. This will be supported by a public education campaign. PHED 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.

### **A. Water Supply**

137. The water supply and distribution 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.

### **B. Sewerage System**

138. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, diesel-fuelled pumps to remove blockages, and tankers to transport the waste hygienically to the STP.

139. Piped sewers are not 100% watertight and leaks can occur at joints. Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be resealed, or the pipe will be removed and replaced.

### **C. STP**

140. The new STP will collect and treat all surface water, domestic wastewater and sewage produced by 67% of the city, and the remainder of the inhabited area and future expansion will be served by additional sewers provided via subsequent funds. The effluent will be treated; with the technology approved by the CPHEEO (attach as appendix -10). The final effluent quality through SBR technology is excellent even for discharge to inland surface water. The Indian discharge standard for treated effluent is depicted in Table 5.

**Table 5: Waste Water Quality Discharge Standards**

Parameter	Inland Surface water	Land for Irrigation
Colour and odour	remove as far as practicable	
Suspended solids mg/l. max.	100	200
Particle size of suspended solids	shall pass 850 micron IS Sieve	
pH value	5.5. to 9.0	5.5 to 9.0
Temperature	shall not exceed 50C above the receiving water temperature	
Oil and grease, mg./l. max.	10	10
Total residual chlorine, mg/l. max.	1.0	
Ammonical nitrogen (as N.) mg/l max	50	
Total Kjeldahl Nitrogen mg/l. max (as NH <sub>3</sub> )	100	
Free ammonia (as NH <sub>3</sub> ), mg/l.max	5.0	
Biochemical oxygen demand (3 days at 270C), mg/l. max.	30	100
Chemical oxygen demand, mg/l, max.	250	
Arsenic (as As) mg/l, max.	0.2	0.2
Mercury (As Hg), mg/l, max.	0.01	
Lead (as Pb) mg/l, max	0.1	
Cadmium (as Cd) mg/l. max	2.0	
Hexavalent chromium (as Cr. +6). mg/l, max	0.1	
Total Chromium (as Cr) mg/l, max	2.0	
Copper (as Cu) mg/l, max	3.0	
Zinc (as Zn) mg/l, max	5.0	
Selenium (as Se) mg/l, max	0.05	
Nickel (as Ni) mg/l, max	3.0	
Cyanide (as CN) mg/l, max	0.2	0.2
Fluoride (as F) mg/l, max	2.0	
Dissolved phosphates (as P) mg/l, max	5.0	
Sulfide (as S) mg/l, max	2.0	
Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH) mg/l, max	1.0	

141. At the STP, sewage sludge will need to be removed from the active treatment ponds every four or five years. Excess sludge from C-Tech Basins is withdrawn through SAS (surplus activated sludge) Pumps and collected in the Sludge Sump. The Sludge shall be then pumped to Solid Bowl Centrifuge for dewatering of sludge with the help of Centrifuge Feed Pumps. Dewatering Polyelectrolyte shall be dosed online prior to Centrifuge. The sludge in form of wet cake from Centrifuges will be collected.

142. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer and farmers are normally allowed to remove the dry material for application to their land. Treated wastewater can also be used to develop aquaculture by developing ponding systems.<sup>8</sup>,

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

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

- (i) Of any potential residual project effects that may occur incrementally over time;

<sup>8</sup> After the confirmation of concern authorities viz- Aizawal municipal Council or PHED Govt of Mizoram.



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

144. In addition, the CIA considered the scope or influence of the subproject. Two boundaries, spatial and temporal<sup>9</sup>, were used.

145. The subproject IEE has identified the VCs as air quality, water (surface and groundwater) quality, noise, geophysical (hydrogeological), traffic management, social-economic and socio-community, and human health. There are no foreseeable projects that will overlap with the subproject. The spatial and temporal boundary of the subproject is the whole GAPA.

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

147. During construction noise levels in the immediate proximity of most work sites are expected to increase. The duration of this exposure will be relatively brief. This exposure represents a temporary, localized, adverse residual effect of low to moderate significance for affected receptors. While building damage due to ground vibrations is unlikely, there may annoyance to spatially located receptors during construction. Noise levels associated with the project operations will be largely imperceptible as the STP site is located far from the city proper.

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

149. Conversion of the private land, although barren and unproductive, to an STP is a relatively small change in the visible landscape and is not likely to be readily apparent at anything at local scale. It is theoretically possible that other private land owners may wish to sell adjacent unproductive lands in the future for similar purposes but there is no program to promote this nor are there any known plans for such operations. This cumulative impact is

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<sup>9</sup> Spatial boundary refers to the area immediately surrounding the subproject location; while the temporal area considers the potential cumulative effects associated with subproject construction, and operation and maintenance, and those associated with other past, existing and reasonably foreseeable projects in the vicinity of the subproject.

therefore not considered as significant. It is also unlikely that the establishment of the STP will encourage significant development of similar wastewater treatment facilities by third parties.

150. Adverse impacts such as localized disruption of vehicle traffic and pedestrian movements in areas along the alignment, and elevated CAC and fugitive dust emissions in proximity to work sites, elevated noise and vibration levels and visual impacts will occur during construction. These short-term effects will be mitigated by providing alternate travel routes or alternating traffic movements and, where possible, access to businesses, schools and residences. However, upon completion of construction the socio-community will benefit from improved water supply and wastewater management system. This is considered a long-term cumulative benefit.

151. Development at the STP site and in the vicinity of the subproject may result in similar impacts relative to water quality and soils, but each impacts are independent of one another and are mitigated on a site-specific basis. Further, while water quality impacts have the ability to compound when taking into account regional water basins into consideration, the subproject will be required to adhere to the mandatory state and local laws, ordinances, regulations, and water quality standards. Regional geologic impacts do not generally compound, and are limited to the site at which they occur.

152. The subproject, when considered with other projects in the same watershed, may result in cumulative impacts to surface and groundwater quality from increased surface impermeability and resultant runoff. Construction projects could result in increased erosion from exposed soil areas, which could contribute sediments into local drainage courses and other waterways. However, it is reasonably assumed that new construction associated with future projects will be required to meet national, state, and local construction and operation standards at least as rigorous as those required at present. Therefore, the potential for cumulative impacts to water quality and soils is deemed to be less than significant.

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

### **3. Anticipated Environmental Impacts and Mitigation Measures**

154. **General.** The work will follow the same procedures during the construction stage. PHED needs to require its operation and maintenance (O&M) contractor to:

- (i) Prepare and submit Operational Manuals for the water supply system and STP;
- (ii) Maintenance of water supply system and STP should be done as per supplier repairing guideline,
- (iii) Reintroduce the collected centrate to the STP at all times;
- (iv) Ensure compliance of treated water from STP to the GOI Wastewater Quality standards at all times;
- (v) Maintain a record of quantity and end-users of dried sludge; and
- (vi) Conduct all sewer network maintenance works during non-monsoon period.

155. 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. PHED needs to require its O&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.

156. **Ecological Resources.** There are no significant ecological resources in or around the project area of the town, so any repairs or maintenance work can be conducted without ecological impacts. As there is no significant flora and fauna in or around project site, there should also not be any ecological impacts from the increase in abstraction.

157. **Economic Development.** Although network repairs could result in shops losing some business if the work means that access is difficult for customers, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. It should therefore not be necessary to compensate for such losses. Nevertheless PHED needs to require its O&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.

158. 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.

159. The use of local contractors will provide economic benefits to the companies and the workers they employ. There is however little prospect of directing these benefits to persons affected by any maintenance or repair works as contractors will utilise their existing workforce. To provide at least some economic benefits to affected communities, unskilled persons employed to maintain and operate the STP should be residents of the neighbouring area.

160. **Social and Cultural Resources.** There is no 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.

161. 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. PHED needs to require its O&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.

162. The citizens of the Aizawl 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 over-all health condition of the town as diseases of poor sanitation (such as diarrhoea and dysentery) will be reduced.

## V. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

### A. Project Stakeholders

163. Three levels of stakeholder consultations were undertaken in Aizawl. The primary stakeholder group or civil society, comprising of community, poor, women and environmental groups and NGOs were consulted to get information on present service levels and quality, and priority for improvements. The secondary stakeholder group comprising of elected representatives at both the state and local level and officials and staff of concerned government departments, the public sector providers of urban services, were consulted for policy, technical, financial, qualitative and quantitative inputs.

164. The social, gender and environmental groups consulted in Aizawl were Centre for Science and Environment, Science Teachers Association of Mizoram and Clean Mizoram Society. The Community Based Organizations (CBOs) consulted in Aizawl included the Young Men's Christian Association (YMCA), the Mizo Hmeichhia Inzawmkhawm Pawl (MHIP) which is the women's Organization and the old People's Association, MUP. Some of the village councils are involved in providing the services related to solid waste management.

165. Consultation with project stakeholders has been an integral part of the project and a continuous process dovetailed into the project as required and feasible throughout the project duration. A range of consultation tools such as workshops, focus group discussions (FGDs), formal and semi structured interviews, presentations, information brochures, informal discussions, mapping, have been used extensively as part of consultations activities. A parallel exercise of consultation in the form of socio economic survey has been conducted extensively in Aizawl with over 990 households being surveyed for project related information.

### B. Public Consultations

166. **Primary Consultations.** A total of 18 primary consultation meetings have been held in Aizawl in from January 2005 to July 2005. Details are summarized in **Appendix 2**. The Resettlement Plan also details updated local consultations conducted in 2011 to 2013.

167. **Secondary Consultations.** The PPTA implementation commenced with the participatory process in the form of an Inception workshop cum state level consultation in January 2005. Stakeholders occupying the highest rung of decision-making in Aizawl attended the consultations to discuss project related issues on a common platform with other project cities.

168. The inception workshop was held to consolidate the way forward in achieving the goals of the project with the support of key stakeholders and was attended in addition to the GoM and other project city representatives. The inception workshop focused on Projects, sustainability issues and environmental and social safeguards, Urban Sector Agenda in the project city.

169. Second state level consultation-cum-Interim workshop was held after the submission of the Interim Report in April 2005. This consultation-cum-workshop sought to appraise project cities of progress of work and to seek further inputs on finalization of sub project proposals in project cities; and to seek advice on governance and policy matter affecting projects. The first day of the workshop comprised of technical presentations on aspects such as city growth, assessments, water supply, sewerage and drainage, solid waste management, transportation, slum upgradation, approach to economic and financial analysis, etc. followed by discussions on the same. The second day of the Interim Workshop cum state level consultation was reserved for discussions on each of the Project cities in response to the presentations made the earlier day and on other issues related to the project.

170. The third state level consultation was held with all project states in October and November 2005. This consultation was sought to appraise the state governments on project

proposals finalized during the PPTA for ADB funding. Further, the purpose was to ascertain the consent on the project proposals and the key institutions.

171. A key meeting was held in May 2005 by the PPTA Team Leader with GoM. At that time the project schedule and implementation arrangements were confirmed with government officials, and a press conference was held to ensure that the general public was informed about the project. Amongst others, government officials confirmed that they wished to follow ADB procedures for procurement, and that they wished the project to move ahead as rapidly as possible.

172. English version of the Environmental Assessment and Review Framework (EARF) has been placed in the offices of PHED and SIPMIU. Mizo (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**

173. UDD extended and expanded the consultation and disclosure process significantly during implementation of NERCCDIP. They have appointed an experienced NGO to handle this key aspect of the program. The NGO will continuously (i) conduct a wide range of activities in relation to all subprojects in the city; and (ii) ensure the needs and concerns of stakeholders are registered and are addressed in subproject design.

174. For this subproject, the NGO/Capacity Development Consultant will develop, in close coordination with SIPMIU and DSMC, a public consultation and disclosure program which is likely to include the following:

- (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 (if any) to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and
  - (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 town 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; and
  - (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 providing a mechanism through which comments can be made.

