

Initial Environmental Examination

July 2017

BAN: Third Urban Governance and Infrastructure Improvement (Sector) Project – Additional Financing – Mymensingh Solid Waste Management Subproject

Prepared by Local Government Engineering Department – Government of Bangladesh for the Asian Development Bank. This is an initial draft available on <http://www.adb.org/projects/39295-038/documents>.

CURRENCY EQUIVALENTS

(as of 3 March 2017)

Currency Unit	=	BDT
BDT1.00	=	\$0.01260
\$1.00	=	BDT79.36

ABBREVIATIONS

ADB	–	Asian Development Bank
BBS	–	Bangladesh Bureau of Statistics
BSCIC	–	Bangladesh Small and Cottage Industries Corporation
BDT	–	Bangladesh Taka
BIWTA	–	Bangladesh Inland Water Transport Agency
BMD	–	Bangladesh Meteorological Department
BNBC	–	Bangladesh National Building Code
BOD	–	Biochemical Oxygen Demand
BOD ₅	–	5-day Biochemical Oxygen Demand
BWDB	–	Bangladesh Water Development Board
CCA	–	climate change adaptation
COD	–	Chemical Oxygen Demand
CRO	–	Complaint Receiving Officer
dB	–	Decibel
DFR	–	Draft Final Report
DoE	–	Department of Environment
DPHE	–	Department of Public Health Engineering
EARF	–	Environmental Assessment and Review Framework
ECA	–	Environmental Conservation Act
ECC	–	Environmental Clearance Certificate
ECR	–	Environment Conservation Rules
EIA	–	Environmental Impact Assessment
EM&MP	–	Environmental Management & Monitoring Plan
EMP	–	Environmental Management Plan
FGD	–	Focus Group Discussion
GHG	–	Green House Gas
GRC	–	Grievance Redress Committee
GRM	–	Grievance Redress Mechanism
H&S	–	Health and Safety
IEE	–	Initial Environmental Examination
IUCN	–	International Union for Conservation of Nature
LGD	–	Local Government Division
LGED	–	Local Government Engineering Department
MDSC	–	Management Design and Supervision Consultant
MLGRDC	–	Ministry of Local Government, Rural Development, and Cooperatives
NEMAP	–	National Environmental Management Action Plan
NGO	–	Non-Government Organization
O&M	–	Operation and Maintenance
OHS	–	Occupational Health and Safety
OHT	–	Over Head Tank
PAP	–	Project Affected Persons

PIU	–	Project Implementation Unit
PM	–	Particulate Matter
PMU	–	Project Management Unit
RAP	–	Resettlement Action Plan
RCC	–	Reinforced Cement Concrete
ROW	–	Right of Way
RUCCA	–	Rapid Urban and Climate Change Assessment reports
SPM	–	Suspended Particulate Matter
SPS	–	Safeguard Policy Statement
SWM	–	Solid Waste Management
SWTP	–	Surface Water Treatment Plant
TDS	–	Total Dissolved Solids
TSS	–	Total Suspended Solids
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
USEPA	–	United States Environmental Protection Agency
WHO	–	World Health Organization
WLCC	–	Ward Level Coordination Committee
WTP	–	Water Treatment Plant

GLOSSARY OF TERMS

<i>beel</i>	–	Permanent water body
<i>bosti</i>	–	Slum
<i>charra</i>	–	Natural drainage channel
<i>ghat</i>	–	Boat landing station
<i>khal</i>	–	Drainage ditch/canal
<i>katcha</i>	–	Poor quality, poorly built
<i>lakepar</i>	–	Side of lake
<i>mahalla</i>	–	Community area
<i>mouza</i>	–	Government-recognized land area
<i>parashad</i>	–	Authority (<i>pourashava</i>)
<i>pourashava</i>	–	Municipality
<i>pucca</i>	–	Good quality, well built, solid
<i>thana</i>	–	Police station
<i>upazila</i>	–	Sub-district

WEIGHTS AND MEASURES

ha	–	hectare
km	–	kilometer
m	–	meter
mm	–	millimeter
km/h	–	kilometer per hour

NOTES

- (i) The fiscal year of the Government of Bangladesh and its agencies ends on 30 June. “FY” before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 30 June 2011.
- (ii) In this report, "\$" refers to US dollars.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the “terms of use” section on ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CONTENTS

	Page
I. INTRODUCTION	1
II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK	2
A. ADB Policy	2
B. National Laws	3
C. Government of Bangladesh Environmental Assessment Procedures	4
D. Relevant Occupational Health and Safety Laws and Rules	5
E. Conventions, Treaties and Protocols	6
III. DESCRIPTION OF THE PROJECT	6
A. The Study Area	6
B. Existing Conditions	8
C. Proposed Subproject Components	14
D. Implementation Schedule	31
IV. DESCRIPTION OF ENVIRONMENT	31
A. Description of Site and Surroundings	31
B. Physical Environment	31
C. Biological Environment	37
D. Physical and Cultural Heritage	38
E. Socio-economic Environment	38
F. Description of Site and Surroundings	40
G. Climate Change Impacts	40
V. ASSESSMENT OF ENVIRONMENTAL IMPACTS AND SAFEGUARDS	41
A. Methodology	41
B. Screening out Areas of No Significant Impact	41
C. Anticipated Impacts and Mitigation Measures – Planning and Design Phase	42
D. Anticipated Impacts and Mitigation Measures – Construction Phase	46
E. Anticipated Impacts and Mitigation Measures – Operations and Maintenance (O&M) Phase	53
F. Cumulative Impact Assessment	59
G. Greenhouse Gas Emissions (GHG)	61
VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION	62
A. Approach	62
B. Major Findings	62
C. Summary	63
D. Proposed Future Consultation Plan	63
VII. GRIEVANCE REDRESS MECHANISM	64
VIII. ENVIRONMENTAL MANAGEMENT PLAN	67
A. Institutional Arrangement	68
B. Safeguard Implementation Arrangement	68
C. Capacity Development Program	102
D. Staffing Requirement and Budget	102
E. Monitoring and Reporting	109

Appendixes

1. Rapid Environmental Assessment Checklist
2. Application Fees for ECC
3. Sample Outline Spoils Management Plan
4. Sample Outline Traffic Management Plan
5. Records of Public Consultations and FGD
6. Sample Grievance Registration Form
7. Sample Semi-Annual Reporting Format
8. Environmental Standards
9. Responsibilities for FSTP Operations

EXECUTIVE SUMMARY

1. After the successful implementation of the first and second Urban Governance and Infrastructure Improvement (Sector) Project (UGIIP-1 and UGIIP-2)¹ in 78 *pourashavas* (municipalities), Local Government Engineering Department (LGED) with the financial assistance of Asian Development Bank (ADB) have been implementing UGIIP-3 in selected 30 *pourashavas* over a period of six years (2014 to 2020). The on-going UGIIP-3 (current project) supports strengthening of urban governance and improvement of urban infrastructure and service delivery in *pourashavas* by providing investment support to *pourashavas* based on their governance performance.² The additional financing will expand the current project and invest in (i) additional priority infrastructure and governance improvement in *pourashavas* under the current project, and (ii) infrastructure and governance improvement in five new *pourashavas*.³ With additional financing the project implementation period is proposed to be extended for one year to 2021.

2. **Subproject scope.** The SWM subproject at Mymensingh is one of the subprojects proposed under the additional financing UGIIP-3. The subproject includes construction of a fecal sludge treatment facility and internal roads at existing landfill and construction of a new landfill with compost plant, leachate treatment, internal roads, boundary wall, bio-medical waste disposal facility and eight transfer stations.

3. **Screening and Categorization.** An environmental assessment of the subproject is required per ADB's Safeguard Policy Statement (SPS, 2009). An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklist for solid waste management (Appendix 1) was conducted and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus the Mymensingh SWM subproject is classified as environmental category B as per ADB SPS and an initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

4. This is the draft Initial Environmental Examination (IEE) based on the feasibility study and preliminary engineering designs prepared during project preparation. This IEE will be finalized during detailed design stage to reflect any changes and latest subproject designs.

5. As per Government of Bangladesh Environment Conservation Act, 1995 (ECA, 1995) and Environment Conservation Rules (ECR, 1997), Mymensingh solid waste subproject is categorized as "red" and location clearance certificate (LCC) and environmental clearance certificate (ECC) must be obtained from the DoE.

6. **Implementation arrangements.** LGED and Department of Public Health Engineering (DPHE), both under the Local Government Division (LGD) of the Ministry of Local Government,

¹ With limited but effective incentives for *pourashavas* to improve their governance, the first UGIIP introduced a performance-based fund allocation strategy through the urban governance improvement action plan (UGIAP) ensuring governance reforms while creating tangible development impacts in an integrated manner.

² Under UGIIP-3 the UGIAP covers the areas (i) citizen awareness and participation, (ii) urban planning, (iii) gender equality and social inclusion, (iv) local resource mobilization, (v) financial management and accountability, (vi) administrative transparency, and (vii) keeping essential *pourashava* services functional.

³ *Pourashavas* to be included under additional financing are Cox's Bazar, Faridpur, Gopalganj, Kushtia, and Mymensingh.

Rural Development and Cooperatives (MLGRDC), are the executing agencies (EA). LGED is responsible for providing support and guidance to *pourashavas* concerning performance criteria and *pourashava* development planning. DPHE will provide support in water supply and sanitation schemes. Implementation activities will be overseen by a project management unit (PMU). Participating *pourashavas* are the implementing agencies (IA), with a project implementation unit (PIU) within the *pourashava* structure. Consultant teams, composed of Management Design and Supervision Consultants, and Governance Improvement and Capacity Development Consultants, are responsible for (i) detailed engineering design, contract documents preparation and safeguards facilitation; (ii) project management and administration support; (iii) assistance in supervising construction; (iii) strengthening of local governance, conducting required studies/surveys and (iv) awareness raising on behavioral change in water, sanitation and solid waste management activities.

7. **Description of the environment.** Subproject components are located in Mymensingh urban area or in its immediate surroundings which were developed into urban land uses. The subproject sites are located in existing right of ways (ROWs) and government-owned land. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near subproject location.

8. **Environmental management.** An environmental management plan (EMP) is included as part of this IEE, which includes (i) mitigation measures for environmental impacts during implementation; (ii) an environmental monitoring program, and the responsible entities for mitigating, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) a grievance redress mechanism. A number of impacts and their significance were reduced through mitigation measures in the preliminary design stage. The EMP will form part of the civil work bidding and contract documents.

9. Locations and siting of the proposed infrastructures were considered to further reduce impacts. The concepts considered in design of the Mymensingh solid waste management subject are: (i) locating facilities on government-owned land to avoid the need for land acquisition and relocation of people; (ii) prioritizing rehabilitation over new construction, using vacant government lands; (iii) taking all possible measures in design and selection of sites to avoid resettlement impacts; (iv) avoiding where possible locations that will result in destruction/disturbance to historical and cultural places/values; (v) avoiding tree-cutting where possible; (vi) ensuring all planning and design interventions and decisions are made in consultation with local communities and reflecting inputs from public consultation and disclosure for site selection. As a result, some measures have already been included in the subproject designs. This means that the impacts and their significance have already been reduced.

10. During the construction phase, impacts mainly arise from (i) occupational health and safety on working in and adjacent to existing dumpsite; (ii) disturbance of residents, businesses, and traffic; (iii) need to manage construction materials and spoils; and (iii) community and workers health and safety. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Measures such as conducting work in lean season and minimizing inconvenience by best construction methods will be employed. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities 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.

11. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. Mitigation will be assured by a program of environmental monitoring to ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

12. **Consultation, disclosure and grievance redress.** The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the *pourashava* and will be disclosed to a wider audience via the ADB and LGED project websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

13. **Monitoring and reporting.** The PMU, PIU (Mymensingh *pourashava*), and Management Design and Supervision Consultants (MDSC) will be responsible for safeguard monitoring. The MDSC will submit monthly monitoring reports to PMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the semi-annual environmental monitoring reports on its website as part of its disclosure requirements.

14. **Conclusions and Recommendations.** The citizens of Mymensingh will be the major beneficiaries of this subproject. With the improved solid waste management services they will enjoy improved over-all cleanliness, livability and better public health in the *pourashava*. Therefore the proposed subproject is unlikely to cause significant adverse impacts and net environmental benefits to citizens of Mymensingh will be positive. The potential 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.

15. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category "B" is confirmed. No further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009).

I. INTRODUCTION

1. After the successful implementation of the first and second Urban Governance and Infrastructure Improvement (Sector) Project (UGIIP-1 and UGIIP-2)¹ in 78 *pourashavas* (municipalities), Local Government Engineering Department (LGED) with the financial assistance of Asian Development Bank (ADB) have been implementing UGIIP-3 in selected 30 *pourashavas* over a period of 6 years (2014 to 2020). The on-going UGIIP-3 (current project) supports strengthening of urban governance and improvement of urban infrastructure and service delivery in *pourashavas* by providing investment support to *pourashavas* based on their governance performance.² The additional financing will expand the current project and invest in (i) additional priority infrastructure and governance improvement in *pourashavas* under the current project, and (ii) infrastructure and governance improvement in five new *pourashavas*.³ With additional financing the project implementation period is proposed to be extended for one year to 2021.

2. LGED and Department of Public Health Engineering (DPHE), both under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), are the executing agencies. LGED is responsible for providing support and guidance to *pourashavas* concerning performance criteria and *pourashava* development planning. DPHE will provide support in water supply and sanitation schemes. Implementation activities will be overseen by a project management unit (PMU). Participating *pourashavas* are the implementing agencies, with a project implementation unit (PIU) within the *pourashava* structure. Consultant teams, composed of Management Design and Supervision Consultants, and Governance Improvement and Capacity Development Consultants, are responsible for (i) detailed engineering design, contract documents preparation and safeguards facilitation; (ii) project management and administration support; (iii) assistance in supervising construction; (iii) strengthening of local governance, conducting required studies/surveys and (iv) awareness raising on behavioral change in water, sanitation and solid waste management activities.

3. **Subproject scope.** Mymensingh solid waste management subproject includes construction of a fecal sludge treatment facility and internal roads at existing landfill and construction of a new landfill with compost plant, leachate treatment, internal roads, boundary wall, bio-medical waste disposal facility and eight transfer stations.

4. **Screening and Categorization.** An environmental assessment of the subproject is required per ADB's Safeguard Policy Statement (SPS, 2009). An environmental assessment using ADB's Rapid Environmental Assessment (REA) checklist for SWM subproject (Appendix 1) was conducted and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus SWM subproject at Mymensingh is classified as environmental category B as per ADB SPS and an initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

¹ With limited but effective incentives for *pourashavas* to improve their governance, the first UGIIP introduced a performance-based fund allocation strategy through the urban governance improvement action plan (UGIAP) ensuring governance reforms while creating tangible development impacts in an integrated manner.

² Under UGIIP-3 the UGIAP covers the areas (i) citizen awareness and participation, (ii) urban planning, (iii) gender equality and social inclusion, (iv) local resource mobilization, (v) financial management and accountability, (vi) administrative transparency, and (vii) keeping essential *pourashava* services functional.

³ *Pourashavas* to be included under additional financing are Cox's Bazar, Faridpur, Gopalganj, Kushtia, and Mymensingh.

5. This initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subproject.

6. This is the draft IEE based on the feasibility study and preliminary engineering designs prepared during project preparation. This IEE will be finalized during detailed design stage to reflect any changes and latest subproject designs.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. 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 ADB investments.

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 impacts, and 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 safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

- (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 the PMU during project implementation upon receipt.

11. **Pollution Prevention and Control Technologies.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of Bangladesh regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 1: Applicable WHO Ambient Air Quality Guidelines

	Averaging Period	Guideline value in $\mu\text{g}/\text{m}^3$
Sulfur dioxide (SO ₂)	24-hour	125 (Interim target-1) 50 (Interim target-2) 20 (guideline)
	10 minute	500 (guideline)
Nitrogen dioxide (NO ₂)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter PM ₁₀	1-year	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline)
	24-hour	150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter PM _{2.5}	1-year	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline)
	24-hour	75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 2: World Bank Group's Noise Level Guidelines

Receptor	One Hour L _{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational ⁵⁵	55	45
Industrial; commercial	70	70

B. National Laws

12. Implementation of all subprojects will be governed by the environmental acts, rules, policies, and regulations of the Government of Bangladesh. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. Many of these are cross-sectoral and several of them are directly related to environmental issues. The most important of these are the Environment Conservation Act, 1995 (ECA, 1995), and the Environment Conservation Rules (ECR, 1997).

13. Table 3 presents specific requirements for the Mymensingh SWM subproject. Appendix 8 provides the environmental standards for air, surface water, groundwater, drinking water, emissions, noise and vehicular exhaust.

Table 3: Applicable Government of Bangladesh Environmental Legislations

	Legislation	Requirements for the Project	Relevance
1.	Environmental Conservation Act of 1995 and amendments in 2000, 2002 and 2010 ^a	<ul style="list-style-type: none"> • Restriction on operation and process, which can be continued or cannot be initiated in the ecologically critical areas • Regulation on vehicles emitting smoke harmful to the environment • Remedial measures for injuries to ecosystems • Standards for quality of air, water, noise and soil for different areas for various purposes and limits for discharging and emitting waste • Environmental guidelines 	The provisions of the act apply to the entire subproject in the construction and operation and maintenance (O&M) phases.
2.	Environmental Conservation Rules of 1997 and amendments in 2002 and 2003	<ul style="list-style-type: none"> • Environmental clearances • Compliance to environmental quality standards 	The subproject is categorized as Orange-B and requires locational clearance certificate (LCC) and environmental clearance certificate (ECC). All requisite clearances from DoE shall be obtained prior to commencement of civil works.
3.	Forest Act of 1927 and amendments (2000)	<ul style="list-style-type: none"> • Clearance for any felling, extraction, and transport of forest produce 	Considered in subproject preparation and implementation.
4.	Bangladesh Climate Change Strategy and Action Plan of 2009	<ul style="list-style-type: none"> • Ensure existing assets is put in place to deal with the likely impacts of climate change. • Enhance the capacity government ministries, civil society and private sector to meet the challenge of climate change 	Considered in subproject preparation and implementation.
5.	Bangladesh Labor Law of 2006	<ul style="list-style-type: none"> • Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement • Prohibition of employment of children and adolescent 	Considered in the EMP.

^a *ECA Amendment 2000* focuses on ascertaining responsibility for compensation in cases of damage to ecosystems, increased provision of punitive measures both for fines and imprisonment and the authority to take cognizance of offences. *ECA Amendment 2002* elaborates restrictions on polluting automobiles; restrictions on the sale, production of environmentally harmful items like polythene bags; assistance from law enforcement agencies for environmental actions; break up of punitive measures; and authority to try environmental cases. In *ECA Amendment 2010*, no individual or institution (government or semi-government/non-government/self-governing can cut any hill or hillock; fill-up or changed any remarked water body however in case of national interest; the mentioned activities can be done after getting clearance from respective the departments.

C. Government of Bangladesh Environmental Assessment Procedures

14. Under ECA, 1995 and ECR, 1997 industrial units and projects are classified into four categories according to “their site and impact on the environment” and investment size, and

each category (Green, Orange-A, Orange-B and Red) requires a different level of environmental assessment as a prerequisite for the Department of Environment (DoE) in granting the locational clearance certificate (LCC) and environmental clearance certificate (ECC) that allow the project to proceed.

15. As per Schedule 1 of ECA, 1995 Mymensingh SWM subproject is likely to be classified as red category (Table 4). Thus LCC and ECC are required from the DoE prior to commencement of the subproject.

Table 4: Likely Government of Bangladesh Classification of Mymensingh Solid Waste Management Subproject

	Subproject	Component	Equivalent in Schedule I of ECR	Department of Environment Classification
1.	Solid waste management	Community storage bins	No similar facility	Green (because bins and STS are small and unlikely to have major impacts)
		Secondary transfer station		
		Medical wastes treatment facilities	Medical wastes treatment facilities	Red
		Waste disposal (includes sanitary landfill, composting site, or access road)	Land-filling by industrial, household and commercial wastes	Red

16. Rule 7 of the ECR, 1997 indicates that the application for ECC must be made to the relevant DoE Divisional Officer, and the application for red category projects will include the following:

- (i) completed application for ECC, and the appropriate fee;
- (ii) report on the feasibility of the project;
- (iii) report on the IEE for the project, and terms of reference (TOR) for the EIA; or EIA report prepared on the basis of TOR previously approved by DoE;
- (iv) report on the environmental management plan (EMP);
- (v) no objection certificate from the local authority;
- (vi) emergency plan relating to adverse environmental impact and plan for mitigation of the effect of pollution; and
- (vii) Outline of the relocation and rehabilitation plan (where applicable).

17. DoE has 60 days to respond to receipt of the ECC application for a red category project.

18. This draft IEE will serve the basis for the ECC application and will be supplemented to fulfill any additional government requirements.

D. Relevant Occupational Health and Safety Laws and Rules

19. The implementation of the subproject shall comply with the relevant occupational health and safety Laws and Rules as shown in Table 5.

Table 5: Relevant Occupational Health and Safety Laws and Rules

Title of Laws and Rules	Descriptions
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.

Title of Laws and Rules	Descriptions
Bangladesh Labor Law of 2006	- Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement - Prohibition of employment of children and adolescent
The Employer's Liability Act, 1938	The Act declares that the doctrine of common employment and of assumed risk shall not be raised as a defense in suits for damages in respect of employment injuries. Under the Maternity Benefit Act, 1939, the Maternity Benefit Act, 1950, the Mines Maternity Benefit Act, 1941, and finally the rules framed thereunder, female employees are entitled to various benefits for maternity, but in practice they enjoy leave of 6 weeks before and 6 weeks after delivery.
Public Health (Emergency Provisions) Ordinance, 1994	The ordinance calls for special provisions with regard to public health. Whereas an emergency has arisen, it is necessary to make special provision for preventing the spread of human disease, safeguarding public health and providing them adequate medical service and other services essential to the health of respective community and workers in particular during the construction related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury and sickness benefit should be paid to people, particularly respective workers at work place under the Act.
Bangladesh Factory Act, 1979	The Act requires every workplace including small or large scale construction where women are employed to have an arrangement of childcare services. Based on this Act and Labor Laws - medical facilities, first aid and accident and emergency arrangements are to be provided by the authority to the workers at workplaces.
Water Supply and Sewerage Authority Act, 1996	The Act specify WASA's responsibility to develop and manage water supply and sewerage systems for the public health and environmental conservation.

E. Conventions, Treaties and Protocols

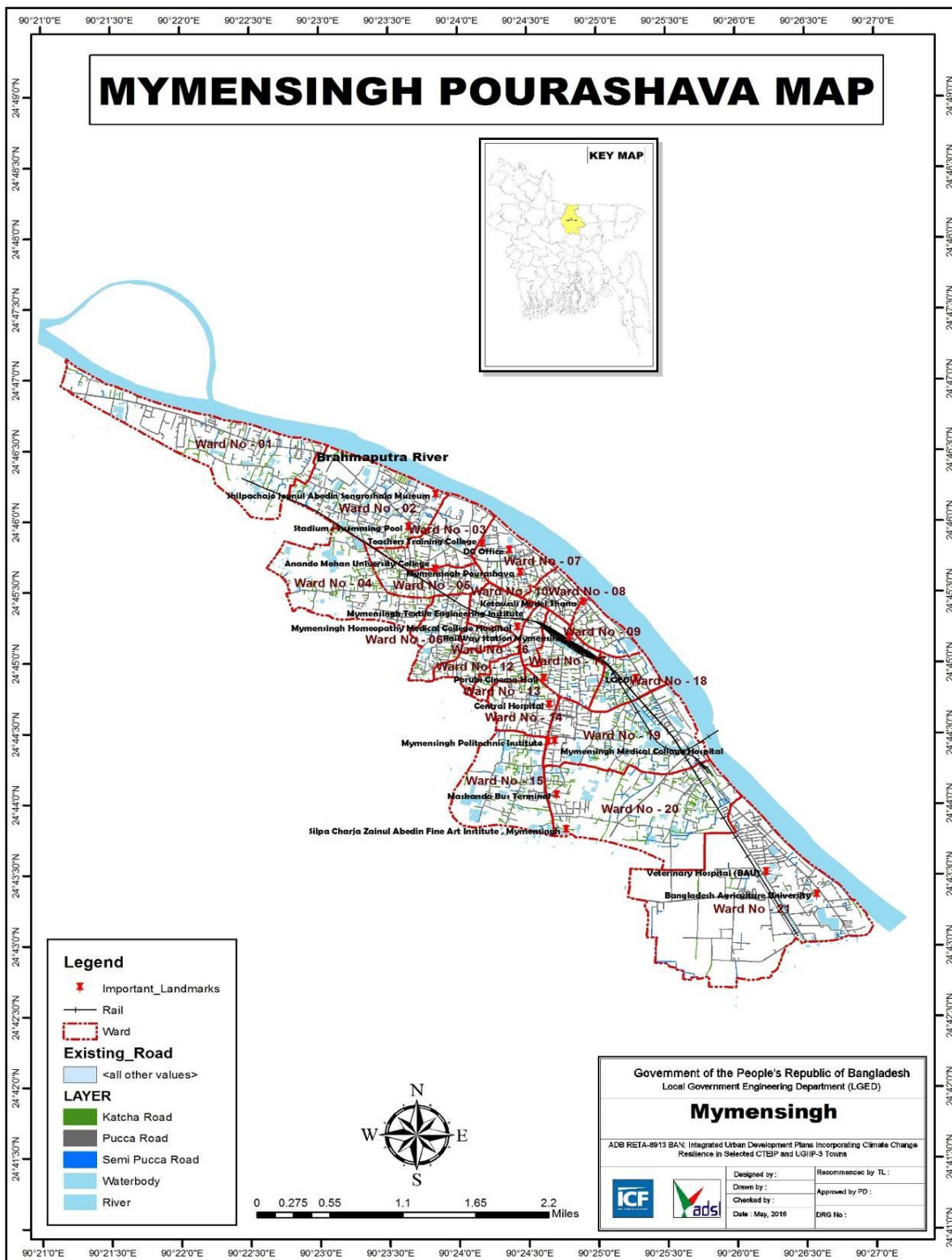
20. Bangladesh has consented to be bound by the terms of some 21 of the 44 principal international conventions, treaties and protocols relating to the environment (Islam, 1996). Those with partial and indirect relevance to industrial projects are the Paris convention of 1972 concerning the protection of the World cultural and natural Heritage, Convention concerning safety in the use of chemicals at work, Geneva 1990, Biodiversity convention, Rio-de-Janeiro, 1992, Convention concerning occupational health services, Geneva 1985 etc.

III. DESCRIPTION OF THE PROJECT

A. The Study Area

21. Mymensingh is a divisional head quarter and one of the oldest district town of Bangladesh. It is located in the northern part of Dhaka. Mymensingh district is bounded by Meghalay state of India in the north, Netrokona and Kishoreganj in the east, Tangail and Gazipur in the south and Jamalpur and Sherpur in the west. Mymensingh *pourashava* (shown in Figure 1) is located 120 kilometer (km) due north of Dhaka. It is well connected with a four-lane highway and railway with Dhaka and takes only 3 hours journey from Dhaka. The *pourashava* covers an area of 21.73 square kilometer (km²) (BBS, 2011). It consists of 21 wards. In 2011 the population of the *pourashava* was 258,040 (BBS, 2011); the population density is 11,875 persons per km².

Figure 1: Mymensingh pourashava map



Source: TA 8913 Report for UGIP-3 additional financing project preparation

22. Mymensingh *pourashava* is located on the south bank of the old Brahmaputra River. The land elevation along the river bank is high and not flooded by the river even at extreme flood periods. The land slopes away from the river bank by about 4.5 m. The southern periphery is prone to flooding during normal floods. Of the municipality's land area, 87% is built-up and 13% still considered as undeveloped or agricultural land.

B. Existing Conditions

23. **Organizational aspects.** Mymensingh Municipality is responsible for solid waste management within the municipal boundary. The area under its jurisdiction is about 21.73 km² distributed across 21 wards.

24. The entire municipal area's solid waste collection and disposal are the responsibilities of the Conservancy and Engineering Departments/Sections of the municipality. Cleaners for solid waste collection and disposal as well as for street sweeping and drain cleaning are provided by the Conservancy section; waste collection vehicles are provided by the Engineering Section. Table 6 shows the staff strength for solid waste management of Mymensingh Municipality.

Table 6: Staff Strength for Solid Waste Management - Mymensingh

Designation	Number of Employees	
	Permanent	Non-Permanent
Conservancy Inspector	1	
Conservancy Supervisor	3	
Truck Driver	15	
Ward Supervisors		21
Conservancy Worker (street sweeping, drain cleaning, and waste collection)		476

Source: Data Collected from the Municipality.

25. **Quantity of waste.** A recent study conducted by the Department of Environment (DOE)⁴ in 2013 has estimated per capita waste generation for different municipalities. This survey was conducted during the dry period of 2012. Typically, during the monsoon period, there is an increase in waste generation rate by at least 30%. The following table shows the per capita waste generation rates of different classes of municipalities during the dry season.

26. Table 7 shows the average per capita waste generation rate of different classes of municipalities during the dry season.

Table 7: Per Capita Waste Generation Rates of Different Municipalities

Population	Per Capita Waste Generation in Dry Season (kg/person/day)
Up to 50,000	0.20
50,001-100,000	0.23
100,001-300,000	0.27
300,001-500,000	0.30

⁴ Department of Environment (2013), "Final Report on Baseline Survey on Waste Generation, Character Analysis and Traffic Volume Survey in Bangladesh", report prepared by CEGIS for the Department of Environment (DOE), Government of Bangladesh.

27. Table 8 shows the average per capita waste generation rate. In Bangladesh the monsoon typically lasts for 5 months while the dry season lasts for 7 months.

Table 8: Average Waste Generation Rate for the Municipalities

Description	Per Capita Waste Generation (kg/person/day) in Dry Season*	Per Capita Waste Generation (kg/person/day) in Wet Season**	Average Per Capita Waste Generation**
Upto 50,000	0.20	0.26	0.22
50,001-100,000	0.23	0.30	0.26
100,001-300,000	0.27	0.35	0.30
300,001-500,000	0.30	0.39	0.33

Source: * DOE 2013 ** Estimated by the PPTA Consultant.

28. There are no data available regarding the total amount of solid wastes generated in the municipality. The PPTA used the average per capita waste generation rate of different municipalities from the DOE study and estimated the amount of solid waste generation for Mymensingh. The following table shows the total amount of waste generated per day in Mymensingh *Pourashava*.

Table 9: Estimated Total Solid Waste Generation - Mymensingh

Population	Year	Average Per Capita Waste Generation (kg/person/day)	Total Waste Generation (tons/day)**
296,107	2015	0.30	89
351,682	2020	0.33	116
417,688	2025	0.33	138
496,082	2030	0.33	164
589,190	2035	0.40	236
699,773	2040	0.40	280

Source: Estimated by TA 8913 consultant team for UGIP-3 additional financing project preparation

29. The total amount of solid waste generated in the Mymensingh municipal area is estimated at 89 tons per day or 32,485 tons per annum for the year 2015. It is estimated that the waste generation will reach 280 tons per day by 2040.

30. Collection of waste. Mymensingh Municipality has a primary waste collection service. Primary Collection Service Providers (PCSPs) collect waste from households or residential buildings using house to house waste collection method. For primary collection of waste, 76 rickshaw vans are currently being used.

31. Each household pays BDT50 per month for primary collection services. The typical dimension of a rickshaw van box is 0.8 m³. Based on the dimensions of the van, it is estimated that around 280 kg waste can be accommodated in the rickshaw van per trip. Each rickshaw van make between 1-3 trips per day. Approximately 22,695 households are covered by house to house waste collection service. Through primary collection services, it is estimated that rickshaw vans can collect 32 tons of waste per day.

32. There is no source separation program of waste being practiced in the municipality. In the municipality, moreover, there has been no awareness raising program by the municipality or by civil society organizations regarding segregation of waste.

33. Within the municipal area, the waste collected from households using house-to-house collection system is disposed at open secondary waste collection points and fixed dustbins. There are 93 open fixed dustbins in the municipality located at different wards. No dustbin was found at ward numbers 4, 13 and 14. Apart from road side dustbins there are 10 trailers located at ward number 9 and 11. Each trailer can carry about 0.75 tons of waste. Apart from 93 dustbins and 10 trailers, there are 88 open waste collection points in the municipality.

34. There are 95 slums in the municipal area with approximately 33,023 households. At present there is no waste collection service provided by the Municipality in the slums. Earlier 95 slum improvement committees were formed for the slums. Besides, 190 CBOs were formed previously by UGIIP II and currently 57 are active. For each CBO, 1 van was provided to collect household waste of the respective CBO area. At present, CBOs do not have any activity on waste collection from the slums. Slum dwellers are currently disposing their waste in low-lying areas and in natural drainage canals near the slums.

35. **Transportation of waste.** Mymensingh Municipality has 15 trucks (5 trucks of 5 ton capacity, 9 trucks of 3 ton capacity, and 1 tractor of 5 ton capacity) for waste transportation. Each truck makes between 1-3 trips per day. According to the truck's load carrying capacity and the number of trips it can make in a single day, the total waste carrying capacity of the existing truck is tons per day, whereas the total solid waste generated is estimated at 79 tons per day. As such, solid waste collection efficiency is estimated at 88%.

36. **Disposal of waste.** The municipality has an official landfill site near Shambhuganj Bridge. The current dumpsite has an area of 4 acres. About 95% of the dumpsite area has already been filled up. Fecal sludge collected by vacuum trucks is also dumped at the same landfill site without any treatment. The landfill site is being used since 1990. Uncontrolled crude dumping methods are used for waste disposal (Figure 2). The height of the landfill site is at the road level and most of the waste is already decomposed. There is a potential to expand the landfill site since vacant land is available around the existing landfill site. The potential also exists to increase the height of the existing landfill to 4 m above ground level by extensive redesigning.

Figure 2: Current improper practice of solid waste management at Mymensingh



Dumping of solid waste into surface drain creating drainage congestion and environmental nuisance



Disposal of solid waste beside road without bin

37. The present waste collection system is not efficient due to the following reasons:

- (i) It encourages multiple handling of waste before disposal: i) from household to rickshaw van, ii) from rickshaw van to open area/secondary storage area (dustbins), iii) open area/secondary storage area to truck, iv) from truck to landfill;
- (ii) There is no standard followed for placement of the collection points and secondary collection areas, and allocation of truck for waste transportation;
- (iii) Since the primary waste collection vehicles, i.e. rickshaw vans or handcarts, are open without a cover, they become very heavy to pull during the monsoon season; and
- (iv) There is no synchronization between primary and secondary collection systems.

Figure 3: Current Crude Dumping Site Near Shambhuganj Bridge Creating Environmental Nuisance



Pollution from existing crude dumpsite to nearby ditches and low land



Existing dumpsite near Shambhuganj Bridge

Dumping is done outside the site just beside the road

38. **Recycling and resource recovery of waste.** The bulk part of the waste generated in Mymensingh Municipality is organic in nature. Currently, the municipality has a 10 ton per day capacity compost plant. As such, the municipality can recycle 13% of the generated organic waste. The plant is located at Akua area of the municipality. Capital costs for the construction of the plant were provided by the Ministry of Environment and Forests (MoEF) through their 64 District Programmatic CDM project. The DOE has already given the environmental clearance to this project. The composting project in Mymensingh is a registered CDM project (CPA under the POA) with the UNFCCC under the 64 District Programmatic CDM project. The project is expected to reduce 1,277 tons of CO₂e per year. The municipality has handed over operation of

the compost plant to a private sector through a lease agreement. The private operator has a license to produce and market compost. As per the agreement, all the O&M costs shall be borne by the private operator, while the municipality will deliver the waste free of cost at the plant. The potential exists to recycle a greater amount of the organic component of the waste, as well as to lower the greenhouse gas emissions from such activities. Recycling of organic waste will also help to increase the life of the landfill site.

39. There are several informal recycling shops in the municipality dealing with inorganic waste such as paper, plastics, pet bottles, and irons and tins. It is estimated that 3-5% of the inorganic material in solid waste is recycled by the informal sector.

40. **Street sweeping and drain cleaning.** Apart from collection and disposal of solid waste, street sweeping and drain cleaning activities constitute major responsibilities of the conservancy section of the municipalities. Street sweeping and drain cleaning are directly related to solid waste management vis-à-vis the disposal of the dirt material removed from the drains. Generally, the common practice in the municipalities is to remove the dug-up-materials (mostly made up of grit, sand and decayed organic material) on the roadsides, then let it dry for several days, before collecting it for disposal. Though it is easy and convenient to collect and dispose the dried up materials, the practice has several shortcomings, which include:

- (i) Sludge left on the roadside gives an appearance to the town that is aesthetically less pleasing;
- (ii) Heaps of sludge are obstructions to pedestrians and other traffic;
- (iii) Sludge is dispersed by the traffic and parts of it may fall back into the drain nullifying the cleaning effort; and
- (iv) As the sludge may contain harmful bacteria and other micro-organisms, the practice may lead to spread of diseases.

41. At present, sweepers in the municipalities are employed for about four to six hours starting at 7 am. Each sweeper is assigned a length of road for which he or she is responsible. When a sweeper completes cleaning of the assigned length of road, he or she quits for the day. Street sweepers are paid on a daily basis.

42. Road sweeping operation is likely to be manual in the foreseeable future and the basic equipment consists of brooms, shovels and handcarts. This equipment should be designed to optimize the output.

43. The following table shows the total length of drains and roads in the municipalities. In terms of road width, 7% of the road are less than 10 feet width

Table 10: Total Length of Drains and Roads in Mymensingh Municipality

Municipality	Total Length of Road (kilometer)	Total Length of Drain (kilometer)
Mymensingh	121	49.87

44. Based on the available data, it is estimated that about 10 tons of waste remains uncollected per day (3,650 tons annually); this ends up in low lying areas or the drainage system, causing water logging during the monsoon season.

45. There is no proper street sweeping and drain cleaning schedule being followed by the conservancy section; there is also no standard followed in the allocation of lengths for drain

cleaning by the cleaners. It is essential that special dedicated vehicles which can access narrow roads are used for drain cleaning and street sweeping waste. Proper monitoring is essential for waste removal for the wards which are close to the large drains and khals. For proper functioning of the drainage system from such wards, the mapping of wards and neighborhoods close to the large drainage canals (which require daily collection and transportation of solid waste) is essential. Ward-wise waste generation and collection data are critical. At present, the municipality is lacking adequate data for waste management. Without proper data, it is difficult to prepare appropriate plans and strategies for waste management.

46. It was found from the field survey that there is only one official landfill site for disposal of collected waste. All the collected waste is improperly disposed of in a crude dumping manner in an unauthorized place near the embankment. The current site is almost 95% filled up.

47. Although the waste composition shows a large percentage of waste as organic in nature, recycling of organic waste is not undertaken on a large scale. Currently, only 13% of the organic waste is recycled per day. There is a potential to promote organic waste recycling by using appropriate technologies using public-private partnerships (PPP). There are opportunities for co-treatment of municipal organic waste and night soil together in the same facility. Recycling of organic waste could reduce the requirement for landfills significantly. There is no solid waste collection and disposal service available in the slums. There are 88 open waste storage points in the municipality. There is a lack of awareness amongst the municipal staff and residents about proper solid waste management. There is a gap of 51% between expenditure and income for the solid waste management.

48. **Existing situation of Fecal sludge management.** As per the National Strategy for Water Supply and Sanitation 2014,⁵ and the Institutional and Regulatory Framework on Fecal Sludge Management prepared by Policy Support Unit (PSU) of the Local Government Division, municipalities are responsible for collection and treatment of the fecal sludge from the on-site sanitation system.

49. Mymensingh *pourashava* has a vacuum truck of 2000-liter capacity for fecal sludge collection. The vacuum truck is not regularly used by the municipality. There is no fecal sludge treatment plant in the *pourashava*. Collected fecal sludge is disposed in the existing landfill site without any treatment. Since the municipality is providing limited fecal sludge collection services, majority of the demand for fecal sludge collection is met by manual cleaners.

50. There is no reliable data available regarding the daily demand for fecal sludge collection and disposal in Mymensingh. Using the estimated current population of the municipalities, and considering the Bangladesh National Building Code (BNBC) 1993, recommended fecal sludge accumulation rate of 0.04 m³/person per year, the total sludge accumulated in Mymensingh municipality has been estimated and shown in Table 11. Previous surveys in secondary towns of Bangladesh have shown that septic tank cleaning rate varies between 3-4 years, while pit latrine cleaning rate is on average 2 years (ADB, 2014 and ADB, 2005). There is no data available on septic tank or pit latrine cleaning rate for Mymensingh *pourashava*. Assuming the septic tank and pit latrine cleaning rates of the previous studies (ADB, 2014 and ADB, 2005), an estimated demand for Mymensingh municipality has been calculated and presented in Table 11.

⁵ <http://www.psu-wss.org/assets/book/nswss2014.pdf>

Table 11: Estimated Demand for Fecal Sludge Collection per Day - Mymensingh

Year	Estimated Population	Estimated Amount of Fecal Sludge Per Year m ³ /year	Percentage of Household Cleaning Septic tanks/Pits Every Year	Estimated Demand Per Day m ³ /day
2015	296,107	11,844	50%	20
2020	351,682	14,067	50%	23
2025	417,688	16,707	50%	28
2030	496,082	19,843	50%	33
2035	589,190	23,567	50%	39
2040	699,773	27,991	50%	47

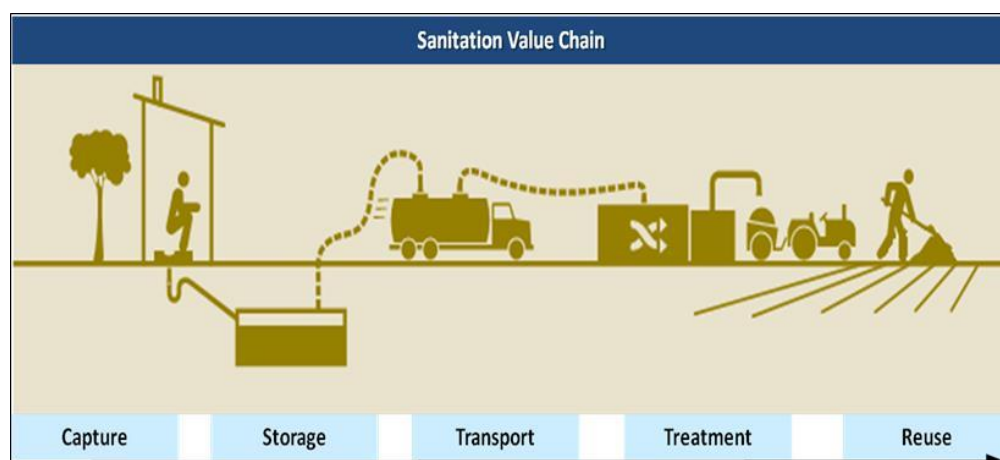
51. Key fecal sludge management issues:

- (i) There is one fecal sludge collection truck in the municipality. Most of the generated fecal sludge is collected by manual sludge cleaners.
- (ii) There is no fecal sludge treatment plant in the municipality.
- (iii) The government has already authorized the municipalities to charge a fee for sewerage/fecal sludge management which is up to 12% of the holding tax.
- (iv) As per the National Sanitation Policy and Strategy 2014, it is the mandate of the municipality to collect fecal sludge using vacuum trucks and also to possess a proper treatment facility.
- (v) There is a lack of awareness amongst the municipal staff and residents about proper fecal management.

C. Proposed Subproject Components

52. The subproject includes construction of a fecal sludge treatment facility and internal roads at existing landfill and construction of a new landfill with compost plant, leachate treatment, internal roads, boundary wall, bio-medical waste disposal facility, and 8 transfer stations.

53. **Proposed interventions for fecal sludge management.** It is recommended that the *pourashava* will construct treatment facilities at the existing landfill site near Shambujanj bridge (Mouza: Char Ishwardia); integrated landfill and resource recovery facilities can be established here with an adequate buffer zone as recommended by DOE. Within the landfill sites, a certain area has been earmarked for fecal sludge treatment. The proposed fecal sludge management intervention for Mymensingh *pourashava* will focus on the entire sanitation value chain, i.e., safely collecting fecal sludge/septage from pits and septic tanks, and conveying it to the fecal sludge treatment plant (FSTP) to be located at the landfill site.

Figure 4: Sanitation Value Chain

54. The proposed fecal sludge management intervention for Mymensingh will focus on the entire sanitation value chain i.e safely collecting fecal sludge/septage from pits and septic tanks, and conveying it to the fecal sludge treatment plant (FSTP) to be located at the landfill site (Figure 4).

55. The proposed treatment facility in Mymensingh will have a maximum capacity of 10 m³ in the existing landfill site in order to allow for incremental expansion to 20 m³ in proposed extension of the existing landfill site near Shambujan bridge ((Mouza: Char Ishwardia). This is keeping in view that an efficient, town-wide FSM system would require effective regulations (standardizing septic tank designs and sizing, disconnection of pits/septic tanks connected to drains) and operational efficiency in desludging practices. This scenario cannot be presumed as an immediate state of affairs but has to be brought about by means of generating awareness and training *pourashava* personnel. As such, once the 10 m³ plant is functional and the regulatory framework is in place (over the immediate project phase of 5 years), the incremental expansion of the treatment capacity can be undertaken for additional faecal sludge generation. It is recommended that the *pourashava* should possess a set of all the collection and conveyance equipment mentioned in Table 12 to meet daily demands.

Table 12: Equipment required for Collection and Conveyance of Fecal Sludge/Septage

SI No.	Equipment	Quantity	Volume of sludge collected (m ³)
1	Bucket System (Manual Gear) with Push Cart	2	-
2	Gulper	2	-
3	Submersible Pump	2	-
4	Transfer Station	-	-
5	Vaccu tug (2.0 cum) existing	1	5
6	Vaccutug (1.5 cum) on pick-up	1	4.5
7	Dung Beetle (0.7 cum) with auto rickshaw or	1	2.8
	Dung Beetle (0.7 cum) with Power Tiller		
Total Volume that can be collected per day			12.3

Note: Assumed number of trips for 2.5 cum, 1.5 cum vaccu tug and 0.7 cum vaccu tug and dung beetle are 2, 3 and 4 respectively.

56. A transfer station is an intermediate storage arrangement for the sludge collected from the septic tanks/pits using small motorized system (which cannot travel far distances for disposal). Transfer stations are suitable for unplanned and high density settlement areas with

limited or no access road width to the location of desludging. The *pourashava* officials, in discussion with the WLCC and TLCC members, should locate these potential areas for establishing a transfer station. An alternative for transfer stations is to unload the collected fecal sludge from small vehicles (such as dung beetle) to large vaccu trucks of 1.5 cubic meter (m^3) or 2.0 m^3 ; these can serve as a mobile transfer station for onward transportation of the collected fecal sludge to the fecal sludge treatment plant.

57. **Treatment and reuse of fecal sludge.** For treatment of fecal sludge/septage in Mymensingh, it is recommended that the fecal sludge treatment plant (FSTP) be established with a combination of the following modules having a capacity of 5 m^3 per day:

- (i) Screen and Grit Chamber;
- (ii) Settling Tank;
- (iii) Anaerobic Digester;
- (iv) Stabilization Reactor;
- (v) Unplanted Drying Bed; and
- (vi) DEWATS or Trickling Filter.

58. **Composting plant for treatment of dried fecal sludge from drying beds with solid waste.** The co-composting of dried fecal sludge with solid waste will sanitize the dried fecal sludge by using aerobic thermophilic composting. Co-composting of fecal sludge with solid waste will make the fecal sludge safe for agricultural reuse. If the *pourashava* is not interested in co-composting, the dried fecal sludge should be landfilled. Proposed conceptual design of the FSTP is shown in Figures 5-6.

Figure 5: Proposed Fecal Sludge Treatment Process

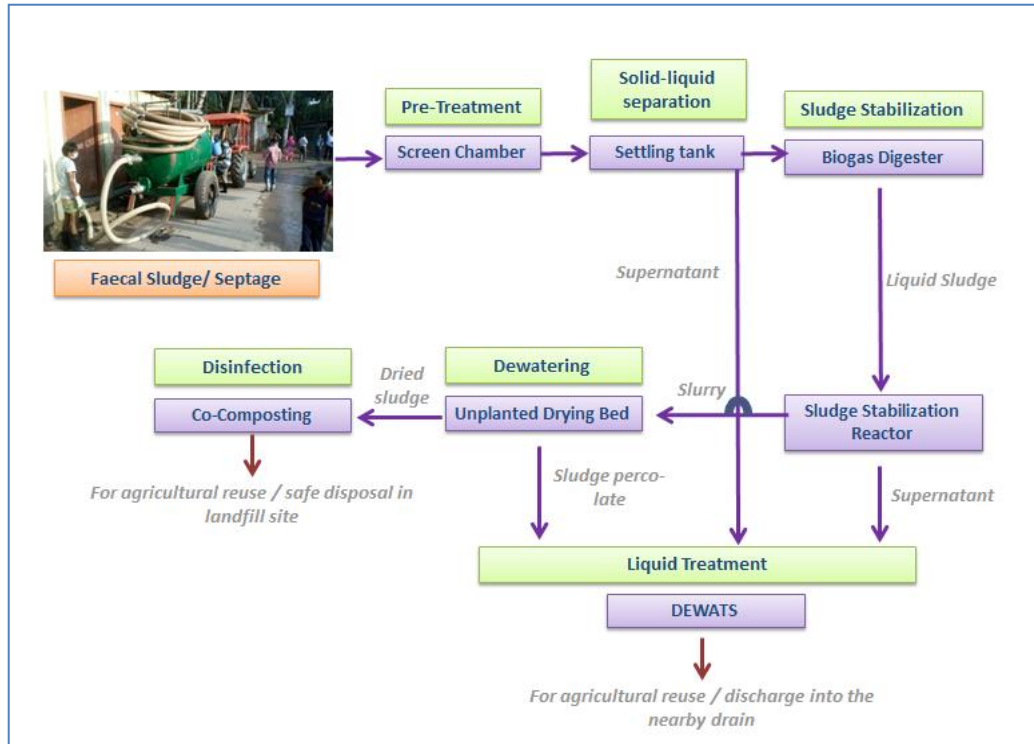
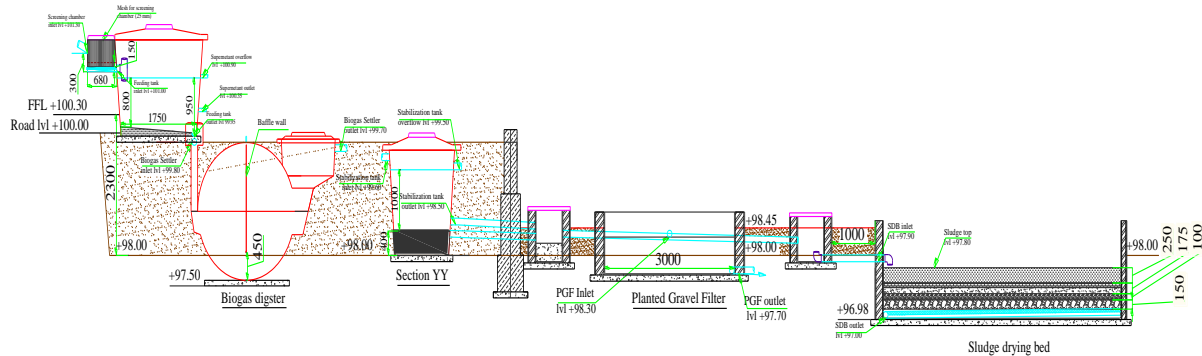


Figure 6: Hydraulic Profile of the Fecal Sludge Treatment Process



59. **Human Resources required per Vehicle for Collection and Conveyance of fecal sludge.** Periodic desludging (collection and conveyance) of pits and septic tanks should be undertaken solely by trained personnel. The collection and conveyance of fecal sludge/septage should be managed in small teams generally consisting of personnel outlined in Table 13.

Table 13: Human Resources required per Vehicle for Collection and Conveyance

Function	Number	Responsibility
Supervisor	1	Effective collection and conveyance operation, documentation, on-site supervision, certification of activity completion
Vehicle Driver	2	Safe driving of vehicle; can also work as an operator if needed
Operator	2	Carrying out collection and conveyance activities, inspections of septic tanks and pits
Helper	2	Support the operator. If driver works as an operator, operator works as a helper. (A helper is only required for desludging of a septic tank)

60. **Human Resources required Fecal Sludge Treatment Plant.** As part of building the required technical capacity to run the treatment facility at Mymensingh, the *pourashava's* Executive Engineer and the Assistant Engineer should be provided the required training in alignment with the roles and responsibilities mentioned in Table 14. In addition to the incumbent staff members' training, a dedicated operator will be provided for the FSTP's maintenance activities.

Table 14: Human Resources Required for Fecal Sludge Treatment Plant

Sl. No.	Executive Engineer	Assistant Engineer	Operator
1	To understand the project and technical design component of the treatment system	To assist the executive engineer	To carry out on-site operational activities as directed by the executive engineer or assistant engineer
2	To plan resources for the O&M activities - time frame, number of staff, equipment required, etc.	To mobilize resources for the O&M activities	
3	To prepare maintenance contract and signing the contract	To supervise O&M activities and to ensure timely completion	
4	To ensure overall supervision of the O&M activities	To train the operator/supervisor	
5	To maintain records and prepare documents and reports		
6	To train assistant engineers and operators		

61. **Cost Details for fecal sludge.** The detailed capital and operational costs are provided for in Table 15 -16 for Collection and Conveyance and FSTP respectively.

Table 15: Capital and Operational Costs for Collection and Conveyance

Equipment	Cost (BDT)
Bucket System (Manual Gear) with Push Cart	35,000
Gulper	70,000
Submersible Pump	80,000
Transfer Station	-
Vaccutug (1.5 cum) with pick-up	2,000,000
Dung Beetle 2 (0.7 cum) with CNG based auto rickshaw or	-
Dung Beetle (0.7cum) with Power Tiller	1,800,000
Total	3,985,000
Fuel Cost (@ BDT 200,000 per vehicle)	600,000
Salaries of Drivers (2 @ BDT 15,000 per month)	360,000
Salaries of Operators (2 @ BDT 9,000 per month)	216,000
Salaries of Helpers (2 @BDT 5,000 per month)	120,000
Maintenance of vaccutruck, vaccutug with pick-up, and dung beetle with power tiller (every three months or after every 10,000 km, whichever is earlier) (@ BDT 10,000 per servicing per vehicle)	120,000
Total	1,416,000

Table 16: Capital and Operational Costs for FSTP

Capital Cost	Cost (BDT)
Screen and Grit Chamber (1 no having total area of 40sq.m)	190,000
Biogas Settler (1 no, 56 cubic meter capacity having total area of 100sq.m)	571,400
Stabilization Reactor (1 no having 2 chambers, total area of 70sq.m)	524,000
Sludge Drying Beds (15 beds having total area of 400 sq.m)	3,000,000
Integrated settler, ABR and AF (1 no having 4 chamber, total area 20sq.m)	460,000
Planted Gravel Filter (1 no having total area of 40sq.m)	360,000
Plumbing and sanitary works	350,000
Sub Total	5,455,400
Contingency cost (15% of the total cost)	818,310
Other costs (boundary wall, road access, electrification, tube well) @ 30% of the sub total; total area 200sq.m	1,636,620
Total	7,910,330
Operator Salary (@ BDT 10,000 per month)	120,000
Salaries of Workers (4 @ BDT 6,000 per month)	288,000
Electricity Cost (@ BDT 1,000 per month)*	12,000
Protection Gear (@ BDT 600 per month)	7,200
Total	427,200

Note: In case pump is required

62. **Operation and Maintenance of Fecal Sludge Treatment Plant (FSTP).** Following options are available for operation and maintenance of FSTP.

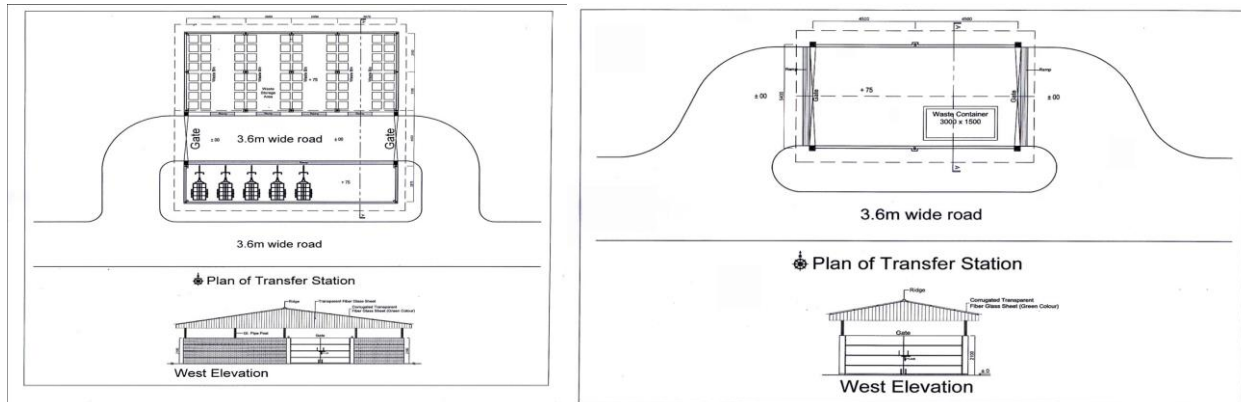
- (i) Option 1: Municipally Owned and Operated System;
- (ii) Option 2: Municipally Owned and Privately Operated System; and
- (iii) Option 3: Privately Owned and Operated System.

63. *Pourashavas* start by establishing the FSM system as a fully municipal owned and operated system as in Option 1 above. Before specific components of the system can be outsourced to private operators (as in Option 2 above), the following features need to be finalized: the capacity of the *pourashava* needs to be established, the system should be fully operational, the costs could be understood, and the benefits should be visible to the public. Once the *pourashava* has built the capacity to manage private operators, it can consider Option 3 where the entire system is privatized. A phased out transition, as described above, is possible under the phased out implementation that has been proposed for all the *pourashavas*, wherein each *pourashava* starts with a basic set of de-sludging equipment and a modular FSTP unit. The approach recommended is one of incremental expansion. The management system can also gradually increase its level of sophistication in corresponding stages. If the *pourashava* is interested in reusing the treated fecal sludge, co-composting of dried fecal sludge seems to be an attractive option since it will be possible to treat and recycle both the fecal sludge and municipal organic waste at the same site. The National Sanitation Strategy 2014 also recommends the use of treated fecal sludge as compost. However, the most critical issue in a co-composting project is the engagement of a competent operator.

64. **Proposed interventions for solid waste management.** Two types of waste collection services are found in the study area, i.e. primary and secondary waste collection. It is customary that the primary and secondary waste collection services should be compatible so that maximum efficiency can be achieved during waste collection.

65. **Improving waste storage for secondary collection of waste.** There are 93 fixed dustbins, 10 trailers and 88 open waste collection points in the municipality. In order to improve waste storage for secondary collection, small size demountable containers (2-2.5 m³ volume) are recommended for the municipality in lieu of open waste collection points and dustbins. It has also been recommended to initiate house-to-house waste collection services in the municipalities using rickshaw vans with 6-8 containers. The containers can then directly discharge the waste into the closed demountable containers for secondary collection of waste; this will reduce multiple handling of waste. Depending upon the population of the wards, at least one container should be placed in each ward. The containers should be placed on a raised base of 9 to 12 inches to avoid water infiltration inside the containers in the case of water logging during monsoon. Moreover, the containers should be not placed near the drains. It is proposed to construct 8 transfer station for solid waste management, Moreover, the containers should be not placed near the drains. It is proposed to construct eight transfer stations for solid waste management; however, the municipality so far identified location of five transfer stations. Remaining 3 will be constructed once their location will be identified by the *pourashava*. All the identified STSs are located in the government land. Proposed layout for sample transfer station is shown in Figure 7.

Figure 7: Proposed Layout Plan and location of five transfer stations in Mymensingh



Proposed Layout Plan of Transfer Station without Ramp (left diagram) and for Trailers (right diagram) for Mymensingh



66. **Improving waste transportation.** In terms of total waste transportation, labor production, and loading time, demountable trucks with closed containers appear extremely efficient compared to open trucks in Bangladeshi conditions (see pictures below). As such, Mymensingh municipality should move from an open truck waste collection and transportation system to demountable container trucks. Depending upon the road width, different types of demountable container trucks can be used. Currently, open trucks are being used in the municipality for transportation of waste. These trucks usually make 2-4 trips per day. Instead of using flat-bed open trucks, it is recommended to use small and medium size demountable container trucks in the municipalities; these types of trucks can make between 6-8 trips per day. Apart from container trucks, tractors with trailers have also been recommended for use in the peripheral wards. Table 17 depicts the O&M costs for transportation of waste using the improved system. O&M costs for the transportation of waste should be covered by the conservancy tax.

Table 17: Operation & Maintenance Costs for Transportation of Solid Waste in Mymensingh

Operational Cost	Cost (BDT/year)
Salaries of Drivers (7 @ BDT 12,000 per month)	1,008,000
Salaries of Helpers (7 @ BDT 7,000 per month)	588,000
Fuel Cost (@ 132liters of diesel per day)	3,131,700
Protection Gear (@ BDT 600 per month)	7,200
Repair and Maintenance Costs	280,000
Total	5,014,900

67. **Improving disposal of waste and resource recovery.** There is a potential to redesign the existing landfill site by excavating the old waste and using the old waste as landfill cover for the fresh waste. By redesigning the existing landfill site, and with the addition of a buffer area and boundary wall along the front side, this landfill site would not be visible from the main road. The depth of the landfill site can easily be up to 5 m with redesigning of the existing landfill site. Moreover, by excavating the old decomposed waste and redesigning, the existing land fill site can be used for a minimum of approximately 4 years. There is also available land near the existing site (8-10 acres) which can be acquired and used for a future landfill site (subsequent to 4 years).

68. The extension of the existing site should be conclusively selected following the DOE guidelines for landfilling. Moreover, an adequate buffer zone has to be provided and a distance of 500 m to the nearest dwelling should be declared as a 'no development zone' by the *pourashava*. The site will have facilities for landfilling of waste, a composting plant, fecal sludge treatment plant of 10 m³ per day capacity, leachate collection and treatment system, boundary wall, small weigh bridge, office facilities, RCC internal road, and an embankment. The landfill will have a liner at the base of the landfill site with landfill gas collection and venting system. Figure 8 shows proposed location of existing landfill with extension. Figure 9 the proposed layout of the integrated landfill and resource recovery facility at the existing site of Shambujan. Equipment such as backhoe has been considered for operation of the landfill. Looking ahead in the medium term range, a second landfill site will be required; the municipality should look for 10-15 acres of land. The *pourashava* has a plan to procure 5-10 acres of land at Pon Ghagra and Ghagra. Both the lands are outside the *pourashava* boundary.

69. Figure 10 shows the integrated process diagram for landfill management. Process flow of a typical compost plant is demonstrated below in following Figure 11. Process flow of biogas production is demonstrated below in following Figure 12. O&M costs for landfill and co-compost plant are shown in the following Table 18 and 19 respectively. O&M costs for the landfill should be covered by the conservancy tax. O&M costs for the compost plant can be covered by outsourcing the operations of the plant to a licensed compost plant operator. As such, no expenditure is required from the municipality. Outsourcing is already being used in Mymensingh and Kushtia Municipalities.