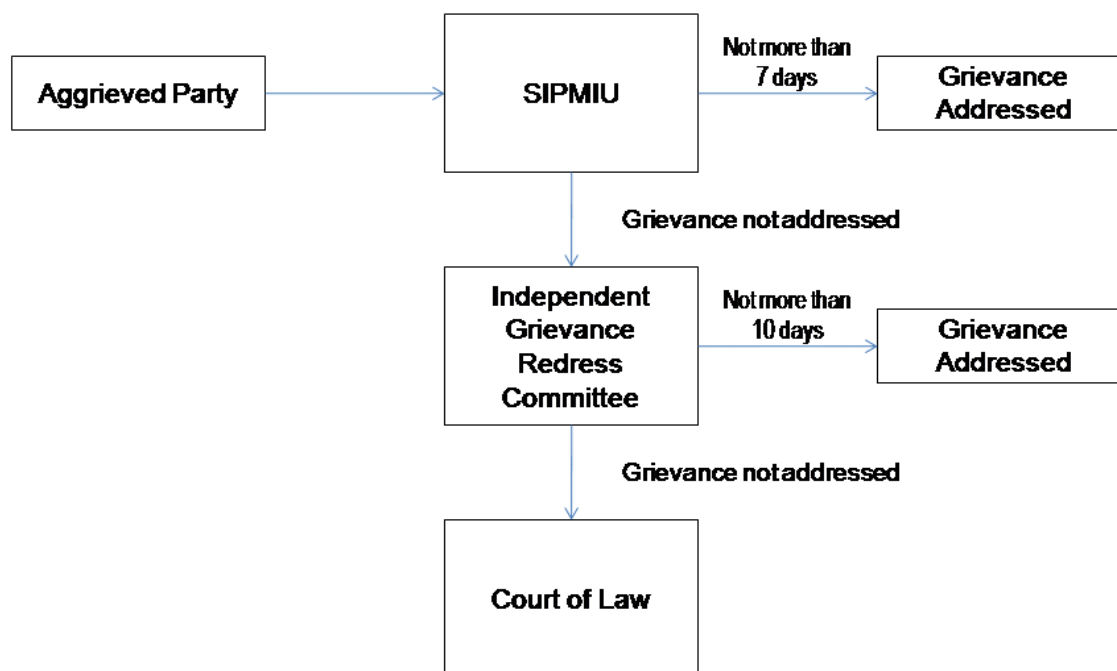
175. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon receipt; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address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

## VI. GRIEVANCE REDRESS MECHANISM

176. Grievances not redressed by the SIPMIU will be brought to the Independent Grievance Redress Committee (IGRC) set up to monitor project implementation in Aizawl. 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 SIPMIU 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 12**.

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

**Figure 12: Grievance Redress Mechanism**



## VII. ENVIRONMENTAL MANAGEMENT PLAN

### A. Institutional Arrangements

178. 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) is established in MOUD. IPCC 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) State Investment Program Management and Implementation Unit (SIPMIU) The 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;
- (iv) The SIPMIU shall comprise of a Safeguards and Social Cell staffed with an Environmental Officer (EO). The EO shall be responsible for implementing the environmental safeguard provisions in the project including (i) ensuring environmental criteria for subproject selection in the EARF 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 to build elements of the infrastructure who are required to submit Environmental Implementation Plans (EIPs) for SIPMIU approval;
- (v) The SIPMIU is assisted by the DSMC, who is responsible for design the infrastructure, manage tendering of contracts, and supervise the construction process; and
- (vi) 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.

#### **1. Responsibilities of SIPMIU**

179. The execution of this subproject comprising of mainly construction of water storage reservoirs and installation a network of water supply pipe lines will be carried out in three contract packages procured through competitive bidding on item rate basis. The comprehensive contract management shall be the responsibility of SIPMIU.

180. **Contract Management.** Interpretation of contract clauses, time management and monitoring, of construction problems and delays (if any) shall be the responsibility of the SIPMIU which shall initiate all efforts to resolve these problems. Time Management shall be effected at Site by prioritizing and allocating the works monthly, weekly and daily. Dispute settlement, issuing notices to contractors on work related issues, levying of liquidated damages for non fulfillment of contractual obligations, issuing of statutory certificates agreed upon in the contract agreement ,settling contractor's claims etc shall also be the responsibility of the unit.

181. **Supervision of Work – Preliminaries.** The formal handing over of the site to the contractor shall be the responsibility of the unit. Utility shifting, if found essential, shall be initiated after assessing the requirement and preparing and submitting the request with drawings to the concerned owner. Making request for diversion of traffic to the concerned authority and managing diversion shall also be done by the unit. Scrutiny of construction - drawings, issuing approval, checking and fixing the alignment of the proposed pipe lines, setting out at site of the proposed civil structures like water storage reservoirs after verification and checking with design and all other similar supports to the contractor shall be provided by the implementing unit.

182. **Supervision of Work – Excavation.** Ensuring adequacy of safety measures, classification of soil, certifying width and depth of the pipe line trenches as well as foundation trenches of civil structures and obtaining & communicating permission for blasting shall be the responsibility of SIPMIU.

183. **Supervision of Work – Pipe Laying.** The unit shall ascertain the conformity of pipes procured and supplied by the contractor to the standards and specifications, verify and ensure lines and levels, assess adequacy of stock of pipes & specials at site, collect and send samples for testing, certify quality of pipes, certify jointing material, certify pressure testing of pipe lines / water proof testing of RCC storage reservoirs and arrange calibration testing of bulk water meters / similar equipments.

184. **Supervision of Work – Concreting and Other Civil Works.** Collecting and sending samples for testing, certifying quality of materials, verifying water-cement ratio/compaction/curing, certifying formwork and accepting quality of the finished structure shall also be taken care of by the implementing unit.

185. **Supervision of Work – Electrical and Mechanical Works.** The unit shall ensure the conformity of supplied materials to specification, check the installation and witness satisfactory trial run of the electro mechanical units & accessories.

186. **Supervision of Work – Daily Supervision.** On site daily supervision, taking pre-measurements and measurements, recording measurements in Measurement Books, taking check measurements and checking of "as built" drawings shall be the responsibility of SIPMIU.

187. **Supervision of Work – Billing and Payment.** The implementing unit shall conduct pre & final verification of the measurements & bills and quality certificates pass the bill and effect payment to the contractors. Post auditing of all the accounts related to contract settlements shall be invariably done by the unit.

188. **Supervision of Work – Obtaining Power Connection.** The unit shall also take care of the contractors request for obtaining connection both temporary for the site and permanent for the subproject.

189. **Supervision of Work – Completion and Handing Over.** Issuing completion certificate, ensuring compliance to warranty during Defect Liability Period, preparation of O & M plan and final report on the contract shall be systematically ensured by the implementing unit at the final stage of the works.

190. **Supervision of Work – Variation in Quantity and Time.** In case additional and excess quantity of works are found essential, suitable decision shall be taken by the SIPMIU after checking the design & schedule and recommending to the Technical Committee for approval.

191. **Supervision of Work – Environmental Monitoring** The SIPMIU shall be responsible for establishing a system for monitoring /review of the environmental impact of the construction activities of the contractor and suggest remedial action, if any, found necessary.

192. The complete management of the works at site shall be the responsibility of the technical wing of the SIPMIU. Some of the routine duties are:

- (i) Visit the project site regularly and monitor day-to-day activities.
- (ii) Ensure time management through effective monthly, weekly and daily allocation of works.
- (iii) Prioritize the works in consultation with the DSMC and the Contractor.
- (iv) Ensure proper planning of diversion of traffic during the work and coordinate with police and transport departments in this regard.

- (v) Ensure that prior notice is given to the public about the disruption of water, electricity and/or communication lines during the execution of works and the situation brought back to normalcy within minimum time.
- (vi) Ensure that caution boards are erected at prime locations displaying the nature of works.
- (vii) Check the line, level and layout of the progressing construction works to ensure conformity with the approved estimate and drawing.
- (viii) Ensure adherence to the contract conditions and laws of the government regarding labor and labor welfare measures and ensure availability & proper utilization of adequate safety equipments at the site.
- (ix) Maintain control over quality and quantity of various items of works executed.
- (x) Get the tests conducted as per the required frequency & supervise the testing of samples at specified laboratories. Whenever the test fails, the materials shall not be used. The work where this test fails shall have to be got redone.
- (xi) Conduct joint measurement along with DSMC & Contractor and record the measurement in the measurement book.
- (xii) Inspect the works regularly to see that the works are executed strictly as per approved drawings and specifications. Any changes from the approved drawings for any reason needs to be got approved by competent authority.
- (xiii) Ensure checking 100 % of the bills submitted by the Contractor with reference to the measurement rate and ensure the satisfactory quality certification from the DSMC before processing the bills for release of payment.
- (xiv) Consider issuance of variation orders during the course of work, if necessary. Such variation due to change in material, specification, size, soil classification etc., from the approved agreement should be brought to the notice of the TC for consideration.
- (xv) Co-ordinate with the DSMC in the preparation of the Final Report summarizing the construction activities undertaken indicating, among other things, contract changes, claims or disputes or any other substantive matters having effect on the cost and progress of the work.
- (xvi) Co-ordinate with the DSMC in the preparation of the Project Completion Report.
- (xvii) Provide any information called for from PHED of GoM and perform any other duties/responsibilities assigned from time-to-time.
- (xviii) Prepare satisfactory reports to audit enquires with respect to works & contracts.
- (xix) Exercise a thorough and efficient control and check on all the project components till the end of handing over the project to PHED.

193. **Quality Control.** The subproject shall be executed adhering to the bid specifications. The Manuals on Quality Control and Quality Assurance (QA/QC Manual) and the volume of Standard Specifications prepared by the SIPMIU for the Program will supplement the bid specifications.

## **2. Responsible for carrying out mitigation measures**

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

195. To ensure implementation of mitigation measures during the construction period, contract clauses (**Appendix 3**) for environmental provisions will be part of the civil works

contracts. Contractors' conformity with contract procedures and specifications during construction will be carefully monitored by SIPMIU and DSMC.

## 2. Responsible for carrying out monitoring measures

196. During construction, Environmental Specialist (ES) of DSMC and the Environmental Officer (EO) of SIPMIU will monitor the construction contractor's environmental performance.

197. During the operation stage, monitoring will be the responsibility of PHED.

## 3. Responsible for reporting

198. DSMC will submit periodic monitoring and implementation reports to SIPMIU, who will take follow-up actions, if necessary. SIPMIU will submit monitoring reports to the PD who will then submit to ADB. SIPMIU will also prepare annual monitoring reports for IPCC and assist IPCC in preparing an annual monitoring report to ADB. The 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. IPCC will seek clearance for submission and disclosure of the annual environmental monitoring report to ADB.

## 4. Capacity Building

199. The proposed training program along with the frequency of sessions is presented in Table 6.

**Table 6: Training Program for Environmental Management**

Program	Description	Participant	Form of Training	Duration/ Location	Training Conducting Agency	Source of Funds
<b>Pre-Construction</b>						
Sensitization Workshop	Introduction to Environment: • Basic Concept of environment • Environmental Regulations and Statutory requirements as per Government of India and ADB	Secretaries, Chief Engineer Superintendent Engineers of PHED, PHED and UDD, the Development Commissioner, Mayor, CEO of PHED and Project Director (PD) and Environmental Officer (EO) of the SIPMIU	Workshop	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost
Session I						
Module I	Introduction to Environment: • Basic Concept of environment • Environmental Regulations and Statutory requirements as per Government of India and ADB	Engineers of PHED, PHED and SWM Division of PHED SIPMIU (Technical Unit) and SIPMIU (Environmental Unit)	Lecture	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost
Module II	Environmental Considerations in Urban Development and Solid Waste Management (SWM) Projects: • Environmental components affected by urban development	Engineers of PHED, PHED and SWM Division of PHED SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO)	Workshop	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost

Program	Description	Participant	Form of Training	Duration/ Location	Training Conducting Agency	Source of Funds
	and SWM in construction and operation stages <ul style="list-style-type: none"> <li>• Activities causing pollution during construction and operation stages</li> <li>• Environmental Management Good Practices in Urban Infrastructure and SWM Projects</li> <li>• MSW Handling Rules, 2000 monitoring requirements.</li> </ul>					
Module III	Review of IEE and its Integration into Designs: <ul style="list-style-type: none"> <li>• IEE Methodology</li> <li>• ADB and Gol requirements</li> <li>• Environmental Provisions in NERCCDIP</li> <li>• Implementation Arrangements</li> <li>• Methodology of Assessment of Pollution Monitoring</li> <li>• Methodology for site selection of borrow areas, waste disposal areas etc.</li> </ul>	Engineers of PHED, PHED and SWM Division of PHED SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO)	Lecture and field visit	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost
Module IV	Improved Coordination with other Departments: <ul style="list-style-type: none"> <li>• Overview of NERCCDIP</li> <li>• Environmental &amp; Social Impacts</li> <li>• Statutory Permissions – Procedural Requirements</li> <li>• Co-operation &amp; Coordination with other Departments.</li> </ul>	Engineers of PHED, PHED and UDD SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO)	Lecture/ Interactive sessions	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost
Module V	Special Issues in NERCCDIP <ul style="list-style-type: none"> <li>• Bio-Diversity Assessment &amp; Conservation</li> <li>• Geomorphological Assessment and Slope Protection</li> <li>• Statutory Permissions – Procedural Requirements</li> <li>• Consultation and Counseling</li> </ul>	SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO)	Lecture	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost

Program	Description	Participant	Form of Training	Duration/ Location	Training Conducting Agency	Source of Funds
<b>B. Construction Stage</b>						
Session II						
Module VI	Role during Construction <ul style="list-style-type: none"> <li>• Roles and Responsibilities of officials/ contractors/ consultants towards protection of environment</li> <li>• Implementation Arrangements</li> <li>• Monitoring mechanisms</li> </ul>	Engineers of PHED, PHED and SWM Division of PHED SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO)	Lecture/ Interactive sessions	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost
Module VII	Monitoring and Reporting System <ul style="list-style-type: none"> <li>• Monitoring mechanisms</li> <li>• MSW Handling Rules, 2000 monitoring requirements.</li> </ul>	SIPMIU (Technical Unit) and SIPMIU (Environmental Unit including the EO); SWM Division of PHED	Lecture/ Interactive sessions	½ Working Day	Environmental Specialist of the Design and Supervision Consultants	Included in the project cost

ADB = Asian Development Bank, CEO = Chief Executive Officer, IEE = initial environmental examination, MSW = municipal solid waste, NERCCDIP = North Eastern Region Capital Cities Development Investment Program, PHED = Public Health Engineering Department, PWD = Public Work Department, SIPMIU = State-level Investment Program Management and Implementation Units, SWM = Solid Waste Management UD&PAD = Urban Development & Poverty Alleviation Department, UDD = Urban Development Department.

## **B. Environmental Mitigation Plan**

200. **Table 7 to 9** shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

## **C. Environmental Monitoring Program**

201. **Table 10 to 12** 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 7: Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan (for Water Supply & Sewerage Sub – Projects)**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Statutory Requirements	Non-compliance with National Laws	(i) Consent to Establish under Water (Prevention and Control of Pollution) Act (ii) Consent to Establish under Air (Prevention and Control of Pollution) Act (iii) Tree-cutting Permit from the Forest Department	SIPMIU with assistance from DSMC	(i) Consent to Establish (Water) (ii) Consent to Establish (Air) (iii) Tree-cutting Permit
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	DSMC	(i) List of affected utilities and operators;  (ii) Bid document to include requirement for a contingency plan for service interruptions
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	Disruption to traffic flow and	(i) Prioritize areas within or	SIPMIU and DSMC to	List of selected sites for

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
mix plants, stockpile areas, storage areas, and disposal areas.	sensitive receptors	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, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community.	determine locations prior to award of construction contracts.	construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage 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 SIPMU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from SIPMU.	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, UD&PAD = Urban Development & Poverty Alleviation Department.

**Table 8: Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan (for Water Supply & Sewerage Sub – Projects)**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment 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; (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.	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) as PM10 and PM2.5; (v) Vehicular emissions such as sulphur dioxide (SO <sub>2</sub> ), nitrous oxides (NO <sub>x</sub> ), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water quality.	(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	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;

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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 according to the Environmental Management Plan (EMP).</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	<p>(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;</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 (dB) when measured at a distance of 10 m or more from the vehicle/s.</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of silencers in noise-producing equipment and sound barriers;</p> <p>(iii) Equivalent day and night time noise levels</p>

<b>Field</b>	<b>Anticipated Impact</b>	<b>Mitigation Measures</b>	<b>Responsible for Mitigation</b>	<b>Monitoring of Mitigation</b>
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; (ii) Coordinate with AMC/PHED 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 conflicts near project locations and haul road	(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; (ii) Schedule transport and hauling activities during non-peak hours; (iii) Locate entry and exit points in areas where there is low potential for traffic	Construction Contractor	(i) Traffic Management Plan; (ii) Complaints from sensitive receptors; (iii) Number of signages placed at subproject location.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		congestion; (iv) Keep the site free from all unnecessary obstructions; (v) Drive vehicles in a considerate manner; (vi) Coordinate with Aizawl Municipal Traffic Office 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.		
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Leave spaces for access between mounds of soil; (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.	Construction Contractor	(i) Complaints from sensitive receptors;  (ii) Number of walkways, signages, and metal 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	Construction Contractor	(i) Employment records;  (ii) records of sources of materials



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(ii) Secure construction materials from local market.		
Occupational Health and safety	Occupational hazards which can arise during work	<p>(i) Develop and implement site-specific Health and safety (H&amp;S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment like helmet, gumboot, safety belt, gloves, nose musk and ear plugs; (c) H&amp;S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the 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&amp;S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p> <p>(viii) Provide visitor orientation</p>	Construction Contractor	<p>(i) Site-specific Health and safety (H&amp;S) Plan;</p> <p>(ii) Equipped first-aid stations;</p> <p>(iii) Medical insurance coverage for workers;</p> <p>(iv) Number of accidents;</p> <p>(v) Supplies of potable drinking water;</p> <p>(vi) Clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) record of H&amp;S orientation trainings</p> <p>(viii) personal protective equipments;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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 hearing protection. The use of hearing protection shall be enforced actively.</p>		
Community Health and safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<p>(i) Plan routes to avoid times of peak-pedestrian activities.</p> <p>(ii) Liaise with SIPMIU/DSMC in identifying high-risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of</p>	Construction Contractor	<p>(i) Traffic Management Plan;</p> <p>(ii) Complaints from sensitive receptors</p>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>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>		
Work Camps	Temporary air and noise pollution from machine operation, 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;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and</p> <p>(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>	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	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
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, if deemed necessary by local authorities; (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, UD&PAD = Urban Development & Poverty Alleviation Department.

**Table 9 (A): Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan (Water Supply)**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
General Maintenance Work	Dust generation and surplus	(i) Prepare and submit Operation and Maintenance Manual; (ii) Conduct work during non-monsoon period; and (iii) Cover construction material like cement to prevent dusts.	PHED and O&M Contractors	Maintenance Records
Pipe Replacement	Temporary disruption of activities like traffic etc	(i) Complete work in sensitive areas quickly; (ii) Prepare a traffic diversion or management plan Consultation the town authorities (iii) Inform all residents and businesses persons or institutions about the nature and duration of any work well in advance so that they can	PHED and O&M Contractors	(i) Complaints from sensitive receptors (ii) site inspection

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		make preparations if necessary; (iv) Conduct these works to provide wooden walkways near any excavated site.		
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 (such as Safety Shoes, Hand Gloves shovels and wheelbarrows); (ii) Ensure First Aid facility at work site.	PHED and O&M Contractors	OH&S Plan approved by PHED
Waste collection & Management	Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous debris	(i) Ensure all removed material will be deposited in the municipal waste storage bins. (ii) Ensure the all non – hazardous waste will be deposited in safe manner at safe site like approved landfill site.	PHED and O&M Contractors	Waste Management Plan approved by PHED
Maintenance of alternative sources of Power Supply (DG Sets)	Soil and water pollution due to fuel, & lubricants	The fuel storage and DG Set establishment site will be stationed such that runoff from the site does not drain into the clear water storage area. Oil interceptors will be provided	PHED and O&M Contractors	Spot checks by concern PHED authorities to time to time
Economic , Social and Cultural Resources	(i) Impediments to residents and businesses (ii) Temporary disruption of daily activities	(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 near any excavated site. (iii) Consult the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;	PHED and O&M Contractors	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(iv) Complete work in sensitive areas quickly; (v) 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		

H&S = health and safety, O&M = operation and maintenance, UD&PAD = Urban Development & Poverty Alleviation Department.

**Table 9 (B): Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan (Sewerage)**

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
General Maintenance Work	Dust generation and surplus	(i) Prepare and submit Operation and Maintenance Manual; (ii) Conduct work during non-monsoon period; and (iii) Cover construction material like cement to prevent dusts.	PHED and O&M Contractors	Maintenance Records
Pipe Replacement	Temporary disruption of activities like traffic etc	(i) Complete work in sensitive areas quickly; (ii) Prepare a traffic diversion or management plan Consultation the town authorities (iii) Inform all residents and businesses persons or institutions about the nature and duration of any work well in advance so that they can make preparations if necessary; (iv) Conduct these works to provide wooden walkways near any excavated site.	PHED and O&M Contractors	(i) Complaints from sensitive receptors (ii) site inspection



<b>Field</b>	<b>Anticipated Impact</b>	<b>Mitigation Measures</b>	<b>Responsible for Mitigation</b>	<b>Monitoring of Mitigation</b>
Occupational Health and Safety	Adverse impacts on the appearance of surrounding environment and exposure of workers to occupational hazard	(i) Ensure persons employed will be provided with suitable equipment (such as Safety Shoes, Hand Gloves shovels and wheelbarrows); (ii) Ensure First Aid facility at work site.	PHED and O&M Contractors	OH&S Plan approved by PHED
Maintenance work Waste collection & Management	Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous debris	(i) Ensure all removed material will be deposited in the municipal waste storage bins. (ii) Ensure the all non – hazardous waste will be deposited in safe manner at safe site like approved landfill site.	PHED and O&M Contractors	Waste Management Plan approved by PHED
Maintenance of alternative sources of Power Supply (DG Sets) at STP site	Soil and water pollution due to fuel, & lubricants	The fuel storage and DG Set establishment site will be stationed such that runoff from the site does not drain into the treated water storage area. Oil interceptors will be provided	PHED and O&M Contractors	Spot checks by concern PHED authorities to time to time
Economic , Social and Cultural Resources	(i) Impediments to residents and businesses (ii) Temporary disruption of daily activities	(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 near any excavated site. (iii) Consult the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity; (iv) Complete work in sensitive areas quickly; (v) Consult municipal authorities, custodians of important buildings, cultural and tourism authorities and	PHED and O&M Contractors	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		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		
Management of sludge and waste from sewer and from the Treatment plant	Adverse impacts on the appearance of surrounding environment and exposure of community to hazardous waste	A waste collection system will be in operation to handle solid wastes, oily rags, and used fuel and lube oil filters in a leak-proof container that will be stored and disposed off at the landfill site, to ensure effective management of solid wastes at the treatment plant site.	PHED and O&M Contractors	Complaints from sensitive receptors
Effective maintenance of the sludge-drying beds at the STP	Adverse impacts on the appearance of surrounding environment	(i) Utilization of dried sludge for horticultural/ agricultural purposes, as suitable, will be carried out. (ii) Reuse of sludge will be explored after testing to meet government safety standards (iii) Disposal of refuse sludge will be at the sanitary landfill site in Aizwal.	PHED and O&M Contractors	O&M Manual for STP and Sludge management Plan
Odor from Raw Sludge of sewer and STP	Adverse impacts on the appearance of surrounding environment and local community	Shielding of the unloading bay & green belt around the STP site to an extent to prevent odorous gases being blown away by the wind	PHED and O&M Contractors	O&M Manual for STP and Raw Sludge management Plan

H&S = health and safety, O&M = operation and maintenance, UD&PAD = Urban Development & Poverty Alleviation Department.