Table 18: Operation & Maintenance Costs for Landfill

Operational Cost	Cost (BDT/year)
Salary of Backhoe Driver (2 @ BDT 12,000 per month)	288,000
Salary of Landfill & Compost Plant Supervisor (1 @ BDT 12,000 per month)	288,000
Fuel Cost (@ 1 litre of diesel per 3 tons of waste landfilled)	593,125
Protection Gear (@ BDT 600 per month) 2 sets	7,200
Repair and Maintenance Costs of Backhoe (40,000
Chemicals for leachate treatment and electricity bill	48,000
Total	1,264,325

Table 19: Operation & Maintenance Costs for 13 TPD Capacity Co-Compost Plant (10 TPD existing compost plant at Akua and proposed 3 TPD co-compost at Shambuganj Landfill Site)

Operational Cost	Cost (BDT/year)
Salaries of workers (13 @ BDT 7000 per month)	1,092,000
PPE (@ 1500 per month)	36,000
Electricity Bill (@ 1000 per month)	24,000
Equipment and Bagging Costs (@ 1800 per month)	21,600
Total	1,173,600

Figure 8: Existing landfill site near Shambhuganj Bridge and proposed extension of the site



Legend:

- Existing Landfill Area
- Proposed Landfill Area

Figure 9: Proposed layout of the integrated landfill and resource recovery facility at the existing site of Shambuganj

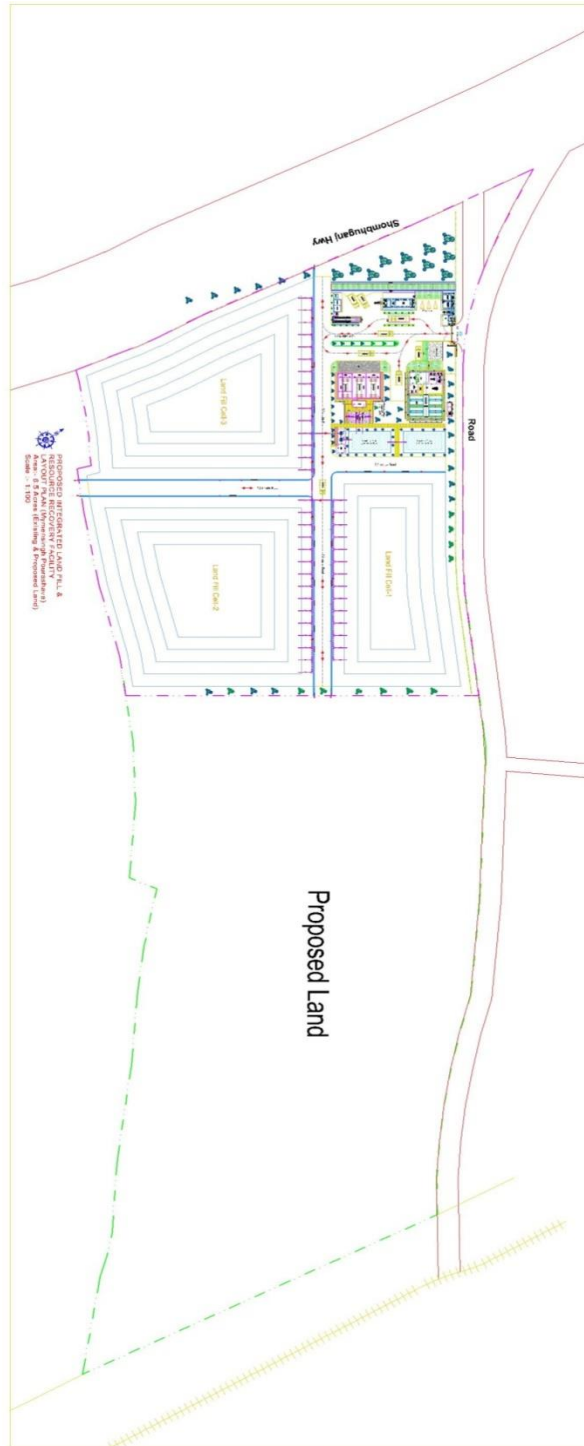


Figure 10: integrated process diagram for landfill management

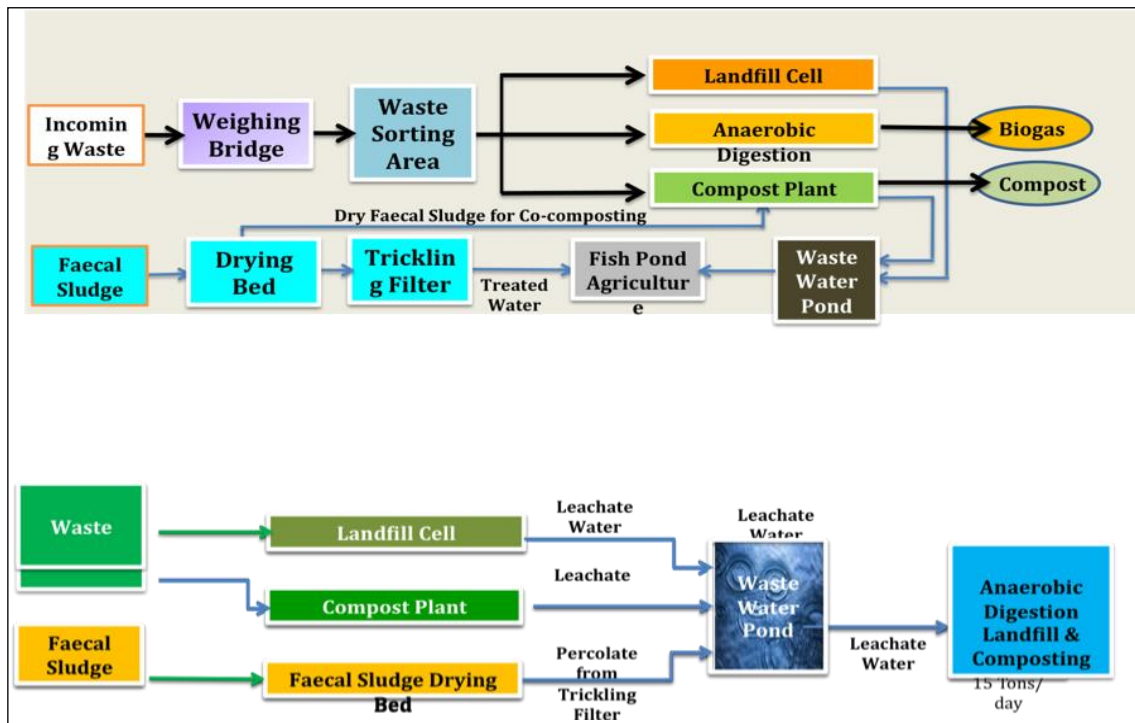


Figure 11: Process flow diagram for biogas production

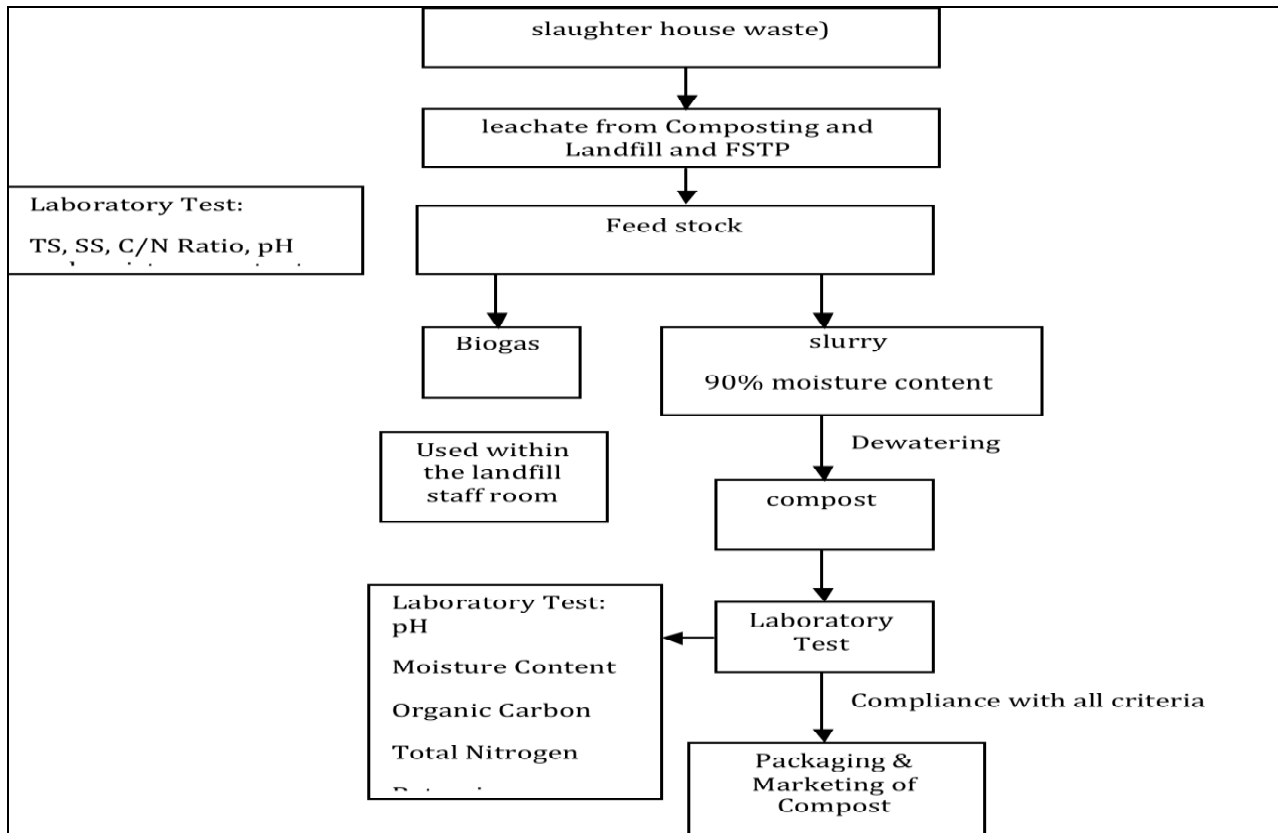
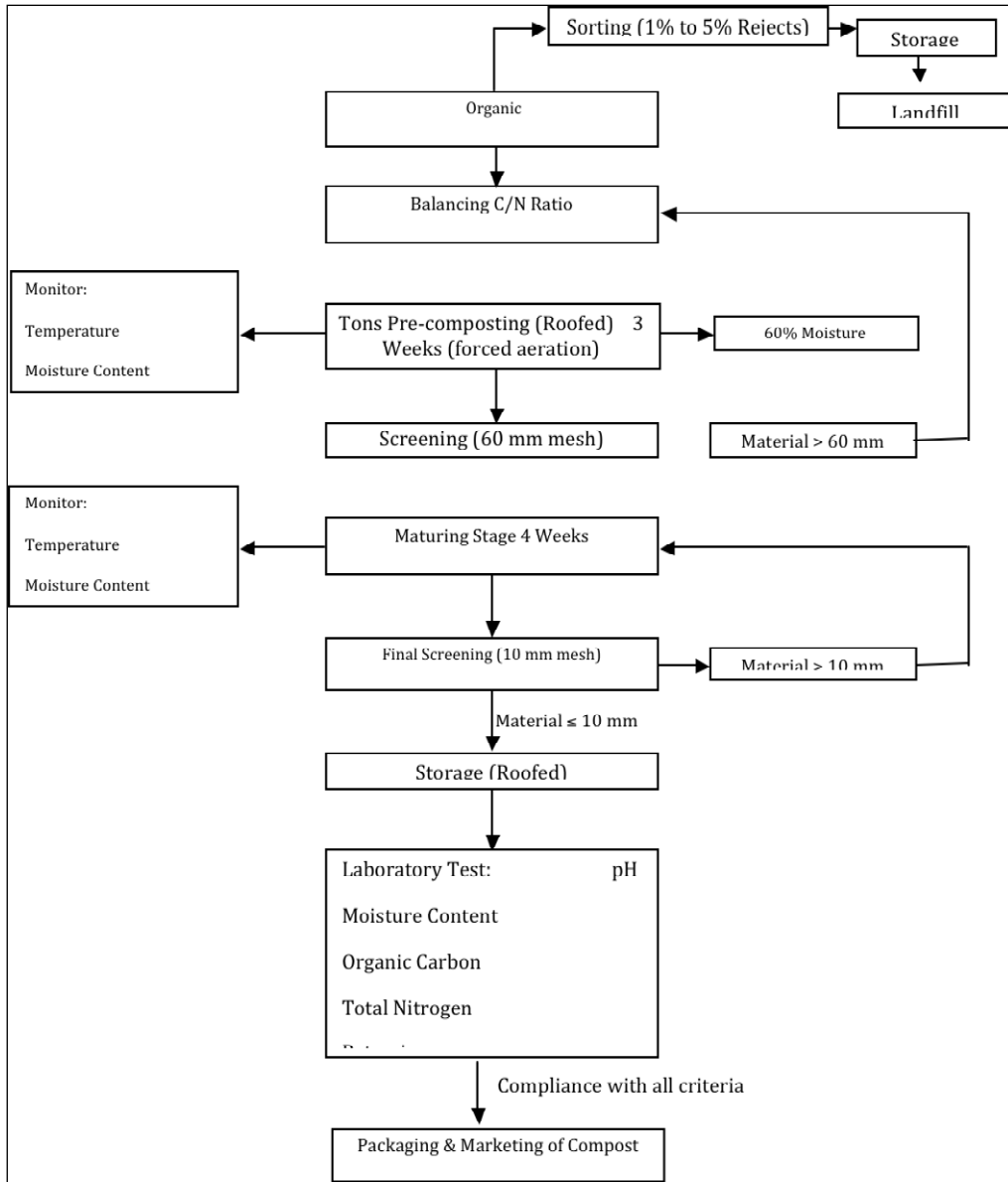


Figure 12: Process flow diagram for composting



70. **Hospital waste management:** Mymensingh *pourashava* currently lacks a proper hospital waste management system. Typically, hospital waste management systems entail both on-site waste management (which is the responsibility of hospitals and clinics) and off-site waste management (which is the *pourashava*'s responsibility).

71. Bangladesh's hospital waste generation rate is estimated at 1.2 kg/bed/day. Eighty percent of Bangladesh's hospital waste is non-hazardous. Mymensingh's 35 hospitals and 106 clinics and diagnostics have a total of 2,619 beds. As such, Mymensingh's total hospital waste generated per day is estimated at 3,123 kg/day out of which 625 kg is hazardous (infectious, sharp and discarded medicines). The hazardous waste must be collected and disposed of separately.

72. **Proposed Interventions for Hospital waste management.** Considering the amount of hazardous waste generated, as well as the current technical and financial capacities of Mymensingh *pourashava*, the following interventions are recommended to initiate proper off-site hospital waste management. For on-site hospital waste management, proper training and awareness raising campaigns must be organized by the relevant hospitals and clinics. Establishing a team of trained, motivated, and well-apprised medical personnel is of paramount importance. The team can then set up a procedure for shift-by-shift or hourly disposal of waste. Waste should be segregated at source. Each container carrying different categories of waste should be neatly packed and labelled. These containers should be stored in a safe place (out of reach of others) at the hospital or clinic for collection and transportation to a final disposal site; the latter should be undertaken under the municipality's supervision. Once the team is organized, there must be brainstorming between various personnel on how to proceed with on-site hospital waste management in an effective and sustainable manner.

73. **Collection and Transportation of Hospital Waste.** The collection and transportation of health care waste shall be carried out in a manner so as to avoid any possible hazards to human health and environment. The chances of segregated health care waste coming into contact with rag pickers at landfill sites, other members of the public, animals, etc are high during the collection and transportation operations. Therefore, all care shall be taken to ensure that the segregated health care waste, handed over by the healthcare units, reach the treatment plant without any damage, spillage, or unauthorized access by public or animals etc. A responsible person from the municipality shall always accompany the vehicle to supervise the collection and transportation of health care waste.

74. **Collection of Hospital Waste.** The health care waste generator is responsible for providing segregated waste to the municipality or municipally-appointed private operator. The wastes shall be segregated as per the Bio Medical Waste Management Rules (2008) of the Government of Bangladesh. The municipality or private operator shall not accept non-segregated waste; such incidents shall be reported to the Prescribed Authority. Temporary storage of hazardous waste shall be at designated places within the hospital or clinic.

75. The coloured bags handed over by the healthcare units shall be collected in similarly-coloured, covered containers. Each bag shall be labeled according to the category to which it belongs; this ensures that, at any time, any healthcare units that are not segregating health care wastes as per the proposed system may be traced back to the source. The coloured containers should be strong enough to withstand any possible damage that may occur during loading, transportation, or unloading of such containers. These containers shall also be labeled. Sharps shall be collected in puncture resistant containers. The individual responsible for collection of health care wastes shall carry a register in order to maintain records such as name of the

healthcare unit, the type and quantity of waste received, signature of the authorized person from the healthcare unit, day and time of collection, etc.

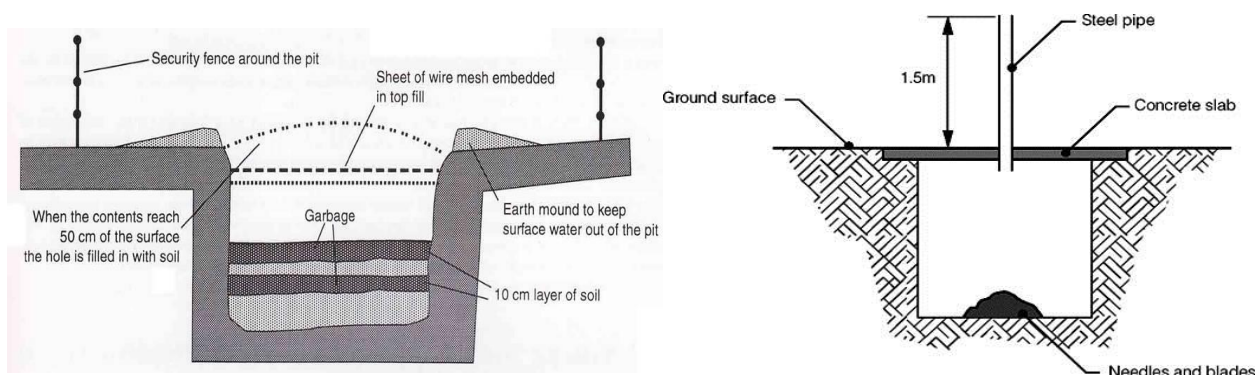
76. Transportation of the collected health care waste to the treatment facility. A specially designed 1 ton capacity small pick-up van has been proposed for the transportation of infectious waste. The waste collected in coloured containers shall be transported to the treatment facility in this fully covered vehicle. Such vehicle shall be solely dedicated for transportation of health care waste. Since the volume of the wastes to be transported is 625 kg per day, therefore a three-wheeler or small pick-up van has been proposed. The vehicle should possess the following features among others:

- (i) Separate cabins shall be provided for driver/staff and the health care waste containers;
- (ii) The base of the waste cabin shall be leak proof to avoid pilferage of liquid during transportation;
- (iii) The waste cabin may be designed for storing waste containers in tiers;
- (iv) The waste cabin shall be designed in such a manner that it is easy to wash and disinfect;
- (v) The inner surface of the waste cabin shall be made of smooth surface to minimize water retention;
- (vi) The waste cabin shall have provisions for sufficient openings in the rear and/or sides so that waste containers can be easily loaded and unloaded; and
- (vii) The vehicle shall be labeled with the health care waste symbol (as per the Bio Medical Waste Management Rules of Bangladesh); the label should also display the name, address, and telephone number of the municipality or the private operator.

77. Disposal for the Hospital Waste. Due to low amounts of hazardous waste generated in the municipality, emphasis has been placed on non-burn technologies for Mymensingh. These alternatives include: an autoclave machine and shredder, a secured landfill, or deep burial. One concrete chamber for sharp waste disposal is also included within the facility. Waste water that is generated (from cleaning and washing of equipments and from washing the waste-carrying vehicles) shall be treated at an effluent treatment plant.

78. Sanitary and Secured Landfill/Deep Burial. A provision of secured landfill has been considered for deep burial of infectious waste. The following figure 13 shows the cross section of the secured landfill.

Figure 13: Cross Section of Secured Landfill/ Deep Burial Pit (left diagram) and Sharp Waste Disposal Pit



79. Table 20 shows Proposed Interventions for Off Site Hospital Waste Management at the Landfill Site

Table 20: Proposed Interventions for Off Site Hospital Waste Management at the Landfill Site

SI No	Equipment	Area/ No.
1	Sharp waste disposal pit	200 sqm
2	Deep burial pit	1000 sqm
3	Effluent treatment plant	1
4	PPE for the staff (@ 12 sets per staff, total staff 2)	24
5	Hazardous waste collection vehicle capacity: 1 Tons, Fuel:1 Ltr/ 7 km)	1
6.	120 Liters Hospital Autoclave Machine as per HWM Rule (50Kgs/Cycle, 1 Cycle= 3 Hrs)	1
7.	Suitable Shredder for Shredding Waste	1

80. **Estimated Cost.** Following Table 21 and Table 22 shows the summary of the cost estimate of the two-stage SWM interventions for Mymensingh.

Table 21: Estimated Cost for Solid Waste Management Interventions in first stage - Mymensingh

Item	BDT (million)	USD (million)
Land acquisition for expansion of existing landfill site (10 acres)	60	0.76
Construction of fecal sludge treatment facility with percolate treatment system at existing landfill with internal roads	5.0	0.07
5 demountable trucks having 2 ton capacity with containers (60 containers of 2.5 m ³)	26.88	0.34
Purchase of 2 tractors with 6 trailers	7.5	0.10
Construction of 2 Transfer Stations (without ramp)	3	0.04
Construction of 6 Transfer Stations for Trailers	6	0.08
60 Improved Rickshaw vans (with bins) for primary collection of waste	1.8	0.02
2 Vacuum trucks (1 no 1,5 m ³ and 1 no 0.7 m ³ capacity dung beetle) and other equipment	4	0.05
Capacity Building	4	0.05
Total	118.18	1.51

Table 22: Estimated Cost for Solid Waste Management Interventions in second stage - Mymensingh

Item	BDT (million)	USD (million)
Expansion of existing landfill with compost plant and leachate treatment with internal roads and boundary wall etc.	50	0.64
Hospital waste management (collection and treatment)	8	0.10
1 excavator with 2 m ³ bucket size	10	0.13
Capacity Building	2	0.03
Sub Total	70	0.9

81. **Capacity building and community awareness campaign.** The subproject will involve training waste workers (drivers, collectors, landfill operators, etc.) and Nagorik committees. Awareness raising campaigns will be done by Mymensingh *pourashava* with assistance of the consultant teams to promote the 3R. Under the SWM subproject, a medical waste management association will be formed involving the owners of the private clinics and diagnostic centers, and the government hospital authority. The association will need to have the capacity in operation and maintenance of the designed service. The workers involved in the medical waste collection, transfer and disposal also need the relevant training.

D. Implementation Schedule

82. Implementation of UGIP-3 is in three phases based on achievement of governance criteria of the *pourashavas*. The additional financing will provide support for the project's (i) second phase = 24 months of that 18 months is assumed for construction, and (ii) third phase of UGIP-3 = 26 months.

83. It is planned to implement SWM subproject for Mymensingh in the second phase of UGIP-3. It is estimated that construction period will cover 18 months. The final detailed implementation schedule will be provided in the updated IEE once the detailed design phase is completed.

IV. DESCRIPTION OF ENVIRONMENT

A. Description of Site and Surroundings

84. Mymensingh *pourashava* was established on April 8, 1869 and later promoted in 1972 as a class "A" *pourashava*. Recently it has just been declared to be promoted to a city corporation. It is expected that Mymensingh's population, the economic activity within its boundaries and the demand for its municipal services will increase. As the regions' economic conditions improve, the municipal sphere of influence¹ will grow and the pace of the urbanization trends will increase even further. The district is a flood plain between the two mighty rivers: the Jamuna and the Meghna. The main river of the district is the Old Brahmaputra River which is a tributary of the Jamuna River and also flowing along the northern periphery of the *pourashava*.

85. Mymensingh, a historic town more than 200 years old, was once a major urban center. In the past two decades, however, the municipal population growth rate has declined, in contrast to Bangladesh's urbanization trend.

B. Physical Environment

1. Landforms, Geology and Soils

86. Bangladesh is located within one of the greatest fluvial deltas system in the world. The three major river system (Ganges-Brahmaputra-Meghna, GBM) transport sediments, supplied by the Himalayan fold belt, over a wide flood plain in to the delta. The present Bengal Basin is consist of major part of Bangladesh, part of the Indian State of West Bengal in the west and Tripura in the east. The Bengal Basin is bordered to the west by the Precambrian Indian shield, to the north by the Shillong massive and to the east by the frontal belt of the Indoburman Range. In the south it is open to the Bay of Bengal.

87. The evaluation of Bengal Basin is resulted from the collision of Indian plate and the Eurasian plate. The major tectonic elements of Bangladesh include (i) Indian / Stable platform in the northwest (ii) Arakan Yoma in the east and (iii) Deep basin to the southeast. In between stable platform and basinal part of Bangladesh there is another important flexure narrow northeast- south west trending zone called " Slope/ Hinge zone" which extends from Kolkata to Mymensingh through Pabna and separate the platform and Basinal part. Here in short the Geology of Platform and so called Hinge zone are mentioned. The Gravity, Magnetic and Seismic data indicate the presence of a structural zone, extending from Kolkata to Mymensingh. This zone has been referred to as the Kolkata -Mymensingh Hinge zone/ slope and is thought to

represent the margin of the Indian platform continental crust. Analysis of the Seismic data from India and northern Bangladesh indicates that during early Tertiary time this Hinge / slope actually represented a contemporary edge to the continental shelf and was the location of Major shelf edge Carbonate buildups during Eocene time. This zone is about 25km wide and is bounded by South slope of Rangpur Saddle and Pabna – Mymensingh Hinge line.

88. The district is a flood plain between the two mighty rivers: the Jamuna and the Meghna. The main river of the district is the Old Brahmaputra River which is a tributary of the Jamuna River and also flowing along the northern periphery of the *pourashava*.

2. Soil

89. Madhupur Tract or Red Soil Tract comprises the former greater districts of Dhaka and Mymensingh and some isolated areas in Chittagong, Comilla and Sylhet districts. The area covered under this tract is around 10,000 sq km. This tract represents the red lateritic soils of Madhupur area, a highland tract above flood level intersected by numerous large and small depressions, locally known as 'baid'. The soils of this tract have clayey texture and contain large quantity of iron and aluminium, which are highly aggregated. The pH value ranges from 5.5 to 6.0 in the topsoil. The cation exchange capacity is low and the soils have the high phosphate fixing capacity. The soils are deficient in organic matter, nitrogen, phosphorus and lime.

90. Soil of Mymensingh is formed with "Poludal" and "Alluvial" deposits. Poludal deposits are marsh clay and peats, while alluvial deposit includes alluvial silt and clay, alluvial silt and Chandina alluvium.

91. Mymensingh *pourashava* is located on the south bank of the old Brahmaputra River. The land elevation along the river bank is high and not flooded by the river even at extreme flood periods. The land slopes away from the river bank by about 4.5 m. The southern periphery is prone to flooding during normal floods. Of the municipality's land area, 87% is built-up and 13% still considered as undeveloped or agricultural land.

3. Earthquake

92. Most part of the Mymensingh district is located in a seismic zone I, referred to as the high risk zone, while a small area in the south and southwestern part is located in seismic zone II referred to as the medium risk zone for earthquake in the country. Seismic events in Bangladesh are relatively infrequent, but historically, have been severe, such as the earthquakes of 1930, 1950 and 2004. The city of Mymensingh stands on the bank of old Brahmaputra River, as in 1897 the great Assam Bengal earthquake changed the main flow from Brahmaputra to the Jamuna River which co-sided west of the greater Mymensingh region.

93. To address any potential impacts due to seismic activities, provisions of the Bangladesh National Building Code (BNBC) 1993 and 2006 shall be strictly followed in the detailed designs of project components, apart from consideration of seismic vulnerability in the specifications for the design and construction of the works, including the choice of materials and methods for construction work.

4. Ambient Air Temperature, Humidity, Rainfall

94. The temperature of the country has the relationship with the period of rainfall. In general, cool seasons coincide with the period of lowest rainfall. Table 23 shows the monthly average

temperature along with average monthly humidity of the project area. Maximum mean temperature of 28.79°C was observed in August and minimum average temperature was 17.94°C in January.

Table 23: Temperature and humidity for project area, 1975-2015

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
Mean Temp (°C)	17.94	20.93	24.96	27.21	27.74	28.49	28.50	28.79	28.35	27.14	23.61	19.41	25.26
Average Humidity (%)	75.63	69.73	68.7	74.61	80.10	85.00	85.88	85	85.3	82.4	78.1	78.02	78.66

Source: Bangladesh Meteorological Department

95. According to the data collected from Bangladesh Meteorological Department (BMD), April to June appears to be the hottest period of the year while November to February is the coolest. Average annual rainfall in Mymensingh is 2,254.15 mm, with maximum in July = 437.3 mm. During heavy rainfall, water logging causes 30-40 cm inundation, which lasts for 12-24 hours.

96. June-October is observed to be the most humid period of the year which matches the rainfall pattern of this region as more than 70% of the yearly precipitation is encountered during this four months.

5. Surface Water

97. Main River beside Mymensingh town is Old Brahmaputra. Main Rivers in the district are Old Brahmaputra, Sutia and Nageshwari. Mymensingh consists of many ponds that were once used for drinking water.

98. As leachate from the solid waste may pollute nearby water body, therefore, it is better to monitor the water quality of nearby water bodies and Brahmaputra river as well. Water samples were collected from nearby ditch of the existing landfill along with leachate. Water sample was also collected from drain near outlet and Brahmaputra river. Samples were tested by Center for Climate Change Sustainability Research, Dhaka University of Engineering and Technology, Gazipur. Results are shown in Table 24.

Table 24: Surface Water Quality Analyses (Date: 28 July 2016)

SL #	Water quality parameters	Unit	Bangladesh Inland Surface Water Quality Standard for Recreation Purpose (ECR, 1997)	River Water at Old Brahmaputra	Concentration present			Effluent discharge standard into inland surface water (ECR 1997)
					Leachate from existing landfill	Ditch water near existing landfill	Drain water near outlet	
1	Chloride	mg/l	-	110	450	170	240	600
2	Colour	PtCo	-	58	440	930	166	-
3	Hardness	mg/l	-	1.5	160	260	130	-
4	Conductivity	µS/cm	-	325	740	425	630	1200
5	Iron (Fe)	mg/l	-	0.8	3.57	1.436	1.136	1
6	pH		6.5-8.5	7.52	7.56	7.21	6.87	6-9
7	Total Dissolved Solid(TDS)	Mg/L	-	158	170	690	126	2100
8	Total	Mg/L	-	29	66	248	78	150

SL #	Water quality parameters	Unit	Bangladesh Inland Surface Water Quality Standard for Recreation Purpose (ECR, 1997)	River Water at Old Brahmaputra	Concentration present			Effluent discharge standard into inland surface water (ECR 1997)
					Leachate from existing landfill	Ditch water near existing landfill	Drain water near outlet	
	Suspended Solid(TSS)							
9	Turbidity	NTU	-	32	32	64.4	14.3	-
10	Dissolved Oxygen	mg/l	5 and above	5.7	0.46	0.98	0.88	4.5-8
11	BOD ₅ (20° C)	mg/l	3 or less	6	220	140	120	50
12	COD	Mg/l	-	11	644	405	143	200
13	NH ₃ -N	Mg/L	-	Nil	13	15	12	50
14	Total Phosphate	Mg/L	-	0.2	1.8	23.2	12.2	-
15	Sulfate	Mg/L	-	1.6	Nil	Nil	Nil	-
16	Alkalinity	Mg/L	-	98	450	1290	250	-
17	As	Mg/L	-	Nil	0.015	Nil	Nil	0.2

99. From the above result, it is observed that the water quality for Old Brahmaputra is still within the Bangladesh Surface Water Quality Standard for recreational purpose. The water was collected during monsoon. Therefore, during winter water quality may further deteriorate. Incoming water from drain and other pollution source may impact a lot in the dry period. Water quality monitoring is important. It is recommended to establish a baseline value for Brahmaputra river by taking sample from nearby the landfill site (may be underneath the Shambujanj bridge) before construction.

100. Leachate quality was analyzed, it is strong in nature with high BOD and COD. It requires treatment before disposal. Preliminary design of proposed landfill considered leachate treatment. Leaking of existing leachate to nearby water body (ditch) already polluted the water body and destroyed the nearby aquatic ecology. It is expected soil is also become polluted. Proposed landfill with proper design, operation and maintenance will improve the existing situation.

6. Groundwater

101. Water aquifers are present beneath the vast majority of Bangladesh, which are being recharged by the major river systems and by infiltration of rainwater. Most ground water is available within 7 m of the surface. This level fluctuates seasonally, approaching the ground surface over most of the country during the months July to September. (during wet season water table varies from 5-7 m and during dry season it varies from 10-12 m: Source DPHE). This fall in groundwater levels is an entirely natural process that arises because of the hydrological link with the river. Groundwater quality was obtained from DPHE in 2016 as shown in Table 25.

Table 25: Groundwater quality of Mymensingh (DPHE, 2016)

Sl. No.	Water Quality Parameters	Unit	Concentration Present at Different Production Wells				Bangladesh Drinking Water Quality Standard
			Golgonda PTW	RR water works PTW	Kalibari PTW	Goziabari Math PTW	
1.	Arsenic	mg/L	0.001	0.001	0.002	<LOQ	0.05

Sl. No.	Water Quality Parameters	Unit	Concentration Present at Different Production Wells				Bangladesh Drinking Water Quality Standard
			Golgonda PTW	RR water works PTW	Kalibari PTW	Goziabari Math PTW	
2.	Iron	mg/L	<LOQ	1.21	1.78	<LOQ	0.3 - 1.0
3.	Manganese	mg/L	0.14	0.14	0.25	0.14	0.10

Source: DPHE zonal laboratory, Barisal. (LOQ- Level of Quantization)

102. It is observed in Table 25 iron and arsenic is within acceptable limit of Bangladesh Standard in two PTWs at RR water works and Kalibari.

103. In order to monitor groundwater pollution from landfill, a groundwater sample from a shallow tube-well (less than 30 m depth) on the landfill was collected and analyzed during the field visit on 28 July 2016. The results are shown in Table 26.

Table 26: Groundwater Quality of Mymensingh

Sl. No.	Water Quality Parameters	Unit	Concentration Present of shallow tube-well water on the landfill	Bangladesh Drinking Water Quality Standard
4.	Chloride	mg/l	140	150-600
5.	Colour	PtCo	20	15
6.	Hardness	mg/l	184	200-500
7.	Conductivity	μS/cm	698	-
8.	Iron (Fe)	mg/l	4.66	0.3-1
9.	pH		6.91	6.5-8.5
10.	Total Dissolved Solid (TDS)	mg/L	161	1000
11.	Total Suspended Solid(TSS)	mg/L	28	10
12.	Turbidity	NTU	30.6	10
13.	Dissolved Oxygen	mg/l	1.98	6
14.	BOD ₅ (20° C)	mg/l	10	0.2
15.	COD	Mg/l	31	4
16.	NH ₃ -N	mg/L	13	0.5
17.	Total Phosphate	mg/L	0.5	6
18.	Sulfate	mg/L	12	400
19.	Alkalinity	mg/L	300	-
20.	As	mg/L	Nil	0.05

104. It is clear from the above result that the tube-well water on the landfill having BOD, COD, nitrate, phosphate, suspended solids from the seepage of leachate from the landfill site into groundwater. Therefore, it is clear that the existing landfill pollutes the groundwater underneath. Proposed landfill with proper design, operation and maintenance will improve the existing situation. However, groundwater monitoring is required.