**Table 10: Pre-construction Environmental Monitoring Program**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Environmental Clearances	Not applicable	DSMC	follow up with SPCB on clearances	Checking of records	Clearances issued	As required	SIPMIU
Baseline Environmental Condition – Ambient Air Quality	Subproject location	DSMC	Establish baseline values of (i) respirable particulate matter (RPM) as PM10 and PM2.5	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	DSMC	Establish baseline values of suspended solids (TSS), pH biological oxygen demand (BOD), faecal coliform	Air 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 interruptions included in bid documents	Once	SIPMIU
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, hot mix plants, 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, hot mix plants, stockpile areas, storage areas, and	Checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and	Once	SIPMIU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			disposal areas.		disposal areas provided to construction contractors prior to commencement of works.		
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 11: Construction Environmental Monitoring Program**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	Quarries and sources of materials	Construction Contractor	Construction Contractor documentation	(i) Checking of records; (ii) visual inspection of sites	(i) Sites are permitted; (ii) Report submitted by construction contractor monthly (until such time there is excavation work)	Monthly submission for construction contractor  As needed for DSMC	DSMC
Air Quality	Construction sites and areas designated for stockpiling of	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors;	(i) Checking of records; (ii) visual inspection of	(i) Stockpiles on designated areas only; (ii) complaints from	Monthly for checking records	DSMC in coordination with Pollution Control Board

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	materials		(iii) heavy equipment and machinery with air pollution control devices; (iv) ambient air for respirable particulate matter (RPM) as PM10 and PM2.5 (v) vehicular emissions such as sulphur dioxide (SO <sub>2</sub> ), nitrous oxides (NO <sub>x</sub> ), carbon monoxide (CO), and hydrocarbons (HC)	sites	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 <sub>2</sub> , NO <sub>x</sub> , CO and HC.		
Surface Water Quality	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials;	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) records of surface water quality inspection; (iv) effectiveness of water management measures; (v) for inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.	visual inspection	(i) Designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) GOI Standards for Water Discharges to Inland Waters and Land for Irrigation	Monthly	DSMC in coordination with Pollution Control Board
Noise Levels	(i) Construction sites; (ii) areas for	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers	(i) Checking of records; (ii) visual	(i) Complaints from sensitive receptors satisfactorily	Monthly	DSMC in coordination with Pollution Control

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps		in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels	inspection	addressed; (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary		Board
Existing Utilities and Infrastructure	Construction sites	Construction Contractor	(i) Existing Utilities Contingency Plan	(i) Checking of records; (ii) visual inspection	Implementation according to Utilities Contingency Plan	As needed	DSMC
Landscape and Aesthetics	(i) Construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction Contractor	(i) Waste Management 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.	(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 addressed.	Monthly	DSMC
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,	Visual inspection	(i) Complaints from sensitive receptors satisfactorily addressed;	Quarterly	DSMC

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			signages, and metal sheets placed at subproject location.		(ii) walkways, ramps, and metal sheets provided (iii) signages visible and located in designated areas		
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&S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (x) sign boards for hazardous areas	(i) Checking of records; (ii) visual inspection	(i) Implementation of H&S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms	Quarterly	DSMC



Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.				
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
Work Camps	Work camps	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, SIPMIU = State-level Investment Program Management and Implementation Units SPM = suspended particulate matter.

**Table 12 (A): Operation and Maintenance Environmental Monitoring Program (Water Supply)**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Drinking Water Quality	(i) 3 service reservoirs	PHED and O&M Contractors	Comparison with BIS & IMC	Sample collection	Indicators \ Standard set by	Quarterly or as prescribed by	PHED Mizoram

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	(ii Random sample form domestic users		standard	and laboratory analyses	BIS or IMC	BIS or IMC	
RPM	Maintenance site	PHED and O&M Contractors	Comparison with PM10 and PM2.5 limits in NAAQM	Sample collection and laboratory analyses	Standard set by CPCB	Quarterly or as prescribed by CPCB	PHED Mizoram
Noise Level	Maintenance site	PHED and O&M Contractors	Comparison with Noise level limits in NANQM	Sample collection and laboratory analyses	Standard set by CPCB	Quarterly or as prescribed by CPCB	PHED Mizoram
Occupational Health and safety	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	(i) Records of training; (ii) H&S Plan approved by PHED	Complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram
General Maintenance	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram
Community Health and safety	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	Checking of records	complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram

CPCB = Central Pollution Control Board, O&M = operation and maintenance, PHED = Public Health and Engineering Department, UD&PAD = Urban Development & Poverty Alleviation Department. NAAQM = National Ambient Air Quality Monitoring NANQM = National Ambient Noise Quality Monitoring, BIS= Bureau of Indian standard, IMC = Indian Medical Council, RPM= Respirable Particulate Matter

**Table 12 (B): Operation and Maintenance Environmental Monitoring Program (Sewerage System)**

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Drinking Water Quality	At the STP Drinking Water Facilities	PHED and O&M Contractors	Comparison with IS & IMC standard	Sample collection and laboratory analyses	Indicators \ Standard set by BIS or IMC	Quarterly or as prescribed by BIS or IMC	PHED Mizoram
Surface water Quality	Treated Sewage & Nearest Surface water Body	PHED and O&M Contractors	Comparison with Surface Water Quality Standard of CPCB, MOEFCC	Sample collection and laboratory analyses	Indicators \ Standard set by CPCB	Quarterly or as prescribed by SPCB Mizoram	PHED Mizoram
RPM	Maintenance site	PHED and O&M Contractors	Comparison with PM10 & PM2.5 limits in NAAQM	Sample collection and laboratory analyses	Standard set by CPCB	Quarterly or as prescribed by CPCB	PHED Mizoram
Noise Level	Maintenance site	PHED and O&M Contractors	Comparison with Noise level limits in NANQM	Sample collection and laboratory analyses	Standard set by CPCB	Quarterly or as prescribed by CPCB	PHED Mizoram
Occupational Health and safety	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	(i) Records of training; (ii) H&S Plan approved by PHED	Complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram
General Maintenance	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	Checking of records	Complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram
Community Health and safety	subproject location	PHED and O&M Contractors	Complaints from sensitive receptors	Checking of records	complaints from sensitive receptors satisfactorily addressed	As needed	PHED Mizoram

CPCB = Central Pollution Control Board, O&M = operation and maintenance, PHED = Public Health and Engineering Department, UD&PAD = Urban Development & Poverty Alleviation Department. NAAQM = National Ambient Air Quality Monitoring NANQM = National Ambient Noise Quality Monitoring, BIS= Bureau of Indian standard, IMC = Indian Medical Council, RPM= Respirable Particulate Matter, MOEFCC = Ministry of Environment Forest and Climate Change, SPCB = State Pollution Control Board.

#### D. Environmental Management Plan Costs

202. 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. 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.

203. The remaining actions in the EMP are the various environmental monitoring activities. These have not been budgeted elsewhere, and their costs are shown in **Table 13**. The figures show that the total cost of environmental management and monitoring for the subproject as a whole (covering design, 3 years of construction and the three years of operation under the defect liability period).

**Table 13: Environmental Management and Monitoring Costs (INR)**

Item	Total Cost (INR lakhs)	Source of Funds
Mitigation Measures (pre-construction)	-	SIPMIU Cost
Mitigation Measures (construction)	-	Construction Contractors Cost
Mitigation Measures (O&M)	-	PHED Cost
Monitoring Measures (Pre-construction)	1.2	DSMC Cost
Monitoring Measures (Construction)	-	Construction Contractor Cost
Monitoring Measures (O&M)		PHED Cost
a. Effluent Monitoring (annual)	0.018	
b. Sludge Monitoring (annual)	0.018	
Capacity Building (pre-construction)	0.075	SIPMIU Cost
Training Sessions (pre-construction)	0.300	SIPMIU Cost
Training Sessions (construction)	0.15	SIPMIU Cost
Tree plantation (after construction)	to be determined	SIPMIU Cost
Maintenance of tree plantations (3 years)	to be determined	SIPMIU Cost

#### VIII. FINDINGS AND RECOMMENDATIONS

204. The environmental impacts of all elements of the infrastructure proposed under the Aizawl Water Supply and Sewerage Subproject were assessed. Potential negative impacts were identified in relation to both construction and operation of the improved infrastructure, but no major 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.

205. During the construction phase, impacts mainly arise from the need to dispose of large quantities of waste soil and import a similar amount of materials to support the pipes in the trenches; 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.

206. Once the system is operating, most facilities will operate with routine maintenance, which should not affect the environment. Leaks in the sewage 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 material.

207. The main impacts of the operating water supply system will be beneficial as the citizens of Aizawl will be provided with a constant supply of water, which will serve a greater proportion of the population, including slum-dwellers. The main impacts of the operating sewerage system will be beneficial as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This will improve the environment and appearance of these areas, and the health and quality of life of the citizens. Diseases of poor sanitation should be reduced, which should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

208. The regular removal of sludge from the STP should also have no environmental impacts, and if tests show that the drying procedure removes bacterial contamination the material should be given as agricultural fertilizers and soil conditioners, as this will provide an environmental gain.

209. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. 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 quality of discharged treated effluent and health status in vicinity of the facility.

210. New location to STP approach may not be the best suitable area for construction of road since the natural flow of the river would be disturbed even though it's going to be minimal. On the other hand the original location is not suitable again for construction of road due to impact on forest land and which is also not welcomed by the Forest Deptt. Identifying of other location without disturbing the river would be the best for the purpose even though the proposed design may be convincing. However, if at all there is no other land available and that the present location is approved, besides the proposed design there may be few more additional scope of work that may be required even after completion. Such scope should be immediately taken up without any delay.

## **IX. CONCLUSIONS**

211. 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.

212. 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: ADB RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST FOR WATER SUPPLY AND WASTEWATER

### A. WATER SUPPLY

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area...			
▪ Densely populated?	✓		Aizawl topographic characteristic limits areas which can be inhabited. The subproject area will cover Aizawl's Zone 1 which has the most number of population.
▪ Heavy with development activities?		✓	There are no developmental activities present in Aizawl
▪ Adjacent to or within any environmentally sensitive areas?		✓	The subproject components will be confined in the built-up areas of Aizawl thus not adjacent to or within any environmentally-sensitive areas.
▪ Cultural heritage site		✓	No cultural heritage site in Aizawl
▪ Protected Area		✓	No protected areas/ecologically sensitive areas within 10 kilometer (km) radius of the subproject. The nearest protected area is Dampa Sanctuary which is situated near the Bangladesh boundary and more that 10 km from the subproject area.
▪ Wetland		✓	No wetland within radius of 10 km.
▪ Mangrove		✓	Not present in Aizawl.
▪ Estuarine		✓	Not present in Aizawl.
▪ Buffer zone of protected area		✓	No buffer zone of a protected area within radius of 10 km.
▪ Special area for protecting biodiversity		✓	No special/notified area for protecting biodiversity in/around the subproject area.
▪ Bay		✓	Not present in Aizawl.
B. Potential Environmental Impacts Will the Project cause...			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		✓	The water supply source is the Tlawng River, located about 12 km away from the city. The existing environmental condition of the river is good. No communities/industries/agricultural activities are present upstream of the water intake. As vegetation in the subproject area is good, soil erosion runoff draining towards the water source is insignificant.
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	No historical/cultural monuments areas in Aizawl
▪ hazard of land subsidence caused by excessive ground water pumping?		✓	Not applicable. Water will not be sourced from groundwater.
▪ social conflicts arising from displacement of communities?		✓	Displacement of communities is not required in this subproject. However during pipe-laying, small-scale displacement will be required which will be temporary in nature. A Resettlement Plan (RP) will be developed to mitigate these temporary impacts.
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	Water quantity is sufficient and additional abstraction from the river will not have significant impact. Groundwater will not be used as source.
▪ unsatisfactory raw water supply (e.g. excessive pathogens or		✓	Raw water is being treated prior to distribution. Water quality of treated water is ensured to

Screening Questions	Yes	No	Remarks
mineral constituents)?			comply with National Standards for Drinking Water.
▪ delivery of unsafe water to distribution system?		✓	The subproject will improve present conditions of primary and secondary distribution network by relaying pipes to prevent leakages and contamination.
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		✓	The existing intake is secured and accessible only to authorized persons. It is also regularly monitored to ensure only treated and unpolluted water are distributed.
▪ over pumping of ground water, leading to salinization and ground subsidence?		✓	Not applicable. Water is being sourced from a river.
▪ excessive algal growth in storage reservoir?		✓	Not expected as storage reservoirs will be completely covered thus algal growth is not promoted by sunlight. In addition, treated water will only be stored in a short period of time.
▪ increase in production of sewage beyond capabilities of community facilities?		✓	The subproject includes sewerage system improvement. Tranche 2 will include improvement in the collection and conveyance of sewerage while the subsequent tranche will include construction of a sewerage treatment plant that can accommodate wastewater for the next 20 years.
▪ inadequate disposal of sludge from water treatment plants?		✓	Very minimal sludge is being generated from the existing treatment plant. This is usually dried and disposed in the city's dumpsite.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	Not applicable. The subproject components include improvement of distribution network only.
▪ impairments associated with transmission lines and access roads?	✓		Expected during pipe-relaying. However, impacts are temporary and short in duration. The environmental management plan (EMP) will ensure 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 applicable. Construction of chlorination plants is not included in the subproject. The chlorine storage area in the existing intake has completely controlled access.
▪ 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 applicable. Construction of chlorination plants is not included in the subproject.
▪ dislocation or involuntary resettlement of people?		✓	Not applicable. Relaying of pipes will be on existing right-of-way (ROW)
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not applicable. The subproject will not affect indigenous peoples or other vulnerable group. The subproject will be beneficial to women and children as water will be available in their home. This will improve the current condition of getting and carrying water in hilly terrains.
▪ noise and dust from construction activities?	✓		Expected during construction activities. However, impacts are temporary and short in duration. The environmental management plan