7. Air Quality

105. Mymensingh is a sub-urban area of Bangladesh. In the sub-urban areas ambient air quality is dependent on many factors like air movement, traffic volume, congestion, emissions from motor vehicles, and suspended dust particles. The proposed sites are visually not found as polluted, therefore, no primary data was collected. However, a continuous monitoring scheme is essential to evaluate air quality and for the development of any plan for mitigation of health risks caused by polluted air. The six "criteria pollutants", particulate matter (PM₁₀, PM_{2.5}), CO, SO_x and NO_x have to be monitored more or less. Hence, to establish the baseline air quality, a primary analysis of air quality is proposed before start of construction. Table 27 shows the

Bangladesh National Ambient Air Quality Standard comparing the WHO Guideline and US EPA Standard

Table 27: Bangladesh National Ambient Air Quality Standard comparing the WHO Guideline and US EPA (Source: Country Synthesis Report on Urban Air Quality Management on Bangladesh, ADB 2006)

Pollutant	Averaging Period	Bangladesh Standards ^a	WHO ^b Guideline Values ($\mu\text{g}/\text{m}^3$)	US EPA Standards ($\mu\text{g}/\text{m}^3$) ^d
CO	8-hour	10,000 $\mu\text{g}/\text{m}^3$ (9 ppm)	10,000 ^c	10,000
	1-hour	40,000 $\mu\text{g}/\text{m}^3$ (35 ppm)	30,000 ^c	40,000
Pb	Annual	0.5 $\mu\text{g}/\text{m}^3$	0.5	–
NO _x	Annual	100 $\mu\text{g}/\text{m}^3$ (0.053 ppm)	–	–
TSP	8-hour	200 $\mu\text{g}/\text{m}^3$	–	–
PM ₁₀	Annual	50 $\mu\text{g}/\text{m}^3$	20	revoked
	24-hour	150 $\mu\text{g}/\text{m}^3$	50	150
PM _{2.5}	Annual	15 $\mu\text{g}/\text{m}^3$	10	15
	24-hour	65 $\mu\text{g}/\text{m}^3$	25	35
O ₃	1-hour	235 $\mu\text{g}/\text{m}^3$ (0.12 ppm)	–	235
	8-hour	157 $\mu\text{g}/\text{m}^3$ (0.08 ppm)	100	157
SO ₂	Annual	80 $\mu\text{g}/\text{m}^3$ (0.03 ppm)	–	78
	24-hour	365 $\mu\text{g}/\text{m}^3$ (0.14 ppm)	20	365

CO = Carbon monoxide; NO_x = Nitrogen oxide; O₃ = ozone; Pb = lead; PM₁₀ = particulate matter with a diameter of not more than 10 microns; PM_{2.5} = particulate matter with a diameter of not more than 2.5 microns; SO₂ = Sulfur dioxide; S.R.O. = US EPA = United States Environmental Protection Agency; TSP = total suspended particulates; WHO = World Health Organization; $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter; ppm = parts per million; – = no value
Source: ^aS.R.O. No. 220-Law, 2005; ^bWHO, 2005; ^cWHO, 2000; and ^dUS EPA, 2006.

8. Acoustic Environment

106. Sound is transmitted through air when an object moves, like water flowing over rocks, or air passing through vocal cords. This movement causes air waves, similar to ripples in water. When these waves reach human ears, they are transformed into sound. Sound is usually measured in decibels (dB). A decibel is a relative measure that is accompanied by a reference scale. Technically, sound pressure is 20 times the logarithm (base 10) of the ratio of the pressure level of any sound to the reference sound pressure in decibels. Sound (noise) levels can be measured and quantified in several ways. All of them use the logarithmic decibel (dB) scale. The dB scale is logarithmic to accommodate the wide range of sound intensities found in the environment. Table 28 shows typical sound levels generated by common indoor and outdoor activities, along with its effect on human.

Table 28: Sound levels and human response

Common Sounds	Noise Level (dB)	Effect
Carrier deck jet operation; Air raid siren	140	Painfully loud
Thunderclap	130	Painfully loud
Jet takeoff (200 feet); Auto horn (3 feet)	120	Maximum vocal effort
Pile driver; Rock concert	110	Extremely loud
Garbage truck; Firecrackers	100	Very loud
Heavy truck (50 feet); City traffic	90	Very annoying Hearing damage (8 hours)
Noisy restaurant; Freeway traffic; Business office	70	Telephone use difficult
Air conditioning unit; Conversational speech	60	Intrusive
Light auto traffic (100 feet)	50	Quiet
Library/soft whisper (15 feet)	30	Very Quiet
Broadcasting studio	20	Very Quiet

Common Sounds	Noise Level (dB)	Effect
Threshold of hearing	0	Hearing begins
Source: Davis and Cornwell (1998)		

107. Existing ambient noise levels can serve as a baseline from which to measure potential disturbance caused by subproject's construction activities. Hence, to establish the baseline noise quality, a primary analysis of noise quality is proposed before start of construction at the proposed site of the subproject. The standard for noise is shown in Table 29.

Table 29: Noise Quality Standards, by Zone and Time of Day

Zone Class	Limits in dB(A)	
	Daytime (6 am – 9 pm)	Nighttime (9 pm – 6 am)
Silent zone	45	35
Residential zone	50	40
Mixed (residential/commercial/industrial) zone	60	50
Commercial zone	70	60
Industrial zone	75	70
Source: Department of Environment (DoE), Bangladesh		

C. Biological Environment

108. There are no endangered species or critical habitats in the subproject areas. The ecological environment is characterized by a human managed sub-urban landscape. In the study area, terrestrial floras are present mainly in the homestead regions, roadsides, village groves, and cultivated lands. Homesteads and orchards have: betel nut, kadam, coconut, date palm, sofeda, mango, jackfruit, pomegranate, guava, grapefruit, lemon, blackberries, plum, toddy palm, koroi, shisoo, shirish, rain tree, evcaiytta, bamboo, babla, jeol, neem, tamarind, banana, ipil-ipil, papaya, mehgan, debdaru, shimul, akashmoni, khai babla, jamrul, chalta, bel, amra, amloki, segun, etc. Roadside plantations includes: datepalm, sal, road chambol, koroi, krishnachura, rain tree, banyan, shisoo, babla, akashmoni, eucalyptus, mango, blackberries, raj koroi, etc. Main crops Paddy, potato, wheat, vegetables. None of these species are listed as Threatened, Nearly Threatened or Rare list in IUCN Red List.

109. Fish species include ruhi, katla, mrigel, boal, gazar, kaliboush, shoil, puti, pabda, mola, koi, khorsala, kholisha, kakila, guchi baem, airh, bacha, bain, batasi, bele, chanda, chang, chapila, chela, chitol, datina, taki, tatkini, veda, magur, shing, shorputi, phali, and tengra. Exotic fishes like grass carp, silver carp, telapia, nilotica, etc. have also been introduced for commercial pisciculture in ponds and tanks.

110. Reptile includes Anjila, Dhura Shap, Matia Shap, Tiktiki, Daraish Shap, Gui Shap, etc. Comon mamals are Babur, Idur, Shial, Chika, Beji, etc. Avifauna (birds) includes Choroi, Doyel, Kak, Ghugho, Shalik, Tuntuni, Machranga, Haludpakhi, Gangchil, etc. Insect fauna includes Dragon fly nymph, Damsel fly nymph, Water strider, Midge, Flies, Ant, Caddisfly, etc. None of these species are listed as Threatened, Nearly Threatened or Rare list in IUCN Red List.

111. This bio-survey data might not reflect the actual biodiversity of that area. One species found in the monsoon might not be seen in the winter. Extensive survey over the year might give an actual status of biodiversity. Present bio-survey list is a snapshot prepared based on the species found during the field visit time.

112. There are two National Parks such as Madhupur National Park (32 km from Mymensingh town) and Kadigarh National Park (more than 50 km from Mymensingh town).

D. Physical and Cultural Heritage

113. Mymensingh, a former district of British India, was in the Dhaka division of Eastern Bengal and Assam at the era of Indian Sub-continent. It occupies a portion of the alluvial valley of the Brahmaputra east of the main channel (called the Jamuna) and north of Dhaka. The administrative headquarters were at Nasirabad, usually called Mymensingh town. The district was acquired by the East India Company with the Dewani Grant from the Mughal Emperor in 1765.

114. The area which constitutes Mymensingh was once a part of the kingdom of Kumrupa. Sultan Hossain Shah of Gaur occupied this area and named it Nasrat Shahi after the name of his son Nasrat Shah. During the period of Mughal Emperor Akbar this area was renamed as Mominshahi Pargana after the name of Mominshah, a prominent lieutenant of the Sultan of Bengal. This area was again renamed as Mymensingh in 1787, the early part of the British rule.

115. Mymensingh is famous in Archaeological as physical and cultural heritage. Archaeological heritage sites are Rajbaris and Bokaynagar Durg (fort) of Gauripur and Muktagachha Rajbari and Shashi kanti Lodge, Musium, Durgabari, Kella Tajpur, Mymensingh Town Hall Fort, Rajbari, Alexandra Castle and Gospel Church in Mymensingh Sadar. Dakbungalow's Char of Mymensingh Sadar, Chakbazar, Jelkhana Char, River bank of Shambhuganj, Boror Char, Bangladesh Agricultural University Compound etc.

116. There are about 61 daily bazars and 41 weekly hats in Mymensingh Sadar upazila (BBS 2013). There are also 15 restaurants and 25 residential hotels in the project area.

E. Socio-economic Environment

1. Population

117. Mymensingh (Town) consists of 21 wards and 95 mahallas. The *pourashava* covers an area of 21.73 km² (BBS, 2011). In 2011 the population of the *pourashava* was 258,040 (BBS, 2011); the population density is 11,875 persons per km²; male 51%, female 49%. The literacy rate among the people in Mymensingh sadar upazila is 51.7% (BBS, 2013).

118. Mymensingh *pourashava* has experienced reasonably high population growth over a long period in the past (1981-2011). Although the annual growth rate differs between various inter-census periods during the period, but the average annual growth rate over a 30-year period between 1981 and 2011 shows 3.25% annual growth of population. Infrastructure improvements will help sustain a reasonably a high growth of population in the *pourashava*.

119. Besides, the *pourashava* is the divisional headquarters of Mymensingh Division and may soon become a city corporation. These positive changes in favor of the *pourashava* will help Mymensingh *pourashava* to sustain a high growth rate. A 3.50% annual average population growth, therefore, seems to be reasonable and may continue in the long-term future.

2. Livelihood Practices and Economic Activities

120. Agriculture 34.57%, non-agricultural laborer 4.05%, industry 1.01%, commerce 19.18%, transport and communication 6.68%, service 16.54%, construction 4.03%, religious service 0.24%, rent and remittance 0.86% and others 12.84%. (Source: Banglapedia). Ownership of

agricultural land Landowner 45.26%, landless 54.74%. Agricultural landowner: urban 37.57% and rural 52%. Fish of different varieties abound in this district. Moreover, varieties of fish are caught from rivers, tributary channels, even from paddy field during rainy season. Some valuable timber and forest trees are grown in the district. Out of 4363.48 km² of the district, forest and riverine areas occupy about 147.00 km² and 106.71 km² respectively.

121. Other than these, diary, poultry and hatchery are also present. Noted manufactories are garments factory, Textile mills, Fish Feed, Jute Mill, Steel Factory, flour mill, ice factory, tannery, welding factory, bidi factory and Shambhuganj Power Station. Among small industries citable are cottage industries, Goldsmith, blacksmith, potteries, wood work, bamboo work, weaving, embroidery, silk work, tailoring etc. Main exports are paddy, banana, leather, vegetables.

122. Main crops are Paddy, jute, sugarcane, wheat, oil seed and pulse, betel leaf, karalla, sweet potato, turmeric, ginger, brinjal, cauliflower etc. Main fruits are Jackfruit, banana, pineapple, papaya, kadbhel, guava, boroi, amloki, palm, latkon etc.

3. Infrastructure

123. **Electricity.** All the wards and unions of the upazila are under rural electrification network. However 38.38% of the dwelling households have access to electricity.

124. **Water Supply:** At present, piped water is supplied to the consumers through 8,233 nos. service connections. All types of the service connections are metered at Mymensingh. Connection fees of 38 mm and 50 mm dia. for domestic, commercial and institutional connections were increased from 1st July, 2016. At present, water supply coverage is only 31% (by production).

125. **Drainage System:** The drainage system of the *pourashava* is limited, with the four primary khals— namely the Sehra, Makarjani, Gohailkandi and Akua Khals—which are stretching from north to south with culverts under the rail line. These khals are fed with almost all the secondary and tertiary drains of the *pourashava* except the few drains falling directly to the river. The Sehra, Makarjani and the Gohailkandi Khals are again falling to the Akua Khal and almost all the storm runoff of the *pourashava* is draining through the Akua Khal. The Akua Khal is running out of the *pourashava* and ultimately falls to the Brahmaputra River away from the *pourashava*. Therefore the efficiency of drainage of the *pourashava* is depending upon the condition of these four khals. In respect of drains, the aggregate drainage length in the *pourashava* stands at 139.95 km. The lengths of brick drain, cement concrete drain, and RCC drain are 100.24 km, 4.52 km, 4.76 km, and 30.43 km respectively. The condition of the drains is largely poor, with most of them have no proper outfall.

126. **Sanitation:** The existing sanitation situation is as follows:

- Total Household (HH) no. as per BBS 2011 : 54,86
- Total Household (HH) no. : 58,085
- % of HH toilets with septic tank +Soak pit : 14%
- % of HH toilets having septic tank only : 28%
- % of HHs with ventilated improved pit latrine: 51%
- % of HHs having no latrines : 7%
- No. of existing Public Toilets : 5
- Pit Latrines installed at slum areas under UPPR, P of LGED: 3996
- No. of existing community latrines : 31 for 3 ~ 5 families (single +double)

127. Mymensingh, a historic town more than 200 years old, was once a major urban center. In the past two decades, however, the municipal population growth rate has declined, in contrast to Bangladesh's urbanization trend.

F. Description of Site and Surroundings

128. Mymensingh *pourashava* was established on April 8, 1869 and later promoted in 1972 as a class "A" *pourashava*. Recently it has just been declared to be promoted to a city corporation. It is expected that Mymensingh's population, the economic activity within its boundaries and the demand for its municipal services will increase. As the regions' economic conditions improve, the municipal sphere of influence¹ will grow and the pace of the urbanization trends will increase even further. The district is a flood plain between the two mighty rivers: the Jamuna and the Meghna. The main river of the district is the Old Brahmaputra River which is a tributary of the Jamuna River and also flowing along the northern periphery of the *pourashava*.

129. Mymensingh, a historic town more than 200 years old, was once a major urban center. In the past two decades, however, the municipal population growth rate has declined, in contrast to Bangladesh's urbanization trend.

130. The Climate Resilient Integrated Urban Plan report prepared by TA 8913 consultants for preparation of additional financing provides a short account of the potential and vulnerabilities of the *pourashava's* economy. Mymensingh has two primary economic drivers, the education and the health service sectors. Despite its proximity to Dhaka, it currently lacks propulsive industries with interdependent linkages that are critical to stimulating economic growth. Current development is mainly organized in a linear pattern along transportation routes. Residential development appears to be expanding in different directions simultaneously, with a widespread distribution of housing that municipal services have not been able to match. Municipal services are severely limited and inadequate to meet current demand.

G. Climate Change Impacts

131. While there is a lack of infrastructure for drainage, roads, solid waste, water supply and sanitation, identification of the resilience dimensions and prioritization of goals for development would be the major tasks for climate resilient integrated urban development in the *pourashava*.

132. Besides, fast growing town, Mymensingh is under threat of climate change impact. It is likely to face the following potential climate change impacts:

- (i) Due to increase of rainfall, drainage congestion, water logging and flash flood will increase. Low laying areas will be inundated, prevail unhygienic condition in drainage and sanitation, will result disease spreading;
- (ii) There will be an increase in the number and severity of tropical cyclones causing damage to property and life;
- (iii) The major problem contributing to Mymensingh's vulnerability as a whole is the lack of basic services, especially water supply, drainage, sanitation and waste management;
- (iv) Unplanned development and lack of control over development arising from lack of attention to urban planning, will cost dearly in the long run;
- (v) There will be increased costs of infrastructure development, and O&M;

- (vi) Agriculture will be affected leading to an increase in poverty. More funds will have to be injected to tackle unemployment and poverty;
- (vii) River bed rise already makes gravitational flow of drainage water into the river difficult; and
- (viii) With agriculture affected in rural areas, there will be poverty and increased rural-urban migration. Urban poverty will increase, requiring more money for poverty alleviation.

V. ASSESSMENT OF ENVIRONMENTAL IMPACTS AND SAFEGUARDS

A. Methodology

133. Issues for consideration have been raised by the following means: (i) input from interested and affected parties; (ii) desktop research of information relevant to the proposed subproject; (iii) site visits; and (iv) evaluation of proposed design scope as per PPTA study and potential impacts.

134. The corridors of impact considered include: (i) existing landfill to be rehabilitated; and (ii) extension is proposed along with existing landfill on vacant land. Land acquisition is required for 8-10 acres land along with the existing landfill. Categorization of the subproject and formulation of mitigation measures have been guided by ADB's REA checklist for roads improvement (Appendix 1) and ADB SPS, 2009.

B. Screening out Areas of No Significant Impact

135. From the preliminary design and results of the rapid environmental assessment, it is clear that implementation of SWM subproject at Mymensingh will not have major negative impacts because activities will be localized/site-specific and short in duration. Construction will be conducted within a relatively small area. Because of these there are several aspects of the environment that are not expected to be affected by the subproject (Table 29) and thus can be screened out of the assessment at this stage but will be assessed again during detailed design stage and before implementation.

Table 29: Fields in Which the Subproject Is Not expected to have Significant Impacts

Field	Rationale
A. Physical Characteristics	
Topography, landforms, geology and soils	Required amount of materials will not cause alteration of topography, landforms, geology and soils. Erosion hazard is insignificant as trenching and excavation works will be conducted only during construction stage (short-term) and specific to sites.
Climatic conditions	Short-term production of dust is the only effect on atmosphere. However, impact is short-term, site-specific and within a relatively small area. There are well developed methods for mitigation.
B. Biological Characteristics	
Biodiversity	Activities being located in the built-up area of Mymensingh <i>pourashava</i> will not cause direct impact on biodiversity values as identified flora and fauna are those commonly found in built up areas. The construction activities do not anticipate any cutting of trees.
C. Socioeconomic Characteristics	
Land use	The subproject is located in an agricultural area.
Type of community spread	No alteration on type of community spread.
Socio-economic status	There is small land acquisition required beside the existing landfill, which is found as vacant land. Affected persons and structures will be addressed separately in the

Field	Rationale
	resettlement plan developed as per Government of Bangladesh laws and ADB SPS, 2009. Manpower will be required during the construction stage, this can result to generation of contractual employment and increase in local revenue.
D. Historical, Cultural, and Archaeological Characteristics	
Physical and cultural heritage	The subproject components are not located in or near and excavation works will not be conducted in the vicinities of identified historical sites.

C. Anticipated Impacts and Mitigation Measures – Planning and Design Phase

136. **Subproject selection criteria.** The project environmental assessment and review framework specifies environmental criteria to avoid or minimize adverse impacts during the identification and finalization of drainage subprojects. Table 30 summarizes site and design considerations as per preliminary design.

Table 30: Site and Design Considerations to Meet Environmental Assessment Review Framework Environmental Criteria

Environmental Selection Guidelines	Remarks
1. Overall selection guideline	
i. Comply with all requirements of relevant national and local laws, rules, and guidelines.	See Section II of this EARF
ii. Avoid/minimize where possible locations in protected areas, including notified reserved forests or biodiversity conservation hotspots (wetlands, national reserves, forest reserves, and sanctuaries).	Approval from concerned authority if unavoidable
iii. Avoid possible locations that will result in destruction/disturbance to historical and cultural places/values.	Provide for the use of “chance find” procedures in the EMP that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.
iv. Avoid tree-cutting where possible. Retain mature roadside trees which are important/valuable or historically significant. If any trees have to be removed, plant two new trees for every one that is lost.	Approval from Department of Environment
v. Ensure all planning and design interventions and decisions are made in consultation with local communities and include women. Reflect inputs from public consultation and disclosure for site selection.	All consultations should be documented and concerns expressed by public addressed in IEEs.
2. Solid waste management	
i. Ensure small (secondary) transfer stations are not located within 30 m of residences, schools, places of worship (such as churches, temples or mosques), and historical and cultural places.	Special design measures to be adopted if this cannot be adhered to.
ii. Ensure all new landfills and secondary transfer stations are not constructed in areas where the groundwater table is less than 2 meters below ground level.	Special design measures to be adopted if this cannot be adhered to.
iii. Locate all new landfills at least 250 m from habitation, sensitive receptors, shops, or any other premises used by people, thus establishing a buffer zone to reduce the effects of noise, dust, and visual appearance of the site, and travel of leachate into any water body..	Distance restriction may be reviewed depending on site availability, buffer zone planning, and leachate technology.
iv. Locate all new facilities/buildings at sites where there is low risk of flooding or other hazards that might impair functioning of, or present a risk of damage to the facilities, or their environs.	Flood data of the project area needs to be reviewed. Location restriction may be reviewed depending on site availability, and flood or other hazards control planning.

Environmental Selection Guidelines	Remarks
v. Ensure no new landfills are constructed within or near water supply wells, and at least 500 m of any groundwater wells.	Locational clearance from Department of Environment needed.
vi. Ensure a buffer zone is provided around the landfill with the distance agreed upon with the regulatory agencies	
vii. Ensure designs and operations of new landfills are done as per norms of modern sanitary facilities and to include all essential elements necessary to prevent environmental pollution and to ensure safe handling of waste during construction and operation.	Landfills to include the following: liner system to prevent leachate, leachate collection system and control facility, gas vent system, final cover system, surface water drainage system, environmental monitoring system for air, water, soil, odour, and gas. Operations and maintenance manual (O&M) shall include closure and post-closure plan.
viii. For medical waste treatment facilities comply with Medical Waste Rules, 2008	Incinerators will not be considered in UGIIP-3
ix. Locate new medical waste treatment facility at least 50 m away from nearest habitation.	Special design measures to be adopted if this cannot be adhered to.
x. Ensure a separate receiving and sorting area for medical wastes	
xi. Provide back-up power source for medical treatment facility to ensure uninterrupted operations	
i. Include measures to address additional sewage/domestic wastewater due to improved/new water supply system	

137. **Land acquisition and resettlement.** The existing land used as a dumping site (4 acres) is owned by Mymensingh *pourashava*. The proposed extension will require another 8-10 acres of land adjacent to the existing landfill. Any land acquisition and involuntary resettlement impacts will be addressed in the RPs prepared as per requirements of ADB SPS and Government of Bangladesh rules and regulations.

138. Cutting of trees will not be required as per preliminary design. This will be reassessed during detailed design stage and if cutting of trees will be required, compensatory plantation for trees lost at a rate of 2 trees for every tree cut will be implemented by the contractor, who will also maintain the saplings for the duration of his contract.

139. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. Locations and siting of the proposed infrastructures were considered to further reduce impacts.

140. The concepts considered in design of the Mymensingh solid waste management subject are: (i) locating facilities on lands owned by the government/*pourashava*; (ii) taking all possible measures in design and selection of site to avoid resettlement impacts; (iii) avoiding where possible locations that will result in destruction/disturbance to historical and cultural places/values; (iv) avoiding tree-cutting where possible; (v) ensuring all planning and design interventions and decisions are made in consultation with local communities and reflecting inputs from public consultation and disclosure for site selection.

141. **Environmental Considerations in Design.** By considering certain features in the engineering design of a sub-project, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a sub-project. Table 31 shows environmental impacts and environmental considerations to be included in design to reduce the impacts, this can be considered during detailed design.

142. **Impact on Sensitive Areas.** There are two National Parks Madhupur National Park (32 km from Mymensingh town) and Kadigarh National Park (more than 50 km from Mymensingh town). However, subprojects would not have any impact on these due to the nature, extent and magnitude of activities.

143. **Selection of construction camp, material shed and site selection of sources of materials.** Site selection of construction work camps, stockpile areas, storage areas, and disposal areas will be done to avoid any impacts on the nearby environment and community.

Table 31: Environmental Impacts and Environmental Considerations to Be Included In Design to Reduce the Impacts

Sub-project	Environmental Impacts	Design Considerations to mitigate impacts
Solid waste management	<p>High volume of solid waste</p> <p>Lack of recycling and segregation of waste</p> <p>Improper solid waste management secondary transfer stations may cause leachate leaching to nearby water bodies including groundwater. This will substantially reduce the dissolved oxygen of the water bodies and affecting the aquatic ecology.</p> <p>Improper disposal of bio-medical waste</p>	<p>Enhance sustainability and promote the 3Rs of waste (reduce, reuse and recycle)</p> <p>Diversion and conversion of bulk part (about 50%) of the waste into resources (compost, biogas, energy, inorganic waste recycling).</p> <p>The remainder will go to a scientifically managed 'cut and fill' system (controlled landfill), where leachate water from waste, venting of landfill gas, impermeable matter introduced at the base as liner, daily cover material on the top fresh waste are considered to be handled scientifically.</p> <p>Secondary transfer station should not be placed within near water body and drains. Depending upon the population of the wards, at least one container should be placed in each ward. The containers should be placed on a raised base of 9 to 12 inches to avoid water infiltration inside the containers in the case of water logging during monsoon. Proper solid waste management practice is strictly required to follow. Regular water quality monitoring of nearby surface water bodies and ground water is required to conduct</p> <p>A bio medical waste management facility is also to be incorporated into the design of the proposed facility.</p> <p>All these approaches are already incorporated in the preliminary design of the solid waste management</p> <p>The existing landfill pollutes the groundwater underneath, nearby water bodies and creates environmental nuisance. Proposed landfill with proper design, operation and maintenance will improve the existing situation. However, groundwater and surface water monitoring is required.</p>

144. **Climate Change Adaptation and Disaster Risk Management Considerations.** The *pourashava* needs to deal with the impacts of climate change that are mainly associated with increased rainfall, rain-driven drainage congestion and urban flash flooding. Inadequate drainage and waste management systems are contributing to localized flooding, drainage congestion, waterlogging and water pollution. The majority of waterlogged areas seem to be in the municipality's newer areas, away from its historic business district. Inadequate drainage and waste management systems are contributing to localized flooding, drainage congestion, water logging and water pollution.

145. Flash flood and waterlogging will be accelerated due to increase of climate change impacts. It is recommended that project design construction, especially design material, method of construction should be taken appropriate to make the Project climate-proof and disaster resilient. During the detailed design, the Environment Specialist properly consulted with the design team to incorporate this impact. The climate change impact and necessary consideration in design for adaptation is shown in Table 32.

Table 32: Climate change impact and design considerations

Climate change effect/impact factor	Impact	Design consideration for mitigation
Water level high/Sea level rise	Inundation of low laying area. Creation of nuisance due to frequent inundation if solid waste landfill and/or secondary transfer station are located on low laying area	Location of the landfill and STS should not be in the low laying area. Build the embankment around the landfill with a height considering highest flood level. Location of landfill should be at least 20m preferably 100m away from river. Tree plantation need on the embankment to create buffer zone
Salinity	All construction material will be impacted due to salinity: corrosion and dampness	All construction material should saline resistant, anti-saline admixture can be used
Cyclone and tidal surge	Wind speed will damage structurally to building, damage to plant and vegetation, tidal surge will damage embankment, cyclone may damage landfill operation, may dislocate waste and create nuisance	Structural design should consider cyclone wind speed; wind breaker can be introduced around the building and site; Plant timber trees, proper cross drainages should be provided to the embankment, design should consider height of the storm surge; drain valve can be used at drain outlet to protect backwater flow from drain. Landfill daily cover and compaction should be strictly maintain in daily operation of the landfill
Floods and water logging	Erosion to internal road surface and structural damage to drain and road due to over topping and water logging; ground floor of the building can be flooded due to low plinth building; overflow of sanitation can create nuisance and disease spreading, tube-well can be contaminated due to intrusion of flood water. Nuisance may create due to frequent flooding/waterlogging if solid waste landfill and/or secondary transfer station are located on flood prone or water logged area	Proper side drainage and cross drainage should be provided to road, road and drain design should consider high flood level, plinth level of building should be raised considering high flood level, toilet and other sanitation structure should constructed on raised ground, tube-well should be also placed raised ground. Location of the landfill and STS should not be in the flood prone/water logging area. Build the embankment around the landfill with a height considering highest flood level.
Lack of drinking water	Effect on water supply, disease can be spread due to drink impure water	Water supply should consider water demand properly, surface water should be used as water source for treatment plant
Drought	Impact on plant and vegetation, water scarcity, delay in landfill digestion mechanism due to lack of moisture, load shedding of electricity	Pond should be excavated and re-excavated, Proper electric supply system should be established, solar electric should be used rather than conventional electric supply, More tube-well should be sunk
Construction materials' quality		Most durable materials possible, even if higher cost, e.g. concrete, high quality bricks should be chosen; anti saline admixture should be used; Construction quality should be monitored and controlled
Rising temperatures		Works during most favorable times of year and day should be executed; Preparing, placing and curing concrete and mortar, to ensure placement, etc., during most favorable

Climate change effect/impact factor	Impact	Design consideration for mitigation
		times should be monitored and controlled; plain high-quality un-rendered brickwork and high quality cement mortar in preference to rendered low-grade bricks should be used; sulphate resisting cement should be used in vulnerable locations (higher heat gain during curing) or cement containing fly ash (less heat gain, so preferred)
Runoff		Trapezoidal section side drains with small low-flow section (cunette) for low flows should be used; Side drains should be lined to achieve higher discharge velocities without increasing risk of scour, etc.

D. Anticipated Impacts and Mitigation Measures – Construction Phase

146. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the built-up area of the *pourashavas*, will not cause direct impact on biodiversity values.

147. **Construction method.** Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the materials (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. The infrastructures will be constructed manually according to design specifications. Any excavated road will be reinstated.

148. Under the SWM subproject the civil construction works are for controlled landfill site development including controlled building, worker shed, heavy equipment shed, compost facility, leachate treatment pond, waste unloading area, leachate collection pond and embankment around the landfill site. The controlled building, worker shed, and heavy equipment shed all will be of tin-shed supported by iron/wooden truss, brick walls and brick/ reinforced cement concrete (RCC) foundation. Other than the heavy equipment shed all will have cement concrete floor and brick/RCC foundation. The heavy equipment shed will be of RCC floor. These structures will be built on the existing waste dumping site and the foundation and base construction works involve removal of the existing decomposed wastes to a required depth, filling it with construction debris and soils, compacting layer-by-layer to make the base of the rooms strong enough to support loads. For the waste unloading area and down-ramp there will be RCC works of top surface and the underneath is sand filling with side slope protection works. Except the front side, which is the highway, three sides of the area will be enclosed with an earthen embankment. The soils required for the construction of the embankment will be imported from other areas. Alternatively, the soils can be taken by making borrow pits in the area inside the embankment subject to the soil investigation; this will increase the waste loading capacity and so the lifespan of the landfill site. The compost plant area will be of cement concrete floor and tin-shed without any surrounding wall to encourage free flow of air/oxygen for promotion of aerobic digestion of composting. The area of the plant will be formed with earth-filling along with side slope protection works for the earth filling works. The leachate pond will be constructed of digging earth subject to the geological investigation of the area (in case there is a natural impermeable soil layer for groundwater protection and groundwater depth is much high). For artificial liner at

the base and groundwater depth is low, the pond will be made of RCC works and in this regard a special type of high density concrete will be required to use.

149. Also there will be two rooms (one for recyclable material storage and sorting, and the other for hazardous medical waste storage and putting other equipment). These two rooms will have tin-sheds, cement concrete floor, brick walls, and brick/RCC foundation.

150. There is sufficient space for a staging area, construction equipment, and stockpiling of materials. However, the contractor will need to remove all construction and demolition wastes on a daily basis.

151. Although construction of these project components involves quite simple techniques of civil work, the invasive nature of excavation and the project sites in built-up areas of Mymensingh where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are short-term, site-specific and within a relatively small area. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, Mymensingh SWM subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with construction activities can be mitigated to acceptable levels with the following mitigation measures (Table 33).

Table 33: Anticipated Impacts and Mitigation Measures – Construction Phase

Field	Impacts	Mitigation Measures
A. Physical Characteristics		
Topography, landforms, geology and soils	On a cumulative effect of all types of subprojects in the <i>Pourashava</i> , a significant amount of gravel, sand, and cement will be required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> Utilize readily available sources of materials. If contractor procures materials from existing borrow pits and quarries, ensure these conform to all relevant regulatory requirements. Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> Prepare and implement a spoils management plan (Appendix 3). Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Mymensingh local authority on designated disposal areas. All earthworks must be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any Solid Waste Management leading to water bodies. Take all precautions to minimize the wastage of water in the construction activities. Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the Solid Waste Management leading to the water bodies.

Field	Impacts	Mitigation Measures
		<ul style="list-style-type: none"> • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross Solid Waste Management channels. • Monitor water quality according to the environmental management plan.
Air quality	<p>Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<ul style="list-style-type: none"> • Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). • Monitor air quality.
Acoustic environment	<p>Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<ul style="list-style-type: none"> • Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Mymensingh local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped during night time. • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum noise levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete

Field	Impacts	Mitigation Measures
Aesthetics	The construction activities do not anticipate any cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<p>work in these areas quickly.</p> <ul style="list-style-type: none"> • Prepare the Debris Disposal Plan • Remove all construction and demolition wastes on a daily basis. • Coordinate with Mymensingh local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas Avoid stockpiling of any excess spoils • Suitably dispose of collected materials from Solid Waste Managements, unutilized materials and debris either through filling up of pits/wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by vehicles of the contractor, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses. • In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. • The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
B. Biological Characteristics		
Biodiversity	Activities being located in the built-up area of Mymensingh <i>pourashava</i> . There are no protected areas in or around subproject sites, and no known areas of ecological interest. There are no trees at the site that need to be removed.	<ul style="list-style-type: none"> • Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist. • All efforts shall be made to preserve trees by evaluation of minor design adjustments/alternatives (as applicable) to save trees. • Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation. • Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. • Prohibit employees from poaching wildlife and cutting of trees for firewood.
C. Socioeconomic Characteristics		
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment. The impacts are negative but	<ul style="list-style-type: none"> • Prepare and implement a Traffic Management Plan (Appendix 4) • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and

Field	Impacts	Mitigation Measures
	<p>short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>pedestrians throughout the construction period.</p> <ul style="list-style-type: none"> • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clientage. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Socio-economic status	<p>Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the 18-month construction stage. This can result in generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term.</p>	<ul style="list-style-type: none"> • Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market.
Other existing amenities for community welfare	<p>Although construction of subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites being in built-up areas of Mymensingh <i>pourashava</i> where there are a variety of human activities, will result to impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc.) located alongside the roads. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<ul style="list-style-type: none"> • Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Obtain details from <i>pourashava</i> nature and location of all existing infrastructure, and plan excavation carefully to avoid any such sites to maximum extent possible; • Integrate construction of the various infrastructure subprojects to be conducted in Mymensingh (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the

Field	Impacts	Mitigation Measures
		<p>subproject sites.</p> <ul style="list-style-type: none"> • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community water bodies, notice to the affected community shall be served 7 days in advance and again 1 day prior to start of construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Community health and safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Mymensingh local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.^a • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made

Field	Impacts	Mitigation Measures
		<p>aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction.</p> <ul style="list-style-type: none"> • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance.
Workers health and safety	<p>There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. 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.</p>	<ul style="list-style-type: none"> • Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. • Produce and implement a site health and safety (H&S) plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectORIZED vests, footwear, gloves, goggles and masks) at all times; (iii) providing (H&S) training^b for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. • Provide medical insurance coverage for workers; • Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;

Field	Impacts	Mitigation Measures
		<ul style="list-style-type: none"> • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
D. Historical, Cultural, and Archaeological Characteristics		
Physical and cultural heritage	Construction works will be on built-up areas of Mymensingh thus risk for chance finds is low.	<ul style="list-style-type: none"> • All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.

^a These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

^b 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.

E. Anticipated Impacts and Mitigation Measures – Operations and Maintenance (O&M) Phase

152. The *pourashava* contractor will manage the operations and maintenance (O&M)⁹ of the composting plant and controlled disposal site, or through a sub-contractor. The contractor, in consultation with Mymensingh *pourashava*, will also develop an O&M manual for the regular and preventive maintenance of the facilities.

153. **Solid waste landfill operation and maintenance.** In the preliminary design solid waste collection, STS, transportation and landfill design was done. The O&M will be prepared by MDSC and training will be provided to *pourashava* for proper implementation. For operation problems, environmental problem, maintenance problem will be recorded by the assistant

⁹ Maintenance activities will include replacement of equipment and consumables, and also horticultural maintenance and repairs to equipment, pavements and other civil works which are part of the contract.

engineer and operator. Record will be kept by *pourashava* and regular inspection and audit will be conducted (monthly or quarterly) by expert team.

154. **Recyclables and reusables.** Source separation at house is encouraged. Awareness will be raised by awareness raising program on source separation of recyclables and reusables. Training will be provided to the *pourashava* staff. Second stage separation will be conducted by house to house collectors and third stage separation will be done at secondary transfer stations. Amount of waste separated and subsequently recycled and reused will be recorded. Record will be kept by *pourashava* and regular inspection and audit will be conducted (monthly or quarterly) by expert team.

155. **Fecal sludge operation and maintenance.**¹⁰ Financial, technical and managerial inputs are needed to ensure the continuous operation of FSTP systems. Operation procedure or operational manual will be prepared during detailed design stage that establish how the treatment facility and equipment are utilized, are documented in several O&M plans, monitoring program, reports and log books, and health and safety plans, which outline the step-by-step tasks that employees are required to carry out in order to ensure the long-term functioning of the FSTP. While many O&M activities are process- specific, others are common to all facilities and all O&M plans should therefore include information on:

- (i) the procedures for receiving and off-loading of fecal sludge at the FSTP;
- (ii) the operation of specific technologies such that they function as designed;
- (iii) maintenance program for plant assets to ensure long-term operation and to minimize breakdowns;
- (iv) the monitoring and reporting procedures for the FSTP O&M activities as well as the management of treatment end products;
- (v) management of health and safety aspects for protection of the workers and the environment;
- (vi) the organizational structure, distribution of and the management of administrative aspects;
- (vii) procedures for the onsite storage of fecal sludge and the off-site transportation;
- (viii) the engineering drawings and FSTP specifications;
- (ix) the manufacturer's literature and equipment operation guidelines;
- (x) the responsible person for each task;
- (xi) the frequency of each activity;
- (xii) the operation procedures and tools required to perform the task;
- (xiii) the safety measures required;
- (xiv) the information that is to be monitored and recorded; and
- (xv) record will be kept by *pourashava* and regular audit will be conducted (monthly or quarterly) by expert team

156. Required manpower is proposed in the preliminary design of FSTP, landfill and hospital waste management. Monitoring will include visual observations of plant conditions, such as scum on a treatment lagoon, the color of the sludge, or odors emanating from a pump tank by using test kits; field monitoring for measuring pH, dissolved oxygen, or temperature; and laboratory testing of samples (either onsite or offsite). Responsibility of Engineer, operator and maintenance is shown in Appendix 9.

¹⁰ Magalie Bassan and David M. Robbins, Operation, Maintenance and Monitoring of Faecal Sludge Treatment Plant, In book: Faecal Sludge Management, systems approach for implementation and operation, IWA publication.

157. Effective O&M programs for FSTPs require that accurate records be kept of all O&M activities, monitoring as well of any malfunctions. Operator frequently refers to records in order to identify previous fluctuations in the operation of the facility and operational problems that may recur periodically, review the effectiveness of mitigation measures that may have been used to correct past operating problems, and to optimize the O&M procedures. These records should therefore be easily accessible to FSTP operator.

158. **Hospital waste collection, transport and storage.** The key to minimization and effective management of health-care waste is segregation (separation) and identification of the waste. Appropriate handling, treatment, and disposal of waste by type reduce costs and do much to protect public health. The most appropriate way of identifying the categories of health-care waste is by sorting the waste into color-coded plastic bags or containers, which is proposed in preliminary design. In addition to the color-coding of waste containers, the following practices are recommended:

- (i) General health-care waste should not join the stream of domestic refuse for disposal;
- (ii) Sharps should all be collected together, regardless of whether or not they are contaminated;
- (iii) Containers should be puncture-proof (usually made of metal or high-density plastic) and fitted with covers. They should be rigid and impermeable so that they safely retain not only the sharps but also any residual liquids from syringes. To discourage abuse, containers should be tamper-proof (difficult to open or break) and needles and syringes should be rendered unusable. Where plastic or metal containers are unavailable or too costly, containers made of dense cardboard are recommended (WHO, 1997); these fold for ease of transport and may be supplied with a plastic lining;
- (iv) Bags and containers for infectious waste should be marked with the international infectious substance symbol;
- (v) Highly infectious waste should, whenever possible, be sterilized immediately by autoclaving. It therefore needs to be packaged in bags that are compatible with the proposed treatment process: red bags, suitable for autoclaving, are recommended;
- (vi) Cytotoxic waste, most of which is produced in major hospital or research facilities, should be collected in strong, leak-proof containers clearly labelled "Cytotoxic wastes";
- (vii) Small amounts of chemical or pharmaceutical waste may be collected together with infectious waste;
- (viii) Large quantities of obsolete or expired pharmaceuticals stored in hospital wards or departments should be returned to the pharmacy for disposal. Other pharmaceutical waste generated at this level, such as spilled or contaminated drugs or packaging containing drug residues should not be returned because of the risk of contaminating the pharmacy; it should be deposited in the correct container at the point of production;
- (ix) Large quantities of chemical waste should be packed in chemical resistant containers and sent to specialized treatment facilities (if available). The identity of the chemicals should be clearly marked on the containers: hazardous chemical wastes of different types should never be mixed;
- (x) Waste with a high content of heavy metals (e.g. cadmium or mercury) should be collected separately;

- (xi) Aerosol containers may be collected with general health-care waste once they are completely empty, provided that the waste is not destined for incineration;
- (xii) Low-level radioactive infectious waste (e.g. swabs, syringes for diagnostic or therapeutic use) may be collected in yellow bags;
- (xiii) The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect;
- (xiv) There should be a water supply for cleaning purposes;
- (xv) The storage area should afford easy access for staff in charge of handling the waste;
- (xvi) It should be possible to lock the store to prevent access by unauthorized persons;
- (xvii) Easy access for waste-collection vehicles is essential;
- (xviii) There should be protection from the sun;
- (xix) The storage area should be inaccessible for animals, insects, and birds;
- (xx) There should be good lighting and at least passive ventilation;
- (xxi) The storage area should not be situated in the proximity of fresh food stores or food preparation areas;
- (xxii) A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area;
- (xxiii) Health-care waste should be transported within the hospital or other facility by means of wheeled trolleys, containers, or carts that are not used for any other purpose and meet the following specifications: easy to load and unload; no sharp edges that could damage waste bags or containers during loading and unloading; easy to clean;
- (xxiv) The vehicles should be cleaned and disinfected daily with an appropriate disinfectant. All waste-bag seals should be in place and intact at the end of transportation. Different types of vehicle for the onsite transportation of health-care waste; and
- (xxv) Record will be kept by *pourashava* and regular audit will be conducted (monthly or quarterly) by expert team.

159. **Land contamination.** The composting plant, autoclave room, sorting room/staging area, and controlled disposal site will not contaminate the lands the way other industrial operations can. The main reason for this is that all facilities will have cemented flooring while the controlled disposal site will have special impermeable layers underneath (in case such protection is not naturally there artificial impermeable layer will be constructed.) Preliminary design has considered lining of the soil in order to protect contamination of soil and groundwater.

160. **Generation of waste materials and by-products.** In general, pollutants generated from the facilities include: wastewater from toilet and cleaning of premises, improper storage of delivered wastes and end-products, and leachate from the solid waste. The contractor will be required to keep the ancillary sites of the transfer composting plants, and controlled disposal site clean, tidy and orderly condition free of litter, waste material (whether solid or liquid) and debris. The contractor will also be responsible for the maintenance of the approach road in consultation with Roads and Highways (RHD) to the controlled landfill (if damaged by his/her works) and to keep it free from litter.

161. **Generation of wastewater and water contamination.** The liquid wastes from the facilities are high in biological oxygen demand. The quantity of leachate may also be huge during especially in the rainy seasons. The wastes from the facilities can end up in water bodies, polluting water resources. Although the contaminants are non-toxic in nature, they can

introduce bacterial contamination and increase nitrates, phosphates and sulfates concentration in water, leading to health problems. Special drains will be constructed to allow wastewater from the transfer stations and composting plants to be diverted away from water wells and adjacent properties. Leachate generated from the controlled landfill will be channeled to a leachate collection pond and will be allowed to evaporate. Leachate will be aerated by falling it from higher height. Remaining leachate will be re-circulated as part of daily maintenance of waste covers and also will be used for composting plant.

162. **Odor.** The facilities will always give a particular stink due to decomposition of wastes. Excessive odor is a nuisance to locals and attracts pests and vermin.

163. **Noise.** Major sources of noise are the chaos created by the laborers working in the facilities and heavy vehicular movement to during collection and transport of wastes.

164. **Health, hygiene, and safety.** Spread of diseases to workers and their families may occur due to inadequate provision of safety equipment and lack of practice of safety rules and precautions. Sufficient, safe, potable and constant supply of fresh water will be made available at adequate pressure throughout the premises of the composting plant and controlled landfill. Suitable facilities for washing of hands and nail brushes should be there, soap or detergent will be provided for the workers. All sanitary facilities will be equipped with suitable flushing appliance.

165. When the controlled landfill begins to function, it is expected to provide a modern sanitary facility for the workers and staff as well as systematic handling, transportation and disposal of solid waste without causing environmental pollution. Providing this occurs there should be few negative environmental impacts and there are several fields that should be unaffected. These are identified in Table 35 below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

166. The potential adverse impacts that are associated with O&M activities can be mitigated to acceptable levels with the following mitigation measures (Table 34).

Table 34: Anticipated Impacts and Mitigation Measures – O&M Phase

Field	Impacts	Mitigation Measures
A. Physical Characteristics		
Water quality	Run-off from stockpiled wastes and end-products of composting which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per ECR, 1997. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet

Field	Impacts	Mitigation Measures
		<p>standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government.</p> <ul style="list-style-type: none"> • Monitor treated wastes quality as per Medical Wastes Rules and conditions of the ECC. Tests at the minimum includes measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual).
Air quality	Moving wastes, by- and end-products (such as composts) may create dusts during dry season. Landfill gas generation. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. • Green belt will be developed around the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum.
Acoustic environment	Increase in noise level due to presence of workers and movement of vehicles. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Plan activities in consultation with Mymensingh pourashava so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.
B. Biological Characteristics		
Biodiversity	Activities in the built-up area of Mymensingh <i>pourashava</i> . There are no protected areas in or around subproject sites, and no known areas of ecological interest.	<ul style="list-style-type: none"> • No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. • Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal). • Monitor survival rate of vegetation (plants and trees) in the green belt of the facilities.
C. Socioeconomic Characteristics		
Existing provisions for pedestrians and other forms of transport	Increase in traffic in the <i>pourashava</i> during collection, loading and unloading of wastes. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Early hour collection will be enforced before the peak traffic hours. • Maintain safe passage for vehicles and pedestrians. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards and contact numbers for concerns/complaints. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Workers health and safety	Workers need to be mindful of the occupational hazards working in waste management facilities. Potential impacts are negative and long-term but reversible by mitigation measures.	<ul style="list-style-type: none"> • Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M health and safety (H&S) plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectORIZED vests, footwear, gloves, goggles and masks) at all times; (iii) providing (H&S) training^a for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v)

Field	Impacts	Mitigation Measures
		maintaining accident reports and records. <ul style="list-style-type: none"> • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • 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; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. 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. • 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	Possible accumulation of waste causing health problems for community. Pests and vermin. Potential impacts are negative and long-term but reversible by mitigation measures.	<ul style="list-style-type: none"> • Wet/biodegradable wastes will be emptied directly from the bins to primary collection vehicles daily and dry/non-biodegradable wastes once in a week. The number and type of bins and vehicles to be procured under the project is sufficient to ensure no accumulation of wastes in the community. • Wastes will be collected regularly to prevent pests and vermin.

^a 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.

F. Cumulative Impact Assessment

167. The cumulative impact assessment examined the interaction between the subproject's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing, and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The project's potential cumulative effects were considered with respect to valued components in environmental and socioeconomic categories, in four areas:

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

168. The project has identified the valued components as water quality, air quality, acoustic environment, socioeconomic and socio-community components, and human health and safety. There are no foreseeable projects that will overlap with the subproject. The spatial boundaries of the subproject are the areas where the facilities (transfer stations, composting plant, and controlled landfill) are located. The temporal boundary can be considered as the whole Mymensingh *pourashava*.

169. The infrastructures will be (i) designed to the current best practice standard and in line with the current LGED guidelines¹¹ for a 10-year design period; (ii) built that the floods do not damage them; and (iii) drains of the facilities are to be kept free from wastes and siltation.

170. **Water quality.** Due to nature of the subproject there is risk of contaminating groundwater and nearby bodies of water during O&M phase. However the infrastructures have been designed ensuring impermeability of surfaces by having concrete surfaces for the transfer stations and composting plant while HDPE/clay liners for the controlled landfill. Drains within the facilities will also ensure wastewater generated during operations will be diverted away from any channel leading to agricultural lands, water bodies, and water sources/tube wells. Short-term negative impacts are possible but can be mitigated through design and implementation of EMP. Potential residual effects is considered to be negligible.

171. **Air quality.** Emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites during construction and O&M phases; these impacts will be short-term and localized to the immediate vicinity of controlled landfill site. Greenhouse gas (GHG) emissions may increase as a result of the subproject activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, land-filling of residual wastes). Given the subproject's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

172. **Acoustic environment.** Noise levels during construction and O&M activities in immediate proximity of work sites are expected to increase. The duration of exposure will be relatively brief and imperceptible. The exposure represents a temporary, localized, adverse residual effect of low significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction and O&M activities. The overall significance rating of potential residual effects is considered to be negligible.

173. **Socioeconomic and socio-community.** Concerns on existing provisions for pedestrians, other forms of transport, and over-all impact on livability particularly nearby the transfer stations and composting plant will occur spatially during construction and O&M activities. Traffic movement will be improved once the construction activities are completed. Since the subproject involves small-scale facilities, it will not conflict with existing or planned land use. O&M manuals for the facilities, comprehensive capacity building, and community involvement to be provided under UGIIP-3 will ensure efficient operation of the facilities and acceptability by the stakeholders. However, following improvement in infrastructures and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance Mymensingh *pourashava*. This can be considered a long-term cumulative benefit of the subproject.

¹¹ Urban Solid Waste Management Manual, May 1998

174. Given the scale of the project it is likely that a number of local people will obtain at least temporary socio-economic benefits, by gaining employment in the construction workforce, and thus raising their levels of income. In addition, a significant amount of employments will be generated associated with the O&M of the facilities to be developed under the subprojects. These benefits can bring wider social gains if they are directed at vulnerable¹² groups.

175. **Community and workers health and safety.** No adverse residual effects to human health will occur as a result of construction or O&M activities, and mitigation measures are in place to ensure public and worker safety, and will be closely monitored. While exposure to elevated noise levels, fugitive dust and common air pollutants will occur in proximity to work sites, due to their short-term and localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

176. Upon completion of the subproject, the socio-community will be the major beneficiaries of this subproject. With the improved solid waste management facilities, additional vehicles and workers PPE, they will be provided with reliable and climate-resilient municipal services. In addition to improved environmental conditions, the subproject will reduce occurrence of diseases and people would spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health. These are considered a long-term cumulative benefit.

177. Therefore the project will benefit the general public by contributing to the long-term improvement of municipal services and community livability in Mymensingh *pourashava*.

178. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the built-up area of the *pourashavas*, will not cause direct impact on biodiversity values.

G. Greenhouse Gas Emissions (GHG)

179. Through plantation in and around the landfill area and turfing and using solar electricity for street light may reduce Carbon-di-oxide gas emission. Composting also reduce substantial amount of carbon emission. The subproject preliminary design includes such approach, which will in fact provide lots of environmental benefit and on the other hand these will reduce GHG emission. Since it is proposed aerobic composting for part of the collected organic waste, there is an emission reduction potential in the sub-project for SWM. Using UNFCCC methodology for avoided methane emission from composting (AMS III F version 11), PPTA report calculated the emission reduction potential from Mymensingh landfill as 1916 ton CO₂ e/year.

¹² Vulnerable groups as those without legal title to land and other assets; households headed by single earner females, the elderly or disabled; indigenous peoples (based on ADB OM); and households with incomes that are below the poverty line.

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Approach

180. During inception stage of the PPTA consultations were held with the LGED, ADB and during site visit consultation were held with *pourashava* local staff, local people and beneficiaries on issues pertaining to the selection of sub-projects and identification of key issues including addressing the current gaps in provision of basic services and improvement of municipal infrastructures within Mymensingh town. These consultations provided inputs in identification of the subprojects' needs of the communities, and the relevant stakeholders, awareness about subprojects, benefits of subprojects, possible environmental impacts and possible mitigation measures. The Rapid Environmental Assessment Checklist for each subprojects questionnaire was also shared with the consultations. Table 36 provides the summary of consultations carried out.

181. The team of environmental experts (Safeguard Specialists and Junior Environmental Engineers) has contacted the local people through field workers and Mymensingh *pourashava* staff. Meetings were arranged in the form of Focus Group Discussion (FGD) with the consent of the local stakeholders at scheduled venues chosen by the locals (Figure 14). Participant attendance is attached in Appendix 5.

B. Major Findings

182. The information on the conducted FGD and key issues identified during consultations is presented on the Table 35. No vulnerable groups are identified during the consultations in the subproject area. Consultation process will continue during implementation and vulnerable groups, if any, will be included.

Table 35: Focus Group Discussion and Key Issues Identified During Consultations

	Proposed Project Facility/ Alignment Related to Which Discussion Held	Date/Time	Venue	No. of Participants & gender	Key Safeguard Issues Discussed	Overall Concerns Expressed Related to subproject	Suggestions From People	Willingness to Participate in Project
1	SWM	Date: 28-08-16 Time: 11.11 am	Tazul Traders, Near Biscuit Factory, Ward-2	M= 15 F= 0 T= 15 <i>Pourashava</i> staff, worker, engineer, business man	Existing landfill creates pollution .	Proper compensation required for land acquisition	They will be happy for landfill improvement; ready to part with dev. work; local employment	People will extend all out supports in the project implementation including construction.
2	SWM	Date: 28-08-16 Time: 01.20 pm	In the office of Counselor, Ward-14	M=08 F=02 T=10 Student, businessman, engineer, service holder	Awareness is necessary for SWM, <i>pourashava</i> staff needs to be trained	Proper Operation and maintenance is important for the success of the SWM	Public awareness of not using drains as dustbins along with drainage improvement is required to arrest the problems.	People are interested to work as daily laborer

C. Summary

183. People want to have all development works but they want to have sound design and construction so that they are not affected by environmental pollution. This is to be addressed in design. Construction supervision should ensure sound and sustainable engineering practice so that there is no further environmental impact to people's life. Following points from FGD can be cited:

- (i) There are residents, Schools, Mosques within a kilometer of the SWM landfill. They thought, if the extension of Landfill is done, it will work similar to current one as openly, air-borne diseases would spread in the area
- (ii) Proper compensation needs to be provided to the affected people for the land acquisition of the SWM landfills
- (iii) Fecal sludge management is important
- (iv) Special care should be taken to minimize noise pollution during construction period.
- (v) Public awareness is important for SWM, Porashava staff needs to be trained
- (vi) All the proposed infrastructure implementation is needed for Mymensingh town, all will provide benefit, no major environmental concern.
- (vii) All development works are essential but sound design and construction is necessary so that they are not affected by environmental pollution.

Figure 14: Stakeholders consultations at Mymensingh (FGDs at Mymensingh)



D. Proposed Future Consultation Plan

184. The future public involvement in monitoring impacts and mitigation measures during the construction and operation stages and includes a Public Consultation Plan as shown in Table 36, Public consultation plans are part of the project implementation and management plan. The

Executive Agency (LGED) and Implementing Agency (Mymensingh *pourashava*) are responsible for public consultation during project implementation. Costs for public consultation activities during construction are proposed to be covered from budget of supervision consultancy contract.

Table 36: Public Consultation Plan

Organizer	Approach	Time and Frequency	Subject	Participants
Pre-Construction stage				
LGED and Mymensingh <i>Pourashava</i>	Workshop	Before starting of construction	Disclosure of all development activities and its impact and disclosure of possible conservation and restoration of the mosque	All elite people of Mymensingh local government people, administrative staff, LGED local staff, Porashava staff, PWD, RHD, Water Development Board, BMD, DPHE and other government departments, local public representatives, educationalist, environmentalist, business man, service holder, beneficiaries, NGOs, local leaders, local concerned people, general peoples, media, etc.
Construction stage				
LGED and Mymensingh <i>Pourashava</i>	Public consultation and site visits	At least once a year	Adjusting mitigation measures if necessary, construction impacts, comments and suggestions	Work staff within construction area; Residents within Construction area
	Expert workshop or press conference	As needed, based on public consultation	Comments and suggestions on mitigation measures, public opinions; adjusting mitigation measures accordingly	Experts from various sectors, media
	Public workshop	At least once a year	Adjusting mitigation measures if necessary construction impacts, comments and suggestions	Representatives of residents and social sectors
Operation Stage				
<i>Pourashava</i>	Public consultation and site visits	At least once	Effectiveness of mitigation measures, impacts of operation, mitigation measures, comments and suggestions	Residents adjacent to project sites, users and beneficiaries
	Public satisfaction survey	At least once	Comments and Suggestions	Project beneficiaries and users

VII. GRIEVANCE REDRESS MECHANISM

185. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected person's concerns, complaints, and grievances about the social and environmental performance at the level of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

186. **Common GRM.** A common GRM will be in place for social, environmental, or any other grievances related to the project; the resettlement plans (RPs) and IEEs will follow the GRM described below, which is developed in consultation with key stakeholders. The GRM will provide an accessible and trusted platform for receiving and facilitating resolution of affected persons' grievances related to the project. The multi-tier GRM for the project is outlined below, each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required.

187. *Pourashava*-wide public awareness campaigns will ensure that awareness on grievance redress procedures is generated through the campaign. The project implementation unit (PIU) designated safeguard focal person and governance improvement and capacity development consultants (GICDC) will conduct *pourashava*-wide awareness campaigns to ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements, and will work with the PMU and management, design and supervision consultants (MDSC) to help ensure that their grievances are addressed.

188. Affected persons (APs) will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes that have already been installed by project *pourashavas* or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaints register in *pourashava* offices. Appendix 6 has the sample grievance registration form. Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. The project management unit (PMU) safeguard officer will have the overall responsibility for timely grievance redressal on environmental and social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party through the PIU designated safeguard focal person.

189. **Grievance redress process.** In case of grievances that are immediate and urgent in the perception of the complainant, the contractor and MDSC on-site personnel will provide the most easily accessible or first level of contact for quick resolution of grievances. Contact phone numbers and names of the concerned PIU safeguard focal person and contractors, will be posted at all construction sites at visible locations.

- (i) **1st Level Grievance.** The phone number of the PIU office should be made available at the construction site signboards. The contractors and PIU safeguard focal person can immediately resolve on-site in consultation with each other, and will be required to do so within 7 days of receipt of a complaint/grievance.
- (ii) **2nd Level Grievance.** All grievances that cannot be redressed within 7 days at field/ward level will be reviewed by the grievance redress cell (GRC) headed by Panel Mayor of the *pourashava* with support from PIU designated safeguard focal person and MDSC regional environment and resettlement specialists. GRC will attempt to resolve them within 15 days. The PIU designated safeguard focal person will be responsible to see through the process of redressal of each grievance.
- (iii) **3rd Level Grievance.** The PIU designated safeguard focal person will refer any unresolved or major issues to the PMU safeguard officer and MDSC national environmental and resettlement specialists. The PMU in consultation with these officers/specialists will resolve them within 30 days.

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

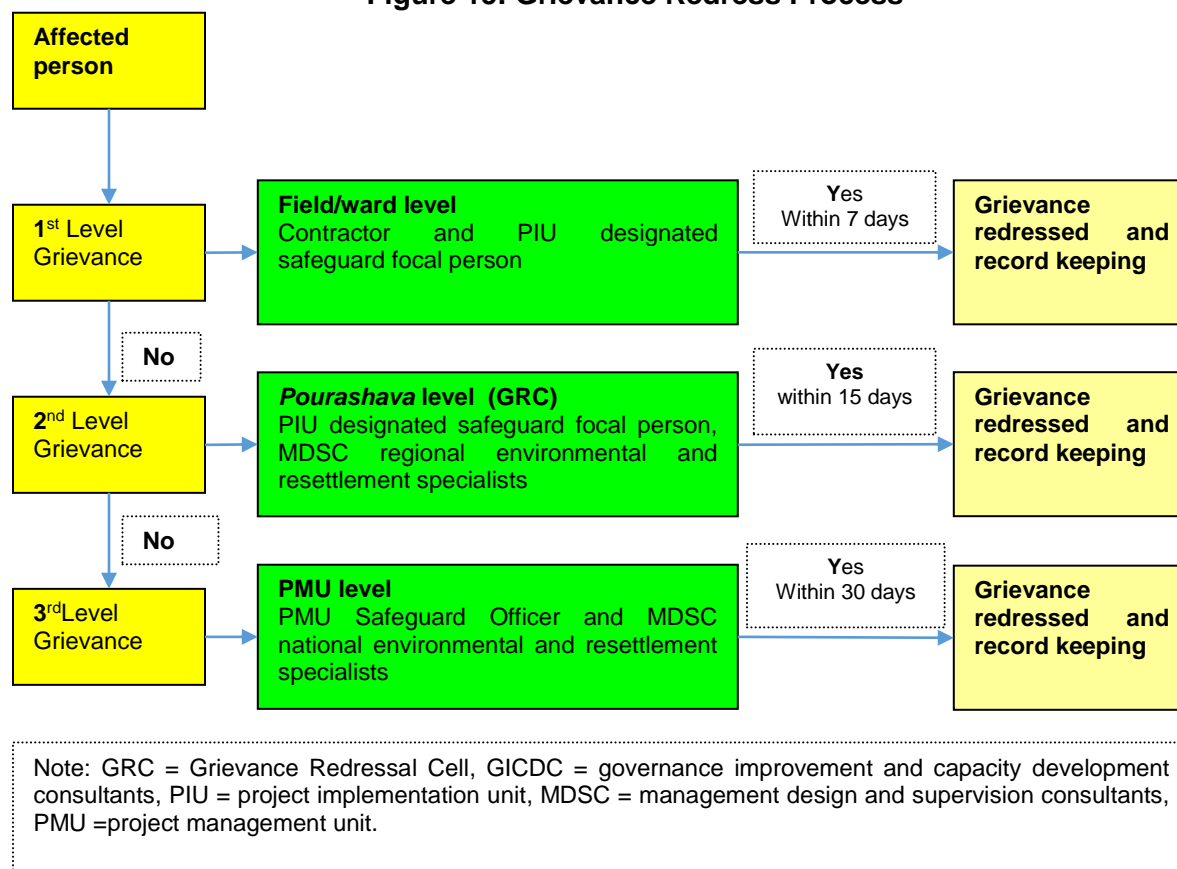
191. In the event that the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism (AM) through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB Bangladesh Resident Mission (BRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will be included in the PID to be distributed to the affected communities, as part of the project GRM.

192. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PMU office, *pourashava* office, and on the web, as well as reported in monitoring reports submitted to ADB on a semi-annual basis.

193. **Periodic review and documentation of lessons learned.** The PMU safeguard officer will periodically review the functioning of the GRM in each *pourashava* and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

194. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the concerned PIU at *pourashava*-level; while costs related to escalated grievances will be met by the PMU. Cost estimates for grievance redress are included in resettlement cost estimates.

Figure 15: Grievance Redress Process



VIII. ENVIRONMENTAL MANAGEMENT PLAN

195. The purpose of the environmental management plan (EMP) is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

196. A copy of the EMP must be kept on work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

197. For civil works, the contractor will be required to (i) establish an operational system for managing environmental impacts (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions.

A. Institutional Arrangement

198. **Executing and implementing agencies.** LGED and DPHE, both under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MLGRDC), are the executing agencies. LGED is responsible for providing support and guidance to *pourashavas* concerning performance criteria and *pourashava* development planning. DPHE will provide support in water supply and sanitation schemes. Participating *pourashavas* are the implementing agencies.

B. Safeguard Implementation Arrangement

199. **Project management unit.** A PMU is established for the overall management of the project. The PMU is headed by Project Director supported by officials including three project managers in charge of (i) municipal infrastructure (excluding water supply and sanitation), (ii) water supply and sanitation, and (iii) governance improvement and capacity development, respectively. The PMU will receive support from national environmental specialist and national resettlement specialist on the MDSC team. Key tasks and responsibilities of the PMU Safeguard (Environment) Officer are as follows:

- (i) confirm existing IEEs/EMPs are updated based on detailed designs, and that new IEEs/EMPs are prepared in accordance with the EARF and subproject selection criteria related to safeguards;
- (ii) confirm whether IEEs/EMPs are included in bidding documents and civil works contracts;
- (iii) provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by project implementation unit (PIU) and contractors;
- (iv) establish a system to monitor environmental safeguards of the project, including monitoring the indicators set out in the monitoring plan of the EMP;
- (v) facilitate and confirm overall compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g., location clearance certificates, environmental clearance certificates, etc.), as relevant;
- (vi) supervise and provide guidance to the PIUs to properly carry out the environmental monitoring and assessments as per the EARF;
- (vii) review, monitor, and evaluate the effectiveness with which the EMPs are implemented, and recommend necessary corrective actions to be taken as necessary;
- (viii) consolidate monthly environmental monitoring reports from PIUs and submit semi-annual monitoring reports to ADB;
- (ix) ensure timely disclosure of final IEEs/EMPs in locations and form accessible to the public; and
- (x) address any grievances brought about through the grievance redress mechanism in a timely manner.