Screening Questions	Yes	No	Remarks
			(EMP) will ensure measures are included to mitigate the impacts.
<ul style="list-style-type: none"> <li>increased road traffic due to interference of construction activities?</li> </ul>	✓		Expected during construction activities. However, impacts are temporary and short in duration. The environmental management plan (EMP) will ensure measures are included to mitigate the impacts. Construction contractors will be required to coordinate with the local traffic police.
<ul style="list-style-type: none"> <li>continuing soil erosion/silt runoff from construction operations?</li> </ul>		✓	As the subproject area is hilly and terrain is rocky, run-off during construction will be more but erosion will be less. However, impacts are temporary and short in duration. The environmental management plan (EMP) will ensure measures are included to mitigate the impacts. Construction contractors will be required to include channelization where it required.
<ul style="list-style-type: none"> <li>delivery of unsafe water due to poor O&amp;M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?</li> </ul>		✓	Not expected. The subproject will not include treatment processes.
<ul style="list-style-type: none"> <li>delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?</li> </ul>		✓	Not expected. Water quality will be regularly monitored by the State Public Health and Engineering Department (PHED). The subproject will not include treatment processes.
<ul style="list-style-type: none"> <li>accidental leakage of chlorine gas?</li> </ul>		✓	Not expected. The subproject will not include treatment processes such as chlorination.
<ul style="list-style-type: none"> <li>excessive abstraction of water affecting downstream water users?</li> </ul>		✓	Tlawng River is a perennial river. with. The detailed engineering study shows that the river has ample water availability.
<ul style="list-style-type: none"> <li>competing uses of water?</li> </ul>		✓	Not expected. Tlawng River is the existing water source and the subproject will not involve any increase in abstraction of surface water.
<ul style="list-style-type: none"> <li>increased sewage flow due to increased water supply</li> </ul>	✓		The subproject includes improvement of the sewerage system. Under tranche 2, collection and conveyance will be included while sewerage treatment will be taken up in the subsequent tranche.
<ul style="list-style-type: none"> <li>increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant</li> </ul>		✓	Not expected.
<ul style="list-style-type: none"> <li>large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</li> </ul>		✓	Priority in employment will be given to local residents. Construction contractors will be required to provide workers camp with water supply and sanitation. PHED has manpower to operate the improved system.
<ul style="list-style-type: none"> <li>social conflicts if workers from other regions or countries are hired?</li> </ul>		✓	Priority in employment will be given to local residents.
<ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of</li> </ul>		✓	Not applicable. Construction will not involve use of explosives and chemicals. Trenching will be done manually.

Screening Questions	Yes	No	Remarks
materials such as explosives, fuel and other chemicals during operation and construction?			
<ul style="list-style-type: none"> <li>community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</li> </ul>		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

## B. SEWERAGE TREATMENT

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area...			
<ul style="list-style-type: none"> <li>Densely populated?</li> </ul>	✓		Aizawl topographic characteristic limits areas which can be inhabited. The subproject area will cover Aizawl's Zone 1 which has the most number of population.
<ul style="list-style-type: none"> <li>Heavy with development activities?</li> </ul>		✓	There are no developmental activities present in Aizawl
Adjacent to or within any environmentally sensitive areas?		✓	The subproject components will be confined in the built-up areas of Aizawl thus not adjacent to or within any environmentally-sensitive areas.
<ul style="list-style-type: none"> <li>Cultural heritage site</li> </ul>		✓	No cultural heritage site in Aizawl
<ul style="list-style-type: none"> <li>Protected Area</li> </ul>		✓	No protected areas/ecologically sensitive areas within 10 kilometer (km) radius of the subproject. The nearest protected area is Dampa Sanctuary which is situated near the Bangladesh boundary and more that 10 km from the subproject area.
<ul style="list-style-type: none"> <li>Wetland</li> </ul>		✓	No wetland within radius of 10 km.
<ul style="list-style-type: none"> <li>Mangrove</li> </ul>		✓	No mangrove vegetation in/around the subproject area.
<ul style="list-style-type: none"> <li>Estuarine</li> </ul>		✓	No estuarine in/around the subproject area.
<ul style="list-style-type: none"> <li>Buffer zone of protected area</li> </ul>		✓	No buffer zone of a protected area within radius of 10 km.
<ul style="list-style-type: none"> <li>Special area for protecting biodiversity</li> </ul>		✓	No special/notified area for protecting biodiversity in/around the subproject area.
<ul style="list-style-type: none"> <li>Bay</li> </ul>		✓	The subproject area is hilly undulated terrain thus no bay is present.
B. Potential Environmental Impacts Will the Project cause...			
<ul style="list-style-type: none"> <li>impairment of historical/cultural monuments/areas and loss/damage to these sites?</li> </ul>		✓	Not expected. Subproject areas are not adjacent to any historical/cultural monuments.
<ul style="list-style-type: none"> <li>interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?</li> </ul>		✓	Not expected. The sewage treatment plant (STP) will be located 2 km from the city. The proposed site is inhabited.
<ul style="list-style-type: none"> <li>dislocation or involuntary resettlement of people?</li> </ul>		✓	Not applicable. Relaying of pipes will be on existing right-of-way (ROW). The STP and toilet blocks will be constructed in government-owned lands.

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</li> </ul>		✓	Not applicable. The subproject will not affect indigenous peoples or other vulnerable group. The subproject will be beneficial to women and children because of improved sanitation.
<ul style="list-style-type: none"> <li>impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?</li> </ul>		✓	The subproject will improve collection and conveyance of sewerage to the proposed STP. This will improve the current unsanitary condition of directly discharging wastewater into drainage and canals. The use of Sequencing Batch Reactors as STP technology will ensure compliance of treated wastewater to Wastewater Quality Standards.
<ul style="list-style-type: none"> <li>overflows and flooding of neighboring properties with raw sewage?</li> </ul>		✓	The subproject will improve collection and conveyance of sewerage to the proposed STP. This will improve current condition of overflows.
<ul style="list-style-type: none"> <li>environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?</li> </ul>		✓	The sludge from the STP will be collected and dried before distribution to farmers as agricultural fertilizer or soil conditioner. Effluents from the industries, which are only small-scale, will not be allowed in the sewers.
<ul style="list-style-type: none"> <li>noise and vibration due to blasting and other civil works?</li> </ul>		✓	Not applicable. There will be no rock-blasting. Rock-cutting and trenching will be conducted manually.
<ul style="list-style-type: none"> <li>Risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?</li> </ul>	✓		Risks and vulnerability during construction are temporary, reversible and short-term in duration. The EMP includes mitigation measures related to occupational health and safety. During operations, O&M contractors will be required to operate the same level of Health and Safety procedures as used in the construction phase to protect workers and the public.
<ul style="list-style-type: none"> <li>discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?</li> </ul>		✓	Not applicable. There are no major industries in Aizawl thus have no sources of hazardous materials.
<ul style="list-style-type: none"> <li>inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?</li> </ul>		✓	A greenbelt (33% of the total land area) will be included in the design of the STP. Landscaping in the community toilet blocks will be considered to improve aesthetic appeal.
<ul style="list-style-type: none"> <li>road blocking and temporary flooding due to land excavation during the rainy season?</li> </ul>		✓	Not expected. Civil works will be conducted during the dry season and in phased manner.
<ul style="list-style-type: none"> <li>noise and dust from construction activities?</li> </ul>	✓		Impacts will be localized, temporary, and short-term duration. The EMP includes measures to mitigate the impacts.
<ul style="list-style-type: none"> <li>traffic disturbances due to construction material transport and wastes?</li> </ul>	✓		Expected during pipe-relaying. However, impacts are temporary and short in duration. The environmental management plan (EMP) will ensure measures are included to mitigate the impacts.
<ul style="list-style-type: none"> <li>temporary silt runoff due to construction?</li> </ul>	✓		As the subproject area is hilly and terrain is rocky, run-off during construction will be more but erosion will be less. However, impacts are temporary and short in duration. The environmental management plan (EMP) will ensure measures are included to mitigate the impacts. Construction contractors will be required to include channelization where it required.

Screening Questions	Yes	No	Remarks
<ul style="list-style-type: none"> <li>hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?</li> </ul>		✓	Not expected. Subproject will improve current condition of overflows and ground water pollution due to lack of sewerage system.
<ul style="list-style-type: none"> <li>deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?</li> </ul>		✓	Subproject will improve current condition by providing collection, conveyance, and treatment of sewage water. The construction of an STP will ensure untreated water will be disposed to water bodies. The STP design will include sludge collection and drying system. Dried sludge will be used as agricultural fertilizer and soil conditioner.
<ul style="list-style-type: none"> <li>contamination of surface and ground waters due to sludge disposal on land?</li> </ul>		✓	Sludge will be analyzed for pathogens, nitrogen and phosphorus prior to use as agricultural fertilizer and soil conditioner. The Public Health and Engineering Department (PHED) will maintain a record of all users of dried sludge.
<ul style="list-style-type: none"> <li>health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?</li> </ul>		✓	The technology to be used in the STP will not involve closed systems/tanks thus accumulation of toxic gases will be expected. Workers in the STP will be trained in accordance with the Operational and Maintenance (O&M) Manual to be developed as part of the subproject. Access to the STP and handling of sludge will be limited to authorized personnel only.
<ul style="list-style-type: none"> <li>large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?</li> </ul>		✓	Priority in employment will be given to local residents. Construction contractors will be required to provide workers camp with water supply and sanitation.
<ul style="list-style-type: none"> <li>social conflicts between construction workers from other areas and community workers?</li> </ul>		✓	Priority in employment will be given to local residents.
<ul style="list-style-type: none"> <li>risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?</li> </ul>		✓	Not applicable. Construction will not involve use of explosives and chemicals. Trenching will be done manually and pipes are of small diameters only.
<ul style="list-style-type: none"> <li>community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</li> </ul>		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.
<b>Climate Change and Disaster Risk Questions</b> The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	
<ul style="list-style-type: none"> <li>Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?</li> </ul>	✓		The topography of Aizawl is characterized as the most variegated topography among all hilly areas in India. It falls under Seismic Zone V (referred to as Very High Damage Risk Zone). Faulting has resulted in creation of steep

Screening Questions	Yes	No	Remarks
			curves, highly dissected ranges with deep ravines, spurs, etc., vulnerable to comprehensive erosion. The rocks are fractured and hence susceptible to failure during monsoon resulting in landslides. Subsidence is another problem encountered in Aizawl.
▪ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		✓	Increase in precipitation beyond the design parameters will affect subproject sustainability.
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?	✓		Ninety eight percent of the population in Aizawl belongs to the scheduled tribes (STs). Though categorized as tribes, they are into modern means of production and consumption.
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?	✓		Aizawl, although classified as very high damage risk zone, has topographic characteristic that limits areas which can be inhabited.