200. **Project implementation unit.** The participating *pourashavas* will establish a PIU within the *pourashava* structure. The PIUs will (i) be responsible for land acquisition; (ii) take necessary action for obtaining rights of way; (iii) plan, implement and monitor public relations activities, gender mainstreaming initiatives and community participation activities at *pourashava* level; (iv) disseminate information related to the project to the public and media; (v) ensure compliance with loan covenants concerning safeguards measures; and (vi) facilitate

implementation of safeguards plans. The PIUs will each designate a Safeguard Officer¹³ and will receive assistance from the assigned MDSC regional environmental specialist to:

- (i) update IEEs/EMPs during detailed design stage and prepare new IEEs/EMPs in accordance with the EARF;
- (ii) conduct environmental compliance audit of existing facilities as per Item F, Appendix 6 of ADB SPS, 2009;
- (iii) include IEEs/EMPs in bidding documents and civil works contracts;
- (iv) comply with all government rules and regulations;
- (v) take necessary action for obtaining rights of way;
- (vi) oversee implementation of EMPs including environmental monitoring by contractors;
- (vii) take corrective actions when necessary to ensure no environmental impacts;
- (viii) submit monthly environmental monitoring reports to PMU,
- (ix) conduct continuous public consultation and awareness;
- (x) address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; and
- (xi) organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.

201. Project Management, Design and Supervision Consultants (MDSC). MDSC will be engaged to work closely with and advise the PMU, to be involved in project supervision including monitoring during construction phase. The MDSC will have one national environmental specialist and three regional environmental specialists as well as one national resettlement specialist and three regional resettlement specialist. The MDSC national environmental specialist will, but not limited to:

- (i) work under the general supervision of the team leader and the deputy team leader;
- (ii) review the environmental guidelines and requirement of the government of Bangladesh and ADB SPS, 2009, environmental subproject selection guidelines and EARF;
- (iii) Guide the implementation of future subprojects;
- (iv) provide technical support to the PMU and PIUs including review and update of EARF and guidelines for specific type of subprojects and assist in preparing terms of reference for environmental assessment;
- (v) assist and guide the MDSC regional environmental specialists to provide support to environmental management functions including updating subproject IEEs in respect to EMP;
- (vi) assist in preparing IEEs and in monitoring impact and mitigation measures associated with subprojects;
- (vii) assist PIUs and MDSC regional environmental specialists working in the steps for preparing the EIA/IEE, capacity building and training, preparation of guidelines and procedure and subproject specific guidance;
- (viii) provide support and guidance to PIUs in undertaking environmental monitoring

¹³ It is recommended that existing *pourashava* health officer or executive engineer will also work as safeguard officer in addition to his/her regular responsibilities within the *pourashava*.

- (ix) support PMU in submitting semi-annual environmental monitoring reports to ADB;
- (x) facilitate in grievance redress and corrective actions;
- (xi) train PIU officials regarding environmental requirement and issues; and
- (xii) perform any other task assigned by the team leader, deputy team leader and the project director.

202. The MDSC regional environmental specialists will, but not limited to:

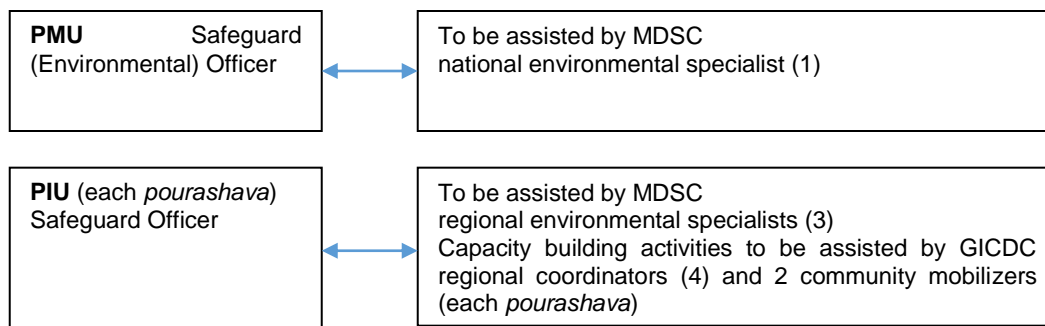
- (i) work under the supervision and guidance of the team leader, deputy team leader and MDSC national environmental specialist;
- (ii) assist PIUs in preparing and updating IEEs including EMPs in accordance with the EARF, and assist in monitoring impact and mitigation measures associated with subprojects including implementation of EMPs by contractors;
- (iii) assist in preparation of IEEs and in the environmental review of subproject consisting of screening at *pourashava* level by PIU through a committee formed with municipal mayor as chairman and representatives from DOE, LGED and other relevant district office as members;
- (iv) assist PIUs in the steps for preparing EIA/IEE, capacity building and training, preparation of guidelines and procedure and subproject specific guidance;
- (v) support PIU in environmental monitoring and submit monitoring reports to PMU as inputs into the semi-annual monitoring report submitted to ADB;
- (vi) undertake mitigation measures and other specific measures in the construction contract;
- (vii) facilitate in grievance redress and corrective actions;
- (viii) follow subproject selection guidelines and EARF to ensure compliance with the environmental guidelines and requirement of the Government of Bangladesh and ADB SPS, 2009;
- (ix) support PMU and MDSC national environment specialist by providing data, information and all other requested assistance;
- (x) train PIU officials regarding environmental issues
- (xi) perform any other task assigned by MDSC national environment specialist, team leader, deputy team leader and the project director.

203. **Civil works contracts and contractors.** EMPs are to be included in bidding and contract documents and verified by the PIUs and PMU. The contractor will be required to designate an environmental supervisor to (i) coordinate with MDSC on updating the IEE/EMP based on detailed designs, and (ii) ensure implementation of EMP during civil works. Contractors are to carry out all environmental mitigation and monitoring measures outlined in their contract.

204. **Governance Improvement and Capacity Development Consultants (GICDC).** The PMU and PIUs will require support on a range of activities related to governance improvement and capacity development of *pourashavas*. The GICDC will support PMU and PIUs in implementing urban government improvement action plan (UGIAP) by providing capacity development, community mobilization and other facilitation services. There will be four GICDC regional offices consisting of four regional coordinators at each regional office. There will be 2 community mobilizers in each project *pourashava*. The regional coordinators will assist *pourashavas* and the local capacity development experts in the activities related to community participation and inclusive development. The community mobilizers will be posted at the *pourashava* and will (i) have to work maintaining close liaison with the mayor, councilors,

pourashava staffs and communities, (ii) provide assistance and support to PIU regarding planning and implementation of citizen awareness and participation activities, urban planning, equity and inclusiveness of women and urban poor. The GICDC will also have a training specialist who will be responsible for identifying and coordinating capacity building activities at *pourashava* level.

Figure 16: Safeguards Implementation Arrangement



GICDC = governance improvement and capacity development consultants, MDSC = management, design and supervision consultant, PIU = project implementation unit, PMU = project management unit.

Table 37: Environmental Management and Monitoring Plan – Prior, During, and Post Construction Phase

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
Design Stage/ Pre-construction stage						
Land acquisition and resettlement impacts	Impact due to land acquisition and resettlement for construction of project components	The proposed extension of landfill will require another 8-10 acres of land adjacent to the existing landfill. Any land acquisition and involuntary resettlement impacts will be addressed in the RPs prepared as per requirements of ADB SPS and Government of Bangladesh rules and regulations	Project management unit (PMU), project implementing unit (PIU), Management Design Supervision Consultants (MDSC)	Covered under RP	Covered under RP	Covered under RP
Existing utilities	Disruption of services.	<ul style="list-style-type: none"> Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction activities Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. Require contractors to prepare spoils management plan (Appendix 3) and traffic management plan (Appendix 4) 	PMU, PIU, and MDSC	<ul style="list-style-type: none"> List of affected utilities and operators; Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), spoil management plan (Appendix 3), and traffic management plan (Appendix 4) 	<ul style="list-style-type: none"> During detailed design phase Review of spoils management plan: Twice (once after first draft and once before final approval) 	<ul style="list-style-type: none"> No cost required. Mitigation measures are included as part of TOR of PMU, PIU, and MDSC.
Pollution of water bodies	Impacts on fisheries and other aquatic ecology due to discharge of untreated leachate	It is recommended to introduce leachate treatment, lining to the landfill so that leachate discharge is not happened before treatment	PMU and MDSC	Incorporated in final design	During detailed design stage	No cost, detailed design is a part of MDSC Terms of Reference

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
Tree cutting or damage	Damage to trees and clearance of vegetation at the SWM landfill location	Tree Plantation: Log trees will be planted at the suggested/appropriate distances on both slopes of the service roads, approach road and wherever possible, which will surplus the loss of trees cut by many times. For one tree cut 2 trees to be replanted.	PMU, PIU, MDSC and contractor	Number of tree cut	Detailed Design stage	No cost. To be included in Contract document
Consents, permits, clearances, no objection certificate (NOC), etc.	Failure to obtain necessary consents, permits, NOCs, etc. can result to design revisions and/or stoppage of works	<ul style="list-style-type: none"> • Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works. • Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc. • Include in detailed design drawings and documents all conditions and provisions if necessary 	PMU, PIU, and MDSC	<ul style="list-style-type: none"> • Incorporated in final design and communicated to contractors. 	<ul style="list-style-type: none"> • Prior to award of contract 	<ul style="list-style-type: none"> • No cost required. Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PMU and PIU. • Mitigation measures are included as part of TOR of PMU, PIU and MDSC.
Locations for disposal of spoil	Improper disposal of spoil	- Determine locations prior to award of construction contracts.	PMU, PIU, MDSC and Contractors	List of spoil sites	Detailed Design Stage	No cost. To be included in Contract document
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	<ul style="list-style-type: none"> • Determine locations prior to award of construction contracts. 	PMU, PIU, and MDSC	<ul style="list-style-type: none"> • List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. • Written consent of landowner/s (not lessee/s) for reuse of excess spoils to agricultural land 	<ul style="list-style-type: none"> • During detailed design phase 	<ul style="list-style-type: none"> • No cost required. • Mitigation measures are included as part of TOR of PMU, PIU, and MDSC.
Sources of	Extraction of	<ul style="list-style-type: none"> • Prepare list of approved 	PMU, PIU, and	<ul style="list-style-type: none"> • List of approved 	<ul style="list-style-type: none"> • During detailed 	<ul style="list-style-type: none"> • No cost required.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
Materials	materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural Solid Waste Management patterns, ponding and water logging, and water pollution.	quarry sites and sources of materials	MDSC	quarry sites and sources of materials; • Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	design phase, as necessary with discussion with detailed design engineers and PIUs	• Mitigation measures are included as part of TOR of PMU, PIU, and MDSC.
Drinking water availability and water arrangement	Lack of water supply at camps	Prior to the initiation of construction activities, the contractor will be responsible for arrangement of water in every workplace at suitable and easily accessible places for the whole construction period. Sufficient supply of cold potable water will be provided and maintained at the construction camps and other ancillary work areas.	MDSC and Contractors	Site management plan and construction plan prepared by contractor	Prior to construction	No cost required. To be included under BoQ of contract document
Updating of IEE based on detailed design	Site-specific impacts not identified, mitigation measures not appropriate and sufficient to address impacts	<ul style="list-style-type: none"> • Update IEE and EMP based on detailed design • Ensure updated EMP is provided to contractors • Relevant information disclosed 	PMU	<ul style="list-style-type: none"> • Updated IEE and reviewed, approved and disclosed 	• Upon completion of detailed design	• No additional cost required
EMP Implementation Training	Irreversible impact to the environment, workers, and community	<ul style="list-style-type: none"> • Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for 	Construction Contractor	<ul style="list-style-type: none"> • Proof of completion (Safeguards Compliance Orientation) • Posting of proof of completion at 	• During detailed design phase prior to mobilization of workers to site	• Cost of EMP Implementation Orientation Training to contractor is responsibility of PMU and PIU.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		construction works; health and safety (H&S), core labor laws, applicable environmental laws, etc.		worksites • Posting of EMP at worksites		• Other costs responsibility of contractor.
Construction Stage						
A. Physical Characteristics						
Topography, landforms, geology and soils	Significant amount of gravel, sand, and cement will be required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> Utilize readily available sources of materials. If contractor procures materials from existing borrow pits and quarries, ensure these conform to all relevant regulatory requirements. Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor. 	Construction Contractor	<ul style="list-style-type: none"> Records of sources of materials 	• Monthly by PIU	• Cost for implementation of mitigation measures responsibility of contractor.
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-	<ul style="list-style-type: none"> Prepare and implement a spoils management plan (Appendix 3). Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Mymensingh local authority on designated disposal areas. All earthworks must to be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as 	Construction Contractor	<ul style="list-style-type: none"> Areas for stockpiles, storage of fuels and lubricants and waste materials; Number of silt traps installed along trenches leading to water bodies; Records of surface water quality inspection; Effectiveness of 	<ul style="list-style-type: none"> Visual inspection by PIU and supervision consultants on monthly basis Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	• Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
	<p>term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>problems from runoff.</p> <ul style="list-style-type: none"> • Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any Solid Waste Management leading to water bodies. • Take all precautions to minimize the wastage of water in the construction activities. • Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the Solid Waste Management leading to the water bodies. • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse and cross Solid Waste Management channels. • Monitor water quality according to the environmental management plan. 		<p>water management measures;</p> <ul style="list-style-type: none"> • No visible degradation to nearby Solid Waste Managements, khals or water bodies due to construction activities 		

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
Air quality	<p>Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<ul style="list-style-type: none"> • Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). • Monitor air quality. 	Construction Contractor	<ul style="list-style-type: none"> • Location of stockpiles; • Number of complaints from sensitive receptors; • Heavy equipment and machinery with air pollution control devices; • Certification that vehicles are compliant with air quality standards. 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.
Acoustic environment	<p>Construction activities will be on settlements, along and near schools, and areas with small-scale businesses. Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. However,</p>	<ul style="list-style-type: none"> • Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Mymensingh local authority so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped 	Construction Contractor	<ul style="list-style-type: none"> • Number of complaints from sensitive receptors; • Use of silencers in noise-producing equipment and sound barriers; • Equivalent day and night time noise levels 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
	<p>the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>during night time.</p> <ul style="list-style-type: none"> • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly. 				
Aesthetics	The construction activities do not anticipate any	<ul style="list-style-type: none"> • Prepare the Debris Disposal Plan • Remove all construction and 	Construction Contractor	<ul style="list-style-type: none"> • Number of complaints from sensitive 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
	<p>cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>demolition wastes on a daily basis.</p> <ul style="list-style-type: none"> • Coordinate with Mymensingh local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas Avoid stockpiling of any excess spoils • Suitably dispose of collected materials from Solid Waste Managements, unutilized materials and debris either through filling up of pits/wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by vehicles of the contractor, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses. • In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. 		<p>receptors;</p> <ul style="list-style-type: none"> • Worksite clear of hazardous wastes such as oil/fuel • Worksite clear of any wastes, collected materials from Solid Waste Managements, unutilized materials and debris • Transport route and worksite cleared of any dust/mud 	<p>consultants on monthly basis</p> <ul style="list-style-type: none"> • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<p>contractor.</p>

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; 				
B. Biological Characteristics						
Biodiversity	Activities being located in the built-up area of Mymensingh <i>pourashava</i> . There are no protected areas in or around subproject sites, and no known areas of ecological interest. There are no trees at the site that need to be removed.	<ul style="list-style-type: none"> Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist. All efforts shall be made to preserve trees by evaluation of minor design adjustments/alternatives (as applicable) to save trees. Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation. Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. Prohibit employees from poaching wildlife and cutting of trees for firewood. 	Construction Contractor	<ul style="list-style-type: none"> PMU and PIU to report in writing the number of trees cut and planted if tree-cutting will be required (to be determined during detailed design stage) Number of complaints from sensitive receptors on disturbance of vegetation, poaching, fishing, etc. 	<ul style="list-style-type: none"> Visual inspection by PIU and supervision consultants on monthly basis Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> Cost for implementation of mitigation measures responsibility of contractor.
C. Socioeconomic Characteristics						
Existing provisions for	Road closure is not anticipated.	<ul style="list-style-type: none"> Prepare and implement a Traffic Management Plan 	Construction Contractor	<ul style="list-style-type: none"> Traffic route during 	<ul style="list-style-type: none"> Visual inspection by PIU and 	<ul style="list-style-type: none"> Cost for implementation of mitigation measures

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
<p>pedestrians and other forms of transport</p>	<p>Hauling of construction materials and equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>(Appendix 4)</p> <ul style="list-style-type: none"> • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of 		<p>construction works including number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 4);</p> <ul style="list-style-type: none"> • Number of complaints from sensitive receptors; • Number of signage placed at project location • Number of walkways, signage, and metal sheets placed at project location 	<p>supervision consultants on monthly basis</p> <ul style="list-style-type: none"> • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<p>responsibility of contractor.</p>

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<p>alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clientage.</p> <ul style="list-style-type: none"> • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions. 				
Socio-economic status	<p>Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the 18-months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term.</p>	<ul style="list-style-type: none"> • Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market. 	Construction Contractor	<ul style="list-style-type: none"> • Employment records; • Records of sources of materials • Records of compliance to Bangladesh Labor Law of 2006 and other applicable standards 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.
Other existing amenities for community welfare	<p>Although construction of subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites</p>	<ul style="list-style-type: none"> • Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Obtain details from pourashava nature and location of all existing infrastructure, and plan 	Construction Contractor	<ul style="list-style-type: none"> • Utilities Contingency Plan • Number of complaints from sensitive receptors 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
	<p>being in built-up areas of Mymensingh <i>pourashava</i> where there are a variety of human activities, will result to impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc.) located alongside the roads. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.</p>	<p>excavation carefully to avoid any such sites to maximum extent possible;</p> <ul style="list-style-type: none"> • Integrate construction of the various infrastructure subprojects to be conducted in Mymensingh (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the subproject sites. • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community water bodies, notice to the affected community shall be served 7 days in advance and again 1 day prior to start of 			<p>stage and final location of) subproject components</p>	

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.				
Community health and safety	Construction works will impede the access of residents and businesses in limited cases. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Lalmonirhat local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock 	Construction Contractor	<ul style="list-style-type: none"> • Number of permanent signage, barricades and flagmen on worksite as per Traffic Management Plan (Appendix 4); • Number of complaints from sensitive receptors; • Number of walkways, signage, and metal sheets placed at project location • Agreement between landowner and contractors in case of using private lands as work camps, storage areas, etc. 	<ul style="list-style-type: none"> • Visual inspection by PIU and consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<p>cracking chemicals, and concrete breaking chemicals.^a</p> <ul style="list-style-type: none"> • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. 				

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<ul style="list-style-type: none"> • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance. 				
Workers health and safety	There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. Workers need to be mindful of the occupational hazards which can arise from working	<ul style="list-style-type: none"> • Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to 	Construction Contractor	<ul style="list-style-type: none"> • Site-specific H&S Plan • Equipped first-aid stations • Medical insurance coverage for workers • Number of accidents • Records of supply of 	<ul style="list-style-type: none"> • Visual inspection by PIU and supervision consultants on monthly basis • Frequency and sampling sites to be finalized during detailed design stage and final location of) 	<ul style="list-style-type: none"> • Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
	<p>in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures.</p>	<p>further explain aspects of environmental or social behavior that are unclear.</p> <ul style="list-style-type: none"> • Produce and implement a site health and safety (H&S) plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectORIZED vests, footwear, gloves, goggles and masks) at all times; (iii) providing (H&S) training^b for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. • Provide medical insurance coverage for workers; • Provide H&S orientation training to all new workers to 		<p>uncontaminated water</p> <ul style="list-style-type: none"> • Condition of eating areas of workers • Record of H&S orientation trainings • Use of personal protective equipment • % of moving equipment outfitted with audible back-up alarms • Permanent sign boards for hazardous areas • Signage for storage and disposal areas • Condition of sanitation facilities for workers 	<p>subproject components</p>	

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<p>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> <ul style="list-style-type: none"> • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use 				

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		of hearing protection shall be enforced actively.				
D. Historical, Cultural, and Archaeological Characteristics						
Physical and cultural heritage	Construction works will be on built-up areas of Mymensingh thus risk for chance finds is low.	<ul style="list-style-type: none"> All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. Stop work immediately to allow further investigation if any finds are suspected. 	Construction Contractor	<ul style="list-style-type: none"> Records of chance finds 	<ul style="list-style-type: none"> Visual inspection by PIU and supervision consultants on monthly basis Frequency and sampling sites to be finalized during detailed design stage and final location of subproject components 	<ul style="list-style-type: none"> Cost for implementation of mitigation measures responsibility of contractor.
E. Others						
Submission of EMP implementation report	Unsatisfactory compliance to EMP	<ul style="list-style-type: none"> Appointment of supervisor to ensure EMP implementation Timely submission of monitoring reports including pictures 	Construction contractor	<ul style="list-style-type: none"> Availability and competency of appointed supervisor Monthly report 	<ul style="list-style-type: none"> Monthly monitoring report to be submitted by PIU to PMU PMU to submit semi-annual monitoring report to ADB 	<ul style="list-style-type: none"> Cost for implementation of mitigation measures responsibility of contractor.
3. Post-construction Activities						
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	<ul style="list-style-type: none"> Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and All excavated roads shall be reinstated to original condition. All disrupted utilities restored All affected structures rehabilitated/compensated The area that previously housed the construction 	Construction Contractor	<ul style="list-style-type: none"> PMU/MDSC report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related 	<ul style="list-style-type: none"> Prior to turn-over of completed works to pourashava 	<ul style="list-style-type: none"> Cost for implementation of mitigation measures responsibility of contractor.

Environmental Issues/Impacts	Impact	Mitigation Measures	Responsibility	Monitoring indicators	Frequency of monitoring	Cost
		<p>camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up.</p> <ul style="list-style-type: none"> • All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document. • The contractor must arrange the cancellation of all temporary services. • Request PMU/CSS to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work. 		structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.		

^a These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

^b 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.

Table 38: Environmental Management and Monitoring Plan – O&M Phase

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
A. Physical Characteristics						
Environmental conditions	Loss of environmental quality due to implementation of subproject	Mymensingh <i>pourashava</i> will undertake seasonal monitoring of air, water, noise, and soil quality through an approved	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	Will be covered under Mymensingh <i>pourashava</i>

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		monitoring agency. The parameters to be monitored, frequency and duration of monitoring, as well as the locations to be monitored will be as per the monitoring plan prepared.				revenue budget
Survival of trees, maintenance of landscaping, and the green buffer zone	Dames of planted trees	Proper care will be taken to increase survival rate of saplings, like regular watering, pruning, provision of tree guards, provision of manure for better nourishment, etc., including timely replacement of perished saplings.	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Management of sludge and waste at the SWM landfill site	Improper handling of sludge and waste at SWM site	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 site.	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Other construction	Damage of drains and roads during construction of trenches for other construction	Care should be taken during construction of trenches for other construction.	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Maintenance of SWM site	Drain blockage and routine maintenance near and around SWM site	Routine maintenance and regular cleaning is necessary using modern equipments	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Maintenance of the fecal sludge treatment plant	Improper maintenance of fecal sludge	<i>pourashava</i> will ensure regular maintenance of the fecal sludge treatment plant. Utilization of dried sludge for horticultural/ agricultural	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		purposes, as suitable, will be carried out. Reuse of sludge will be explored after testing to meet government safety standards.				
Odor related	Odor related and other Impacts on surrounding habitations and proposed developments	Controlled land filling shall reduce the chances of foul odor to a large extent	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Flooding during monsoon season will	Impact of flooding during monsoon and creation of nuisance and pollute surrounding area with leachate	Storm drains surrounding the landfill to ensure surface water drains to handle heaviest rain	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Noise	Noise pollution from Refuse vehicles movement	Green buffer to be developed around the site	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Traffic	Traffic may be impeded by heavy waste vehicles	Carry waste to landfill outside peak traffic periods	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Disposal of waste	Improper disposal of waste at bin, secondary transfer stations and landfills will create nuisance and irregular SWM transport service and improper management of landfill will further crease environmental pollution: create nuisance, odor, water pollution to nearby surface water body and groundwater and air pollution.	It is necessary to train <i>pourashava</i> staff for proper solid waste management and also create awareness to public in disposal of solid waste into bins, etc	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Landfill Gas	Production of	As gas collection system is	Mymensingh	Monitoring report	Twice a year	As above

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
production	methane gas may be produced which could ignite in the presence of a spark or open flame. Hydrogen sulfide may also be generated in sufficient quantities to be toxic and may pose hazard in enclosed areas.	integrated with SWM landfill, this might not have any impact. However, proper monitoring on gas collection system is necessary along with air pollution monitoring near landfill site.	<i>pourashava</i>			
Spill of solid waste	Solid waste spilled onto pavement pose a potential road hazard because they can create wet, slick surfaces for motor vehicles, and/or can obstruct traffic flow.	Proper practice mentioned in SWM subproject for collection and transport is strictly necessary to follow	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Land application of biosolids	Environmental nuisance and disease spreading happens from improper land application of biosolids from fecal sludge	A properly managed land application program achieves beneficial reuse of waste organic matter and nutrients without adversely affecting public health. In many cases, septage is stabilized before application to land to reduce levels of pathogenic organisms, lower the potential for putrefaction, and reduce odors. The simplest and most economical technique for stabilization of septage is the addition of lime or other alkaline material, which is added to liquid septage in quantities sufficient to increase the pH of the septage to at least 12.0 for 30 minutes.	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Control and management of	Pollution from improper control and	Recommended measures to prevent, minimize, and	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
septage and other fecal sludge	management of septage and other fecal sludge	control releases of septage and other fecal sludge are included in the EMP. Operation and maintenance of fecal sludge management and solid waste management is presented in the SWM proposal. It should be shared responsibility between the user communities or maintenance committee formed by the local community, who will be educated on the technology and with support from the <i>pourashava</i> for periodical maintenance.				
SWM at landfill	Management of sludge and waste at the SWM landfill site	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 site.	Mymensingh <i>pourashava</i>	Monitoring report	Twice a year	As above
Water quality	Run-off from stockpiled wastes and end-products of composting which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> • Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review 	<ul style="list-style-type: none"> • Mymensingh <i>pourashava</i> 	<ul style="list-style-type: none"> • No visible degradation to nearby khals and water bodies • Leachate/discharge quality and ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, 	<ul style="list-style-type: none"> • Everyday visual inspection for khals, drains, and water bodies within 30 m circumference of the facilities • Monthly monitoring of leachate and/or as prescribe by ECR, 1997 	<ul style="list-style-type: none"> • Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		<p>of ECC conditions.</p> <ul style="list-style-type: none"> • Monitor compost quality. • Monitor treated wastes quality. 		<p>total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phenol compounds and others as per ECR, 1997.</p> <ul style="list-style-type: none"> • Compost quality to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the government. • Autoclave operations as per manufacturers specification, Medical Wastes Rules and conditions of the ECC • Treated medical wastes to meet standards for spore tests, and other routine tests (visual). 	<ul style="list-style-type: none"> • Prior to packaging of compost visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. • Monthly monitoring of compost and/or as prescribed by the government. • Daily monitoring of autoclave operations • Monthly monitoring of spore and routine tests and/or as prescribed by the government. 	
Air quality	<p>Moving wastes, by- and end-products (such as composts) may create dusts during dry season. Landfill gas generation. The impacts are negative but short-term, site-specific within a</p>	<ul style="list-style-type: none"> • Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. • Green belt will be developed around the 	<ul style="list-style-type: none"> • Mymensingh pourashava 	<ul style="list-style-type: none"> • No complaints from sensitive receptors 	<ul style="list-style-type: none"> • During collection of wastes • During transport of wastes, by-, and end-products to the facilities • During 	<ul style="list-style-type: none"> • Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
	relatively small area and reversible by mitigation measures.	facilities to act as a barrier for dust pollution. <ul style="list-style-type: none"> Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum. 			transport of cover materials	
Acoustic environment	Increase in noise level due to presence of workers and movement of vehicles. The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	<ul style="list-style-type: none"> Plan activities in consultation with Mymensingh pourashava so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. 	<ul style="list-style-type: none"> Mymensingh pourashava 	<ul style="list-style-type: none"> No complaints from sensitive receptors 	<ul style="list-style-type: none"> During O&M phase 	<ul style="list-style-type: none"> Included in O&M cost
B. Biological Characteristics						
Biodiversity	Activities in the built-up area of Mymensingh <i>pourashava</i> . There are no protected areas in or around subproject sites, and no known areas of ecological interest.	<ul style="list-style-type: none"> No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal). Monitor survival rate of vegetation (plants and trees) in the green belt of the facilities. 	<ul style="list-style-type: none"> Mymensingh pourashava 	<ul style="list-style-type: none"> No complaints from sensitive receptors Survival rate of vegetation/green belt 	<ul style="list-style-type: none"> During O&M phase Vegetation monitoring to be implemented until trees are 2 m high 	<ul style="list-style-type: none"> Included in O&M cost
C. Socioeconomic Characteristics						
Existing provisions for pedestrians and other forms of transport	Increase in traffic in the <i>pourashava</i> during collection, loading and unloading of wastes. The impacts are negative but short-term, site-specific within a	<ul style="list-style-type: none"> Early hour collection will be enforced before the peak traffic hours. Maintain safe passage for vehicles and pedestrians. Erect and maintain barricades, including signs, markings, flags and 	<ul style="list-style-type: none"> Mymensingh pourashava 	<ul style="list-style-type: none"> No complaints from sensitive receptors 	<ul style="list-style-type: none"> During O&M phase 	<ul style="list-style-type: none"> Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
	relatively small area and reversible by mitigation measures.	<p>flagmen informing diversions and alternative routes when required.</p> <ul style="list-style-type: none"> • Notify affected sensitive receptors by providing sign boards and contact numbers for concerns/complaints. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions. 				
Workers health and safety	Workers need to be mindful of the occupational hazards working in waste management facilities. Potential impacts are negative and long-term but reversible by mitigation measures.	<ul style="list-style-type: none"> • Comply with requirements of Government of Bangladesh Labor Law of 2006 and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M health and safety (H&S) plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective 	<ul style="list-style-type: none"> • Mymensingh pourashava 	<ul style="list-style-type: none"> • No complaints from sensitive receptors • No complaints from workers related to O&M activities • Zero accident 	<ul style="list-style-type: none"> • Duration of repair works 	<ul style="list-style-type: none"> • Included in O&M cost

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost Source and of Funds
		<p>equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing (H&S) training^a for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records.</p> <ul style="list-style-type: none"> • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • 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; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. 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. • Disallow worker exposure 				

Field	Impacts	Mitigation Measures	Responsible for Implementation	Monitoring Indicator	Frequency of Monitoring	Cost and Source of Funds
		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	Possible accumulation of waste causing health problems for community. Pests and vermin. Potential impacts are negative and long-term but reversible by mitigation measures.	<ul style="list-style-type: none"> Wet/biodegradable wastes will be emptied directly from the bins to primary collection vehicles daily and dry/non-biodegradable wastes once in a week. The number and type of bins and vehicles to be procured under the project is sufficient to ensure no accumulation of wastes in the community. Wastes will be collected regularly to prevent pests and vermin. 	<ul style="list-style-type: none"> Mymensingh pourashava 	<ul style="list-style-type: none"> No complaints from sensitive receptors 	<ul style="list-style-type: none"> During O&M phase 	<ul style="list-style-type: none"> Included in O&M cost

^a 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.

Table 39: Monitoring Plan For Proposed Subprojects During Construction Phase

Attributes	Base line	Parameters to be Monitored	Location	Frequency	Responsibility
Air Quality at landfill site and secondary transfer station	Baseline is to be established at the selected location before start of construction	PM/SPM (PM10/PM2.5), SOx, NOx, CO, odor	At the landfill site (at least 1 locations) At secondary transfer station (1 location at each transfer station)	Twice in a Year (at least once in dry season) for the entire construction period	Contractor, through approved Monitoring Agency, PIU (Mymensingh <i>pourashava</i> and PMU (LGED and PMSC)
Noise Levels in silence zone (near school, hospital, etc.)	Baseline is to be established at the selected location before start of	Equivalent Day & Night Time Noise Levels	At the landfill site (at least 1 locations) At secondary transfer station (1 location at	Twice in a year	Same as above

Attributes	Base line	Parameters to be Monitored	Location	Frequency	Responsibility
	construction		each transfer station)		
Water quality near water body beside landfill site and secondary transfer station	Baseline is to be established at the selected location before start of construction	Dissolved Oxygen (DO), TDS, TSS, pH, BOD5/COD, Nitrogen and Phosphorus oil and grease	At one location in the water body	Twice a year (at least once in dry season) for the entire period of construction	Same as above
Groundwater quality	Baseline is to be established at the selected location before start of construction	All drinking water quality parameters including Total Coliform (TC) and Fecal Coliform (FC)	At the monitoring wells proposed in the design of SWM landfill	Twice a year (at least once in dry season) for the entire period of construction	Same as above
Soil quality	Baseline is to be established before start of construction	Nitrogen and phosphorus and heavy metals (Cd, Cr, Cu, As, Pb, Ni, Zn, etc.	Near or beneath secondary transfer station and at existing dumpsite and proposed land fill	Twice a year (at least once in dry season) for the entire period of construction	Same as above
Survival Rate of Plantation and landscaping	No plants	Survival Rate of Proposed plantations	Along the landfill site and in landscaped portions	Before and after construction	Contractor through PIU and PMSC

Table 40: Monitoring Plan for proposed subprojects during operational phase

Attributes	Base line	Parameters to be Monitored	Location	Frequency	Responsibility
Air Quality at each location of items	Baseline is to be established just after construction	PM/SPM (PM10/PM2.5), SO _x , NO _x , CO, Odor	At the subproject areas (at least 1 locations)	Twice in a Year (at least once in dry season) up to 3 years after construction	Mymensingh <i>pourashava</i> support from LGED
Water quality	Baseline is to be established just after construction	Dissolved Oxygen (DO), TDS, TSS, pH, BOD5/COD, Ammonia, Phosphate, oil and grease (for boat landing station only)	Any nearest water body near the landfill site and secondary transfer station site	Twice a year up to 3 years after construction	Same as above
Groundwater quality	Baseline is to be established just after construction	All drinking water quality parameters including Total Coliform (TC) and Fecal Coliform (FC)	At all monitoring wells designed under the sanitary landfill	Twice in a year up to 3 years after construction	Same as above
Traffic congestion	Baseline is to be established just after construction	Travel delay, visual observation of traffic congestion, number of times traffic congestion per day	-in the approach road of sanitary landfill	When traffic congestion suspected up to 3 years after construction	Same as above
Drainage congestion	No drainage congestion	Visual observation of drainage congestion	At the point where drainage congestion occurs in and around the road	When drainage congestion occurs up to 3 years after construction	Same as above

Attributes	Base line	Parameters to be Monitored	Location	Frequency	Responsibility
Survival Rate of Plantation and landscaping	Baseline is to be established just after construction	Survival Rate of Proposed plantations	At the subproject location and in the landscaped portions	Twice in a year up to 3 years after construction	Same as above
Soil quality	Baseline is to be established before start of construction	Nitrogen and phosphorus and heavy metals (Cd, Cr, Cu, As, Pb, Ni, Zn, etc.	Near or beneath secondary transfer station and at existing dumpsite and proposed land fill	Twice a year (at least once in dry season) for the entire period of construction	Same as above
Leachate Monitoring	Baseline is to be established just after construction	Overflowing of leachate pits, Checking of leachate pipes. Quality of leachate in terms of pH, TDS, BOD,COD, Coliforms (TC and FC)	At landfill site	Daily inspection by operation and monthly inspection by the PIU/PMU (for first 3years of operation). Leachate Quality monitoring to be done twice a year for first three years of operation	Same as above
Odor Monitoring in peripheral residential areas of the landfill site in the downwind direction	No odor	Hydrogen Sulphide (H ₂ S) and Ammonia (NH ₃)	At roadway (at least one location)	Twice a year for first three years of operation	Same as above
Standard for compost	Standard for compost	Cd, Cr, Cu, Pb, Ni, Zn etc	On collected Compost	Twice a year	Same as above
Collection efficiency	Baseline is to be established just after construction	Visual inspection to check for uncleared garbage piles and spillage along haul routes	5 different localities/ month covered by the Collection network	Once every month for the first 3 years of operation	Mymensingh <i>pourashava</i>
Community Perception	-	Community Perception Survey to identify the problems associated with the process and develop suitable modifications	5 different localities/ month covered by the Collection network	Once every month for the first 3 years of operation	Mymensingh <i>pourashava</i>
Socioeconomic monitoring	-	Compensation disbursement accuracy and efficiency, public feedback on this issue.	Affected population who have faced land acquisition	Monthly basis till all compensations are paid and feedbacks gathered	Mymensingh <i>pourashava</i>

C. Capacity Development Program

205. The MDSC national and regional environmental specialists will be responsible for trainings on environmental awareness and management in accordance with both ADB and government requirements. Specific modules customized for the available skill set will be devised after assessing the capabilities of the target participants and the requirements of the project. Typical modules would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in solid waste management projects; (iii) review of IEEs and integration into the project detailed design; (iv) improved coordination within nodal departments; and (v) monitoring and reporting system. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The proposed training project along with the frequency of sessions is presented in Table 41.

Table 41: Training Program for Environmental Management

Description	Contents	Schedule	Participants
Pre-construction stage			
Orientation workshop	Module 1 – Orientation <ul style="list-style-type: none"> • ADB Safeguards Policy Statement • Government of Bangladesh Environmental Laws and Regulations Module 2 – Environmental Assessment Process <ul style="list-style-type: none"> • ADB environmental process, identification of impacts and mitigation measures, formulation of an environmental management plan (EMP), implementation, and monitoring requirements • Review of environmental assessment report to comply with ADB requirements • Incorporation of EMP into the project design and contracts 	1 day	LGED, DPHE, PMU, and PIUs officials involved in the project implementation
Construction stage			
Orientation program/ workshop for contractors and supervisory staff	<ul style="list-style-type: none"> • Roles and responsibilities of officials/contractors/ consultants towards protection of environment • Environmental issues during construction • Implementation of EMP • Monitoring of EMP implementation • Reporting requirements 	1 day	PMU PIUs Contractors
Experiences and best practices sharing	<ul style="list-style-type: none"> • Experiences on EMP implementation – issues and challenges • Best practices followed 	1 day on a regular period to be determined by PMU, PIUs, and PMSC	PMU PIUs Contractors

D. Staffing Requirement and Budget

206. Costs required for implementing the EMP will cover the following activities:

- (i) Updating IEE, preparing and submitting reports and public consultation and disclosure;
- (ii) Application for environmental clearances; and
- (iii) Implementation of EMP, environmental monitoring program and long-term surveys.

207. The infrastructure involved in each scheme is generally straightforward and will take between three and nine months to build. Environmental monitoring during construction will also be straightforward and will involve periodic site observations and interviews with workers and others, plus checks of reports and other documents. This will be conducted by MDSC environmental management specialist assisted by the PMU environment officer. The environmental management specialist will use the IEE as necessary and perform tasks as specified in the TOR. Therefore no separate budget required for MDSC environment management specialist.

208. The cost of mitigation measures and surveys during construction stage will be incorporated into the contractor's costs, which will be binding on him for implementation. The surveys will be conducted by the contractors.

209. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of Mymensingh *pourashava*. All monitoring during the operation and maintenance phase will be conducted by LGED and DPHE, therefore, there are no additional costs.

210. The indicative costs to implement the EMP are shown in Tables 42 and 43 (by source of funds).

Table 42: Cost Estimates to Implement the Environmental Management Plan

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
A. Mitigation Measures							
1.	Environmental mitigation / enhancement measures integrated into the designs and costs included as part of civil works	Construction				Covered under BoQ of Construction Document (CCD)	Civil Works Contract
2	Compensatory plantation measures	Construction	Per tree	50	1,500	75,000	Civil works contract
B. Monitoring parameter for establishing baseline during detailed design/before construction							
1.	Air Quality Monitoring	Before construction	Per contract package	2	20,000	40,000	Civil works contractor
2.	Noise level	Before construction	Per contract package	10	5,000	50,000	Civil works contractor
3.	Water Quality monitoring (Surface water)	Before construction	Per contract package	2	20,000	40,000	Civil works contractor
4	Water Quality monitoring ¹⁴ (Ground water)	Before construction	Per contract package	2	20,000	40,000	Civil works contractor
5	Soil quality	Before construction	Per contract package	2	20,000	40,000	Civil works contractor
C. Monitoring parameter during construction							
1.	Air Quality monitoring	Construction	Per contract package	2	20,000	40,000	Civil works Contract

¹⁴ The frequency of groundwater monitoring may be increased to monitor potential contamination from leachate

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
2.	Noise level	Construction	Per contract package	10	5,000	50,000	Civil work contractor
3.	Water Quality monitoring (Surface water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
4	Water Quality monitoring (Ground water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
5	Soil quality	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
6.	Survival Rate of Plantation and landscaping	Construction	Per contract package, (where applicable)	2	5,000	10,000	Civil work Contractor
D. Monitoring Parameter during operation							
1.	Water Quality monitoring (Surface water)	Operation	Per subproject per year	2	20,000	40,000	Mymensingh <i>pourashava</i>
2	Water Quality monitoring (Ground water)	Operation	Per subproject per year	2	20,000	40,000	Mymensingh <i>pourashava</i>
3	Soil quality	Operation	Per contract package	2	20,000	40,000	Mymensingh <i>pourashava</i>
4	Socioeconomic monitoring	Operation	Per subproject per year	1	25,000	25,000	Mymensingh <i>pourashava</i>
5	Odor Monitoring in peripheral residential areas of the landfill site in the downwind direction	Operation	Per subproject per year	1	25,000	25,000	Mymensingh <i>pourashava</i>
6	Standard for compost	Operation	Per subproject per year (where applicable)	1	25,000	25,000	Mymensingh <i>pourashava</i>
7	Collection efficiency	Operation	Per subproject per year	5	5,000	25,000	Mymensingh <i>pourashava</i>
8	Community Perception	Operation	Per subproject per year	5	5,000	25,000	Mymensingh <i>pourashava</i>
9.	Survival Rate of Plantation and landscaping	Operation	Per subproject per year (where applicable)	2	5,000	10,000	Mymensingh <i>pourashava</i>
E. Capacity Building							
1.	i) Orientation workshop for officials involved in the project implementation on ADB Safeguards Policy Statement, Government of Bangladesh environmental laws and regulations, and environmental assessment	Module 1 – immediately upon engagement of the MDSC environmental specialists Module 2 – prior to award of civil works contracts (twice a year for 3.5 years)	lump sum 1 times 7 times 1 times		Module 1 – 50,000 Module 2 – 50,000 Module 2 – 50,000	450,000	Covered under MDSC

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
	process; (ii) induction course contractors, preparing them on EMP implementation and environmental monitoring requirements related to mitigation measures; and taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;	Module 3 – prior to start of Phase 3 and upon completion of the project	(Combined for all subprojects)				
3.	Experiences and best practices sharing	Construction (before phase 2)	Cumulative for all subprojects	LS		100,000	Covered under MDSC
D	Public Consultation	During detailed design (For update of IEE/EIA) and preconstruction		LS		500,000	Covered under MDSC
E	GRM implementation	During construction	As per requirement			As per PMU budget	Covered under PMU & PIUs
F	Consultant cost						MDSC cost
	MDSC national environmental specialist (1 person)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36 person months	320,000 per person month	11,520,000	Remuneration and budget for travel covered in the MDSC contract
	MDSC regional environmental specialists (2 persons)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36+17 each = 53 person-months	320,000 per person-month	16,960,000	Remuneration and budget for travel covered in the MDSC contract
G	Administrative cost						
	Legislation, permits, and agreements	During construction Permit for excavation, tree-cutting permits, etc	Per package	LS		50,000	These consents are to be obtained by contractor at his own expense.
	Environmental assessment and environmental clearances as per ECA and ECR requirements	Before construction ECC for red and Orange subproject	Per subproject (where applicable)	LS		500,000	LGED cost for municipal infrastructure

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
H	Other costs						
	Any unanticipated impact due to project implementation	Mitigation of any unanticipated impact arising during construction phase and defect liability period		LS		Contractors' liability	Can be covered through contractor's insurance

Table 43: Cost Estimates to Implement the EMP (funding by source)

	Particulars	Stages	Subproject/ package	Total number	Rate (million n BDT)	Cost (million BDT)	Costs covered by
A. Contractor							
1.	Environmental mitigation / enhancement measures integrated into the designs and costs included as part of civil works	Construction				Covered under BoQ of Construction Document (CCD)	Civil Works Contractor
2	Compensatory plantation measures	Construction	Per tree	50	1,500	75,000	Civil works contractor
3.	Air Quality Monitoring	Before construction	Per contract package	2	20,000	40,000	Civil works contractor
4.	Noise level	Before construction	Per contract package	10	5,000	50,000	MDSC Cost/ Civil works contractor
5.	Water Quality monitoring (Surface water)	Before construction	Per contract package	2	20,000	40,000	MDSC Cost/ Civil works contractor
6	Water Quality monitoring (Ground water)	Before construction	Per contract package	2	20,000	40,000	MDSC Cost/ Civil works contractor
7	Soil quality	Before construction	Per contract package	2	20,000	40,000	MDSC Cost/ Civil works contractor
8.	Air Quality monitoring	Construction	Per contract package	2	20,000	40,000	Civil works Contractor
9.	Noise level	Construction	Per contract package	10	5,000	50,000	Civil work contractor
10	Water Quality monitoring (Surface water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
11	Water Quality monitoring (Ground water)	Construction	Per contract package	2	20,000	40,000	Civil work Contractor
12	Soil quality	Construction	Per contract	2	20,000	40,000	Civil work

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
			package				Contractor
13	Survival Rate of Plantation and landscaping	Construction	Per contract package, (where applicable)	2	5,000	10,000	Civil work Contractor
14	Any unanticipated impact due to project implementation	Mitigation of any unanticipated impact arising during construction phase and defect liability period		LS		Contractors' liability	Can be covered through contractor's insurance
B. Pourashava							
1.	Water Quality monitoring (Surface water)	Operation	Per subproject per year	2	20,000	40,000	Mymensingh pourashava
2	Water Quality monitoring (Ground water)	Operation	Per subproject per year	2	20,000	40,000	Mymensingh pourashava
3	Soil quality	Operation	Per contract package	2	20,000	40,000	Mymensingh pourashava
4	Socioeconomic monitoring	Operation	Per subproject per year	1	25,000	25,000	Mymensingh pourashava
5	Odor Monitoring in peripheral residential areas of the landfill site in the downwind direction	Operation	Per subproject per year	1	25,000	25,000	Mymensingh pourashava
6	Standard for compost	Operation	Per subproject per year (where applicable)	1	25,000	25,000	Mymensingh pourashava
7	Collection efficiency	Operation	Per subproject per year	5	5,000	25,000	Mymensingh pourashava
8	Community Perception	Operation	Per subproject per year	5	5,000	25,000	Mymensingh pourashava
9.	Survival Rate of Plantation and landscaping	Operation	Per subproject per year (where applicable)	2	5,000	10,000	Mymensingh pourashava
C. MDSC							
1.	i) Orientation workshop for officials involved in the project implementation on ADB Safeguards Policy Statement, Government of	Module 1 – immediately upon engagement of the MDSC environmental specialists Module 2 – prior to award of civil works	lump sum 1 times 7 times		Module 1 – 50,000 Module 2 – 50,000 Module 2 – 50,000	450,000	Covered under MDSC

	Particulars	Stages	Subproject/ package	Total number	Rate (millio n BDT)	Cost (million BDT)	Costs covered by
	Bangladesh environmental laws and regulations, and environmental assessment process; (ii) induction course contractors, preparing them on EMP implementation and environmental monitoring requirements related to mitigation measures; and taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;	contracts (twice a year for 3.5 years) Module 3 – prior to start of Phase 3 and upon completion of the project	1 times (Combined for all subprojects)				
2.	Experiences and best practices sharing	Construction (before phase 2)	Cumulative for all subprojects	LS		100,000	Covered under MDSC
3	MDSC national environmental specialist (1 person)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36 person months	320,000 per person month	11,520,000	Remuneration and budget for travel covered in the MDSC contract
4	MDSC regional environmental specialists (2 persons)	Responsible for environmental safeguards of the project	person months (spread over entire project implementation period)	36+17 each = 53 person-months	320,000 per person-month	16,960,000	Remuneration and budget for travel covered in the MDSC contract
5	Public Consultation	During detailed design (For update of IEE/EIA) and preconstruction		LS		500,000	Covered under MDSC

	Particulars	Stages	Subproject/ package	Total number	Rate (million BDT)	Cost (million BDT)	Costs covered by
D. PMU Cost							
1	GRM implementation	During construction	As per requirement			As per PMU budget	Covered under PMU & PIUs
2	Legislation, permits, and agreements	During construction Permit for excavation, tree-cutting permits, etc	Per package	LS		50,000	These consents are to be obtained by contractor at his own expense.
3	Environmental assessment and environmental clearances as per ECA and ECR requirements	Before construction ECC for red and Orange subproject	Per subproject (where applicable)	LS		500,000	LGED cost for municipal infrastructure

E. Monitoring and Reporting

211. The PMU will monitor and measure the progress of EMP implementation. The monitoring activities will correspond with the project's risks and impacts, and will be identified in the IEEs for the projects. In addition to recording information on the work and deviation of work components from original scope PMU, PIU, and MDSC will undertake site inspections and document review to verify compliance with the EMP and progress toward the final outcome.

212. The MDSC will submit monthly monitoring and implementation reports to PMU, who will take follow-up actions, if necessary. PMU will submit semi-annual monitoring reports to ADB (as per sample in annex 5). Subproject budgets will reflect the costs of monitoring and reporting requirements. Monitoring reports will be posted in a location accessible to the public.

213. The LGED will document monitoring results, identify the necessary corrective actions, reflect them in a corrective action plan, and for each quarter, will study the compliance with the action plan developed in the previous quarter. Compliance with loan covenants will be screened by the Local Government Division (LGD) of the Ministry of Local Government, Rural Development, and Cooperatives (MLGRDC).

214. The ADB will review project performance against the MLGRDC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system. ADB will monitor projects on an ongoing basis until a project completion report is issued. ADB will carry out the following monitoring actions to supervise project implementation:

- (i) conduct periodic site visits for projects with adverse environmental or social impacts;

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

IX. CONCLUSION AND RECOMMENDATION

215. The process described in this document has assessed the environmental impacts of all elements of Mymensingh SWM subproject. All potential impacts were identified in relation to design and location, construction, and operation phases.

216. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible; thus, environmental impacts as being due to the project design or location were not significant.

217. Most of the individual elements of the subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant. Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation. However, the routine nature of the impacts means that most can be easily mitigated. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. Mitigation will be assured by a program of environmental monitoring to ensure that all measures are implemented, and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

218. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB and LGED project websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

219. The PMU and MDSC will be responsible for monitoring. The MDSC will submit monthly monitoring reports to PMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

220. The EMP will assist the PMU, MDSC, and contractors in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project. The EMP will also ensure efficient lines of communication between the implementing agency, project management unit, and contractors. A copy of the EMP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on

the site, and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance.

221. Therefore the proposed subproject is unlikely to cause significant adverse impacts and net environmental benefits to citizens of Mymensingh will be positive. The potential 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.

222. As per Government of Bangladesh ECA, 1995 and ECR, 1997, the subproject is categorized as “red”; and LCC and ECC must be obtained from DoE.

223. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category “B” is confirmed. No further special study or detailed EIA needs to be undertaken to comply with ADB SPS, 2009.

APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLISTS

Country/Project Title: Bangladesh: Third Urban Governance and Infrastructure Improvement (Sector) Project (UGIP-3) – Additional Financing

Solid Waste Management (SWM) Rapid Environmental Assessment (REA) Checklist

Town: Mymensingh

Subproject Title: Mymensingh solid waste management subproject includes construction of a fecal sludge treatment facility and internal roads at existing landfill and construction of a new landfill with compost plant, leachate treatment, internal roads, boundary wall, bio-medical waste disposal facility and 8 transfer stations.

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area...			
• Densely populated?	✓		Area of Mymensingh <i>pourashava</i> is 21.73 km ² with population of 258,040 and density of 11,875 person per km ² .
• Heavy with development activities?		✓	The area is dominated by residential area. A trace area is composed of agricultural land (newly formed wards)
Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		✓	
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
Potential Environmental Impacts Will the Project cause...			
• Impacts associated with transport of wastes to the disposal site or treatment facility	✓		Subproject will improve the current situation. The EMP includes measures to mitigate impacts. O&M Manual to be developed under the project will follow EMP.
• Impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	
• Degradation of aesthetic and property value loss?		✓	Subproject will improve the current situation.
• Nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.?		✓	Subproject will improve the current situation. O&M Manual to be developed under the project will include odour and pest control.
• Dislocation or involuntary resettlement of people?		✓	Not applicable
• Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not applicable. Rag pickers/scavengers are not present in the existing dumpsite.
• Risks and vulnerabilities related occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	✓		Anticipated. However, impacts are temporary, short in duration and can be mitigated thru environmental health and safety considerations in the EMP and O&M Manual. The EMP includes measures to mitigate impacts. O&M Manual to be developed under the project will follow EMP.
• Public health hazards from odor, smoke from fire,		✓	Not anticipated. O&M Manual to be developed under the project will include fire,

Screening Questions	Yes	No	Remarks
and diseases transmitted by flies, insects, birds and rats?			odour and appropriate pest control.
• Deterioration of water quality as a result of contamination of receiving waters by leachate from land disposal system?		✓	Not anticipated. Leachate management measures have been incorporated in the preliminary design
• Contamination of ground and/or surface water by leachate from land disposal system?		✓	Not anticipated. Preliminary design includes construction of impermeable layer at the base of the site and inner side slope of the embankment for groundwater protection (subject to detailed geological investigation during detailed design)
• Land use conflicts?		✓	Not anticipated. The proposed land fill site- presently the land is used as agricultural land and aquaculture by un-authorized people.
• Pollution of surface and ground water from leachate coming from sanitary landfill sites or methane gas produced from decomposition of solid wastes in the absence of air, which could enter the aquifer or escape through soil fissures at places far from the landfill site?		✓	Not anticipated. Leachate and landfill gas management measures have been incorporated in the preliminary design.
• Inadequate buffer zone around landfill site to alleviate nuisances?		✓	Not anticipated. Buffer zone and greenbelt around facilities included in preliminary designs.
• Road blocking and/or increased traffic during construction of facilities?		✓	Not anticipated. Road closures are not required. Construction contractors will be required to implement traffic management plan and coordinate with local authority.
• Noise and dust from construction activities?	✓		Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants. The impacts are negative but short-term, site-specific within a relatively small area and reversible through mitigation measures specified in the EMP.
• Temporary silt runoff due to construction?	✓		Due to excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants. The impacts are negative but short-term, site-specific within a relatively small area and reversible through mitigation measures specified in the EMP.
• Hazards to public health due to inadequate management of landfill site caused by inadequate institutional and financial capabilities for the management of the landfill operation?		✓	Institutional development and capacity building for <i>pourashava</i> are included in the project
• Emission of potentially toxic volatile organics from land disposal site?		✓	Not anticipated.
• Surface and ground water pollution from leachate and methane gas migration?		✓	Leachate and landfill gas management measures have been incorporated in the preliminary design.
• Loss of deep-rooted vegetation (e.g. trees) from landfill gas?		✓	Not anticipated. Deep-rooted vegetation not present in existing dumpsite as well as the proposed sites.
• Explosion of toxic response from accumulated landfill gas in buildings?		✓	Not anticipated. Expected GHG generation is insignificant. Preliminary design includes gas vents.
• Contamination of air quality from incineration?		✓	Not applicable.
• Health and safety hazards to workers from toxic gases and hazardous materials in the site?		✓	Personal protective equipment will be provided to workers. Regular training will also be conducted to ensure that workers

Screening Questions	Yes	No	Remarks
			are aware of construction hazards and risks of chemicals during O&M.
• Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Improved solid waste management systems through capacity building and institutional development will ensure reduced burden on services and infrastructure.
• Social conflicts if workers from other regions or countries are hired?		✓	Priority in employment will be given to local residents.
• 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?		✓	Not applicable. Construction will not involve use of explosives and chemicals.
• Community safety risks due to both accidental and natural hazards, especially where the structural elements or components (e.g., landfill or incinerator) of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		✓	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the operational sites.

A Checklist for Preliminary Climate Risk Screening

Screening Questions	Score	Remarks ^a
Location and Design of project	1	Project site is located in areas subject to cyclones and flooding. Components are designed to withstand such events
	0	
Materials and Maintenance	1	The area does not experience large temperature range (between 5 and 36 degrees C)
	0	Possible temporary loss of transportation for short periods due to damage in extreme events
Performance of project outputs	0	The landfills are designed on basis that peak water will never flow over the landfill.

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

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1

Very Likely	2
-------------	---

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

Result of Initial Screening (Low, Medium, High): Medium risk

Subproject Classification as per ADB SPS 2009:

The impacts are not major and impacts are local. No significant irreversible impacts are envisioned on human populations or environmentally sensitive areas including wetlands, forests, grasslands, and other natural habitats. All impacts can be mitigated under the scope of IEE.

Classification: Category B

Subproject Categorization as per DOE (ECR 1997)

Classification: Red for landfill and Medical Waste Management

Environmental Assessment Requirements: IEE as per ADB SPS (2009) and EIA as per DOE (ECR 1997)

Prepared by: TA 8913 consultant team for project preparation of UGIIP-3 additional financing

Designation: International Environmental Safeguard Specialist and National Environmental Safeguard Specialist

Date: August-October 2016

APPENDIX 2: APPLICATION FEES FOR ECC
[This table (APPENDIX-2) Not Required as these rates are not updated]

¹“**SCHEDULE – 13**”

Fees for Environmental Clearance Certificate or Renewal

[See Rules 7(5), 8(2) and 14]

1. Industrial unit or project

Investment (in Taka)	Fees for Environmental Clearance Certificate (in Taka)	Certificate Renewal Fee
(1)	(2)	(3)
(a) Between Tk. 100,000 and 5,00,000	Tk. 1,500	One-fourth of the fees in Column (2).
(b) Between Tk. 5,00,000 and 10,00,000	Tk. 3,000	-Do-
(c) Between Tk. 10,00,000 and 50,00,000	Tk. 5,000	-Do-
(d) Between Tk. 50,00,000 and 10,00,00,000	Tk. 10,000	-Do-

¹ Schedule-13 was substituted by Notification S.R.O. No. 234-Law/2002 dated 24/08/2002 and came into force on 26/08/2002 being the date of publication in Bangladesh Gazette extraordinary issue.

crifek ArBb msKjb

224

(1)	(2)	(3)
(e) Between Tk. 10,000,000 and 2,00,000,000	Tk. 25,000	One-fourth of the fees in Column (2).
(f) Between Tk. 2,00,000,000 and 5,00,000,000	Tk. 50,000	-Do-
(g) Above Tk. 5,00,000,000	Tk. 1,00,000	-Do-

APPENDIX 3: SAMPLE OUTLINE SPOILS MANAGEMENT PLAN

- I. Spoils information
 - A. Materials type
 - B. Potential contamination
 - C. Expected volume and sources
 - D. Spoil classification

- II. Spoils management
 - A. Transportation of spoil
 - B. Storage of spoil
 - C. Contaminated spoil
 - D. Approved reuse and/or disposal sites

- III. Records of reuse and/or disposal

APPENDIX 4: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:
 - (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
 - (ii) protection of work crews from hazards associated with moving traffic;
 - (iii) mitigation of the adverse impact on road capacity and delays to the road users;
 - (iv) maintenance of access to adjoining properties; and
 - (v) addressing issues that may delay the project.

B. Operating Policies for TMP

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

3. Figure A2 to Figure A12 illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

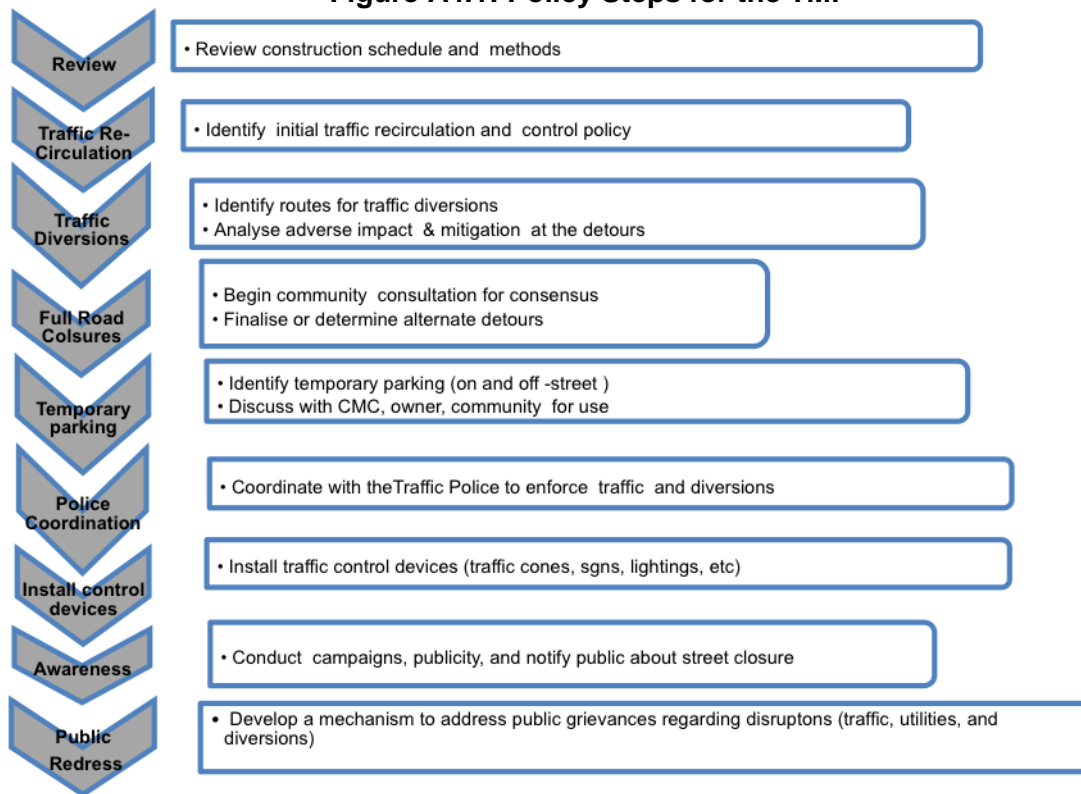
C. Analyze the impact due to street closure

4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:
 - (i) approval from the ULB/CMC/Public Works Department (PWD) to use the local streets as detours;
 - (ii) consultation with businesses, community members, traffic police, PWD, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
 - (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
 - (iv) determining if additional traffic control or temporary improvements are needed along the detour route;

- (v) considering how access will be provided to the worksite;
- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

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

Figure A4.1: Policy Steps for the TMP



D. Public awareness and notifications

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

7. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for

this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

8. The PIU will also conduct an awareness campaign to educate the public about the following issues:

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

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

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

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

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

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

- (i) Signs
- (ii) Pavement Markings
- (iii) Channelizing Devices
- (iv) Arrow Panels
- (v) Warning Lights

12. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work

zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

13. **Figure A4.2 to Figure A4.12** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

- (i) Work on shoulder or parking lane
- (ii) Shoulder or parking lane closed on divided road
- (iii) Work in Travel lane
- (iv) Lane closure on road with low volume
- (v) Lane closure on a two-line road with low volume (with yield sign)
- (vi) Lane closure on a two-line road with low volume (one flagger operation)
- (vii) Lane closure on a two lane road (two flagger operation)
- (viii) Lane closure on a four lane undivided Road
- (ix) Lane closure on divided roadway
- (x) Half road closure on multi-lane roadway
- (xi) Street closure with detour

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

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

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

Figure A4.2 & A4.3: Work on shoulder or parking lane and shoulder or parking lane closed on divided road