## APPENDIX 2: RECORDS OF PUBLIC CONSULTATIONS AND INFORMATION DISCLOSURE

No.	Type of Consultation	Stakeholder	VC Area	Venue	No of Participants	Date	Time	Duration
<b>COMMUNITY</b>								
1	Focus Group Discussion (FGD)	Community	Bawngkawn	Guest House, LASA	12	07-Jun-05	8.45-9.45	60 min
2	FGD	Community and PHED officials	Aizawl	PHED office	8	8-Jun-05	11.30-12.30	60 min
3	Individual Interviews (2 Nos)	Residents of Tuipol North	Tuipol North	Residence of VCP	2	8-Jun-05	16.45-17.40	60 min
4	FGD	YMA member and local residents	Village - Republic Veng	YMA Hall	10	9-Jun-05	7.15-8.15	60 min
5	FGD	VCP, local residents, YMA member	Village - Bungkawn Nursery	Residence of VCP	11	9-Jun-05	9.30-10.45	75 min
6	FGD	Local Residents, VCP, PHED Engineer	Venghnuai	Residence of VCP	17	9-Jun-05	17.00-18.00	60 min
7	FGD	VCP and local residents	Maubawk (slum)	Village Count	9	9-Jun-05	11.20-12.00	40 min
8	FGD	VCP and local residents	Salem Veng (slum)	Residence of VCP	10	9-Jun-05	18.15-19.15	60 min
9	FGD	Local Residents, YMA member, Vice President MHIP	Khatla South	YMA Hall	9	9-Jun-05	15.00-16.00	60 min
<b>GENDER AND WOMEN GROUPS</b>								
10	Meeting with CBO-MHIP (Women's Organization)	President, Vice President, MHIP	Aizawl	Office of MHIP	2	10-Jun-05	13.00-14.00	60 min
11	Semi structured interview	President, Vice President, Secretary, MHIP, and other women	Tiangnuam Village	Village Community Hall	35	18-Jun-05	11.00	90 min
12	Semi structured interview	Secretary and other women	Salem Veng	Residence of MHIP President	14	18-Jun-05	14.00	100 min
13	Semi structured interview	Ms. B.Sangkhumi, Central MHIP President Ms. Darhmingthangi, CMHIP Senior	Aizawl city	Central MHIP office	6	20-Jun-05	15.3	90 min
		Vice President						
14	FGD	Director, Social Welfare Department Former Director Rural Development and other women rights activists	Aizawl city	Tourist Lodge	6	20-Jun-05	10.00	90 min
<b>NON GOVERNMENTAL ORGANISATION (NGOS) / COMMUNITY BASED ORGANISATIONS (CBO)</b>								
1	Presentation	NGOs and representatives	Aizawl	LAD		20-Apr-05	15.00-16.30	90 min
2	FGD	President, Vice President and Secretary, CYMA	Aizawl	Office of Consultants, Aizawl	3	11-Jun-05	10.00-11.00	60 min
3	Semi structured interview	Coordinator of the NGO, Centre for Environment Protection	Aizawl	Office of local daily	1	10-Jun-05	15.00-16.00	60 min
4	Semi structured interview	Executive member, Science Teacher Association of Mizoram	Aizawl	Office of STAM	4	11-Jun-05	11.30-12.15	45 min

Date	Secondary Stakeholders	Main Issues Discussed
20/02/05 - 27/02/05	LAD	<ul style="list-style-type: none"> <li>* Possibilities of exploiting ground water in and around Aizawl town</li> <li>* Possibilities of exploring the rain water harvesting and impounding the rainwater at a higher level</li> <li>* Emphasis on need for dedicated uninterrupted power line to be provided to PHED so as to bring down the O&amp;M cost and to provide better service of continuous water supply</li> <li>* Need to look for other alternatives under the present situation of huge cost involved due to high lift of pumping water</li> </ul>
22/02/05 - 27/02/05	LAD, PHED	<ul style="list-style-type: none"> <li>* Existing solid waste management within the city including collection, transportation and disposal</li> <li>* Management of market waste and the no. of existing and proposed disposal ground</li> <li>* Augmentation methods for the existing disposal site and the proposed disposal site at Muallungthu</li> <li>* Existing operation of Clean Mizoram project in the city and how their involvement in awareness campaign for good practices to manage SW was also seen</li> <li>* Discussions on the working of compost plant</li> </ul>
26/04/05 and 27/04/05	PHED	<ul style="list-style-type: none"> <li>* Proposed sewerage system for Aizawl city;</li> <li>* Discussion on zoning of city for sewerage zones;</li> <li>* Provision of community type septic tanks for sparsely located areas</li> <li>* Type of sewerage treatment system - trickling type being preferred by Executive Engineer</li> <li>* Condition of existing septic tanks in city;</li> </ul>
29/04/05 and 30/04/05	LAD, PHED	<ul style="list-style-type: none"> <li>* Possibility of combining treatment plant of Zone II and Zone III;</li> <li>* Verification of proposed location of STP of Zone III at site-found unsuitable due to non-availability of land and difficult topography</li> </ul>

Sector	Stakeholders consulted	Issues raised/suggestions received	Response	Inconsistencies/Gaps/Conflicts
1. Water Supply  2. Sewerage  3. Solid Waste Management	PHED, Communities	<p>Need for identification of alternative sources of water due to high O&amp;M costs of the present system; Lack of access to regular water supply leading to dependency on untreated water, including water from polluted/contaminated sources, purchase of water at exorbitant prices.</p> <p>Options for identification and development of alternative sources to include: (i) Utilization of ground water (ii) Tapping of natural streams at higher elevations, including construction of impounding reservoirs</p>	<ul style="list-style-type: none"> <li>* Construction of new reservoirs;</li> <li>* Construction of 128 kilometers of primary pipelines;</li> <li>* Construction and replacement of 418 kilometers of secondary and tertiary pipelines;</li> <li>* Construction of chlorinators at major reservoirs to supplement the treatment provided at the main treatment plant; and</li> <li>* Supply and erection of pumping machineries, at intake, raw water and treated water pumping stations</li> <li>* Provision of a dedicated power supply system;</li> <li>* Provision of sludge drying and disposal facilities</li> </ul>	<ul style="list-style-type: none"> <li>* Construction of impounding reservoir is a long-term solution. The inclusion of the same in the NERUDP shall not be possible for the following reasons:</li> <li>* The time frame required for planning, and implementations shall not conform to the present project implementations schedule 2006-11</li> <li>* The suitability of the site shall be required to be further assessed in terms of geo-technical, environment social and economic considerations</li> <li>* The present source shall be sufficient to address the W.S demand till 2020. Therefore, the construction of the reservoir shall be taken up by the GoM with other sources of funding</li> </ul>

## Photographs Related to Public Consultation for STP & STP Approach Road





## Photographs Related to Public Consultation for Water Supply Sub – Project



## **APPENDIX 3: SUGGESTED CONTRACT CLAUSES (CONSTRUCTION)**

### **Sources of Materials**

- (i) Use quarry sites and 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.

### **Air Quality**

- (i) Consult with SIPMIU/DSMC on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
- (ii) Excavate the SRs foundations at the same time as the access roads (if needed) are built so that dug material is used immediately, avoiding the need to stockpile on site;
- (iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
- (iv) Bring materials (aggregates) as and when required;
- (v) Use tarpaulins to cover sand and other loose material when transported by vehicles;
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; and
- (vii) Clean wheels and undercarriage of vehicles prior to leaving construction site.

### **Surface Water Quality**

- (i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with 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).

### **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) Provide prior information to the local public about the work schedule;
- (iii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiseling;

- (v) 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
- (vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

### **Landscape and Aesthetics**

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

### **Accessibility**

- (i) Plan pipeline work in consultation with the traffic police;
- (ii) Conduct work during light traffic;
- (iii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
- (iv) Provide for immediate consolidation of backfilling material to desired compaction to avoid future settlement risk - this will allow immediate road restoration and therefore will minimize disturbance to the traffic movement;
- (v) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line;
- (vi) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
- (vii) In case of closure of main roads, provide information to the public through media – daily news papers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes;
- (viii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.

### **Socio-Economic – Income**

- (i) Leave space for access between mounds of excavated soil;
- (ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required;

- (iii) Consult affected businesspeople to inform them in advance when work will occur;
- (iv) Address livelihood issues; implement the Resettlement Plan (RP) to address these issues;
- (v) Provide prior public information about the work schedule in particular locality and the traffic diversions/changes in any – information shall disseminated through local papers and cable television services;
- (vi) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and
- (vii) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

### **Socio-Economic – Employment**

- (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.

### **Occupational Health and safety**

- (i) Develop and implement site-specific Health and safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S Training<sup>10</sup> for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (iii) Provide medical insurance coverage for workers;
- (iv) Secure all installations from unauthorized intrusion and accident risks;
- (v) Provide supplies of potable drinking water;
- (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (x) Ensure moving equipment is outfitted with audible back-up alarms;

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

- (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and
- (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.

### **Community Health and safety**

- (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.

### **Quarry Sites and Borrow Pits**

- (i) Verify suitability of all material sources and obtain approval of DSMC;
- (ii) Prioritize government-approved quarries and borrow pits;
- (iii) Obtain approval of DSMC if new quarries and borrow sites are necessary;
- (iv) Obtain approval of DSMC if extracting rocks, gravel, and sand from small rivers or streams is necessary. The extraction points shall be spread out along the length of the river to minimize disruption in river flow and to prevent instability to embankments. Local residents and water users shall be consulted to ensure that irrigation intakes, bunds, and local fishing are not adversely impacted; and
- (v) Request DSMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

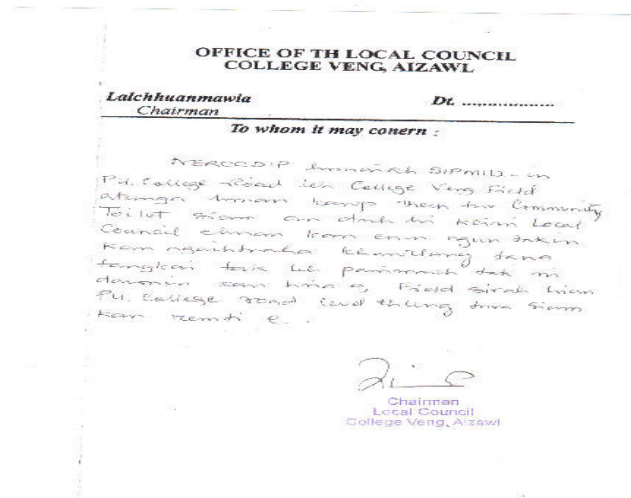
### **Work Camps**

- (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.

## **Social and Cultural Resources – Chance Finds**

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

## APPENDIX 4: NOCS for Community Toilets with Site Photographs & Typical Drawings



## Noc for Community Toilets @ College Veng



### College Veng Toilet Site



(41)

**OFFICE OF THE DEPUTY MEDICAL SUPERINTENDENT,  
KULIKAWN HOSPITAL, AIZAWL**

NO.A.60011/2/12/DMS(K)/ 591 : Dated Aizawl, the 27<sup>th</sup> November, 2013.

To,

The Project Director,  
SIPMIU,  
Mizoram : Aizawl.

Ref : Your letter No.W.11028/3/2011-PD/SIPMIU (NERCCDIP)/42  
dated Aizawl 20<sup>th</sup> Nov., 2013

Subject : Permission for construction of Community Toilet – reg.

Sir,

In response to your letter no. and subject cited above, I have the honour to inform you that you are welcomed to Construct Community Toilet in Kulikawn Hospital Compound on the following conditions :-

1. There shall be claim for the land utilised.
2. The structure so constructed should be handed over to this department under no

Incumbency	

(DR. JOHN M. RALTE)  
Deputy Medical Superintendent,  
Kulikawn Hospital.

Memo NO.A.60011/2/12/DMS(K)/ : Dated Aizawl, the ..... November, 2013.

Copy to :- (Team Leader)

1. The Principal Director, Health & Family Welfare Department for information.
2. Director, Hospital & Medical Education for information

Office of the Project Director  
SIPMIU (NERCCDIP)  
Aizawl (Mizoram)

Received 16.12  
Date 27/11/13  
Signature

Deputy Medical Superintendent,  
Kulikawn Hospital,  
Mizoram : Aizawl.



**NOC for Kulikawn Hospital Community Toilet Site**

**Pic of Kulikawn Hospital Community Toilet Site**



OFFICE OF THE AIZAWL CITY BUS OWNERS' ASSOCIATION  
AIZAWL : MIZORAM



Regd. No. SR – 21 of 1990

Phone No : 2325957/9436199682

No. 79/ACBOA/GEN/'13-'14/01.

Dated Aizawl, the 25<sup>th</sup> Jan 2014

**TO WHOM IT MAY CONCERN**

This is to Certify that Aizawl City Bus Owners' Association (ACBOA) does not have any objection for Construction of Community Toilet for Public use inside our Land Area (Vide MISC No. 18 of 1993).

Hence, this No Objection Certificate (NOC) has been issue.

**Your's Faithfully**

  
(JEFFREY L. FANAI)  
General Secretary  
Aizawl City Bus Owners' Association



## Some Photographs of Completed Community Toilets



**AMC Thuampui**



**Bawngkawn**

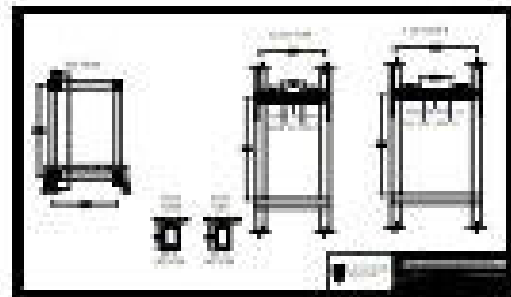
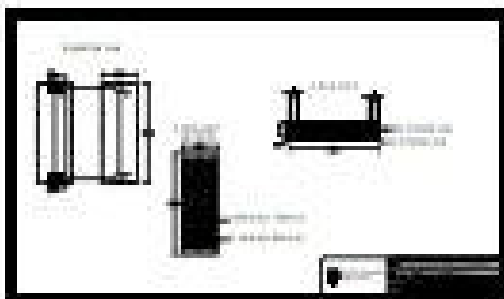
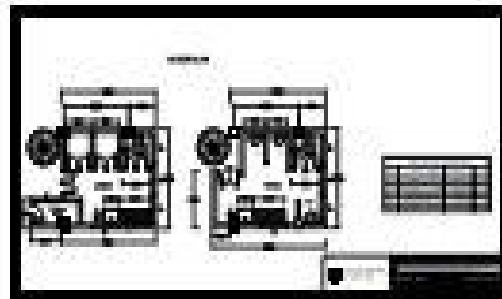
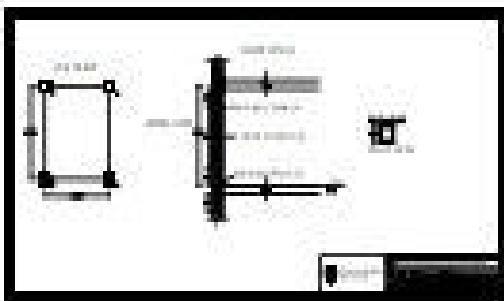
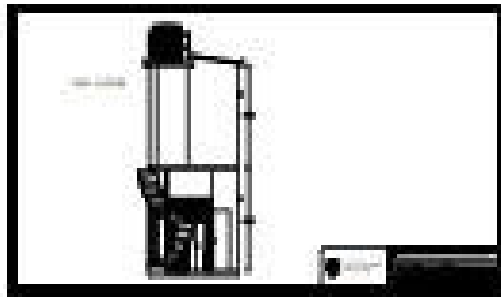


**Bethlehem Vengthlang**



**Zarkawt**

## Typical Drawing for Community Toilet



APPENDIX 5: NOC for Tree Felling for STP & Approach Road

(271)

**GOVERNMENT OF MIZORAM  
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS  
MIZORAM : AIZAWL**

No.B.14017/16/95-PCCF(G)/271 : Dated Aizawl, the 23<sup>rd</sup> April, 2014.

To

The Divisional Forest Officer,  
Aizawl Forest Division,  
Aizawl : Mizoram.

**Subj :** Permission for cutting Trees at the location of approach road to STP site at Chite River (Pu Chawngthanga ram chhung).


**Ref:** No. W.11020/5/2008-PD/SIPMIU(NERCCDIP)/29 : Dt.26.03.2014

Sir,

With reference to the above letter, I am sending herewith a copy of letter received from Project Director, SIPMIU(NERCCDIP) and request you to verify the matter on the spot and to submit the report through CF(CC).

*Enclosed : As above.*


Yours faithfully,

  
( C. VANLALENA )  
Deputy Conservator of Forests(Hqrs)

Memo.No.B.14017/16/95-PCCF(G)/271 : Dated Aizawl, the 23<sup>rd</sup> April, 2014.

Copy to:

- 1) Project Director, SIPMIU(NERCCDIP) for information.
- 2) Conservator of Forests(Central Circle) for information.

  
Deputy Conservator of Forests(Hqrs)

87C  
Issue No. 32  
Date 23/4/2014

## APPENDIX 6: Consent for STP

### Current Valid CTE

**OFFICE OF THE MIZORAM STATE POLLUTION CONTROL BOARD  
AIZAWL : MIZORAM**

**NO OBJECTION CERTIFICATE (CONSENT TO ESTABLISH)  
(RENEWED)**

No. H.88088/Poltn/9 (153)/2011-MPCB/ 144 : Dated Aizawl, the 3<sup>rd</sup> August, 2016  
Validity: 24.8.2016 – 23.8.2017

**NO OBJECTION CERTIFICATE (CONSENT TO ESTABLISH)** granted to the **Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram** for setting up of **Sewerage Treatment Plant with Primary Settling followed by activated Sludge Process (PS+ASP) technology** having a capacity of **10 MLD** at **Bethlehem Vengthlang** on the bank of **Chite River, Aizawl, Mizoram** vide letter No. H.88088/Poltn/9(153)/2011-MPCB/27-31 Dt. 23.08.2012 is hereby **extended** for another **1 year** with effect from **24.08.2016** under Section 21 of Air (Prevention & Control of Pollution) Act, 1981 and Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 with reference to the application No. W. 11020/7/2008-PD/SIPMIU (NERCCDIP)/25 Dt. 18.07.2016.

*All the conditions stipulated in the original certificate shall remain same and shall be strictly complied with.*

Sd/-C.LALDUHAWMA  
Member Secretary  
Mizoram Pollution Control Board  
Dated Aizawl, the 3<sup>rd</sup> August, 2016

Memo No. H.88088/Poltn/9 (153)/2011-MPCB/ :  
Copy to: **Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram** with reference to the application No. W. 11020/7/2008-PD/SIPMIU (NERCCDIP)/25 Dt. 18.07.2016.

(C.LALDUHAWMA)  
Member Secretary  
Mizoram Pollution Control Board

Mizoram Pollution Control Board, Silver House, Tuikhahlang, Aizawl, Mizoram-796001  
Ph.No.2326173/2316590 Fax:2316591 Email:mpcb\_azh@yahoo.com Website:http://www.mizenvia.nic.in

**Office of the Program Director  
SIPMIU (NERCCDIP)  
Aizawl : Mizoram**  
Receipt No. 69  
Date: 2/9/16  
Section: \_\_\_\_\_

579  
Aizawl



OFFICE OF THE MIZORAM STATE POLLUTION CONTROL BOARD  
AIZAWL: MIZORAM

CONSENT TO ESTABLISH CERTIFICATE  
(NO OBJECTION CERTIFICATE)  
(RENEWED)

No.H.88088/Poltn/9(153)/2011-MPCB/27-31 : Dated Aizawl, the 23<sup>rd</sup> August 2012.

CONSENT TO ESTABLISH is hereby renewed to the Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram for setting up of Sewage Treatment Plant with Primary Settling followed by Activated Sludge Process (PS+ASP) technology, having a capacity of 10 MLD at Bethelchem Vengthlang on the bank of Chite River, Aizawl, Mizoram under Section 21 of Air (Prevention & Control of Pollution) Act, 1981, Section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 with reference to the Application No. W.11020/2/2008-PD/SIPMIU (NERCCDIP)/17 dt 13.8.2012 and subsequent correspondence including site verification in accordance with the terms & conditions as mentioned below:

1. No air, water and soil pollution shall be created by the industry beyond the prescribed permissible limits.
2. To maintain the environment and ecology of the area, provisions of green belt by planting selected species of trees, around the plant site shall be made invariably.
3. As per the provision of Water (Prevention & Control of Pollution) Act, 1974 as amended and Air (Prevention & Control of Pollution) Act, 1981 as amended, any officer empowered by the Board on its behalf shall, have without any interruption, the right at any time to enter the industry for inspection, collection of sample for analysis and may call for any information etc. Violation of this right will cause withdrawal of this consent.
4. It shall be the prime responsibility of the industry that the nearby population, vegetation and any other assets etc. shall not be affected due to emission/effluent emanating out of the industry.
5. All efforts should be made by the industry's authority to maintain the ambient air quality of the area to the lowest possible limits well below the prescribed permissible limits by utilizing the best available technologies in this regard.
6. Efforts shall have to be made by the industry for recycle and recovery of waste to the maximum extent possible.
7. Infrastructure facilities should be provided for monitoring of stack emissions and ambient air quality including meteorological data by installing appropriate air pollution monitoring instruments and establishments and establishment of a well equipped laboratory before commissioning of the plant.

8. With regards to different individual units of the plant, appropriate pollution control devices or guidelines as listed in the Annexure should be adopted /installed to ensure that the emissions/effluents are within the prescribed standards.
9. The industry shall have to submit a detailed action plan for installation of requisite pollution control devices as required in clause 8 above along with technical details of such devices etc, as early as possible.
10. The industry shall have to submit a detailed report on compliance to the terms and conditions as laid down in this CONSENT TO ESTABLISH and to apply for CONSENT TO OPERATE before commissioning of the plant. No operation of the plant shall be allowed unless the industry fulfilled all the stipulated terms and conditions of this Certificate.
11. This Certificate has been accorded basing on the particulars furnished by the applicant on behalf of the Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram and subject to addition of further or more conditions if so warranted by subsequent developments. The consent will automatically become invalid if any change or alteration or deviation is made in actual practice.
12. This certificate will remain valid for a period of 1(one) year from the date of issue.



(C.LALDUHAWMA)  
Member Secretary

Memo No.H.88088/Poltn/9(153)/2011-MPCB/

Dated Aizawl, the 23<sup>rd</sup> August 2012

Copy to:

1. The Director of Industries, Govt. of Mizoram, Aizawl for favour of information.
- ✓ The Project Director, State Investment Program Management & Implementation Unit (SIPMIU), Government of Mizoram with reference to the application No. W.11020/2/2008-PD/SIPMIU (NERCCDIP)/17 dt 13.8.2012

(C.LALDUHAWMA)  
Member Secretary

## ANNEXURE

1. Efforts should be made to bring the Noise level (within & outside the premises) at 55 dB(A) Leq at day time and 45 dB(A) Leq at night time. Day time starts from 6:00 A.M and extends up to 6:00 P.M and Night time means 6:00 P.M to 6:00 A.M.
2. The following STANDARDS shall be maintained for discharge of sewage

Sl. No.	Parameter	Standards	
		Inland surface water (a)	Land for irrigation (b)
1	Colour and odour	all efforts should be made to remove colour and unpleasant odour as far as practicable	all efforts should be made to remove colour and unpleasant odour as far as practicable
2	pH	5.5 to 9.0	5.5 to 9.0
3	Conductivity	1000 $\mu$ Mhos/cm	1000 $\mu$ Mhos/cm
4	Temperature	shall not exceed 5°C above the receiving water temperature	shall not exceed 5°C above the receiving water temperature
5	Suspended solids	10 mg/l max.	200 mg/l max.
6	Particle size of suspended solids	shall pass 850 micron IS Sieve	
7	Hardness	600 mg/l max.	600 mg/l max.
8	Total residual chlorine	1 mg/l max.	1 mg/l max.
9	Oil and grease,	10 mg/l max.	10 mg/l max.
10	Ammonical nitrogen (as N)	50 mg/l, max	-
11	Free ammonia (as NH <sub>3</sub> )	5.0 mg/l, max.	
12	Nitrate Nitrogen	10 mg/l	
13	Biochemical Oxygen Demand (3 days at 27°C)	30 mg/l, max	100
14	Chemical Oxygen Demand (COD)	250 mg/l, max.	



5. A fence shall be constructed to prevent unwanted entry.
6. Proper care should be taken to ensure zero leakage in the sewer lines at all times.
7. Provision should be made for preventive measures against natural calamities like lightning should be adopted to take care of the treatment plant, health and safety of workers and the surrounding environment.