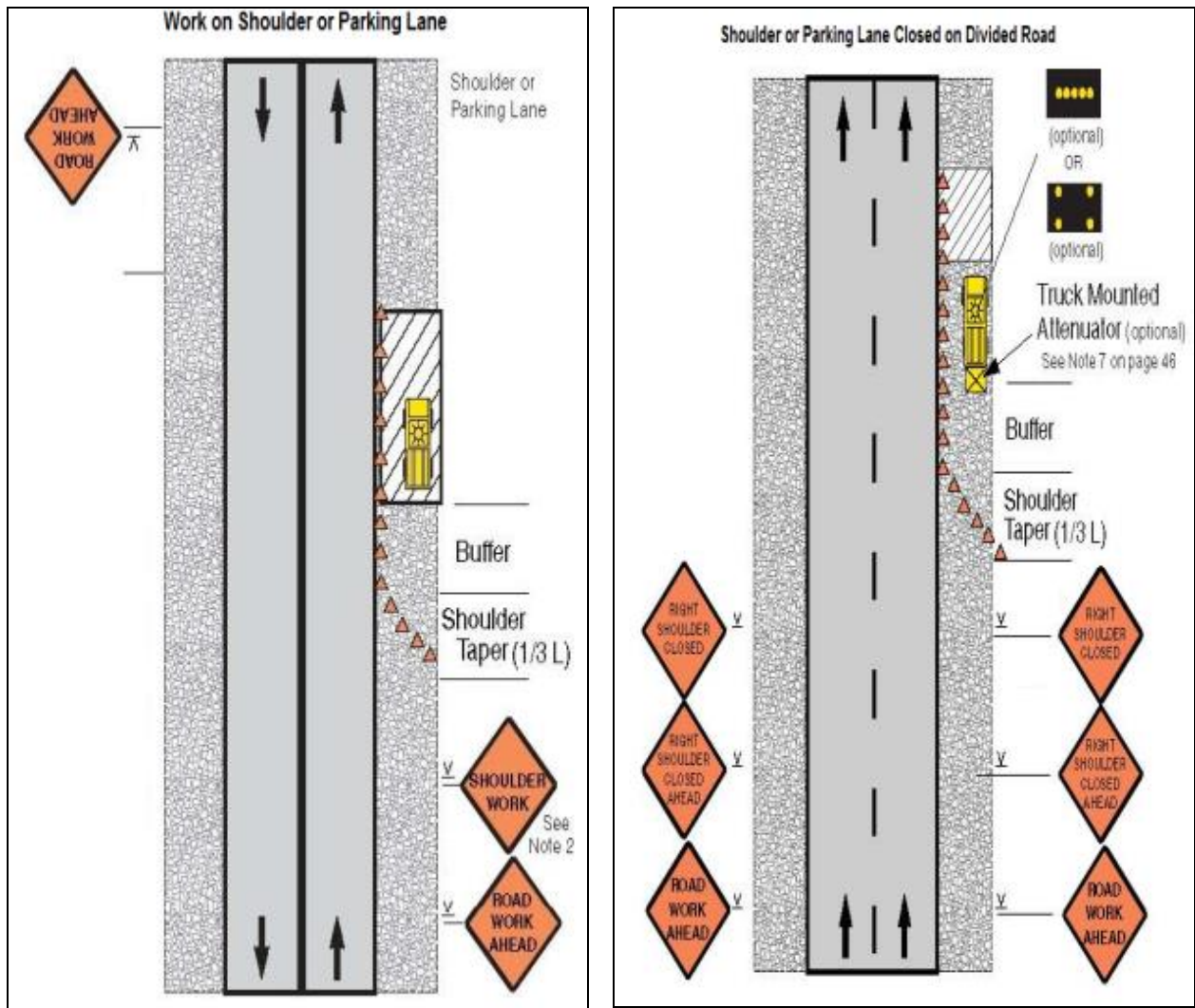


Figure A4.4 & A4.5: Work in Travel lane & Lane closure on road with low volume

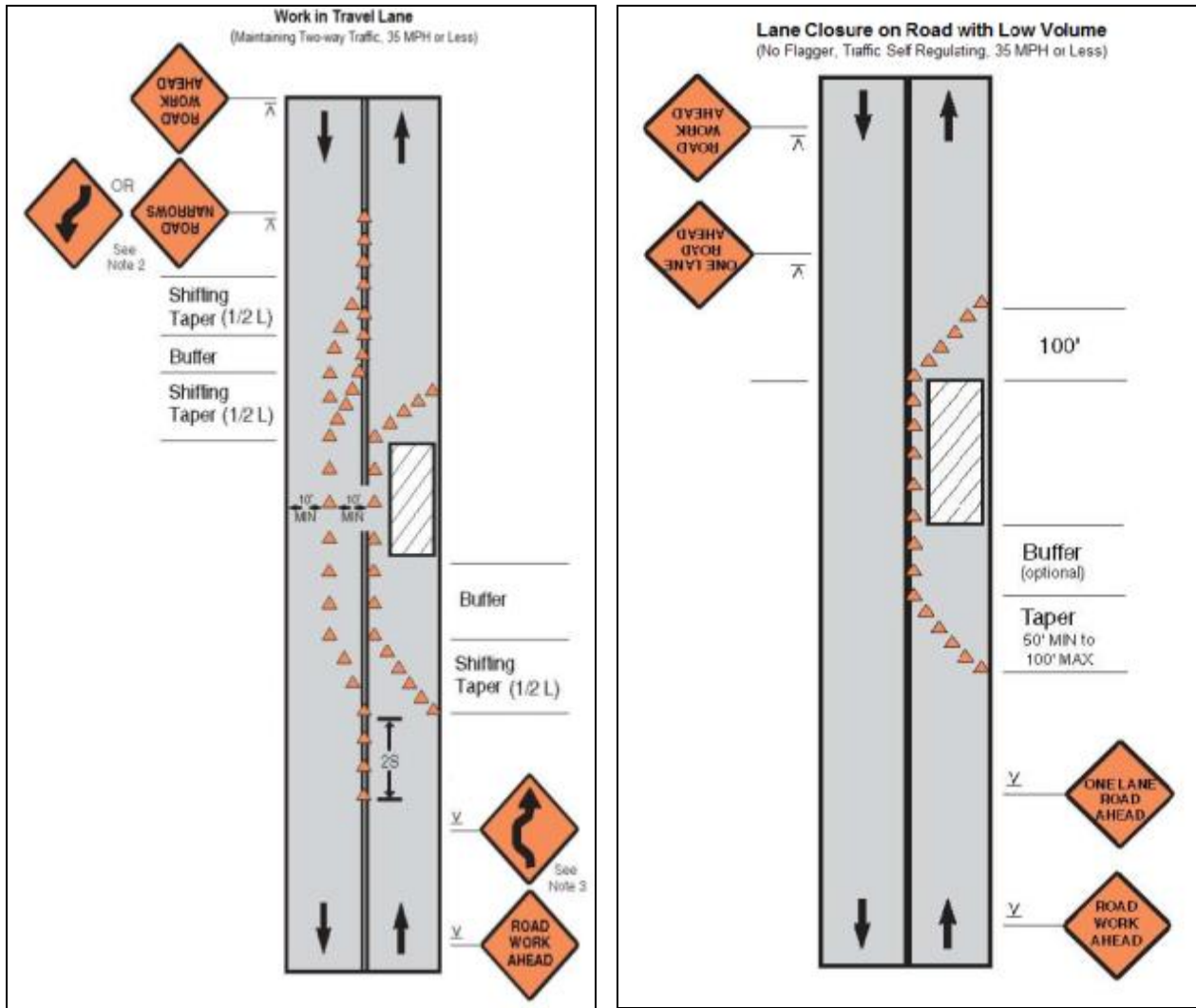


Figure A4.6 & A4.7: Lane closure on a two-line road with low volume (with yield sign) & Lane closure on a two-line road with low volume (one flagger operation)

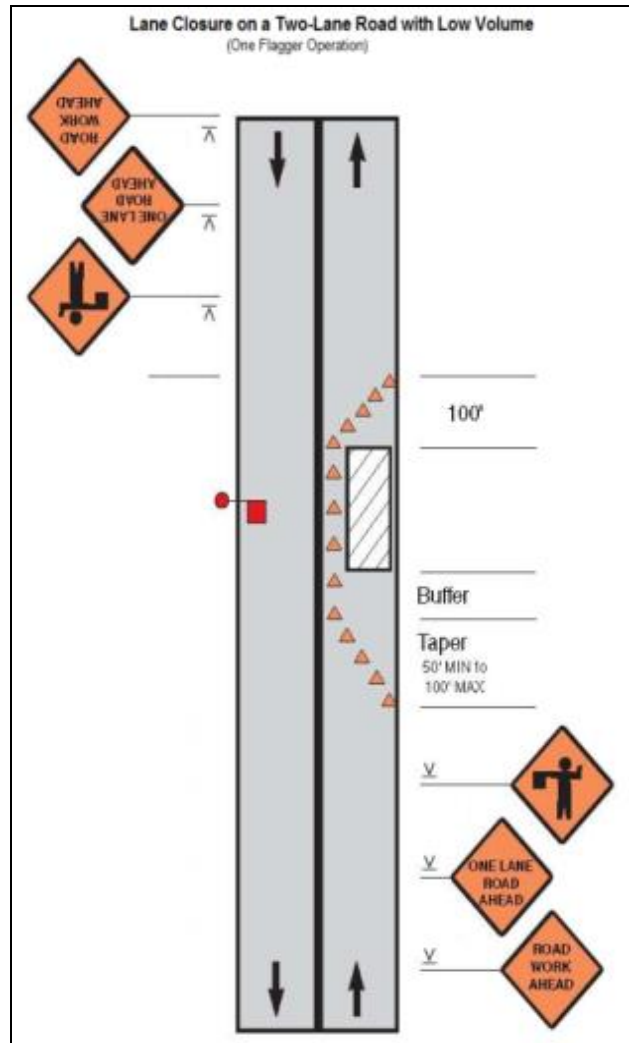
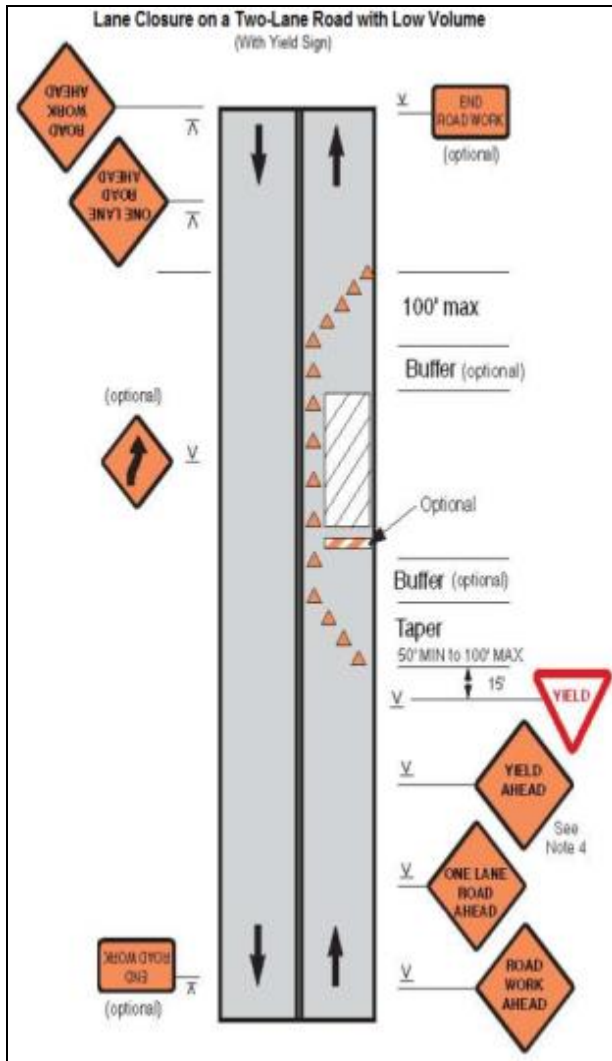


Figure A4.8 & A4.9: Lane Closure on a Two-Lane Road (Two Flagger Operation) & Lane Closure on a Four-Lane Undivided Road

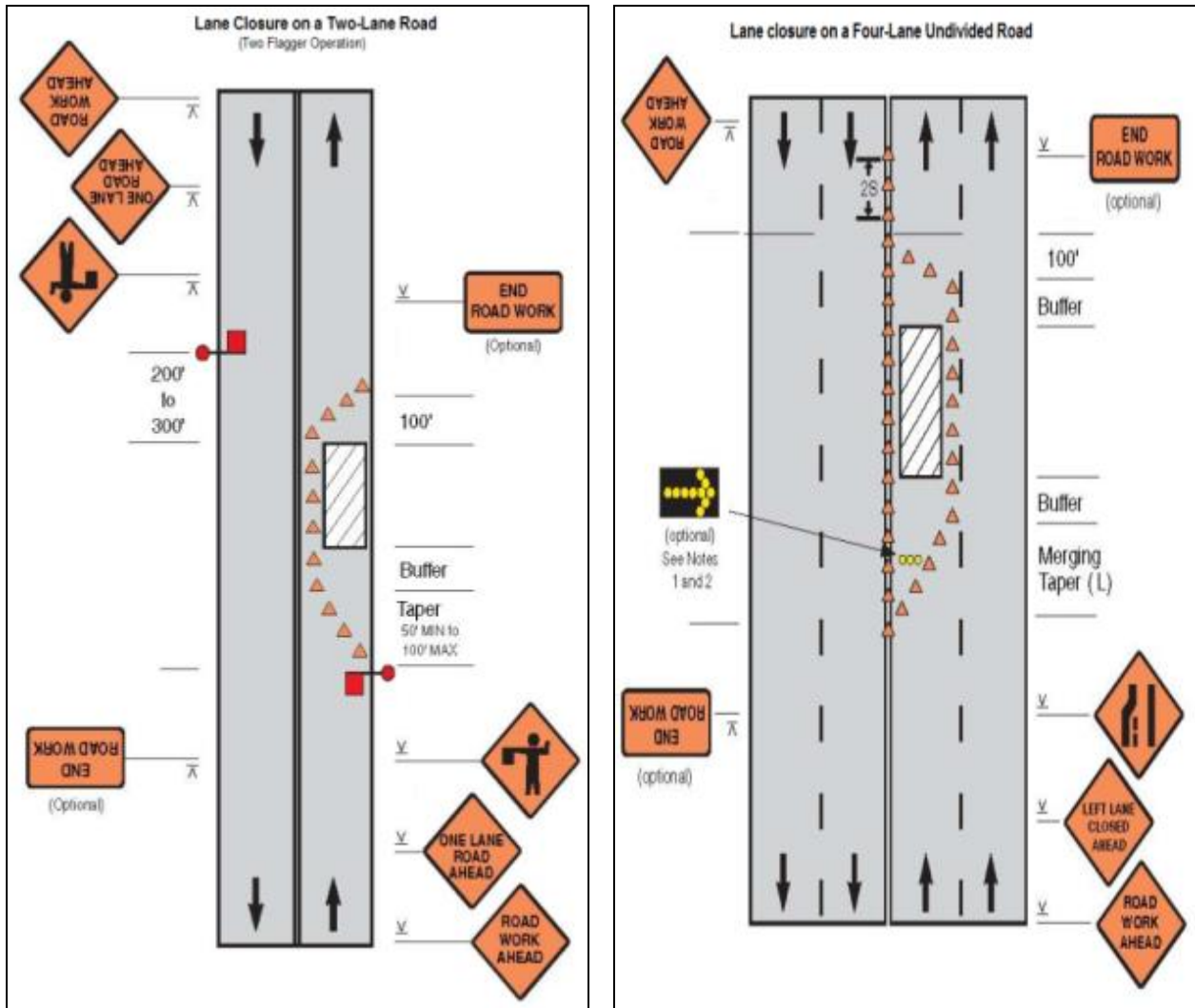


Figure A4.10 & A4.11: Lane Closure on Divided Roadway & Half Road Closure On Multi-Lane Roadway

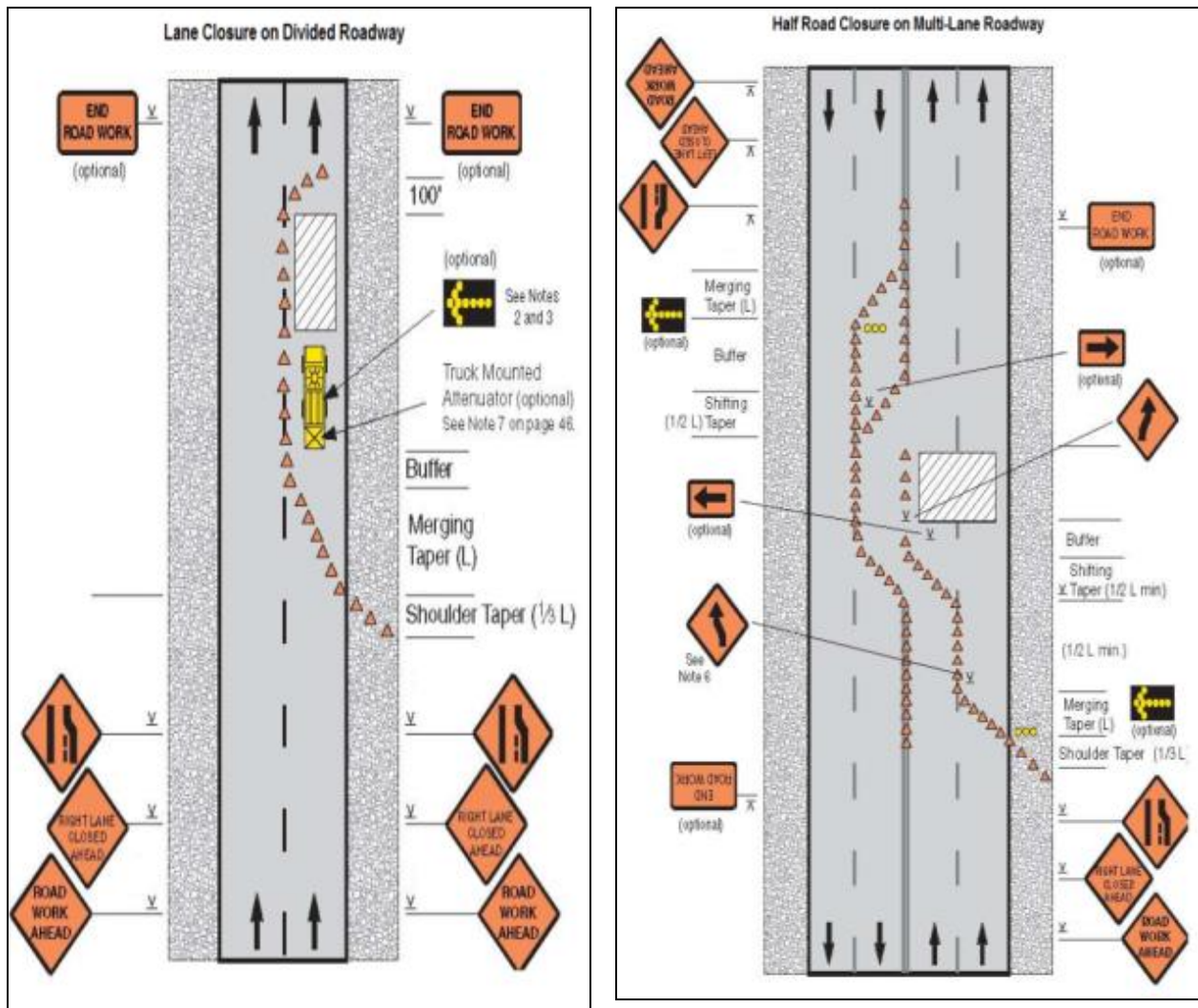
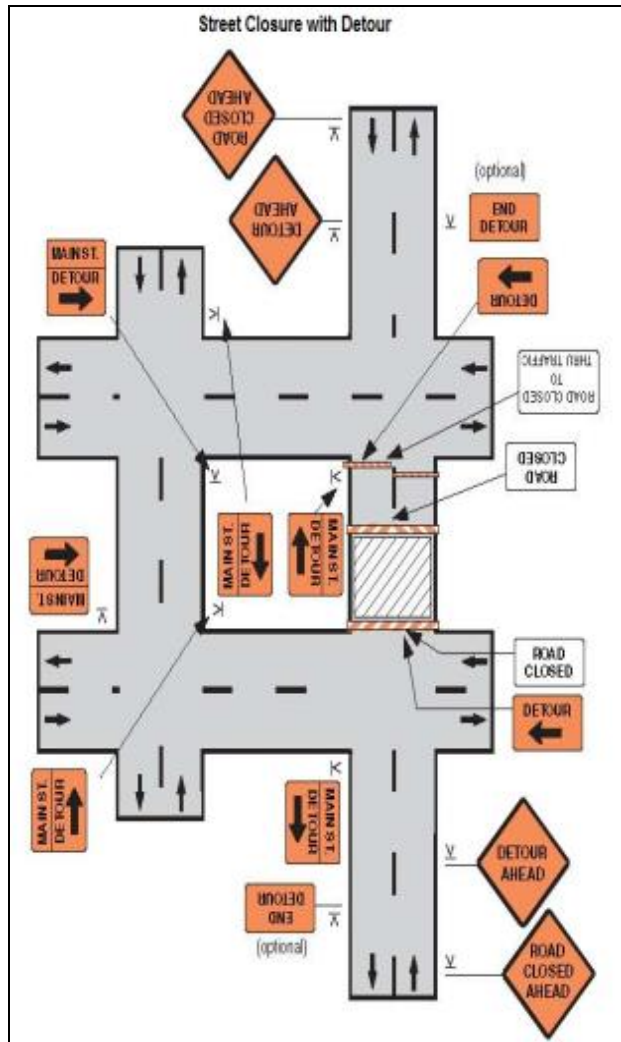


Figure A4.12: Street closure with detour



APPENDIX 5: RECORDS OF PUBLIC CONSULTATIONS AND FGDS**PARTICIPANTS LIST****Mymensingh Town****Component: SWM****Meeting Place: Tazul Traders, Near Biscuit Factory, Ward-2****Date: 28-08-16**

Time: 11.11 am

	Name	Sex	Occupation	Cell Number
1	Md. Gulzar Mian	Male	Counselor	01816-662989
2	Md. Tazul Islam	Male	Businessman	01811-697520
3	Md. Emran	Male	Mechanics	
4	Md. Monsur Ali	Male	Raj Mistree	01913-743559
5	Md. Ferdouse Ahmed	Male	Businessman	
6	Md. Abdur Rahim	Male	Raj Mistree	01946-796247
7	Md. Hasan	Male	Labour	01951-694383
8	Md. Nazrul Islam Pathan	Male	Retired Service	01714-500115
9	SM Golam Mostafa	Male	Assistant Engineer	01757-807468
10	Md. Azizul Haque	Male	Assistant Engineer	01790810363
11	Manosh Bishas	Male	Town Planer	01712-288404
12	Kamrul Islam	Male	Businessman	01732-744039
13	Murad	Male	Businessman	01724-336992
14	Md. Nasir Uddin Khan	Male	Retire SI	01677-055590
15	Md.Nuruzzaman	Male		01767-859470

PARTICIPANTS LIST**Mymensingh Town****Component: SWM****Meeting Place: In the office of Counselor, Ward-14****Date: 28-08-16**

Time: 01.20 pm

	Name	Sex	Occupation	Cell Number
1	Md. Dulal Uddin Dulal	Male	Counselor	01711-683062
2	Nusrat Jannat	Female	Student	01745-998969
3	Nasrin Sultana	Female	Student	01739-349318
4	Mohammed Ali	Male	Businessman	01714-879998
5	AbdulJabbar	Male	Businessman	01915-028266
6	Tariqul Islam Minto	Male	Service	01715-393293
7	Md.Amirul Islam Shakil	Male	Businessman	01712-763045
8	SM Golam Mostafa	Male	Assistant Engineer	01757-807468
9	Md. Azizul Haque	Male	Assistant Engineer	01790-810363
10	Manosh Bishas	Male	Town Planer	01712-288404

APPENDIX 6: SAMPLE GRIEVANCE REGISTRATION FORM
(To be available in Bangla and English)

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

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

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

FOR OFFICIAL USE ONLY

Registered by: (Name of Official Registering Grievance)	
Mode of Communication: Note/Letter E-mail Verbal/Telephonic	
Reviewed by: (Names/Positions of Officials Reviewing Grievance)	
Action Taken:	
Whether Action Taken Disclosed:	Yes No
Means of Disclosure:	

APPENDIX 7: SAMPLE SEMI-ANNUAL REPORTING FORMAT

This template must be included as an appendix in the EIA/IEE that will be prepared for the project. It can be adapted to the specific project as necessary.

I. INTRODUCTION

Overall project description and objectives

Environmental category as per ADB Safeguard Policy Statement, 2009

Environmental category of each subproject as per national laws and regulations

Project Safeguards Team

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

Overall project and sub-project progress and status

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

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

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

II. COMPLIANCE STATUS WITH NATIONAL/ STATE/ LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS

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

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

^b Specify if obtained, submitted and awaiting approval, application not yet submitted

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

III. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

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

IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

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

Package-wise IEE Documentation Status

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

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

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

Package Name	Contractor	Nodal Person	Email Address	Contact Number

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

Summary of Environmental Monitoring Activities (for the Reporting Period)¹

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

Summary of Environmental Monitoring Activities (for the Reporting Period)²

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

¹ Attach Laboratory Results and Sampling Map/Locations
² Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with CEMP / EMP

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

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

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

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

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

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

Air Quality Results

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

Water Quality Results

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

Noise Quality Results

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

VII. GRIEVANCE REDRESS MECHANISM

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

VIII. COMPLAINTS RECEIVED DURING THE REPORTING PERIOD

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

IX. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

APPENDIXES

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

APPENDIX 8: ENVIRONMENTAL STANDARDS

SCHEDULE-2 Standards for Air

Density in microgram per cusec meter

Sl. No.	Categories of Area	Suspended Particulate Matters (SPM)	Sulphur-dioxide	Carbon Monoxide	Oxides Nitrogen
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

- (i) At national level, sensitive area includes monuments, health center, hospital, archeological site, educational institution, and government designated areas (if any).
- (ii) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. nos. c and d above.
- (iii) Suspended Particulate Matter means airborne particles of a diameter of 10 micron or less.

SCHEDULE -3
Standards for Water

A. Standards for inland surface water

Best Practice based classification		Parameter			
		pH	BOD mg/l	DO mg/l	Total Coliform number/100
a.	Source of drinking water for supply only after disinfecting:	6.5-8.5	2 or less	6 or above	50 or less
b.	Water usable for recreational activity :	6.5 - 8.5	3 or less	5 or more	200 or less
c.	Source of drinking water for supply after conventional treatment :	6.5 - 8.5	6 of less	6 or more	5000 or less
d.	Water usable by fisheries:	6.5 - 8.5	6 of less	5 or more	---
e.	Water usable by various process and cooling industries :	6.5 - 8.5	10 or less	5 or more	5000 or less
f.	Water usable for irrigation:	6.5 - 8.5	10 or less	5 or more	1000 or less

Notes:

1. In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2. Electrical conductivity for irrigation water - 2250 μ mhos/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Standards for drinking water

SI. No	Parameter	Unit	Standards
1	2	3	4
1.	Aluminum	mg/l	0.2
2.	Ammonia (NH ₃)	"	0.5
3.	Arsenic	"	0.05
4.	Balium	"	0.01
6.	BOD5 20°C	"	0.2
7.	Boron	"	1.0
8.	Cadmium	"	0.005
9.	Calcium	"	75
10.	Chloride	"	150 - 600*
11.	Chlorinated alkanes carbontetrachloride	"	0.01
	1.1 dichloroethylene	"	0.001
	1.2 dichloroethylene	"	0.03
	tetrachloroethylene	"	0.03
12.	trichloroethylene	"	0.09
	Chlorinated phenols - pentachlorophenol	mg/l	0.03
	- 2.4.6 trichlorophenol	"	0.03
13.	Chlorine (residual)	"	0.2
14.	Chloroform	"	0.09
15.	Chromium (hexavalent)	"	0.05
16.	Chromium (total)	"	0.05
17.	COD	"	4
18.	Coliform (fecal)	"	0
19.	Coliform (total)	"	0
20.	Color	"	15
21.	Copper	"	1
22.	Cyanide	"	0.1

Sl. No	Parameter	Unit	Standards
1	2	3	4
23.	Detergents	"	0.2
24.	DO	"	6
25.	Fluoride	"	1
26.	Hardness (as CaCO ₃)	"	200 - 500
27.	Iron	"	0.3 - 1.0
28.	Kjeldhl Nitrogen (total)	"	1
29.	Lead	"	0.05
30.	Magnesium	"	30 - 35
31.	Manganese	"	0.1
32.	Mercury	"	0.001
33.	Nickel	"	0.1
34.	Nitrate	"	10
35.	Nitrite	"	<1
36.	Odor	"	Odorless
37.	Oil and grease	"	0.01
38.	pH	"	6.5 - 8.5
39.	Phenolic compounds	"	0.002
40.	Phosphate	"	6
41.	Phosphorus	"	0
42.	Potassium	"	12
43.	Radioactive materials (gross alpha activity)	Bq/l	0.01
44.	Radioactive materials (gross beta activity)	Bq/l	0.1
45.	Selenium	mg/l	0.01
46.	Silver	"	0.02
47.	Sodium	"	200
48.	Suspended particulate matters	"	10
49.	Sufide	"	0
50.	Sulfate	"	400
51.	Total dissolved solids	"	1000
52.	Temperature	°C	20-30
53.	Tin	mg/l	2
54.	Turbidity	JTU	10
55.	Zinc	mg/l	5

SCHEDULE - 4
Standards for Sound

Sl. No.	Category of areas	Standards determined at dBa unit	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

Notes:

- (i) The time from 6 a.m. to 9 p.m. is counted as daytime.
- (ii) The time from 9 p.m. to 6 a.m. is counted as night time.
- (iii) Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited.

SCHEDULE – 5
Standards for Sound originating from Motor Vehicles or Mechanized Vessels

Category of Vehicles	Unit	Standards	Remarks
*Motor Vehicles (all types)	dBa	85	As measured at a distance of 7.5 meters from exhaust pipe.
		100	As measured at a distance of 0.5 meter from exhaust pipe
Mechanized Vessels	dBa	85	As measured at a distance of 7.5 meters from the vessel which is not in motion, not loaded and is at two thirds of its maximum rotating speed.
		100	As measured at a distance of 0.5 meter from the vessel which is in the same condition as above.

At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:-

- (i) Diesel engine - maximum rotating speed.
- (ii) Gasoline engine -at two thirds of its maximum rotating speed and without any load.
- (iii) Motorcycle - If maximum rotating speed is above 5000 rpm; two- thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

SCHEDULE - 6
Standards for Emission from Motor Vehicles

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit	65
	(HSU)	
Carbon Monoxide	gm/k.m.	24
	percent area	04
Hydrocarbon	gm/k.m.	02
	ppm	180
Oxides of Nitrogen	gm/k.m.	02
	ppm	600

As measured at two thirds of maximum rotating speed.

SCHEDULE- 7
Standards for Emission from Mechanized Vessels

Parameter	Unit	Standard Limit
Black Smoke*	Hartridge Smoke Unit (HSU)	65

As measured at two thirds of maximum rotating speed.

SCHEDULE - 8
Standards for Odor

Parameter	Unit	Standard Limit
Acetaldehyde	ppm	0.5 - 5
Ammonia	"	1 - 5
Hydrogen Sulfide	"	0.02-0.2
Methyl Disulfide	"	0.009 - 0.1
Methyl Sulfide	"	0.01 - 0.2
Styrene	"	0.4 - 2.0
Trim ethylamine	"	0.005 - 0.07

Notes:

- (i) Following regulatory limit shall be generally applicable to emission/exhaust outlet pipe f above 5 meter height:
 $Q = 0.108 \times He^2 C_m$ (Where Q = Gas Emission rate Nm³/hour)
 He = Height of exhaust outlet pipe (m)
 Cm = Above mentioned limit (ppm)
- (ii) In case where a special parameter has been mentioned, the lower limit shall be applicable for warning purpose, and the higher limit shall be applicable for prosecution purpose or punitive measure.

SCHEDULE - 9
Standards for Sewage Discharge

Parameter	Unit	Standard Limit
BOD	miligram/l	40
Nitrate	"	250
Phosphate	"	35
Suspended Solids (SS)	"	100
Temperature	Degree Centigrade	30
Coliform	number per 100 ml	1000

Notes:

- (i) This limit shall be applicable to discharges into surface and inland waters bodies.
 (ii) Sewage shall be chlorinated before final discharge.

APPENDIX 9: RESPONSIBILITIES FOR FSTP OPERATIONS¹

The FSTP **Engineer's** roles and responsibilities include:

- (i) ensuring the overall efficiency of the plant and optimization of the treatment process;
- (ii) controlling operating expenses;
- (iii) organizing and coordinating the work carried out by subordinate teams (e.g. sludge removal from drying beds);
- (iv) recommending technical solutions to problems that may be encountered;
- (v) contributing to the monitoring and reporting on the performance of equipment and processes; and
- (vi) managing technical subcontractors and suppliers.

Plant operator's roles and responsibilities include:

- (i) performing equipment inspections, monitoring operations, and collecting samples in order to
- (ii) verify system performance in collaboration with laboratory employees;
- (iii) operating trucks, pumps, blowers, generators, compressors, and other machinery/equipment;
- (iv) testing, calibrating, repairing, and operating control and instrumentation systems under general
- (v) supervision;
- (vi) keeping records of operational activities, degradations and failures;
- (vii) preparing field and office reports summarizing the records and providing recommendations for optimizing the system; and
- (viii) assisting in site environmental investigations, field surveys, and cleanups as required.

Plant maintenance person/technician's roles and responsibilities include:

The FSTP maintenance technician performs routine and emergency maintenance and repairs on plant facilities, pumps, engines, motors, filters, bar screens, valves, pipes, and other equipment at the FSTP. Typical responsibilities include:

- (i) checking, adjusting and maintaining mechanical equipment including greasing of moving parts,
- (ii) changing oil, and performing other routine maintenance activities;
- (iii) maintaining buildings, roads and grounds;
- (iv) performing janitorial work;
- (v) replacing worn parts and performing routine and emergency service and repairs including replacing
- (vi) motors, bearings, flanges, seals and other equipment components;
- (vii) inspecting mechanical and hydraulic equipment being installed under contracts to ensure
- (viii) compliance with contract requirements;
- (ix) monitoring facilities and equipment in order to identify and repair leaks or other malfunctions; and
- (x) keeping records through the logging of maintenance activities and repairs, and preparing reports
- (xi) summarizing the main activities, malfunctions and recommendations.

¹ Magalie Bassan and David M. Robbins, Operation, Maintenance and Monitoring of Faecal Sludge Treatment Plant, In book: Faecal Sludge Management, systems approach for implementation and operation, IWA publication