Every conductive path like sewer lines and the ground/neutral of the power mains that enters the building or machineries should be bonded, at the perimeter, to the ground system



CHAWMA 25/3  
(C.LALDUHAWMA)  
Member Secretary,  
Mizoram Pollution Control Board

**APPENDIX 7: NOC from PWD Mizoram for STP Approach Road**



**GOVERNMENT OF MIZORAM  
OFFICE OF THE EXECUTIVE ENGINEER : PWD :  
AIZAWL ROAD NORTH DIVISION : AIZAWL**

No- T-11013/19/09/ARN/APL/SD-I/216

Dated Aizawl, the 9<sup>th</sup>, Dec/2014

To,

The Project Director,  
SIPMIU (NERCCDIP) Govt. of Mizoram,  
Aizawl, Mizoram.

Subject: NOC for Joining STP Approach Road with PWD Road under NERCCDIP Project ADB Funded.


Reference: Your Letter No. D.11011/3/2014-PD/SIPMIU (NERCCDIP)/28 : Dated Aizawl, the 7<sup>th</sup> October, 2014.

Sir,

In regards to your Letter No. and Subject cited above, I have the honour to convey you that this office has no objection with the construction of the STP approach road as per your proposed design.




Yours faithfully,

  
(R. ZATAWNA)  
Executive Engineer, PWD.,  
Aizawl Road North Division,  
Aizawl

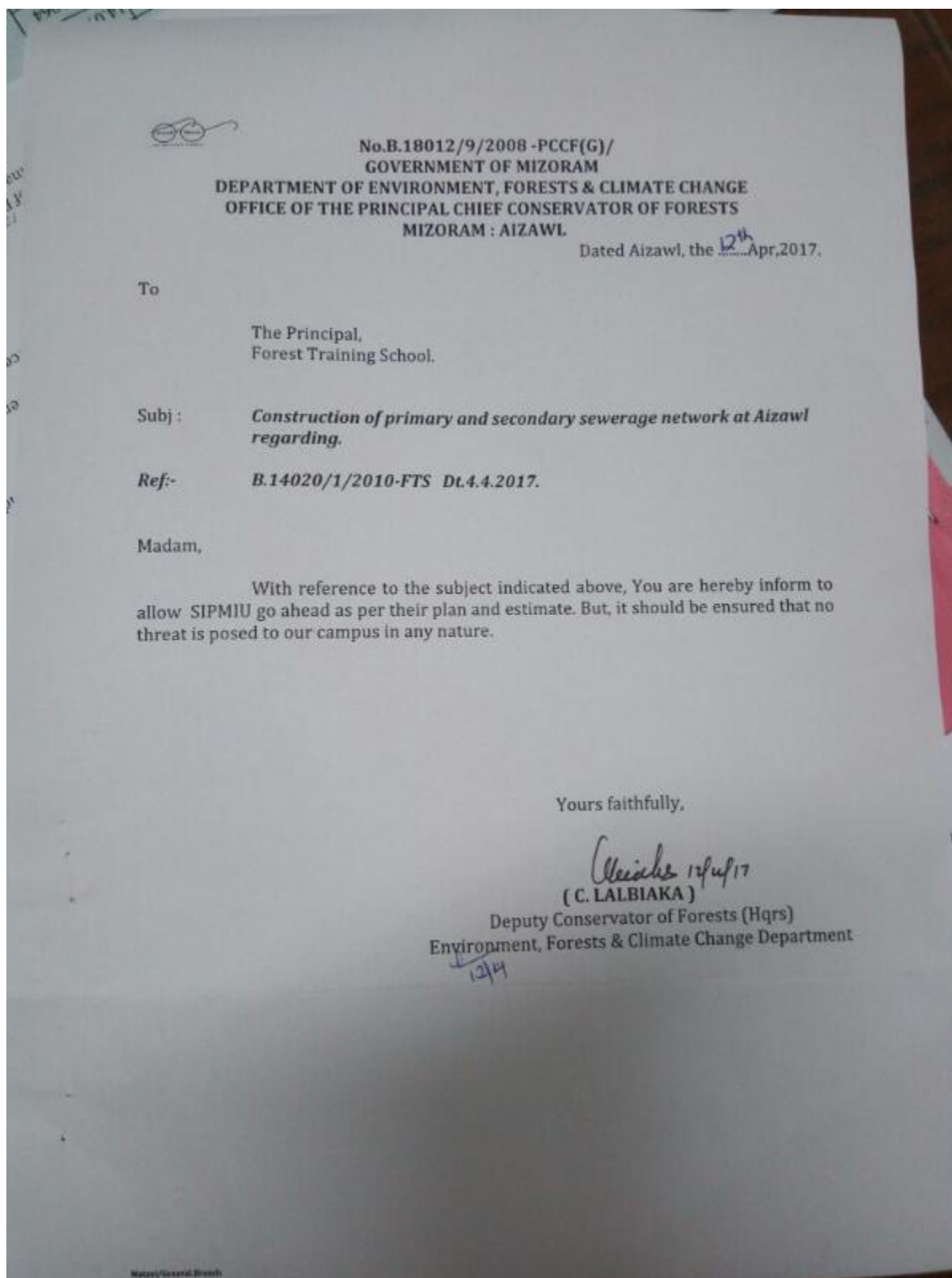
Memo. No: No- T-11013/19/09/ARN/APL/SD-I/216 'A' : Dated Aizawl, the 9<sup>th</sup>, Dec/2014

Copy to:

- 1) The Chief Engineer, PWD, Buildings, for favour of information.
- 2) The Superintending Engineer, PWD, Building Circle, for favour of information.
- 3) The Sub-Divisional Officer Aizawl Road North Sub Division-I for Information.

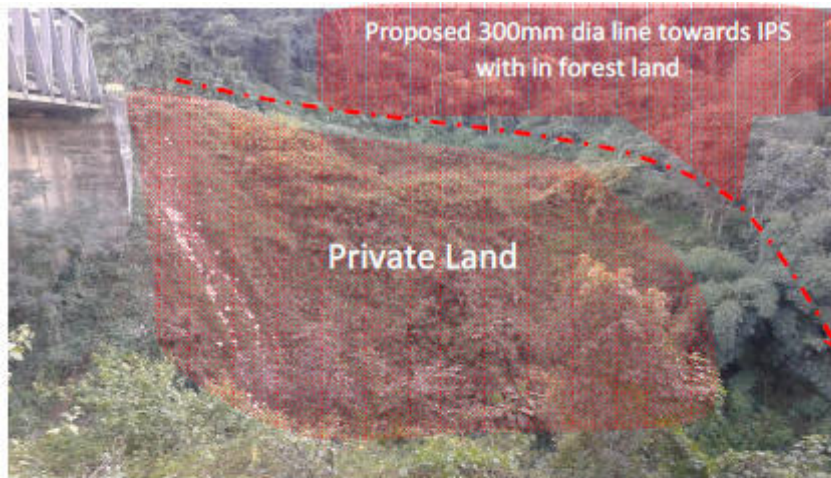
  
Executive Engineer, PWD.,  
Aizawl Road North Division,  
Aizawl

**APPENDIX 8: Internal correspondence from MoEFCC Mizoram related to Forest NOC**



## APPENDIX 9: Revised alignment for sewage pipeline

Picture Showing Location B as mentioned in Google Drawing (Figure 4 in Text)





Picture Showing Location A as mentioned in Google Drawing (Figure 4 in Text)



## **APPENDIX 10: Approved Technology for STP Plant – SBR**

### **PROCESS DESCRIPTION**

#### **Description of Process Offered:**

The Plant is based on Sequential Batch Reactor Technology popularly known as SBR Technology. Unlike various processes of treatments the raw sewage as obtained for the treatment undergoes Physio-Chemical & Biological Treatments. The first part of Physio-Chemical treatment is the Primary Treatment to the raw sewage, which covers the physical activities like screening, de-gritting, flow measurement, flow distribution etc. The plant is designed in accordance with the characteristics of influent and effluent as provided and according to the guidelines set up by the 'CPHEEO Manual', published by the Govt. of India. The detailed description of individual units & their functions are given below.

#### **Raw Sewage Pumping Station:**

As per the requirement of the plant, the Raw Sewage Pumping Station is designed to handle average, peak and lean flows. The Coarse Screen Chamber is provided ahead of sump. Screens will be provided in the Coarse Screen Chamber to screen the raw influent. Necessary hand operated sluice gate shall be provided to isolate the screen when it is under maintenance. The Screened sewage is then allowed to flow to the Raw Sewage Collection Sump. The detention time stipulated as per the tender is adopted for the hydraulic design of wet well. The necessary pumps will be provided to pump the screened raw sewage for further treatment.

The common rising main is provided to carry the sewage from raw sewage sump to Primary units.

**Chlorine Contact Tank:**

The Effluent from the SBR basins will be collected in Chlorine Contact Tank .The supernatant thus collected will get disinfected in Chlorine Contact Tank by adding suitable dose of chlorine and finally it is discharged in to nearby nallah.

**Sludge Handling System:**

The sludge as collected from SBR basins is collected into sludge sump and conveyed to centrifuge unit for dewatering the same. The necessary centrifuge feed pumps & Centrifuges will be provided. There will be an arrangement of dosing polyelectrolyte if necessary.



### Explanation of cyclic operation:

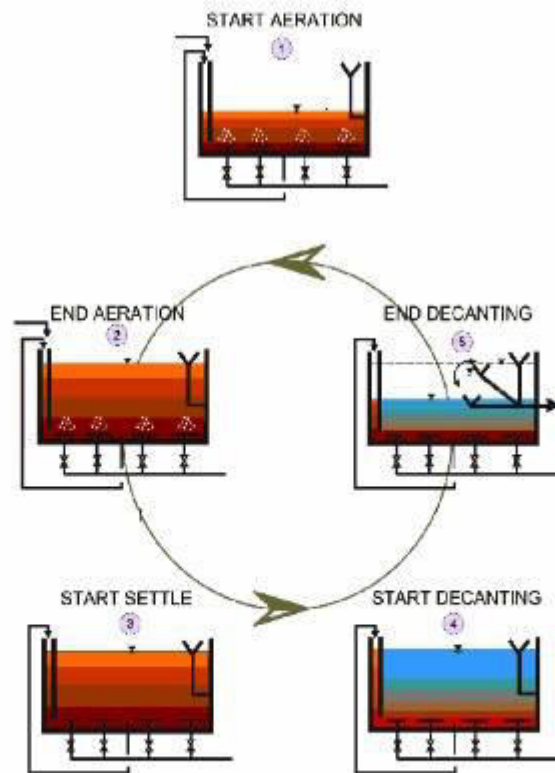
A basic cycle comprises:

- Fill-Aeration (F/A)
- Settlement (S)
- Decanting (D)

### A Typical Cycle

During the period of a cycle, the liquid is filled in the SBR Basin up to a set operating water level. Aeration Blowers are started for aeration of the effluent. After the aeration cycle, the biomass settles under perfect settling conditions. Once Settled the supernatant is removed from the top using a DECANTER. Solids are wasted from the tanks during the decanting phase.

These phases in a sequence constitute a cycle, which is then repeated.





### **Primary Units:**

The first unit of Primary treatment is the Inlet Chamber, in which the discharge from Common rising main through Raw Sewage Pumps is received. The inlet chamber is mainly used to control the velocity of raw influent and also for its smooth distribution of flow to the fine screen channel. The fine screen channel will be equipped with manual screen & mechanical screen as required designed for peak flow velocity. Necessary hand operated sluice gate shall be provided at upstream of the chamber to isolate the screen when it is under maintenance. The screenings is conveyed to the disposal through a belt conveyor and further it is to be disposed off by suitable arrangement.

The screened influent then flows to the Grit chambers where the heavy inorganic matter is separated. The Grit free waste thus obtained will flow to SBR basin. At this stage physical treatment of raw influent known as Primary Treatment completes.

### **SBR Process:**

**SBR** is a **SEQUENTIAL BATCH REACTOR** process. It provides highest treatment efficiency possible in a single step biological process.

**SBR** – System is operated in a batch reactor mode which eliminates all the inefficiencies of the continuous processes. A batch reactor is a perfect reactor, which ensures 100% treatment. Two modules are provided to ensure continuous treatment. The complete process takes place in a single reactor, within which all biological treatment steps take place sequentially.

NO additional settling unit / secondary clarifier is required!

The complete biological operation is divided into cycles. Each cycle is of 3 – 5 hrs duration, during which all treatment steps take place.